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(71) Applicant: **Komori Corporation**
Sumida-ku
Tokyo (JP)

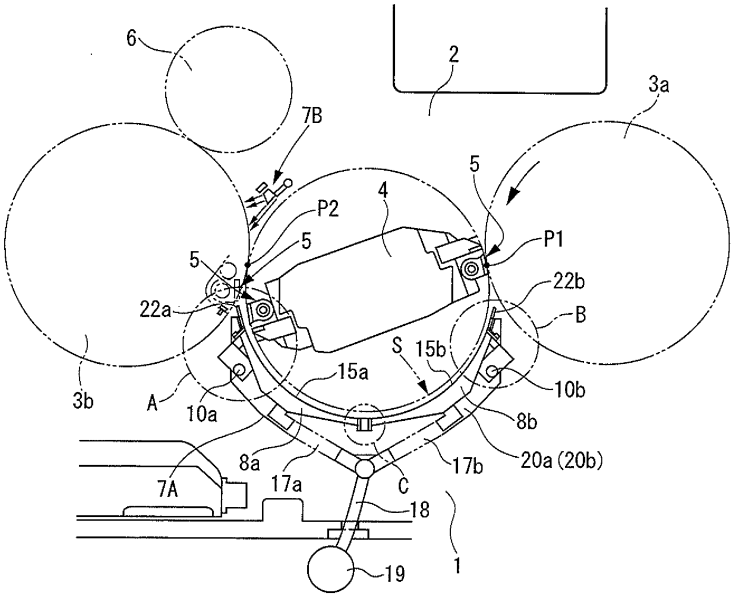
(72) Inventors:
- **Ohrui, Koichi**
  Tsukuba-shi Ibaraki 300-1268 (JP)
- **Shimizu, You**
  Tsukuba-shi Ibaraki 300-1268 (JP)

(74) Representative: **UEXKÜLL & STOLBERG**
Patentanwälte
Beselerstrasse 4
22607 Hamburg (DE)

(54) Sheet guide apparatus

(57) A sheet guide apparatus includes an impression cylinder (3b) having a gripper device (5) for holding a thin sheet (Wa) or a thick sheet (Wb) and adapted to transport the thin sheet (Wa) or the thick sheet (Wb), and an air blowing device comprising an air discharge duct (31) and discharge nozzles (33) for blowing air on the thin sheet (Wa) or thick sheet (Wb) being transported by the impression cylinder (3b). The sheet guide apparatus comprises: a displacement gauge (42) for detecting the distance to the thin sheet (Wa) or thick sheet (Wb) being transported by the impression cylinder (3b); and a control device (40) for controlling the air blowing device, based on the detection results of the displacement gauge (42), to adjust the flow rate of discharged air so that the distance between the thin sheet (Wa) or thick sheet (Wb) and the displacement gauge (42) becomes a distance which prevents the unstable motion of the thin sheet (Wa) or thick sheet (Wb).

Fig.1



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Description

[Technical Field]

[0001] This invention relates to a sheet guide apparatus which is provided in a printing press (may hereinafter be referred to as the machine) for printing a sheet, or a coater for coating a sheet, and which transports, in a stable state, a sheet to be transported.

[Background Art]

[0002] In a multicolor sheet-fed printing press for four colors, for example, a transfer cylinder (intermediate cylinder) 104 is disposed between respective printing units (103a to 103d) in a printing unit section 102 located between a feeder unit 100 and a delivery unit 101, as shown in Fig. 12. A sheet of paper (or a sheet) moves from an impression cylinder 105 of the preceding unit past the transfer cylinder 104 to an impression cylinder 105 of the succeeding unit via a gripper device (paper gripping device; not shown). The printing press for thin paper adopts a cylinder-shaped shell as the transfer cylinder 104. The printing press for thick paper, on the other hand, adopts a skeleton shell, and is designed to avoid marked bending of tough thick paper.

[0003] In recent years, there has been a demand for a printing press suitable for both of thin paper and thick paper, and a printing press of a skeleton configuration adaptable to both of thin paper and thick paper has appeared. As will be understood from what has been mentioned above, such a printing press is at a disadvantage against thin paper. Thin paper without toughness is not supported by a cylinder, and thus moves unstably, causing a printing trouble. The same holds true of coating on a sheet and, if the sheet is thin, a coating failure occurs. In order to stabilize the sheet being transported, thereby preventing the printing trouble or coating failure, therefore, it has been common practice to provide various sheet guide devices along the transfer cylinder, constructed as the skeleton shell, for passing the sheet on to the impression cylinder (see Patent Document 1 and Patent Document 2).

[0004] Moreover, Patent Document 3 discloses a printing press in which an air blowing means comprising a discharge duct and discharge nozzles is provided above a transfer position at which the sheet is passed from the skeleton shell on to the impression cylinder, and air is blown on the sheet received by the impression cylinder to suppress the unstable motion of the sheet.

[Citation List]
[Patent Literature]

[0005]

[Patent Document 1] JP-A-2001-293843
[Patent Document 2] JP-A-2001-293844
[Patent Document 3] Japanese Patent No. 4061107

[Summary of Invention]

[Technical Problem]

[0006] With the printing press of Patent Document 3 mentioned above, however, the unstable motion of the sheet is not similar depending on the type of the sheet, the size of the sheet, a printing image, etc. Thus, an operator has adjusted the flow rate of air by relying on the operator's experience and intuition.

[0007] Thus, a heavy burden is imposed on the operator, and a less experienced operator has difficulty in making adjustment and cannot suppress the unstable motion of the sheet. This has posed the problem that a printing trouble due to the unstable motion of the sheet cannot be prevented. As a result, the operation rate of the machine is low, and a waste sheet occurs.

[0008] Under these circumstances, it is an object of the present invention to provide a sheet guide apparatus which controls an air blowing means automatically without relying on the operator's experience and intuition, thereby sufficiently suppressing the unstable motion of the sheet, and which enables even an operator with a limited work experience in printing, etc. to do printing, etc. with a sense of security.

[Solution to Problem]

[0009] To solve the above-mentioned problems, the present invention provides a sheet guide apparatus including

a transport cylinder having holding means for holding a sheet and adapted to transport the sheet, and
air blowing means for blowing air on the sheet being transported by the transport cylinder,
the sheet guide apparatus, comprising:

detection means for detecting a distance to the sheet being transported by the transport cylinder; and
control means for controlling the air blowing means, based on detection results of the detection means, such that the distance between the sheet and the detection means becomes a distance which prevents an unstable motion of the sheet.

[0010] The sheet guide apparatus is also **characterized in that** the control means controls the air blowing means to adjust a flow rate of discharged air so that the distance between the sheet and the detection means becomes a set distance.

[0011] The sheet guide apparatus is also **characterized in that** the distance which prevents the unstable motion of the sheet differs according to whether the sheet

is a thin sheet or a thick sheet.

[0012] The sheet guide apparatus is also **characterized in that** the distance, which prevents the unstable motion of the thick sheet when the sheet is the thick sheet, is shorter than the distance which prevents the unstable motion of the thin sheet when the sheet is the thin sheet.

[0013] The sheet guide apparatus is also **characterized in that** the detection means is provided on a downstream side in a sheet transport direction with respect to the air blowing means and on an upstream side in the sheet transport direction with respect to a cylinder in contact with the transport cylinder.

[0014] The sheet guide apparatus is also **characterized in that** the detection means is provided at a position opposing a surface of the sheet.

[0015] The sheet guide apparatus further comprises a sheet thickness input unit for inputting a thickness of the sheet, and wherein the control means judges the sheet as a thin sheet when the thickness of the sheet inputted by the sheet thickness input unit is less than a given value, and judges the sheet as a thick sheet when the thickness of the sheet inputted by the sheet thickness input unit is the given value or higher.

[0016] The sheet guide apparatus further comprises a sheet thickness input unit for inputting a thickness of the sheet, and wherein the control means judges the sheet as a thin sheet when the thickness of the sheet inputted by the sheet thickness input unit is a given value or lower, and judges the sheet as a thick sheet when the thickness of the sheet inputted by the sheet thickness input unit exceeds the given value.

[0017] The sheet guide apparatus is also **characterized in that** the air blowing means includes an air discharge duct having discharge holes, and discharge nozzles, and the control means exercises control such that air is discharged from the discharge holes of the air discharge duct and the discharge nozzles when the sheet is a thick sheet, and exercises control such that air is discharged only from the discharge holes of the air discharge duct when the sheet is a thin sheet.

[0018] The sheet guide apparatus is also **characterized in that** the distance which prevents the unstable motion of the sheet when the sheet is a thick sheet is a distance from a position between a sheet motion instability position and an improper position to the detection means, the sheet motion instability position being a position at which the sheet is excessively separated from the transport cylinder, and the improper position being a position at which the sheet is excessively close to the transport cylinder.

[0019] The sheet guide apparatus is also **characterized in that** the detection means is a displacement gauge.

[Advantageous Effects of Invention]

[0020] According to the present invention, the unstable motion of the sheet is detected, and the air blowing means is controlled automatically, whereby the flow rate of air can be adjusted appropriately. Thus, the unstable motion of the sheet can be fully suppressed, and the sheet can be transported stably. Hence, even a little experienced operator can perform an operation, such as printing, with a sense of security. Since a printing trouble due to the unstable motion of the sheet does not occur, moreover, the rate of operation of the machine is increased, and waste sheets are also decreased.

[Brief Description of Drawings]

[0021]

[Fig. 1]
Fig. 1 is a side view of essential parts of a multicolor sheet-fed printing press showing an embodiment of the present invention.
[Fig. 2]
Fig. 2 is a plan view of a first guide device.
[Fig. 3]
Fig. 3 is an enlarged view of a portion A in Fig. 1.
[Fig. 4]
Fig. 4 is an enlarged view of a portion B in Fig. 1.
[Fig. 5]
Fig. 5 is an enlarged view of a portion C in Fig. 1.
[Figs. 6(a) to 6(c)]
Figs. 6(a) to 6(c) are explanation drawings of the structure of a guide plate, Fig. 6(a) being a plan view, Fig. 6(b) being a side view, and Fig. 6(c) being a sectional view.
[Fig. 7]
Fig. 7 is an enlarged side view of a second guide device.
[Fig. 8]
Fig. 8 is an enlarged plan view of the second guide device.
[Fig. 9]
Fig. 9 is a control block diagram of an air blowing device.
[Fig. 10]
Fig. 10 is an operational explanation drawing of the air blowing device for a thin sheet.
[Fig. 11]
Fig. 11 is an operational explanation drawing of the air blowing device for a thick sheet.
[Fig. 12]
Fig. 12 is an overall side view of a four-color sheet-fed printing press.

[Description of Embodiments]

[0022] A sheet guide apparatus according to the present invention will be described in detail by an embodiment with reference to the accompanying drawings.

[Embodiment]

[0023] Fig. 1 is a side view of essential parts of a multicolor sheet-fed printing press showing an embodiment of the present invention. Fig. 2 is a plan view of a first guide device. Fig. 3 is an enlarged view of a portion A in Fig. 1. Fig. 4 is an enlarged view of a portion B in Fig. 1. Fig. 5 is an enlarged view of a portion C in Fig. 1. Figs. 6(a) to 6(c) are explanation drawings of the structure of a guide plate, Fig. 6(a) being a plan view, Fig. 6(b) being a side view, and Fig. 6(c) being a sectional view. Fig. 7 is an enlarged side view of a second guide device. Fig. 8 is an enlarged plan view of the second guide device. Fig. 9 is a control block diagram of an air blowing device. Fig. 10 is an operational explanation drawing of the air blowing device for a thin sheet. Fig. 11 is an operational explanation drawing of the air blowing device for a thick sheet.

[0024] In a printing unit section of a multicolor sheet-fed printing press for four colors, etc., an upstream-side impression cylinder 3a and a downstream-side impression cylinder (transport cylinder) 3b are rotatably supported between right and left frames 2 erected on a bed 1, and a transfer cylinder 4 comprising a skeleton shell is likewise rotatably supported between these impression cylinders 3a and 3b, as shown in Fig. 1. The impression cylinders 3a, 3b and the transfer cylinder 4 are each equipped with a gripper device (paper gripping device) 5 as a holding means for holding a printing sheet (a sheet; see a thin sheet Wa in Fig. 10, and a thick sheet Wb in Fig. 11). In Fig. 1, the numeral 6 denotes a blanket cylinder in contact with each impression cylinder 3a or 3b.

[0025] A first guide device 7A, which guides the printing sheet being transported in a region ranging between transfer positions P1 and P2 of the printing sheet on the upstream and downstream sides in the flow direction of the printing sheet, is provided below the transfer cylinder 4. Moreover, a second guide device 7B, which guides the printing sheet transported by the downstream-side impression cylinder 3b, is provided above the transfer position P2 of the printing sheet on the downstream side.

[0026] The first guide device 7A, as shown in Figs. 2 to 4, is divided into two portions in the flow direction of the printing sheet, and is furnished with guide plates 15a, 15b covering the open upper surfaces of air discharge ducts 8a, 8b spreadingly provided over most of the space between the transfer positions P1 and P2 of the printing sheet on the upstream and downstream sides, a plate-shaped resinous guide 22b disposed in the vicinity of the transfer position P1 of the printing sheet on the upstream side, and a plate-shaped resinous guide 22a disposed in the vicinity of the transfer position P2 of the printing sheet on the downstream side.

[0027] The air discharge ducts 8a, 8b are supported, on their outer end sides, by stays 10a, 10b spanning the right and left frames 2 via holders 11a, 11b and blocks 12a, 12b, and have their inner ends bound together by bolts 14 between their bars 13a and 13b, as shown in Fig. 5.

[0028] The guide plates 15a, 15b each comprise an arcuate plate extending along the movement trajectory S of the gripper device 5 of the transfer cylinder 4, and each have many air jet holes 16 formed to be open so that air flows rightward and leftward symmetrically with respect to the machine center along their guide surfaces (i.e., air flows in the sheet width direction of the printing sheet), as shown in Fig. 6(c) as well.

[0029] The interior of the air discharge ducts 8a, 8b is supplied with pressurized air from a blower pump 19 outside the machine via pipings 17a, 17b and collecting piping 18.

[0030] Between the forward and rearward stays 10a and 10b as a pair, subframes 20a and 20b located on both sides of the guide plates 15a and 15b are installed to span the stays 10a and 10b. Bars 21a and 21b are installed to span the front ends and rear ends of the subframes 20a and 20b.

[0031] The plate-shaped guide 22a extending in the sheet width direction of the printing sheet is fixed to an upper surface part of the bar 21a on the upstream side in the transport direction of the printing sheet with respect to the transfer position P2 of the printing sheet so as to become as close as possible to the transfer position P2 of the printing sheet. An end of the plate-shaped guide 22a facing the transfer position P2 of the printing sheet is formed in the shape of a comb (comb-shaped) to have notches 27a at predetermined intervals in the sheet width direction of the printing sheet. The notches 27a are arranged parallel in the axial direction of the gripper device 5 of the downstream-side impression cylinder 3b, and are provided at positions corresponding to grippers so that a plurality of the grippers protruding from the circumferential surface of the impression cylinder 3b can pass without interfering with the plate-shaped guide 22a.

[0032] The plate-shaped guide 22b extending in the sheet width direction of the printing sheet is fixed to an upper surface part of the bar 21b on the downstream side in the transport direction of the printing sheet with respect to the transfer position P1 of the printing sheet so as to become as close as possible to the transfer position P1 of the printing sheet, as is the plate-shaped guide 22a fixed to the upper surface part of the bar 21a. An end of the plate-shaped guide 22b facing the transfer position P1 of the printing sheet is formed in the shape of a comb (comb-shaped) to have notches 27b at predetermined intervals in the sheet width direction of the printing sheet. The notches 27b are arranged parallel in the axial direction of the gripper device 5 of the upstream-side impression cylinder 3a, and are provided at positions corresponding to grippers so that a plurality of the grippers protruding from the circumferential surface of the impression cylinder 3a can pass without interfering with the plate-shaped guide 22b.

[0033] The second guide device 7B, as shown in Figs. 7 and 8, comprises an air discharge duct 31 and an air discharge pipe 32 installed to span the right and left

frames 2 via support members such as L-shaped brackets 30a, 30b, the air discharge duct 31 having many discharge holes 31a formed in the flow direction and the sheet width direction of the printing sheet, and the air discharge pipe 32 having many discharge nozzles 33 in the sheet width direction of the printing sheet.

[0034] The air discharge duct 31 and the air discharge pipe 32 are supplied with pressurized air from a blower pump 35 outside the machine via pipings 34a and 34b. This pressurized air is blown via the discharge holes 31a and the discharge nozzles 33 toward the circumferential surface of the downstream-side impression cylinder 3b located on the downstream side in the flow direction of the printing sheet with respect to the transfer position P2 of the printing sheet, the directions of blowing being a direction nearly perpendicular to the printing surface of the printing sheet and a direction opposite to the flowing direction of the printing sheet.

[0035] In Fig. 7, the numeral 36 denotes a valve provided midway through the piping 34b on the discharge nozzle side for supplying pressurized air from the blower pump 35 to the discharge nozzles 33, or for stopping the supply of pressurized air. The above-described air discharge duct 31, air discharge pipe 32, discharge nozzles 33, pipings 34a, 34b, blower pump 35 and valve 36 constitute an air blowing device (air blowing means).

[0036] A displacement gauge (detection means) 42, which is located at an intermediate part in the sheet width direction of the printing sheet for detecting the distance to the printing sheet being transported by the impression cylinder 3b, is installed on the upper surface of the air discharge duct 31. A detection signal of the displacement gauge 42 (i.e., floating amount of the printing sheet) is inputted to a control device (control means) 40 (to be described later). The displacement gauge 42 is provided at a position opposed to the printing surface of the printing sheet.

[0037] That is, as shown in Fig. 9, the control device 40 also receives signals from a sheet thickness input unit 41 provided on an operating panel or the like, in addition to the signals from the displacement gauge 42. Based on these input signals, the control device 40 exercises opening and closing control of the valve 36 in the air blowing device and effects driving control of a pump drive motor 43 for the blower pump 35 in the air blowing device to adjust the flow rate of discharged air in such a manner that the distance between the printing sheet and the displacement gauge 42 is suitable for preventing the unstable motion of the sheet.

[0038] Because of the above features, when the printing sheet is transported from the impression cylinder 3a of the preceding printing unit to the transfer cylinder 4, and then to the impression cylinder 3b of the succeeding printing unit via the gripper devices 5, pressurized air gushing from the air jet holes 16 of the guide plates 15a, 15b and flowing in the sheet width direction while being directed from the center toward both side edges of the printing sheet (see arrows in Fig. 6(c)) causes the printing sheet to be sucked toward the guide surfaces of the guide plates 15a, 15b and transported in a stable state along the guide surfaces. That is, the printing sheet without toughness (e.g., thin sheet Wa) is prevented from making an unstable motion by the action of the transfer cylinder 4 comprising the skeleton shell, thereby causing a printing trouble.

[0039] In leading end portions of the plate-shaped guides 22a, 22b provided to be continuous with the guide plates 15a, 15b, moreover, the many notches 27a, 27b are formed at predetermined intervals in the sheet width direction of the printing press to avoid interference with the grippers of the gripper devices 5 of the impression cylinders 3a, 3b, Thus, the leading end portions of the plate-shaped guides 22a, 22b not corresponding to the grippers can be extended all the more to sites near the transfer positions P1, P2 of the printing sheet. As a result, the zones where the printing sheet is not guided by the guide plates 15a, 15b are rendered as narrow as possible, and the printing sheet is transported in a stable state.

[0040] In the present embodiment, when the printing sheet passes the transfer position P2 of the printing sheet, pressurized air gushed with a predetermined length in the flow direction of the printing sheet from the discharge holes 31a of the air discharge duct 31 and the discharge nozzles 33 of the air discharge pipe 32 in the air blowing device of the second guide device 7B brings the printing sheet into intimate contact with the circumferential surface of the impression cylinder 3b to suppress its fluttering or unstable motion, thus preventing a printing trouble.

[0041] In detail, the air blowing device is controlled by the control device 40 in the following manner:

> When the thickness of the thin sheet Wa (see Fig. 10) with a sheet thickness less than a given value is inputted by the sheet thickness input unit 41, the valve 36 interposed in the piping 34b is closed to stop the blowing of air from the discharge nozzles 33 of the air discharge pipe 32, whereas pressurized air is gushed from the discharge holes 31a of the air discharge duct 31.

[0042] That is, in accordance with the distance to the thin sheet Wa measured by the displacement gauge 42 (indicating the amount of floating of the sheet), the pump drive motor 43 for the blower pump 35 is drivingly controlled, and the frequency to the pump drive motor 43 is boosted to increase the flow rate of air so that the thin sheet Wa is moved, for example, from a sheet motion instability position (NG position) indicated by a long dashed double-dotted line to a proper position (OK position) indicated by a solid line in Fig. 10.

[0043] In the case of the thin sheet Wa, as seen above, pressurized air is gushed only from the discharge holes 31a of the air discharge duct 31. Thus, the thin sheet Wa is pressed uniformly against the circumferential surface of the impression cylinder 3b and transported in a stable

state. In other words, wrinkles or the like due to local pressurization by an air jet from the discharge nozzles 33 do not occur.

[0044] When the thickness of the thick sheet Wb (see Fig. 11) with a sheet thickness of the given value or more is inputted by the sheet thickness input unit 41, the valve 36 interposed in the piping 34b is opened to gush pressurized air from the discharge nozzles 33 of the air discharge pipe 32 and also gush pressurized air from the discharge holes 31a of the air discharge duct 31.

[0045] That is, in accordance with the distance to the thick sheet Wb measured by the displacement gauge 42 (indicating the amount of floating of the sheet), the pump drive motor 43 for the blower pump 35 is drivingly controlled, and the frequency to the pump drive motor 43 is boosted or lowered to increase or decrease the flow rate of air so that the thick sheet Wb is moved, for example, from a sheet motion instability position (NG position excessively separated from the impression cylinder 3b) indicated by a long dashed double-dotted line or an improper position (NG position excessively close to the impression cylinder 3b) indicated by another long dashed double-dotted line to a proper position (OK position) indicated by a solid line in Fig. 11.

[0046] In detail, when the thick sheet Wb is located at the NG position excessively separated from the impression cylinder 3b, the frequency to the pump drive motor 43 is boosted to increase the flow rate of air. When the thick sheet Wb is located at the NG position excessively close to the impression cylinder 3b, by contrast, the frequency to the pump drive motor 43 is lowered to decrease the flow rate of air. The reason why NG is given when the thick sheet Wb becomes too close to the impression cylinder 3b is as follows : When the thick sheet Wb passes the air blowing device and is freed from the gush of the pressurized air, the thick sheet Wb has a possibility to rebound greatly because of its own elasticity, eventually causing the same state as the unstable motion of the sheet. To avoid this situation, a position which enables the above rebound to be suppressed as much as possible and which fits the contour of the impression cylinder 3b as much as possible is set as the above-mentioned proper position (OK position). The distance defined by the above proper position (OK position) of the thick sheet Wb, namely, the distance for preventing the unstable motion of the thick sheet Wb, is shorter than the distance defined by the aforementioned proper position (OK position) of the thin sheet Wa, namely, the distance for preventing the unstable motion of the thin sheet Wa.

[0047] Because of the above features, for the thick sheet Wb, a combination of pressurized air from the discharge holes 31a of the air discharge duct 31 and pressurized air from the discharge nozzles 33 of the air discharge pipe 32 presses the thick sheet Wb against the circumferential surface of the impression cylinder 3b as strongly as possible, and can thereby suppress the fluttering or unstable motion of the sheet. The control device 40 may judge the sheet as the thin sheet Wa when the thickness of the sheet inputted by the sheet thickness input unit 41 is the given value or higher, and may judge the sheet as the thick sheet Wb when the thickness of the sheet inputted by the sheet thickness input unit 41 exceeds the given value.

[0048] According to the present embodiment, as described above, the unstable motion of the sheet is detected by the displacement gauge 42, and the air blowing device is controlled automatically, whereby the flow rate of air can be adjusted appropriately. Thus, the unstable motion of the sheet can be fully suppressed, and the printing sheet can be transported stably. Hence, even a little experienced operator can do printing with a sense of security. Since a printing trouble due to the unstable motion of the sheet does not occur, the rate of operation of the machine is increased, and waste sheets are also decreased.

[0049] It goes without saying that the present invention is not limited to the above-described embodiment, and various changes and modifications may be made without departing from the gist of the present invention. For example, even for the thin sheet Wa, pressurized air may be gushed from the nozzles 33, depending on the paper quality of the sheet or the like. Nor is it necessary to gush pressurized air from the nozzles 33 toward the thick sheet Wb, depending on its paper quality or the like. Moreover, the blower pump 35 may be provided for each of the pipings 34a and 34b, and the respective blower pumps 35 may be controlled independently.

[0050] Furthermore, the plate-shaped guides 22a, 22b may each be configured to have a flat leading end surface without the notches 27a, 27b over the sheet width direction of the printing sheet. Alternatively, there may be a configuration in which a plurality of rod-shaped guides are arranged parallel in the sheet width direction of the printing sheet, instead of the plate-shaped guides 22a, 22b. There may also be a configuration in which the plate-shaped guides 22a, 22b or the rod-shaped guides each have the front extremity in a semispherical or arcuate shape. The plate-shaped guides 22a, 22b may each be composed of a plurality of plates each having a strip-shaped leading end portion, rather than a one-piece plate having the notches 27a, 27b. The transport cylinder is not limited to the impression cylinder, and may be a blanket cylinder having a means for holding a sheet, such as a gripper device. The means for holding the sheet is not limited to the gripper, and may be a suction-attracting pad.

[0051] The sheet guide apparatus according to the present invention can be applied even to a sheet which is not a printing sheet, but a film, and can also be applied to a coater for coating the sheet.

[Reference Signs List]

[0052]

1 Bed

2 Frame
3a, 3b Impression cylinder
4 Transfer cylinder
5 Gripper device (paper gripping device)
6 Blanket cylinder
7A First guide device
7B Second guide device
8a, 8b Air discharge duct
10a, 10b Stay
11a, 11b Holder
12a, 12b Block
13a, 13b Bar
14 Bolt
15a, 15b Guide plate
16 Air jet hole
17a, 17b Piping
18 Collecting piping
19 Blower pump
20a, 20b Subframe
21a, 21b Bar
22a, 22b Plate-shaped resinous guide
27a, 27b Notch
30a, 30b L-shaped bracket
31 Air discharge duct
31a Discharge hole
32 Air discharge pipe
33 Discharge nozzle
34a, 34b Piping
35 Blower pump
36 Valve
40 Control device
41 Sheet thickness input unit
42 Displacement gauge
43 Pump drive motor
P1, P2 Transfer position of printing sheet
S Movement trajectory of gripper device
Wa Thin sheet
Wb Thick sheet

Claims

1. A sheet guide apparatus including
a transport cylinder (3b) having holding means (5) for holding a sheet (Wa, Wb) and adapted to transport the sheet, and
air blowing means (31, 33) for blowing air on the sheet being transported by the transport cylinder,
the sheet guide apparatus, comprising:

detection means (42) for detecting a distance to the sheet being transported by the transport cylinder; and
control means (40) for controlling the air blowing means, based on detection results of the detection means, such that the distance between the sheet and the detection means becomes a distance which prevents an unstable motion of the sheet.

2. The sheet guide apparatus according to claim 1, **characterized in that**
the control means (40) controls the air blowing means to adjust a flow rate of discharged air so that the distance between the sheet and the detection means becomes a set distance.

3. The sheet guide apparatus according to claim 1, **characterized in that**
the distance which prevents the unstable motion of the sheet differs according to whether the sheet is a thin sheet (Wa) or a thick sheet (Wb).

4. The sheet guide apparatus according to claim 3, **characterized in that**
the distance, which prevents the unstable motion of the thick sheet when the sheet is the thick sheet, is shorter than the distance which prevents the unstable motion of the thin sheet when the sheet is the thin sheet.

5. The sheet guide apparatus according to claim 1, **characterized in that**
the detection means (42) is provided on a downstream side in a sheet transport direction with respect to the air blowing means (31, 33) and on an upstream side in the sheet transport direction with respect to a cylinder (6) in contact with the transport cylinder.

6. The sheet guide apparatus according to claim 1, **characterized in that**
the detection means (42) is provided at a position opposing a surface of the sheet (Wa, Wb).

7. The sheet guide apparatus according to claim 1, further comprising
a sheet thickness input unit (41) for inputting a thickness of the sheet (Wa, Wb), and wherein
the control means (40) judges the sheet as a thin sheet when the thickness of the sheet inputted by the sheet thickness input unit is less than a given value, and judges the sheet as a thick sheet when the thickness of the sheet inputted by the sheet thickness input unit is the given value or higher.

8. The sheet guide apparatus according to claim 1, further comprising
a sheet thickness input unit (41) for inputting a thickness of the sheet (Wa, Wb), and wherein
the control means (40) judges the sheet as a thin sheet when the thickness of the sheet inputted by the sheet thickness input unit is a given value or lower, and judges the sheet as a thick sheet when the thickness of the sheet inputted by the sheet thickness input unit exceeds the given value.

9. The sheet guide apparatus according to claim 1, **characterized in that**
the air blowing means includes an air discharge duct (31) having discharge holes (31a), and discharge nozzles (33), and
the control means (40) exercises control such that air is discharged from the discharge holes of the air discharge duct and the discharge nozzles when the sheet is a thick sheet (Wb), and exercises control such that air is discharged only from the discharge holes of the air discharge duct when the sheet is a thin sheet (Wa) .

10. The sheet guide apparatus according to claim 1, **characterized in that**
the distance which prevents the unstable motion of the sheet when the sheet is a thick sheet (Wb) is a distance from a position between a sheet motion instability position and an improper position to the detection means,
the sheet motion instability position being a position at which the sheet is excessively separated from the transport cylinder (3b), and
the improper position being a position at which the sheet is excessively close to the transport cylinder (3b).

11. The sheet guide apparatus according to claim 1, **characterized in that**
the detection means is a displacement gauge (42).

Fig.1

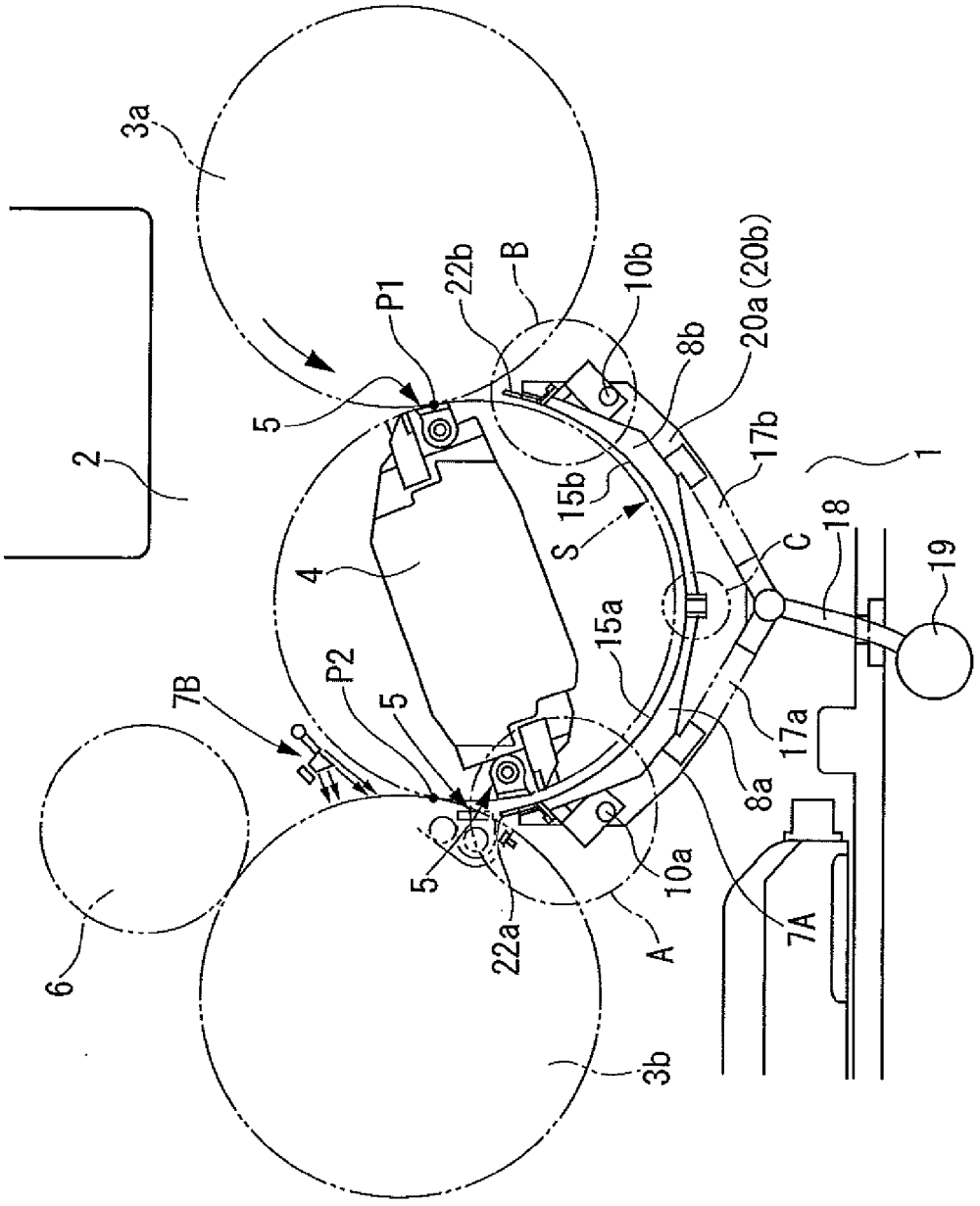

3a
2
5
P1
22b
B
10b
8b
20a (20b)
17b
1
15b
S
C
18
19
4
15a
P2
7B
5
17a
8a
10a
5
22a
A
7A
6
3b

Fig. 2

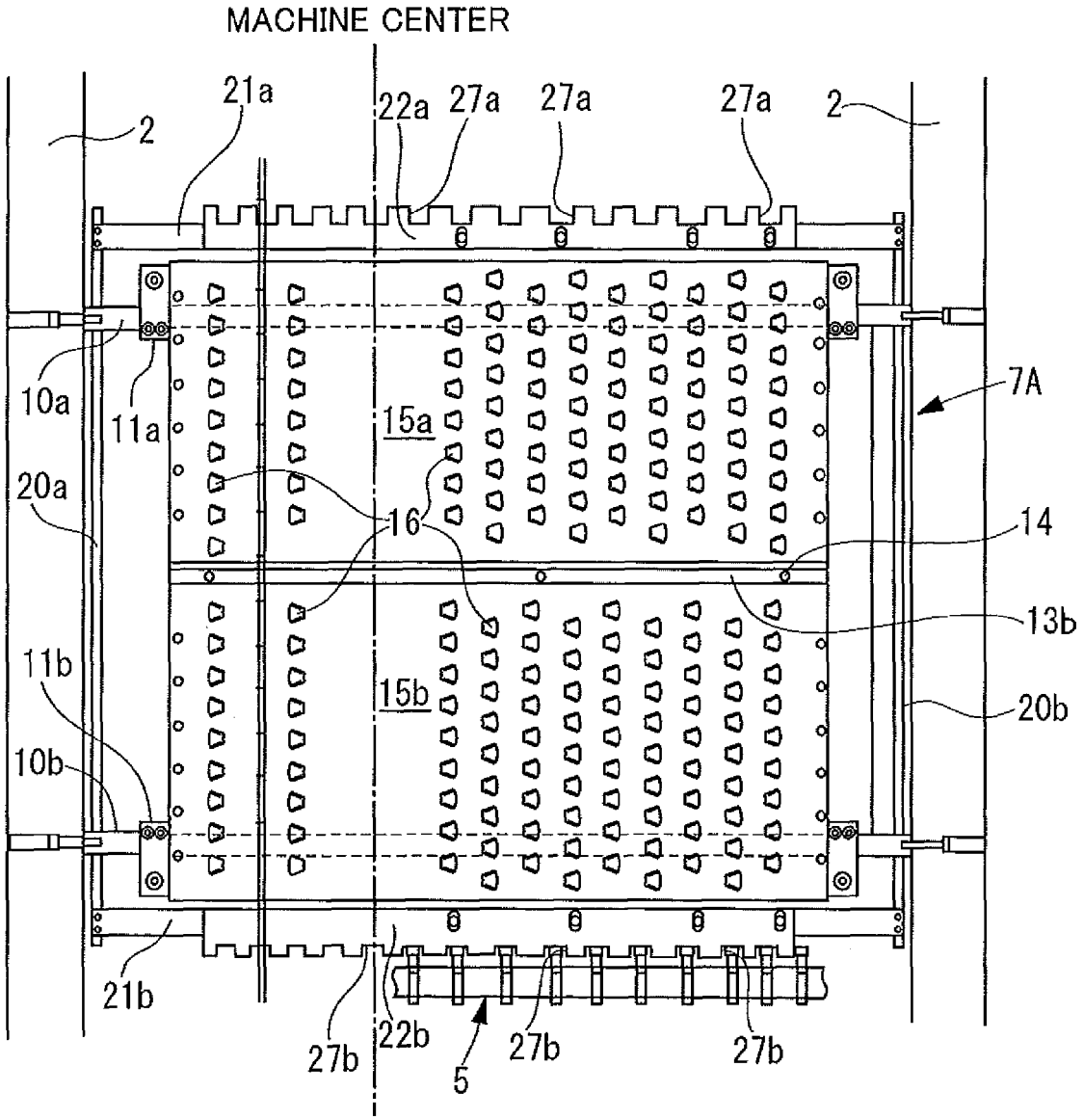

MACHINE CENTER
21a
22a
27a
27a
27a
2
2
10a
11a
15a
7A
20a
16
14
13b
11b
15b
20b
10b
21b
27b
22b
5
27b
27b

Fig. 3

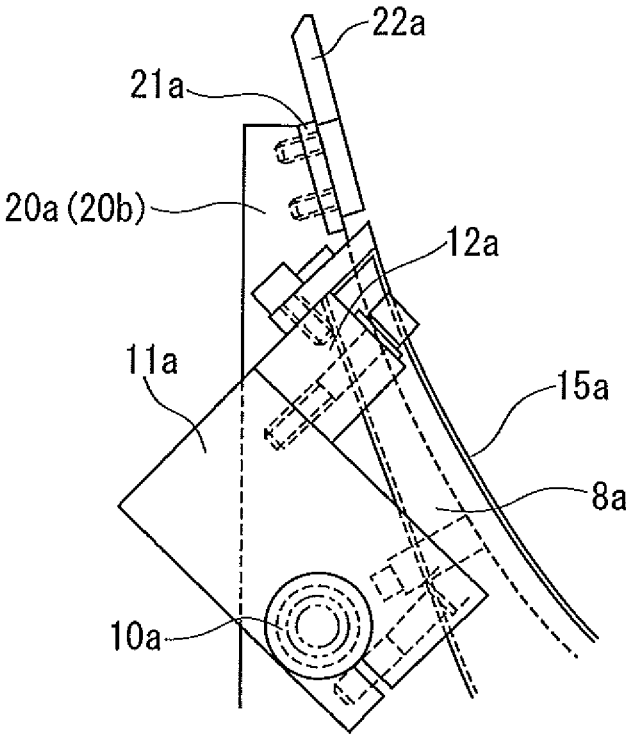


Fig. 4

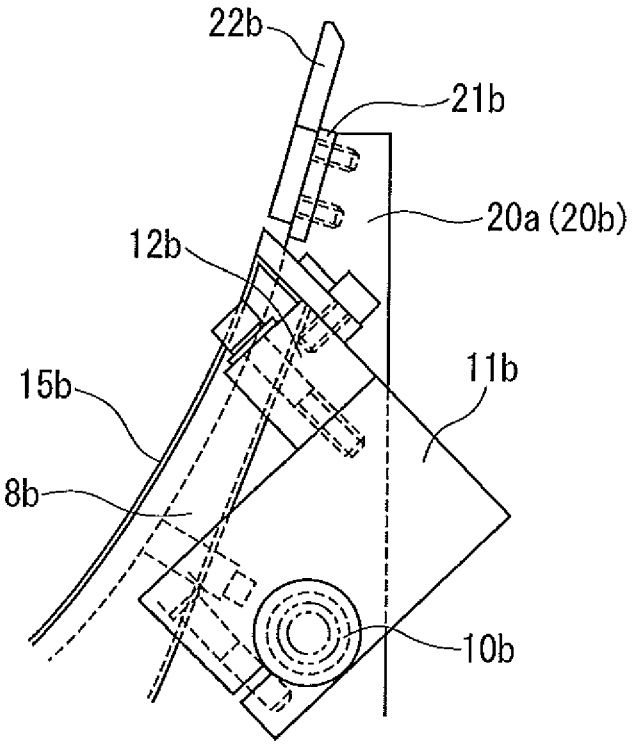


Fig. 5

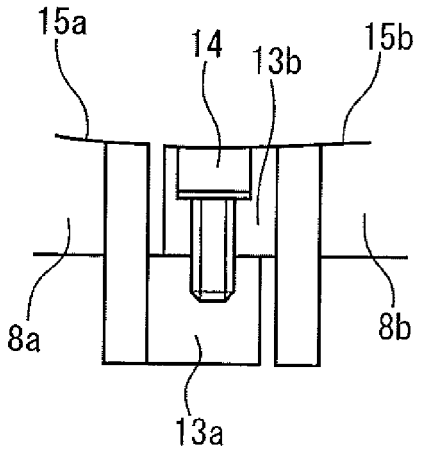


Fig. 6

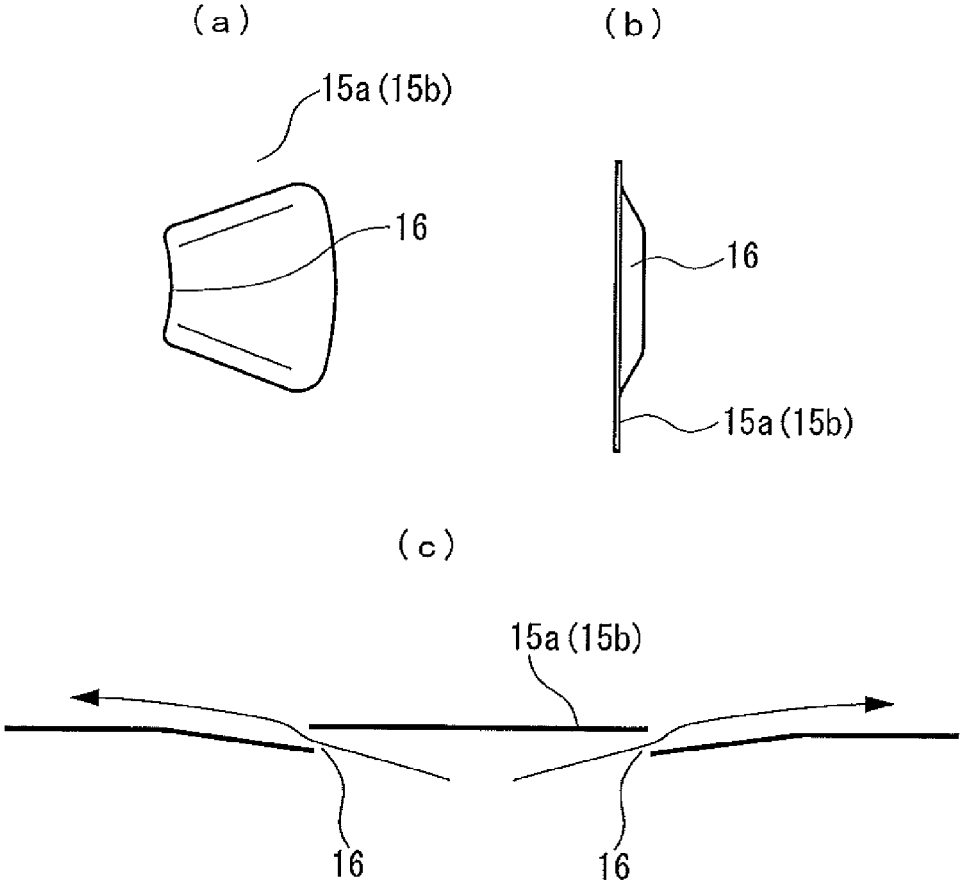


Fig. 7

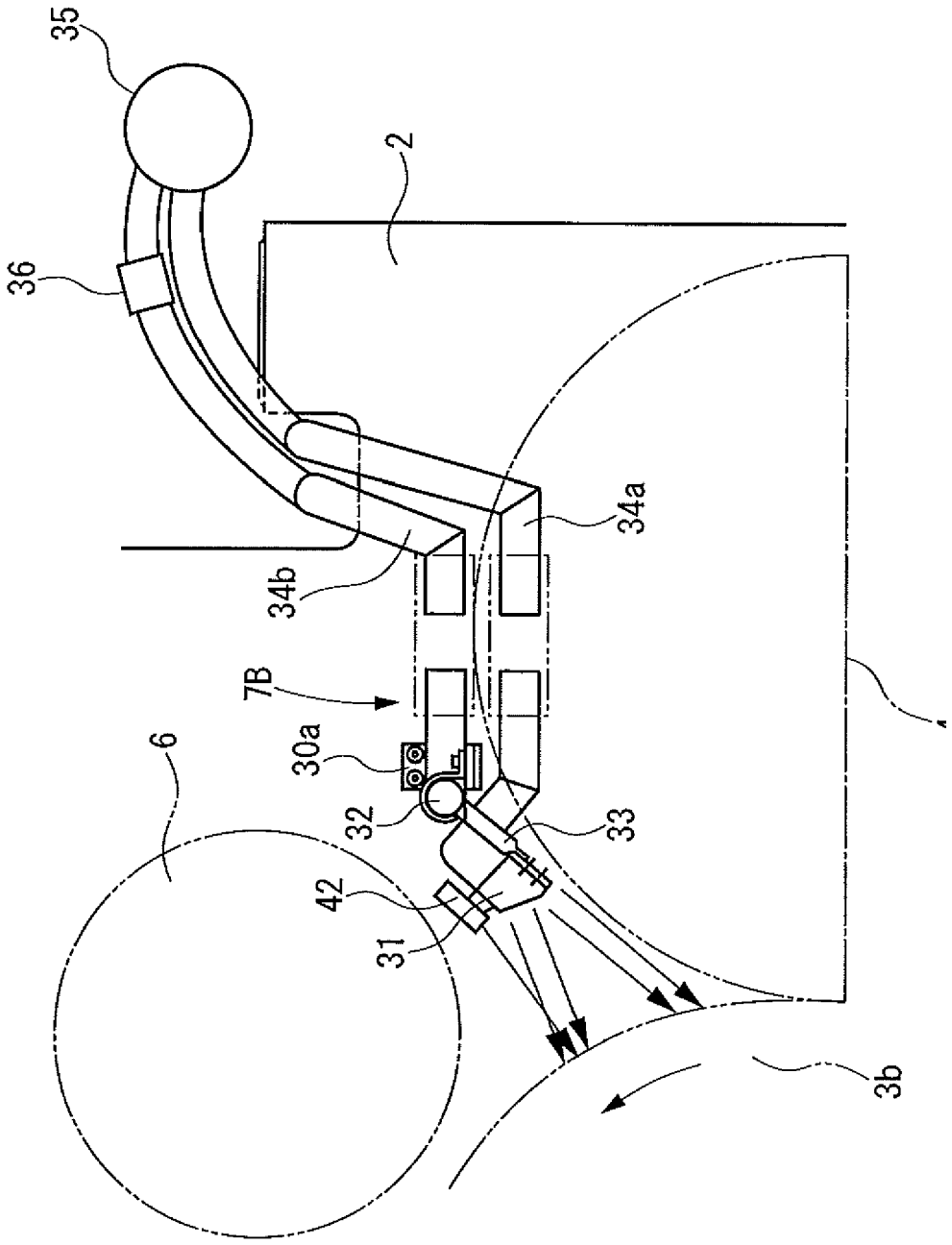


Fig. 8

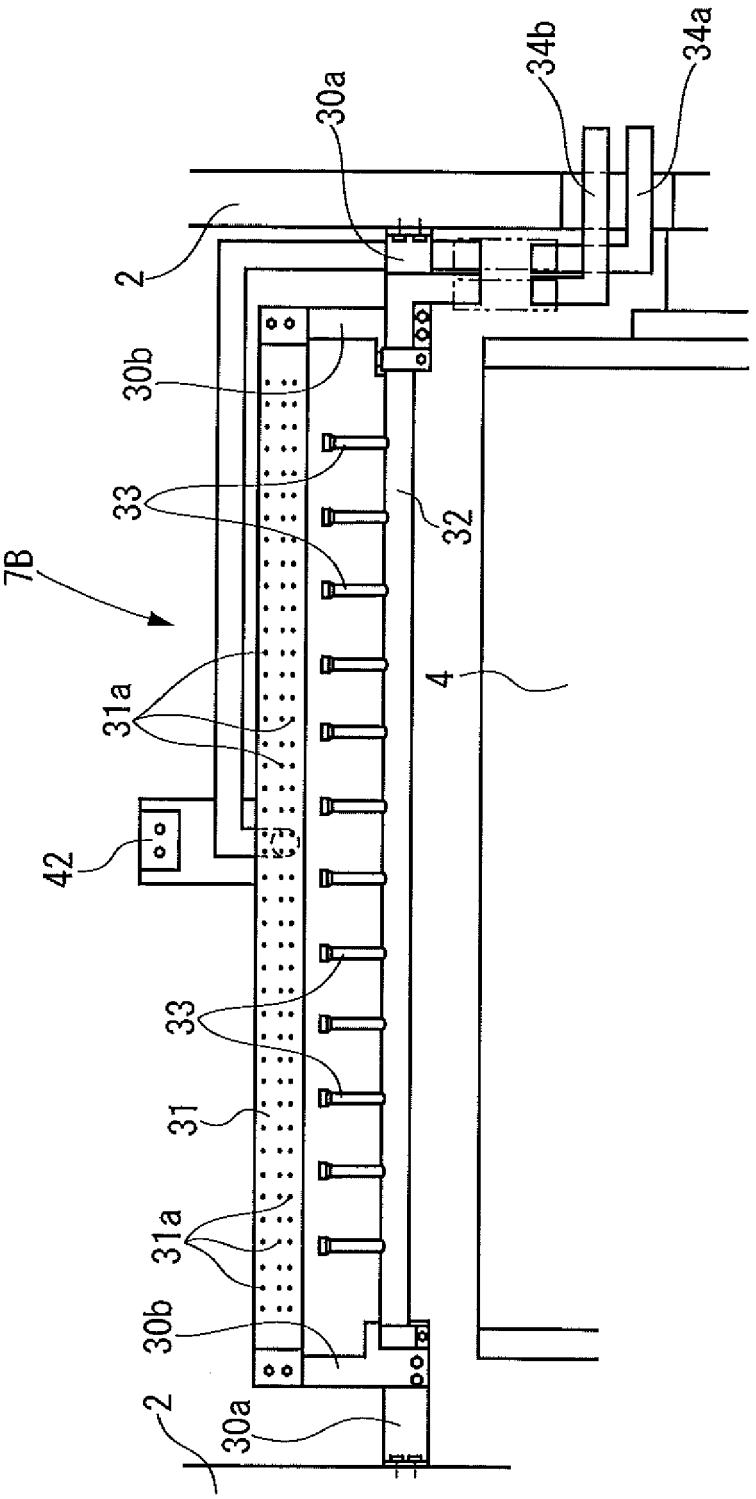


Fig. 9

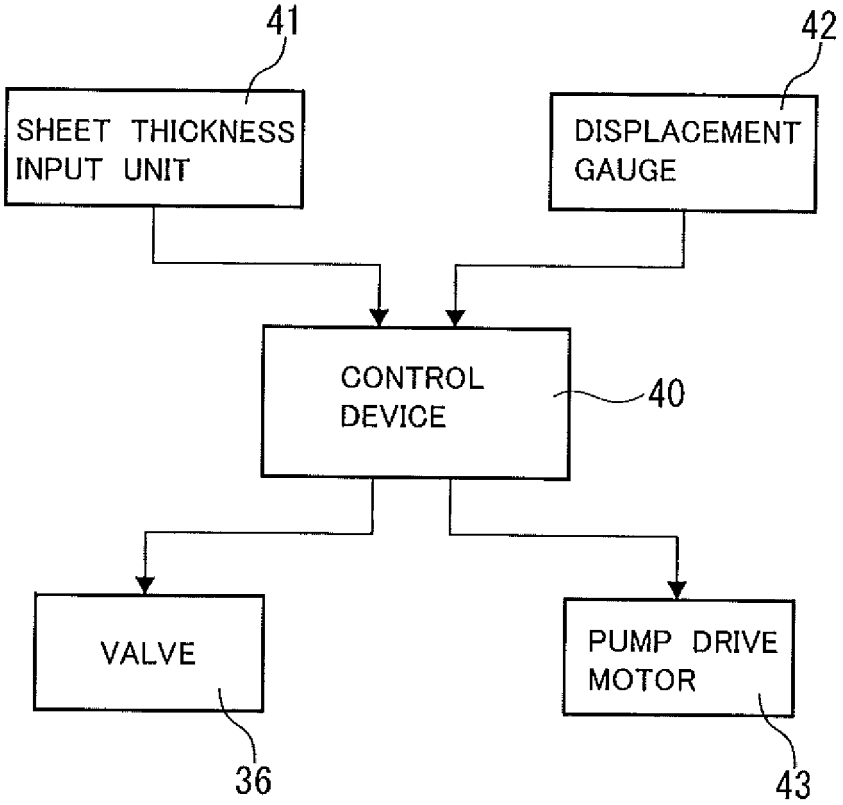

41
SHEET THICKNESS INPUT UNIT
42
DISPLACEMENT GAUGE
CONTROL DEVICE
40
VALVE
36
PUMP DRIVE MOTOR
43

Fig. 10

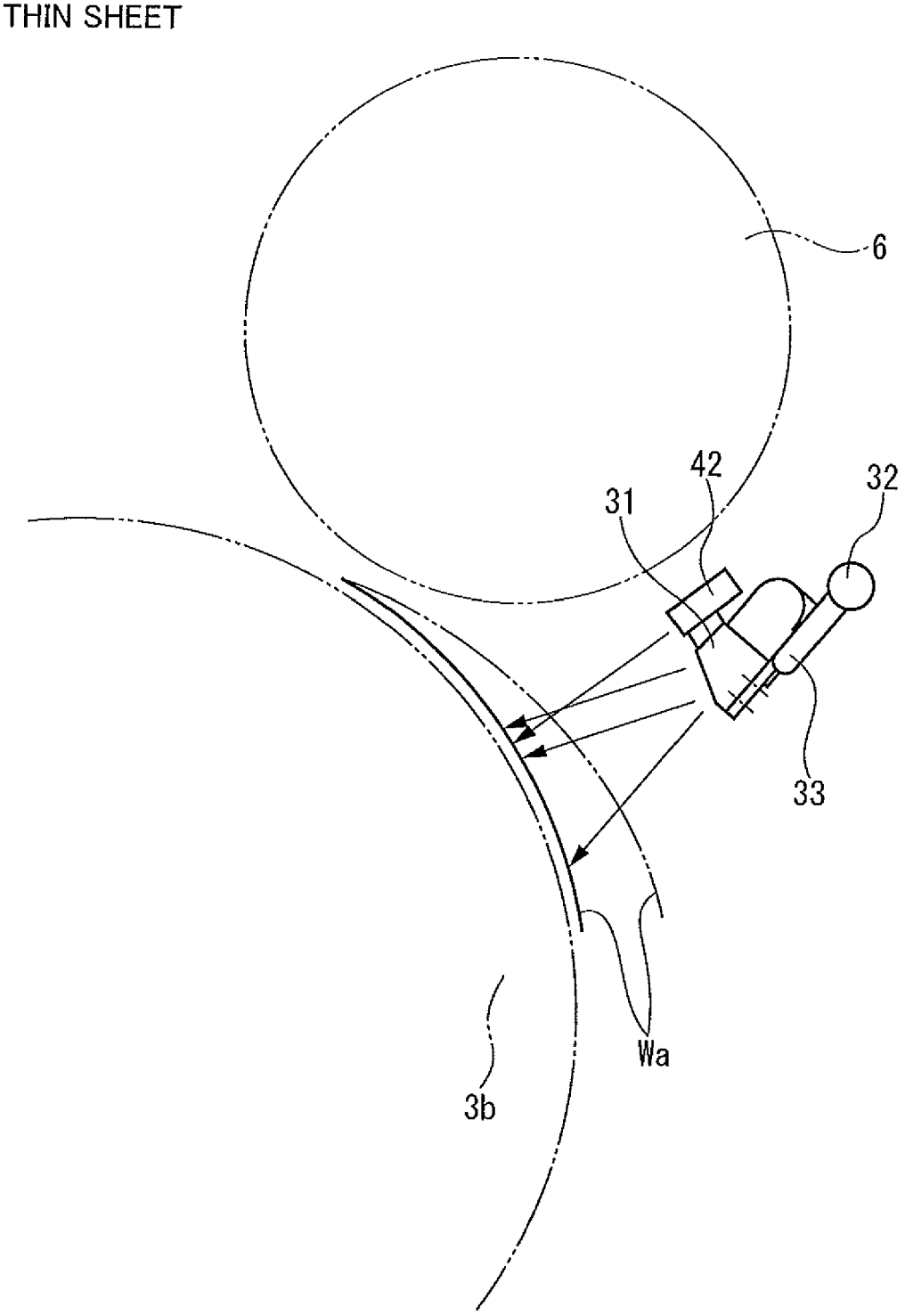


Fig. 11

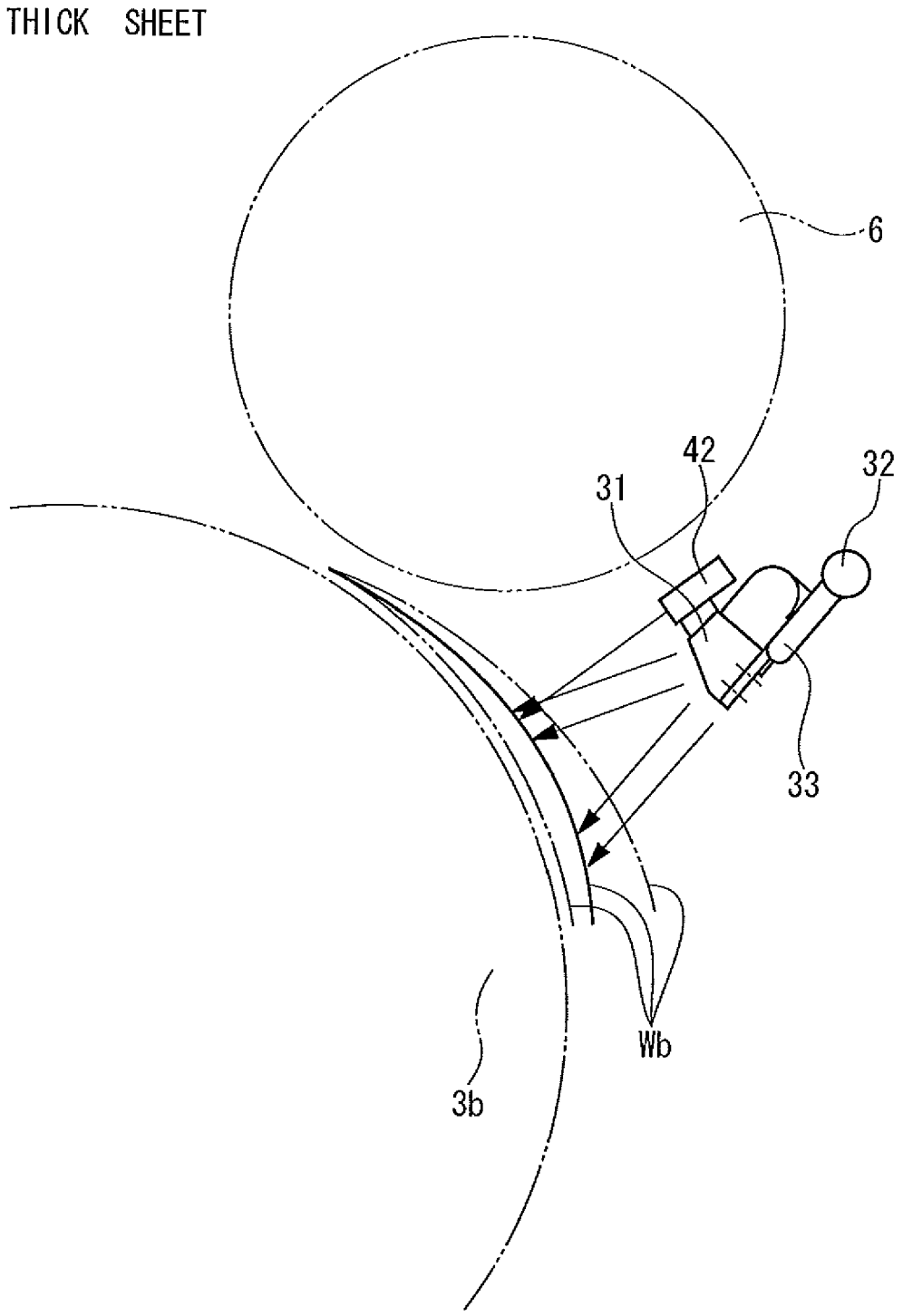
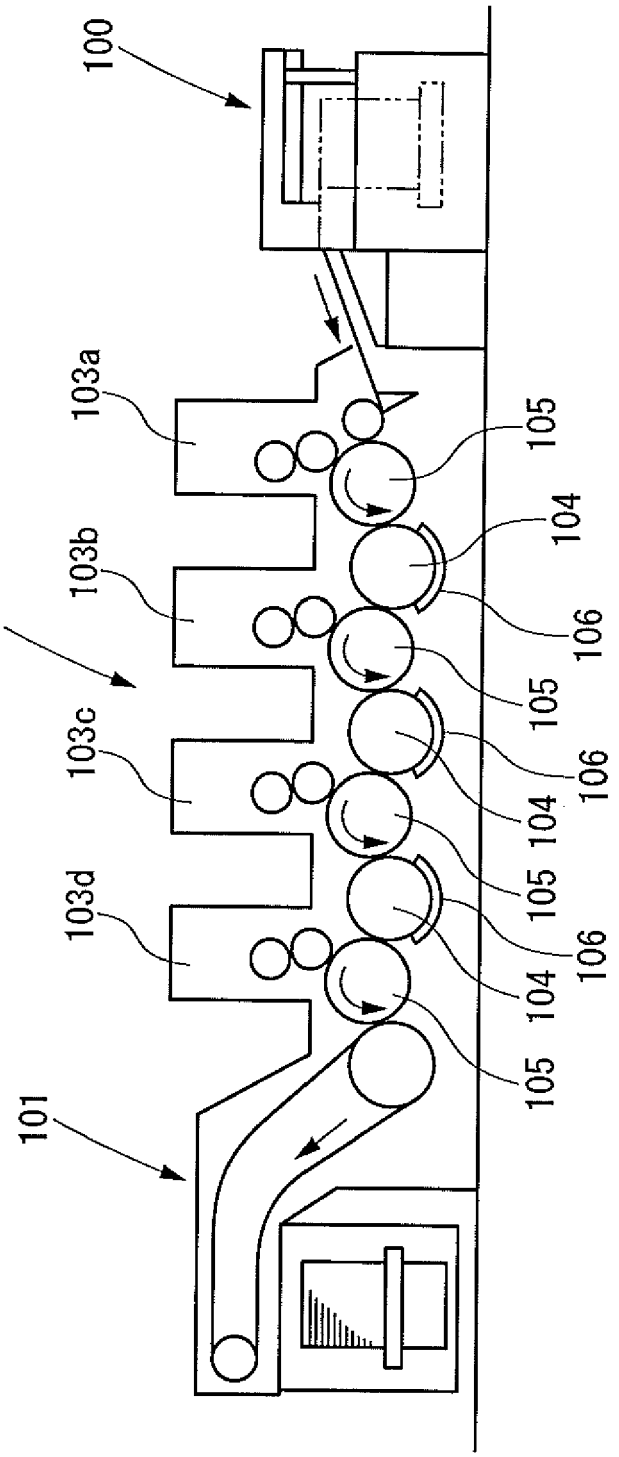


Fig. 12
Prior Art



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EUROPEAN SEARCH REPORT

Application Number
EP 10 15 4974

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2007/006754 A1 (ECKART THORSTEN [DE] ET AL ECKART THORSTEN [DE] ET AL) 11 January 2007 (2007-01-11) * paragraphs [0008], [0015], [0016], [0023] - [0030]; figures 1-6 *	1-11	INV. B41F21/00 B41F21/10
A	EP 1 352 738 A2 (KOMORI PRINTING MACH [JP]) 15 October 2003 (2003-10-15) * paragraphs [0022] - [0043]; figures 1-10 *	1-11	
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TECHNICAL FIELDS SEARCHED (IPC)

B41F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	1 June 2010	Findeli, Bernard

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