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

(11) **EP 2 692 674 A2**

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
05.02.2014 Bulletin 2014/06

(51) Int Cl.:
B65H 29/04 *(2006.01)*

(21) Application number: **13003814.4**

(22) Date of filing: **31.07.2013**

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

(30) Priority: **03.08.2012 JP 2012172764**

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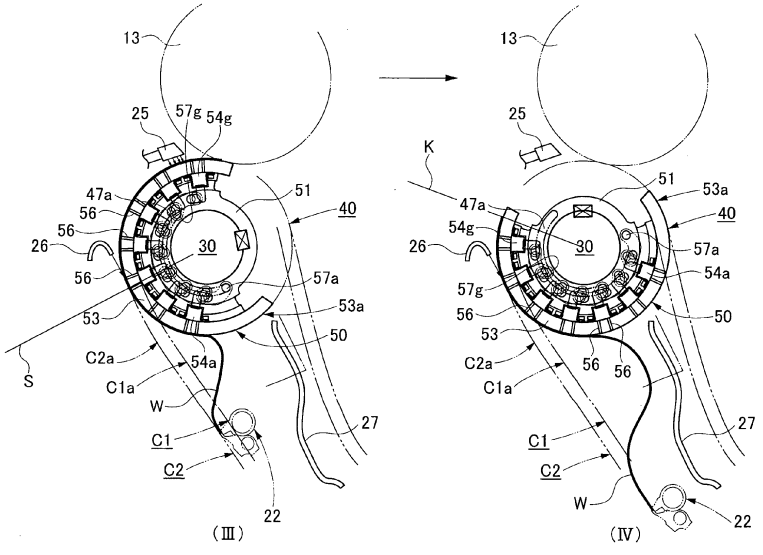
(54) Sheet guiding device and sheet processing apparatus including the sheet guiding device

(57) A sheet guiding device includes: gripper bars 22 provided to delivery chains 20 and each having a holding portion configured to hold an end portion of a paper sheet W, the gripper bars 22 configured to transport the paper sheet W along a paper sheet transporting route C2 spaced away from a travelling route C 1 of the delivery chains 20; a delivery cylinder 21 having a guide surface 53a and configured to guide the transported paper sheet W, the guide surface extending along an arc-shaped transporting route portion C2b in the paper sheet transporting route C2 which is located outside an arc-shaped travelling route portion C1b in the travelling route C1 of the delivery chains 20 which is formed by the holding portion travelling along the arc-shaped travelling route portion C1b; a linear travelling route portion C1a formed downstream of the arc-shaped travelling route portion C1b in a travelling direction of the delivery chains 20; and a suction guide 40 for guiding the paper sheet W to an inner side than the linear travelling route portion Cla, the paper sheet W located in a region downstream of a shift position S from the arc-shaped travelling route portion C1b to the linear travelling route portion C1a in a sheet transporting direction.

Fig.6B



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Description

[Technical Field]

[0001] The present invention relates to a guiding device for a sheet which is transported while being held by a sheet holding device provided to a transporting chain and to a sheet processing apparatus including the sheet guiding device.

[Background Art]

[0002] Patent Literature 1, for example, discloses one of such guiding devices. In this guiding device, a sheet guide is provided to guide a sheet which is transported while being held by a gripper bar provided in a transporting chain.

[0003] However, the guiding device has the following defect. Since the sheet guide is provided outside a transporting route of the sheet, an outer surface of the sheet comes in contact with the sheet guide. Hence, it is impossible to perform processing on the sheet transported by the gripping bar, such as checking the outer surface of the sheet with a checking device and printing the outer surface of the sheet.

[0004] Meanwhile, Patent Literature 2 describes an apparatus in which a guiding device guides an inner surface of a sheet transported by a transporting chain along an arc shaped trajectory and a checking device checks an outer surface of the sheet.

[Citation List]

[Patent Literatures]

[0005]

[Patent Literature 1] Japanese Utility Model Registration No. 2576838
[Patent Literature 2] Japanese Patent Application Publication No. 2010-221410

[Summary of Invention]

[Technical Problem]

[0006] In a normal configuration, there is a certain distance (gap) between a travelling route of the transporting chain and the sheet transporting route by the gripper bar, as in Patent Literature 1. In a linear travelling route portion of the travelling route of the transporting chain, the travelling speed of the transporting chain and the transporting speed of the sheet are the same. However, in an arc-shaped travelling route portion of the travelling route of the transporting chain, the travelling speed of the transporting chain and the transporting speed of the sheet are different from each other due to a difference between the curvature radius of the arc-shaped travelling route portion of the transporting chain and the curvature radius of an arc-shaped transporting route portion of the sheet.

[0007] Particularly, when the arc-shaped transporting route portion of the sheet is located outside the arc-shaped travelling route portion of the transporting chain as in Patent Literature 1, the transporting speed of the sheet in the arc-shaped transporting route portion of the sheet is faster than the travelling speed of the transporting chain. Moreover, in a case where the linear transporting route portion follows the arc-shaped transporting route portion of the sheet, the leading end of the sheet is transported at the same speed as the transporting chain while the trailing end of the sheet is transported at a faster speed than the transporting chain.

[0008] The faster speed of the trailing end of the sheet as described above makes the sheet loose. In a case where the guiding device (sheet guide) is provided inside the transporting route of the sheet as in Patent Literature 2, the looseness of the sheet causes the sheet to flutter, and thereby the sheet may be damaged or rubbed. Moreover, the fluttering of the sheet also makes the sheet on the sheet guide unstable and accurate check with the checking device (camera) may be hindered.

[0009] In view of this, an object of the present invention is to provide a sheet guiding device capable of stably transporting a sheet at a shift position from an arc-shaped travelling route portion to a linear travelling route portion of the transporting chain, and to provide a sheet processing apparatus including the sheet guiding device.

[Solution to Problem]

[0010] To achieve the object described above, the present invention provides a sheet guiding device including:

a sheet holding device provided to a transporting chain, and having a holding portion configured to hold an end portion of a sheet, the sheet holding device configured to transport the sheet along a sheet transporting route formed by the holding portion and spaced away from a travelling route of the transporting chain; and
a guide having a guide surface and configured to guide the transported sheet, the guide surface extending along an arc-shaped transporting route portion in the sheet transporting route which is located outside an arc-shaped travelling route portion in the travelling route of the transporting chain and which is formed by the holding portion travelling along the arc-shaped travelling route portion, **characterized in that**
the sheet guiding device comprises:

a linear travelling route portion formed downstream of the arc-shaped travelling route portion in a travelling direction of the transporting chain; and

guiding means for guiding the sheet to an inner side than the linear travelling route portion, the sheet located in a region downstream of a shift position from the arc-shaped travelling route portion to the linear travelling route portion in a sheet transporting direction.

[0011] Moreover, the sheet guiding device is **characterized in that**
the guiding means includes sheet contact means which brings the sheet in contact with the guide surface of the guide which is located on an inner side than the linear travelling route portion, the sheet located in the region downstream of the shift position from the arc-shaped travelling route portion to the linear travelling route portion in the sheet transporting direction.

[0012] Furthermore, the sheet guiding device is **characterized in that** the guide surface of the guide is formed in an arc shape and is a rotating body configured to rotate at a circumferential speed substantially equal to a transporting speed of the sheet transported by the holding portion in the sheet holding device travelling along the arc-shaped transporting route portion.

[0013] Moreover, the sheet guiding device is **characterized in that** the sheet contact means includes sucking means for sucking the sheet in a region of the arc-shaped guide surface downstream of the shift position in the sheet transporting direction.

[0014] Furthermore, the sheet guiding device is **characterized in that** the sucking means sucks the sheet also in a region upstream of the shift position in the paper-sheet transporting direction.

[0015] Moreover, the sheet guiding device is **characterized in that** the sheet contact means includes air blowing means for blowing air to the sheet.

[0016] To achieve the object described above, the present invention provides a sheet processing apparatus including the sheet guiding device, **characterized in that** the sheet processing apparatus comprises a processing device configured to perform processing on the sheet on the guide surface of the guide extending along the arc-shaped transporting route portion.

[Advantageous Effects of Invention]

[0017] In the sheet guiding device of the present invention, a loose portion of the sheet is smoothly guided by the guiding means without fluttering, the loose portion formed due to the speed difference in sheet transporting at the shift position from the arc-shaped travelling route portion to the linear travelling route portion of the travelling route of the transport chain. Accordingly, the sheet can be stably transported.

[0018] In the sheet processing apparatus of the present invention, the sheet can be highly accurately processed while being stably transported.

[Brief Description of Drawings]

[0019]

[Fig. 1] Fig. 1 shows an embodiment of the present invention and is a plan cross-sectional view of a delivery cylinder portion.
[Fig. 2] Fig. 2 is an enlarged cross-sectional view of a main portion of Fig. 1.
[Fig. 3] Fig. 3 is a view in the direction of the arrow III of Fig. 1.
[Fig. 4] Fig. 4 is a view in the direction of the arrow IV of Fig. 1.
[Fig. 5] Fig. 5 is an enlarged side view of a main portion of a four-color offset perfector.
[Fig. 6A] Fig. 6A is a view for explaining an operation of a suction guide.
[Fig. 6B]Fig. 6B is another view for explaining the operation of the suction guide.

[Description of Embodiment]

[0020] A sheet guiding device of the present invention and a sheet processing apparatus including the sheet guiding device are described below in detail by using an embodiment and the drawings.

[Embodiment]

[0021] Fig. 1 shows an embodiment of the present invention and is a plan cross-sectional view of a delivery cylinder portion, Fig. 2 is an enlarged cross-sectional view of a main portion of Fig. 1, Fig. 3 is a view in the direction of the arrow III of Fig. 1, Fig. 4 is a view in the direction of the arrow IV of Fig. 1, Fig. 5 is an enlarged side view of a main portion of a four-color offset perfector, Fig. 6A is a view for explaining an operation of a suction guide, and Fig. 6B is another view for explaining the operation of the suction guide.

[0022] As shown in Fig. 5, in a printing unit 1 of the four-color offset perfector, a blanket impression cylinder 2 including a paper-sheet gripping device (not illustrated) and a blanket cylinder 3 including no paper-sheet gripping device are substantially-horizontally supported, and circumferential surfaces of the cylinders come in contact with each other. Moreover, the blanket cylinder 3 is in contact with the blanket impression cylinder 2 while being disposed lateral to the blanket impression cylinder 2, and the blanket impression cylinder 2 and the blanket cylinder 3 are arranged respectively on a delivery unit (not illustrated) side and a feeding unit (not illustrated) side.

[0023] Furthermore, four plate cylinders 4 are disposed on the circumferential surface of the blanket impression cylinder 2 while four plate cylinders 5 are disposed on the circumferential surface of the blanket cylinder 3. Inking units 6 and 7 are provided to be movable toward and away from the plate cylinders 4 and 5, and can supply inks and water in a state in contact with the

plate cylinders 4 and 5.

[0024] Moreover, four transfer cylinders 9 to 12 including paper-sheet gripping devices (not illustrated) and configured to receive the paper sheet (sheet) W (see Figs. 6A and 6B) from a register 8 and transfer the paper sheet W to the blanket impression cylinder 2 are arranged above the blanket impression cylinder 2, that is upstream of a printing position P1 in a rotating direction of the blanket impression cylinder 2, the printing position P1 being a contact position between the blanket impression cylinder 2 and the blanket cylinder 3. In addition, a transfer cylinder 13 including a paper-sheet gripping device and configured to receive the paper sheet W from the blanket impression cylinder 2 and transfer the paper sheet W to delivery chains (transporting chain) 20 is provided below the blanket impression cylinder 2, that is downstream of the printing position P1 in the rotating direction of the blanket impression cylinder 2.

[0025] The paper sheet W is supplied from the feeding unit to the register 8 via a feeder board 14. Moreover, the paper sheet W is transported from the transfer cylinder 13 onto a delivery pile (not illustrated) of the delivery unit via the delivery chains 20 including gripper bars (sheet holding device) 22 (see Fig. 2 and other drawings). Specifically, a delivery cylinder 21 on an upstream side of the delivery chains 20 in a paper-sheet transporting direction is in contact with a lower side of the transfer cylinder 13, and receives the paper sheet W from the transfer cylinder 13.

[0026] The delivery chains 20 are arranged in the following way. The delivery cylinder 21 on the upstream side thereof is arranged below the blanket impression cylinder 2 and the delivery chains 20 extend along a floor to the delivery unit side of the delivery cylinder 21, on the right side of the drawing, without traversing a space below the contact position between the blanket impression cylinder 2 and the blanket cylinder 3.

[0027] In the illustrated example, the blanket impression cylinder 2 and the blanket cylinder 3 are triple-size cylinders while the four transfer cylinders 9 to 12, the four plate cylinders 4, the four plate cylinders 5, the transfer cylinder 13, and the delivery cylinder 21 are single-size cylinders.

[0028] Moreover, a checking camera (processing device) 23 configured to detect a printing condition on one surface of the paper sheet W on the delivery cylinder 21 is located on the feeding unit side of the delivery cylinder 21 together with paired illuminators 24 and is arranged in an oblique downward direction in such a way that its axis is directed toward the delivery cylinder 21, the paper sheet W transported by being transferred from the paper-sheet gripping device of the transfer cylinder 13 to the gripper bar 22 of the delivery chains 20. Note that an optical-electronic imaging device such as a CCD line camera and a CCD line sensor is used as the checking camera 23.

[0029] Furthermore, a first air blowing nozzle (air blowing means: sheet contact means: guiding means) 25 is disposed upstream of, and close to, the paired illuminators 24 in the paper-sheet transporting direction while a second air blowing nozzle (air blowing means: sheet contact means: guiding means) 26 is disposed downstream of, and close to, the paired illuminators 24 in the paper-sheet transporting direction. Reference numeral 27 in Fig. 5 denotes a paper-sheet guide for guiding the paper sheet W which has just moved from a position on the delivery cylinder 21 to a position on the delivery chains 20.

[0030] The first air blowing nozzle 25 blows compressed air sent from a not-illustrated compressed air supply source such as a compressor, to a circumferential surface (guide surface) of the delivery cylinder 21. Meanwhile, the second air blowing nozzle 26 blows the compressed air sent from the not-illustrated compressed air supply source such as a compressor, along a linear travelling route portion C1a (see Fig. 3) in a travelling route (trajectory of the delivery chains: travelling route of the transporting chain) C1 of the delivery chains 20.

[0031] The checking camera 23, the paired illuminators 24, the first air blowing nozzle 25, the second air blowing nozzle 26, and the paper-sheet guide 27 are supported by paired left and right main unit frames 28 via a not-illustrated supporting bar.

[0032] As shown in Figs. 1 and 2, in the delivery cylinder 21, left and right end portions of a shaft 30 are rotatably supported respectively by the paired left and right main unit frames 28 via bearings 31 and a rotating force of a not-illustrated drive motor is transmitted, via a gear train, to a gear 32 fixedly provided at a shaft end on the drive side, in such a way that the shaft 30 is rotationally driven.

[0033] Moreover, sprockets 34 are fixedly provided in both end portions of the shaft 30 via keys 35 to be located in the main body frames 28 and the delivery chains 20 described above are wound around the sprockets 34 and paired left and right sprockets provided on a terminal end side of the not-illustrated delivery unit. Multiple gripper bars 22 described above are laid between the paired left and right delivery chains 20 at predetermined intervals in a chain longitudinal direction. Reference numeral 36 in Fig. 1 denotes a chain guide.

[0034] Furthermore, in the embodiment, a suction guide (sucking means: sheet contact means: guiding means) 40 is provided on a portion of the shaft 30 located between the paired left and right sprockets 34.

[0035] Specifically, as shown also in Figs. 3 and 4, four supporting legs 41 are implanted in an inner surface of each of the paired left and right main unit frames 28 and a base end portion 42b of a supporting plate 42 is joined to the supporting legs 41 by bolts 43 with a half-circular arc portion 42a surrounding substantially a half of a circumference of the shaft 30 with a gap therebetween.

[0036] A base end portion 44b of a suction duct 44 is joined to an inner surface of each of the supporting plates 42 by two reamer bolts 45 with a half-circular arc portion 44a surrounding substantially the half of the circumfer-

ence of the shaft 30 with a minor gap therebetween. Thereby the suction duct 44 is attached to be movable relative to the supporting plate 42 in a cylinder axial direction. In other words, a gap H (see Fig. 2) for play is set between a head of each reamer bolt 45 and a stepped surface of the suction duct 44 in which a shaft of the reamer bolt 45 is inserted. Moreover, compression coil springs 46 are installed in four positions between opposed surfaces of each supporting plate 42 and the corresponding suction duct 44 through respective spring receiving holes 42c, 44c. Accordingly, the suction duct 44 is constantly biased in a direction away from the supporting plate 42 and a side surface of the suction duct 44 is pressed against a side surface of a corresponding one of ring-shaped end plates 51 in a suction cylinder (rotating body) 50 to be described later.

[0037] A suction open groove 47a is formed in the inner surface of the half-circular arc portion 44a of each suction duct 44 to extend along the shape of the half-circular arc portion 44a substantially over the entire length thereof. The suction open groove 47a communicates with a communication hole 47b formed inside the base end portion 44b. The communication hole 47b is connected to a suction hose 49 via a joint 48 to communicate with a not-illustrated negative pressure source such as a vacuum pump.

[0038] The left and right end plates 51 forming the suction cylinder 50 are fixedly provided on the shaft 30 via keys 52 at positions adjacent to the suction ducts 44. An arc-shaped guide plate (guide) 53 having a length of substantially 3/4 of the circumference of an imaginary circle in a side view, i.e. having a length long enough to place a maximum-length sheet to be transported, stretches between the left and right end plates 51. The guide plate 53 has an arc-shaped guide surface 53a extending along an arc-shaped transporting route portion C2b in a transporting route (transporting route of the sheet) C2 of the paper sheet W (to be exact, a trajectory of a holding portion of the paper sheet W which includes a gripper 22a and a gripper pad 22b of each gripper bar 22), the arc-shaped transporting route portion C2b formed outside an arc-shaped travelling route portion C1b in the travelling route C1 by the travelling of the aforementioned delivery chains 20 along the arc-shaped travelling route portion C1b (see Fig. 3).

[0039] Multiple (seven in the illustrated example) elongated negative pressure boxes 54a to 54g each having a length equal to the length of the guide plate 53 in the cylinder axial direction are arranged on a back surface of the guide plate 53 at equal intervals in the circumferential direction. In each of the negative pressure boxes 54a to 54g, suction holes 56 are formed in the guide plate 53 in two rows in the circumferential direction and many in the cylinder axial direction to communicate with the corresponding negative pressure box.

[0040] Multiple (seven in the illustrated example to correspond to the number of the negative pressure boxes 54) communication holes 57a to 57g are formed in each of the left and right end plates 51 at equal intervals in the circumferential direction. Two, i.e., left-side and right-side portions of each of the negative pressure boxes 54a to 54g are connected to corresponding two of suction hoses 59a to 59g. Thus, the negative pressure boxes 54a to 54g always communicate with inner-surface-side opening portions of the communication holes 57a to 57g through joints 58a to 58g and the suction hoses 59a to 59g.

[0041] Meanwhile, outer-surface-side opening portions of the communication holes 57a to 57g in each of the left and right end plates 51 are sequentially made to communicate with the aforementioned suction open groove 47a of the corresponding suction duct 44 and are then sequentially isolated from the suction open groove 47a at predetermined timings by the rotation of the left and right end plates 51 (i.e. the suction cylinder 50).

[0042] Due to this configuration, each of the paper sheets W supplied from the feeding unit and positioned by the register 8 is transported along a route shown by the arrows in the drawings, specifically along the circumferential surfaces of the transfer cylinders 9 to 12, the blanket impression cylinder 2, the transfer cylinder 13, and the delivery cylinder 21 in this order, and is subjected to printing simultaneously on both surfaces upon passing through the printing position P1 between the blanket impression cylinder 2 and the blanket cylinder 3 from above to below.

[0043] The paper sheets W having been subjected to printing are transported one by one to the delivery unit by the delivery chains 20 and are piled on a predetermined delivery pile in the delivery unit.

[0044] Moreover, in the embodiment, the printing condition on one surface of the paper sheet W transferred from the paper-sheet gripping device of the transfer cylinder 13 to the gripper bar 22 of the delivery cylinder 21 at a sheet transferring position P2 of the paper sheet W is detected by a checking camera 23 while the paper sheet W is transported on the delivery cylinder 21, i.e. in the arc-shaped transporting route portion C2b in the transporting route C2 of the paper sheet W.

[0045] In this case, the paper sheet W is brought in contact with a guide surface 53a of the guide plate 53 which extends along the arc-shaped transporting route portion C2b, by the air blow operation of the first air blowing nozzle 25 and the second air blowing nozzle 26 and by the suction operation of the suction cylinder 50 in the suction guide 40 to be described later. Accordingly, in a checking unit of the delivery cylinder 21, the paper sheet W can be highly accurately checked while being stably transported.

[0046] Moreover, when the paper sheet W is transferred from the transfer cylinder 13 and is transported by the delivery chains 20 through the arc-shaped travelling route portion C1b of the travelling route C1, the travelling speed of the delivery chains 20 and the transporting speed of the paper sheet W are different from each other due to a difference between the curvature radius of the

arc-shaped travelling route portion C1b of the delivery chains 20 and the curvature radius of the arc-shaped transporting route portion C2b in the transporting route C2 of the paper sheet W.

[0047] Specifically, when the arc-shaped transporting route portion C2b of the paper sheet W is located outside the arc-shaped travelling route portion C1b of the delivery chains 20, the transporting speed of the paper sheet W in the arc-shaped transporting route portion C2b of the paper sheet W is faster than the travelling speed of the delivery chains 20. Moreover, since the speed of a leading end of the paper sheet W having passed a shift position S (see Fig. 3) from arc-shaped transporting route portion C2b to a linear transporting route portion C2a of the paper sheet W is equal to the speed of the delivery chains 20, a trailing end of the paper sheet W is transported at a faster speed than the delivery chains 20.

[0048] The faster speed of the trailing end of the paper sheet P as described above makes the paper sheet W loose and fluttering of the paper sheet W occurs. The paper sheet W may be thereby damaged or rubbed. Moreover, the fluttering of the paper sheet W also makes the paper sheet W on the guide plate 53 unstable and accurate check with the checking camera 23 may be hindered.

[0049] In the embodiment, a loose portion of the paper sheet W which is formed by the speed difference in paper-sheet transport as described above is smoothly guided without fluttering due to the suction operation of the suction cylinder 50 in the aforementioned suction guide 40 and the sheet can be stably transported.

[0050] Specifically, as shown in Figs. 6A and 6B, when the paper sheet W is transferred from the paper-sheet gripping device of the transfer cylinder 13 to the gripper bar 22 of the delivery cylinder 21 at the transferring position P2 (see the transferring position (I) in Fig. 6A) and the first communication hole 57a formed in each end plate 51 reaches (communicates with) a front end portion of the suction open groove 47a formed in the corresponding suction duct 44 due to the rotation of the suction cylinder 50 (see a suction start position (II) of the first communication hole 57a in Fig. 6A), the first negative pressure box 54a communicates with the negative pressure source via the suction hose 59a, the joint 58a, the communication hole 57a, the suction open groove 47a, the communication hole 47b, the joint 48, and the suction hose 49, and suction is performed in the first negative pressure box 54a.

[0051] Due to this, a negative pressure acts on the paper sheet W transported along the arc-shaped transporting route portion C2b in the transporting route C2 of the paper sheet W through the many suction holes 56. As a result, the paper sheet W is brought in contact with the guide surface 53a of the guide plate 53.

[0052] Thereafter, the second communication hole 57b to the seventh communication hole 57g sequentially reach (communicate with) the front end portion of the fixed suction open groove 47a due to the further rotation of the suction cylinder 50, and suction is performed sequentially in the second negative box 54b to the seventh negative box 54g. Accordingly, portions of the paper sheet W are sequentially brought in contact with the guide surface 53a of the guide plate 53 from the leading end to the trailing end.

[0053] Then, when the first communication hole 57a passes a base end portion of the suction open groove 47a (see suction end position (III) of the first communication hole 57a in Fig. 6B), the communication between the first communication hole 57a and the suction open groove 47a is blocked and the suction operation by the first communication hole 57a is terminated. Thereafter, the second communication hole 57b to the seventh communication hole 57g sequentially pass the base end portion of the suction open groove 47a, the communication between the suction open groove 47a and each of the communication holes is blocked, and the suction operations by the second communication hole 57b to the seventh communication hole 57g are terminated.

[0054] In this state, the suction guide 40 is configured to continuously perform sucking even after passing the shift position S where the transporting route C2 of the paper sheet W shifts from the arc-shaped transporting route portion C2b to the linear transporting route portion C2a, according to the preset length of the suction open groove 47a from the front end portion to the base end portion thereof and the preset circumferential length of the suction guide 40 including the number of the communication holes 57a to 57g and the number of negative pressure boxes 54a to 54g. Accordingly, even when a loose portion is formed in the paper sheet W at the shift position S due to the speed difference in paper-sheet transport described above, a rear half of the loose portion is sucked to the guide plate 53 by the suction operation of the suction cylinder 50 and does not flutter. In this state, the loose portion is held not only when the sheet trailing end passes a check position K (see check end position (IV) of the checking camera 23 in Fig. 6B) of the checking camera 23, but also after the sheet trailing end passes the shift position S. In other words, the loose portion is held until the communication hole 57g passes the suction open groove 47a.

[0055] As described above, in the embodiment, since the loose portion of the paper sheet W formed by the speed difference in paper-sheet transport is smoothly guided with the fluttering prevented by the suction cylinder 50, the paper sheet W can be stably transported. Accordingly, there are no risk of the paper sheet W being damaged and rubbed and no risk of accurate checking by the checking camera 23 being hindered.

[0056] Moreover, in the suction guide 40, the side surface of each suction duct 44 is biased to be pushed against the side surface of the corresponding ring-shaped end plate 51 in the suction cylinder 50. This configuration effectively absorbs an assembly error of the suction cylinder 50, mechanical vibrations, and the like. Accordingly, the stable suction operation is achieved and

the reliability is high.

[0057] Moreover, the present invention has such an advantage that a portion of the paper sheet W having passed the shift position S is guided to an inner side than the linear travelling route portion C1a by the air blown from the second air blowing nozzle 26 and the contact of the paper sheet W to the guide plate 53 is thereby assisted.

[0058] Note that the present invention is not limited to the embodiment described above, and various changes can be made within the scope not departing from the sprit of the present invention as a matter of course. For example, the structure of the suction guide including the suction cylinder can be changed and the processing device such as the checking camera can be changed. Moreover, although the description is given of the embodiment using both of the suction guide 40 and the second air blowing nozzle 26 as the guiding means, only one of the suction guide 40 and the second air blowing nozzle 26 can be used. In a case where only the second air blowing nozzle 26 is used, the suction guide 40 may be simply an arc-shaped guide with no suction force acting thereon. In this case also, the portion of the paper sheet W having passed the shift position S is guided to the inner side than the linear travelling route portion C1a by the air from the second air blowing nozzle 26 and is brought in contact with the guide surface 53a of the guide plate 53. Moreover, although the guide plate 53 is described as a single plate, multiple plates can be arranged in the circumferential direction. In this case, the suction holes 56 and the negative pressure box 54 are configured to be provided in each of the plates.

[Industrial Applicability]

[0059] The sheet guiding device of the present invention and the sheet processing apparatus including the sheet guiding device can be effectively used in a printing press for printing bank notes, securities, and the like in which quality control is important.

[Reference Signs List]

[0060]

1 PRINTING UNIT
2 BLANKET IMPRESSION CYLINDER
3 BLANKET CYLINDER
4 PLATE CYLINDER
5 PLATE CYLINDER
6 INKING UNIT
7 INKING UNIT
8 REGISTER
9 to 12 TRANSFER CYLINDER
13 TRANSFER CYLINDER
14 FEEDER BOARD
20 DELIVERY CHAIN (TRANSPORTING CHAIN)
21 DELIVERY CYLINDER
22 GRIPPER BAR (SHEET HOLDING DEVICE)
22a GRIPPER
22b GRIPPER PAD
23 CHECKING CAMERA (PROCESSING DEVICE)
24 PAIRED ILLUMINATORS
25 FIRST AIR BLOWING NOZZLE (AIR BLOWING MEANS: SHEET CONTACT MEANS: GUIDING MEANS)
26 SECOND AIR BLOWING NOZZLE (AIR BLOWING MEANS: SHEET CONTACT MEANS: GUIDING MEANS)
27 PAPER-SHEET GUIDE
28 MAIN UNIT FRAME
30 SHAFT
31 BEARING
32 GEAR
34 SPROCKET
35 KEY
36 CHAIN GUIDE
40 SUCTION GUIDE (SUCKING MEANS: SHEET CONTACT MEANS: GUIDING MEANS)
41 SUPPORTING LEG
42 SUPPORTING PLATE
42a HALF-CIRCULAR ARC PORTION
42b BASE END PORTION
42c SPRING RECEIVING HOLE
43 BOLT
44 SUCTION DUCT
44a HALF-CIRCULAR ARC PORTION
44b BASE END PORTION
44c SPRING RECEIVING HOLE
45 REAMER BOLT
46 COMPRESSION COIL SPRING
47a SUCTION OPEN GROOVE
47b COMMUNICATION HOLE
48 JOINT
49 SUCTION HOSE
50 SUCTION CYLINDER (ROTATING BODY)
51 END PLATE
52 KEY
53 GUIDE PLATE (GUIDE)
53a GUIDE SURFACE
54a to 54g NEGATIVE PRESSURE BOX
56 SUCTION HOLE
57a to 57g COMMUNICATION HOLE
58a to 58g JOINT
59a to 59g SUCTION HOSE
W PAPER SHEET (SHEET)
H GAP
P1 PRINTING POSITION
P2 SHEET TRANSFERRING POSITION
S SHIFT POSITION FROM ARC-SHAPED TRAVELLING (TRANSPORTING) ROUTE PORTION TO LINEAR TRAVELLING (TRANSPORTING) ROUTE PORTION
K CHECKING POSITION OF CHECKING CAMERA
C1 TRAVELLING ROUTE OF DELIVERY CHAINS (TRAJECTORY OF DELIVERY CHAINS: TRAVEL-

LING ROUTE OF TRANSPORTING CHAIN)
C1a LINEAR TRAVELLING ROUTE PORTION
C1b ARC-SHAPED TRAVELLING ROUTE PORTION
C2 TRANSPORTING ROUTE OF PAPER SHEET (TRAJECTORY OF HOLDING PORTION OF PAPER SHEET WHICH INCLUDES GRIPPER AND GRIPPER PAD OF EACH GRIPPER BAR: TRANSPORTING ROUTE OF SHEET)
C2a LINEAR TRANSPORTING ROUTE PORTION
C2b ARC-SHAPED TRANSPORTING ROUTE PORTION

Claims

1. A sheet guiding device including:

a sheet holding device (22) provided to a transporting chain (20), and having a holding portion (22a, 22b) configured to hold an end portion of a sheet (W), the sheet holding device (22) configured to transport the sheet (W) along a sheet transporting route (C2) formed by the holding portion (22a, 22b) and spaced away from a travelling route (C1) of the transporting chain (20); and

a guide (53) having a guide surface (53a) and configured to guide the transported sheet (W), the guide surface (53a) extending along an arc-shaped transporting route portion (C2b) in the sheet transporting route (C2) which is located outside an arc-shaped travelling route portion (C1b) in the travelling route (C1) of the transporting chain (20) and which is formed by the holding portion (22a, 22b) travelling along the arc-shaped travelling route portion (C1b), **characterized in that**

the sheet guiding device comprises:

a linear travelling route portion (C1a) formed downstream of the arc-shaped travelling route portion (C1b) in a travelling direction of the transporting chain (20); and

guiding means (25, 26, 40) for guiding the sheet (W) to an inner side than the linear travelling route portion (C1a), the sheet (W) located in a region downstream of a shift position (S) from the arc-shaped travelling route portion (C1b) to the linear travelling route portion (C1a) in a sheet transporting direction.

2. The sheet guiding device according to claim 1, **characterized in that**

the guiding means (25, 26, 40) includes sheet contact means (25, 26, 40) which brings the sheet (W) in contact with the guide surface (53a) of the guide (53) which is located on an inner side than the linear travelling route portion (C1a), the sheet (W) located in the region downstream of the shift position (S) from the arc-shaped travelling route portion (C1b) to the linear travelling route portion (C1a) in the sheet transporting direction.

3. The sheet guiding device according to claim 2, **characterized in that** the guide surface (53a) of the guide (53) is formed in an arc shape and is a rotating body (50) configured to rotate at a circumferential speed substantially equal to a transporting speed of the sheet (W) transported by the holding portion (22a, 22b) in the sheet holding device (22) travelling along the arc-shaped transporting route portion (C2b).

4. The sheet guiding device according to claim 3, **characterized in that** the sheet contact means (25, 26, 40) includes sucking means (40) for sucking the sheet (W) in a region of the arc-shaped guide surface (53a) downstream of the shift position (S) in the sheet transporting direction.

5. The sheet guiding device according to claim 4, **characterized in that** the sucking means (40) sucks the sheet (W) also in a region upstream of the shift position (S) in the sheet transporting direction.

6. The sheet guiding device according to claim 2, **characterized in that** the sheet contact means (25, 26, 40) includes air blowing means (25, 26) for blowing air to the sheet (W).

7. A sheet processing apparatus including the sheet guiding device according to any one of claims 1 to 6, **characterized in that**

the sheet processing apparatus comprises a processing device (23) configured to perform processing on the sheet (W) on the guide surface (53a) of the guide (53) extending along the arc-shaped transporting route portion (C2b).

Fig.1

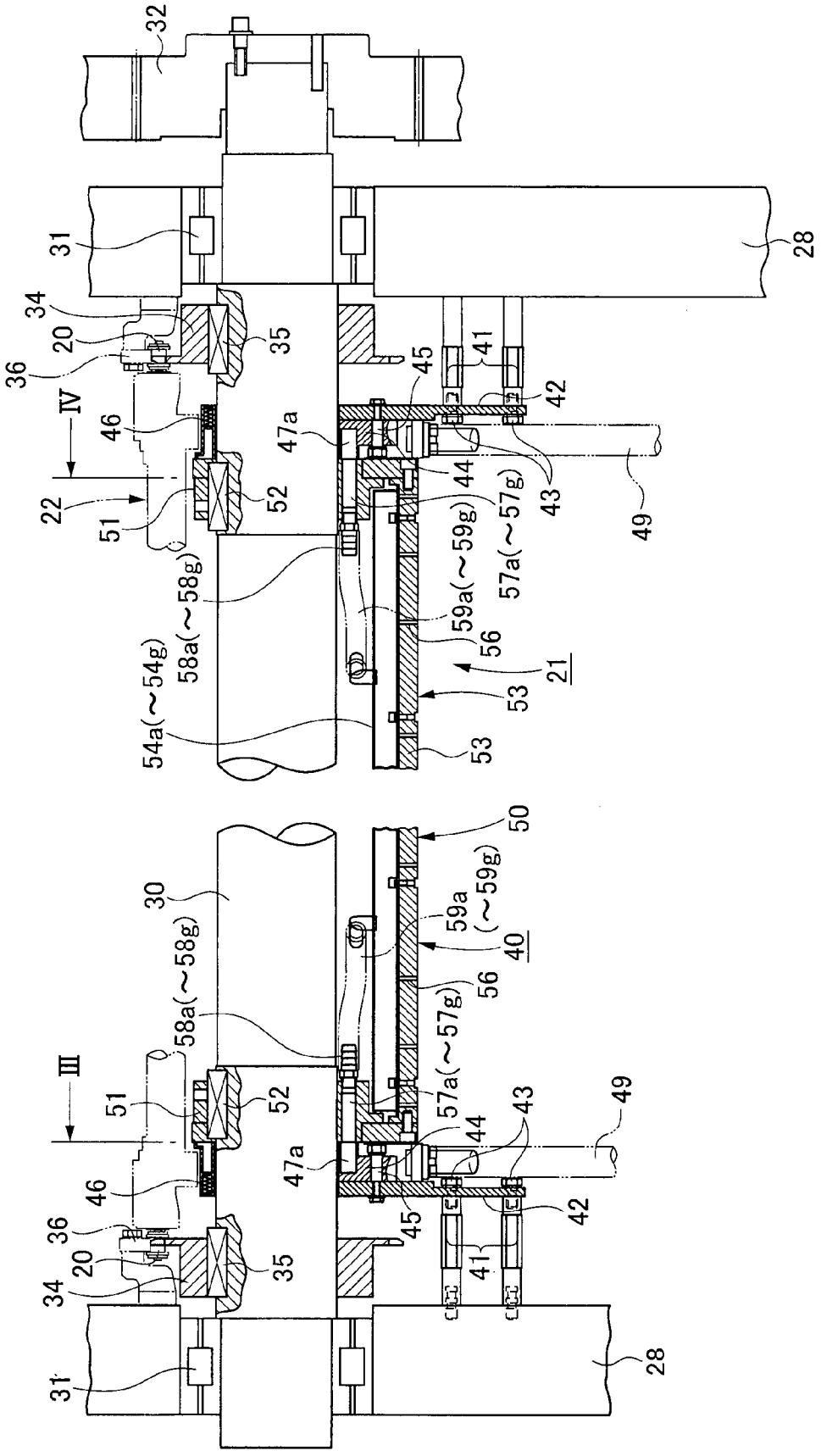

32
31
28
34
20
36
35
45
41
42
IV
46
47a
44
43
49
22
51
52
57a(~57g)
59a(~59g)
58a(~58g)
54a(~54g)
56
21
53
50
30
59a
(~59g)
40
III
47a
31'

Fig.2

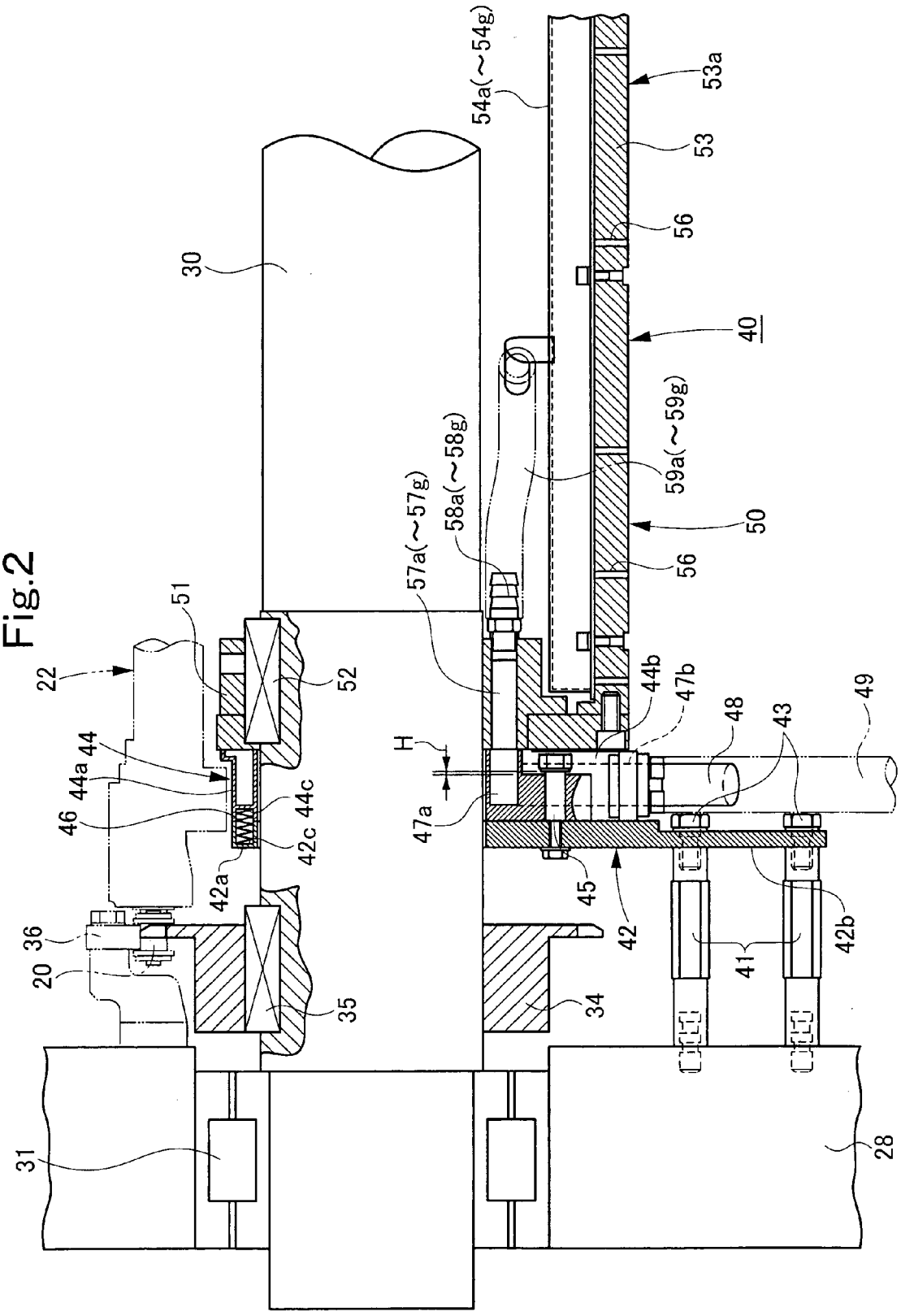

54a(~54g)
53a
53
56
30
40
59a(~59g)
58a(~58g)
57a(~57g)
50
56
51
22
52
44b
47b
48
43
49
H
44
44a
44c
46
42c
47a
42a
45
42
42b
36
20
41
35
34
31
28

Fig.3

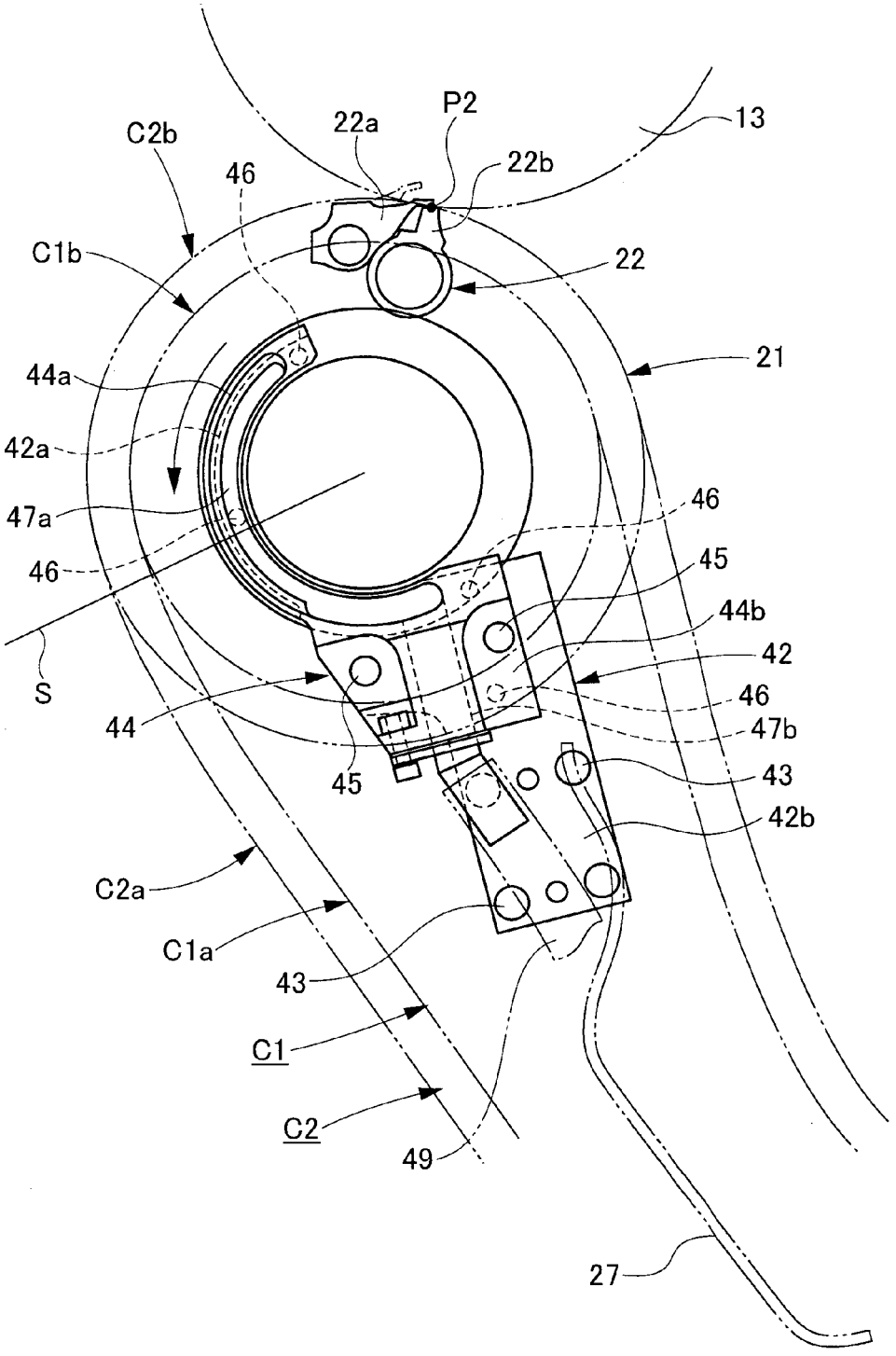
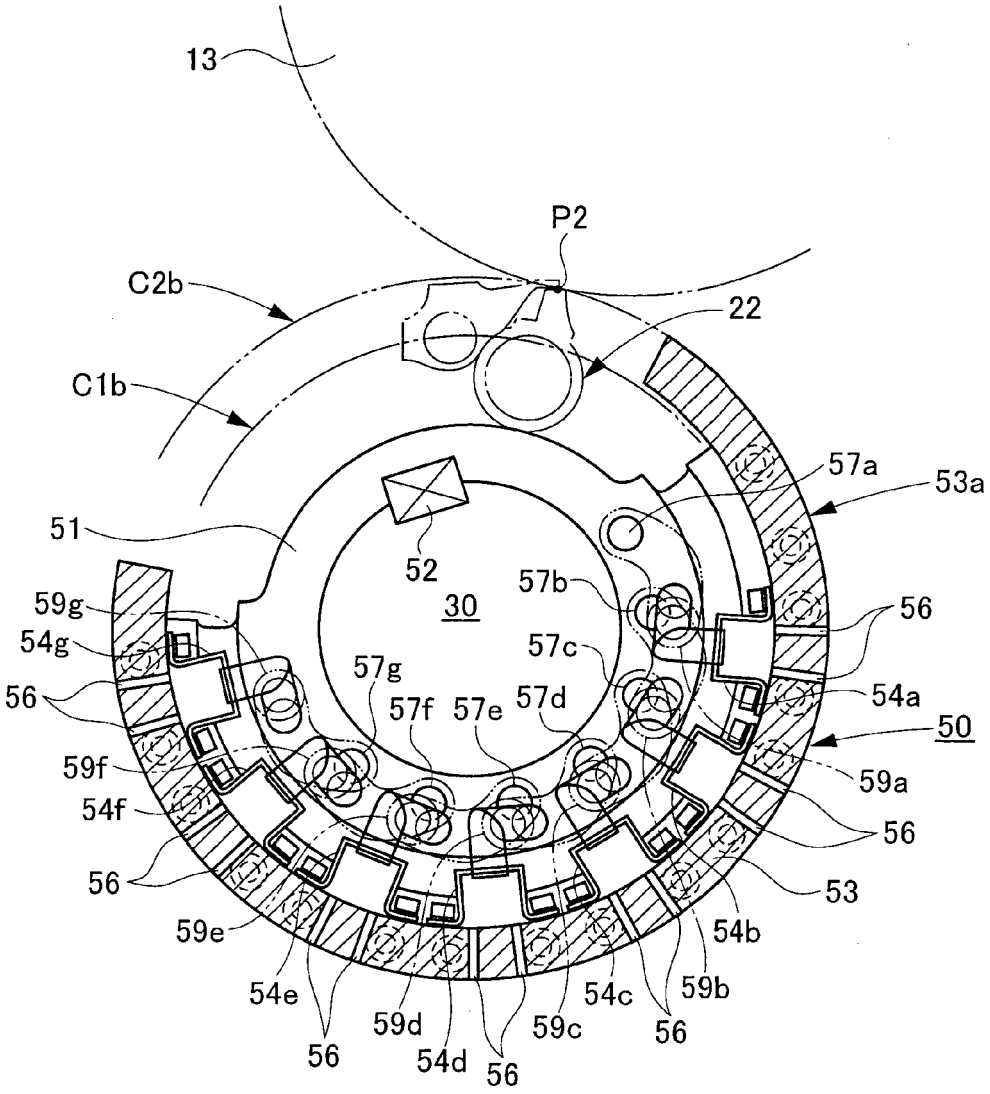

C2b
46
22a
P2
22b
13
C1b
22
21
44a
42a
47a
46
46
45
44b
S
42
44
46
47b
45
43
42b
C2a
C1a
43
C1
C2
49
27

Fig.4


13
P2
C2b
22
C1b
57a
53a
51
52
30
57b
59g
56
54g
57c
57g
54a
56
57f
57e
57d
50
59f
59a
54f
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59e
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54e
59d
54c
59b
59c
56
56
54d
56

Fig.5

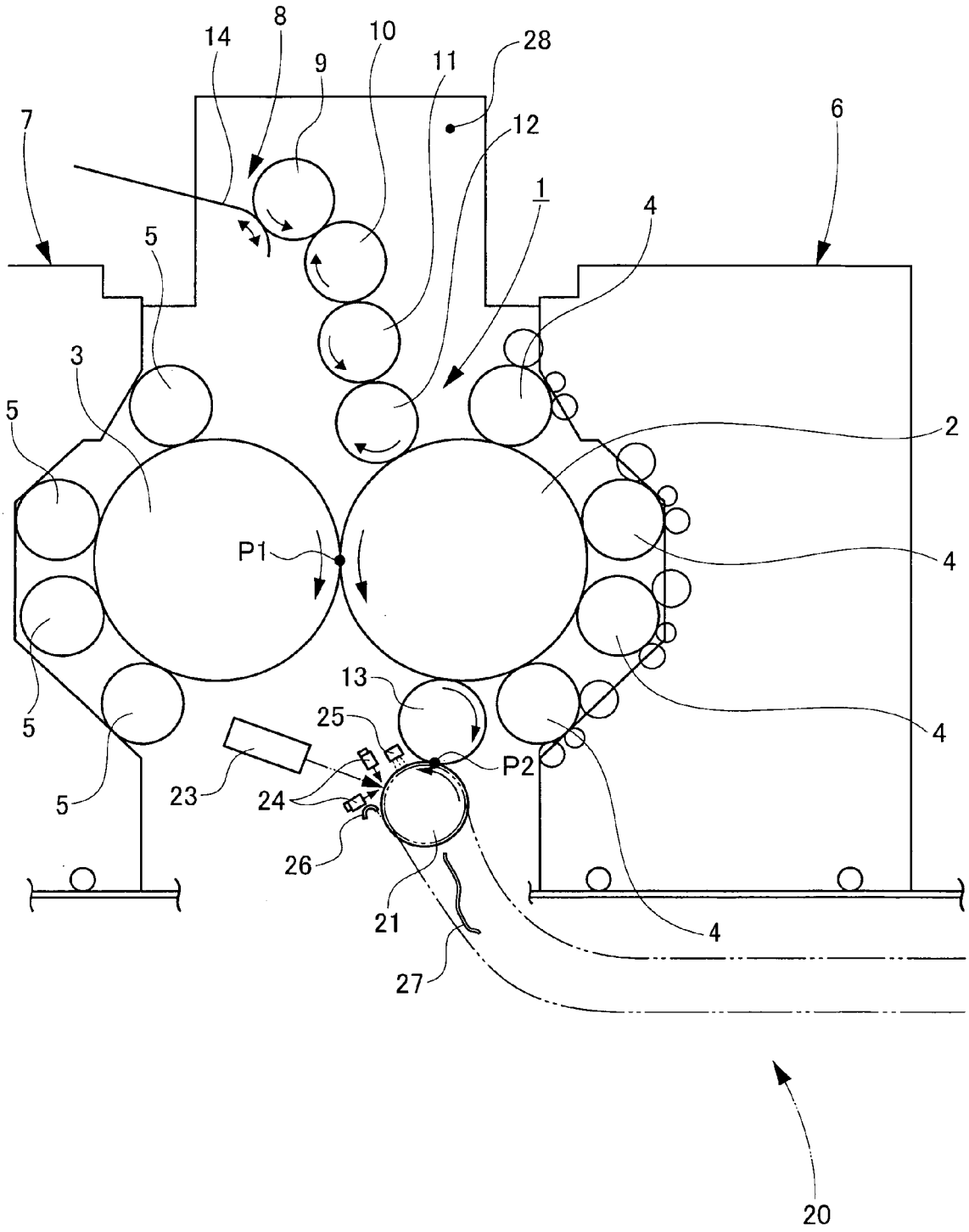


Fig.6A

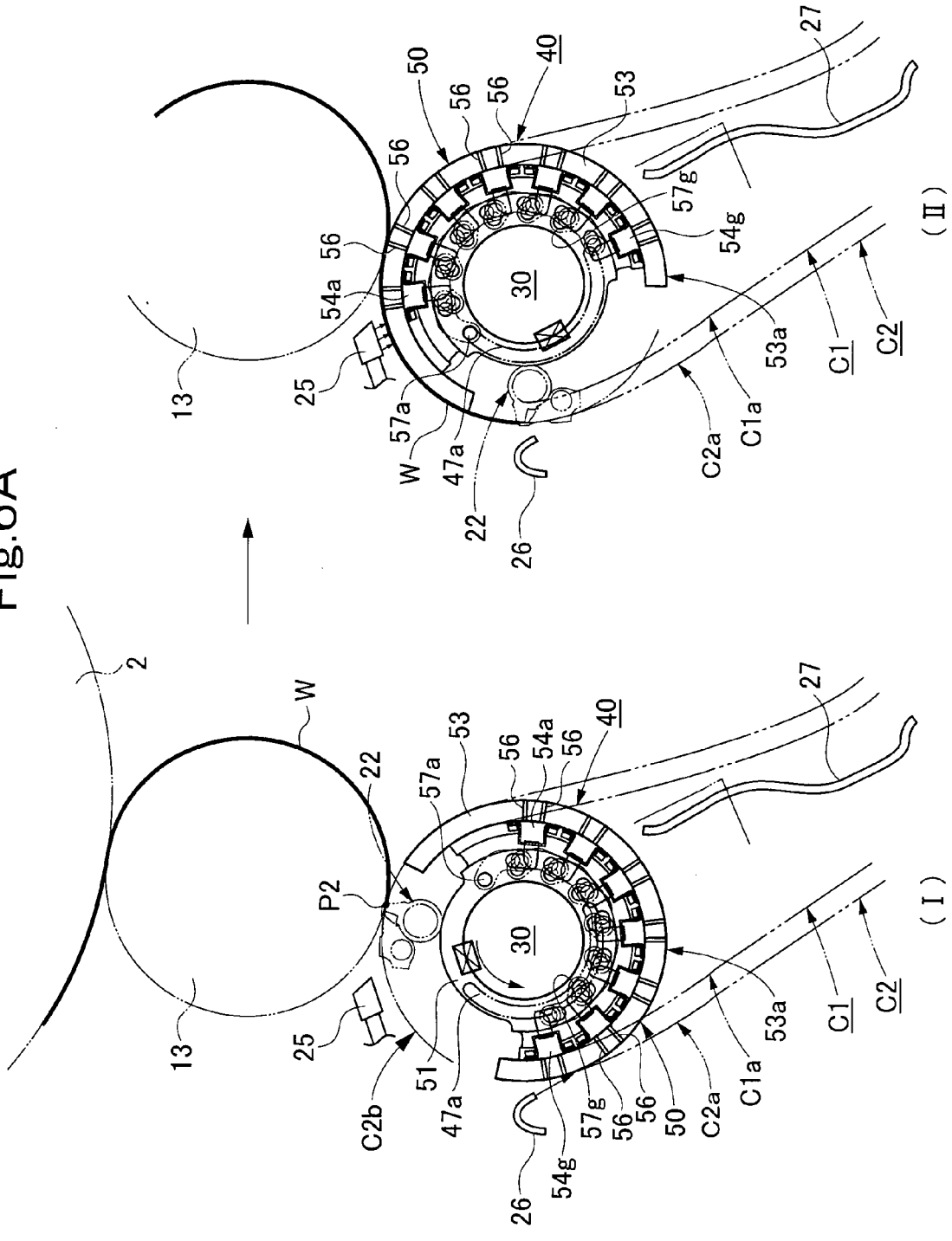
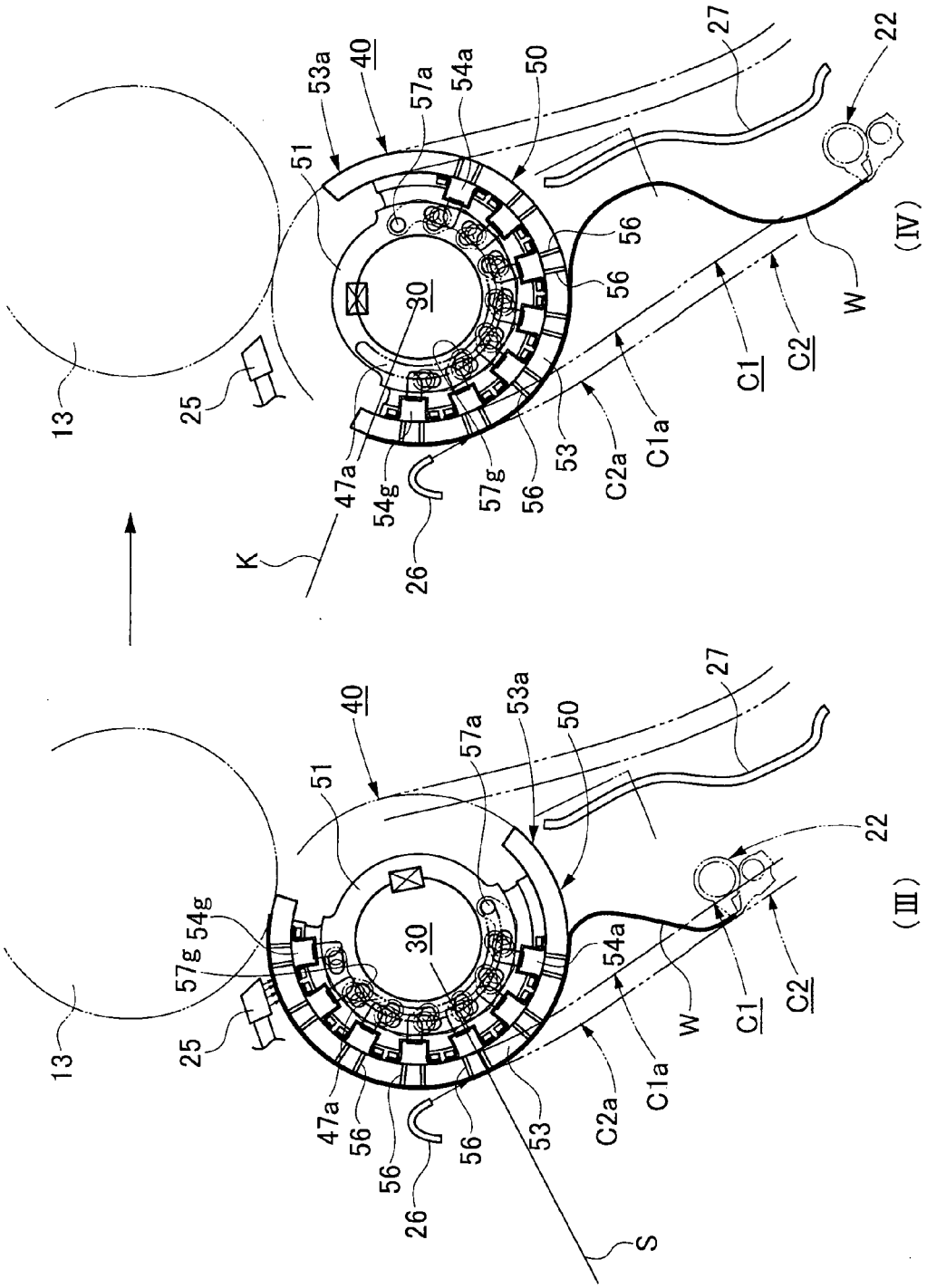

2
W
22
P2
13
25
C2b
51
47a
57a
53
56
54a
56
40
30
27
C1
C2
53a
C1a
C2a
50
56
56
57g
54g
26
(I)
(II)

Fig.6B


(IV)
(III)
13
25
K
47a
54g
57g
26
56
53
S
C2a
C1a
W
C1
C2
22
27
50
53a
40
51
57a
54a
30

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2576838 B **[0005]**
- JP 2010221410 A **[0005]**