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(54) **PAPER SHEET PROCESSING APPARATUS**

(57) A sheet handling apparatus (1) includes a first sheet shifting mechanism (20) disposed in a sheet transporting direction, and a second sheet shifting mechanism (30) disposed downstream of the first sheet shifting mechanism (20), as a plurality of kinds of sheet shifting mechanisms disposed along an extending direction of a transport path (2), and configured to shift a transported sheet in a width direction. Each of the first sheet shifting mechanism (20) and the second sheet shifting mechanism (30) has a different mechanism to shift the sheet in the width direction.

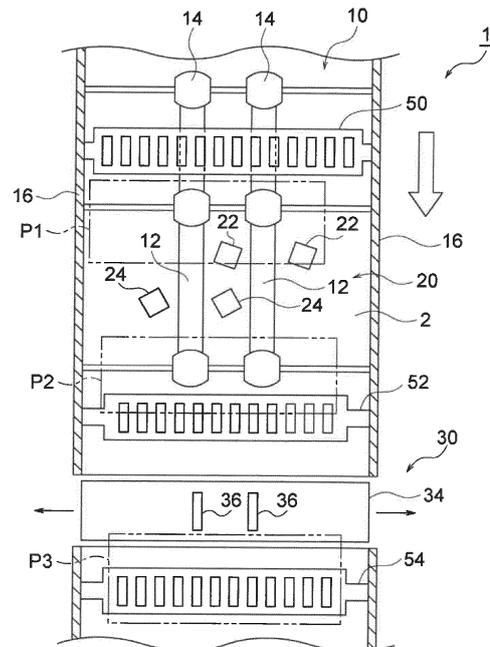


FIG. 1

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## Description

### TECHNICAL FIELD

**[0001]** The present invention relates to a sheet handling apparatus that transports sheets such as banknotes, and particularly to a sheet handling apparatus that shifts transported sheets to a predetermined position such as the center position in the width direction of a transport path.

### BACKGROUND ART

**[0002]** In a banknote depositing and dispensing machine, such as an ATM installed in a financial facility including a bank, which performs depositing and dispensing of banknotes, a transport unit for transporting banknotes is mounted in the machine. Banknotes transported by such a transport unit are stored in a storage cassette. When the width of the transport path for banknotes in the transport unit is greater than the width of an opening portion of the storage cassette, banknotes transported by the transport unit need to be shifted to a predetermined position such as the center position in the width direction of the transport path. More specifically, there are a plurality of kinds of banknotes, and the size of the banknote varies depending on denominations and countries in which banknotes are issued. Therefore, in a case where various kinds of banknotes are handled, when each banknote is to be stored for each kind in the storage cassette which has an appropriate size for the banknote, the size of the opening portion of the storage cassette is also varied according to the kind of the banknote. Accordingly, the positions of the banknotes in the width direction need to be adjusted to predetermined positions in order to assuredly send the banknotes into the various kinds of storage cassettes.

**[0003]** Japanese Patent No. 4297855 (JP4297855B) discloses, as a device for adjusting positions of banknotes in the width direction of the transport path, a banknote-position shifting device that includes skew rollers which are skewed relative to the extending direction of the transport path. In such a banknote-position shifting device, when a banknote is transported by the skew rollers, the banknote is shifted in the width direction of the transport path. Furthermore, Japanese Laid-Open Patent Publication No. 2002-308472 (JP2002-308472A) discloses an orientation correction device which has rollers structured such that the angles of the rollers relative to the extending direction of the transport path are adjustable. In such an orientation correction device, when a banknote is transported by the rollers in a state where the rollers are skewed relative to the extending direction of the transport path, the banknote is shifted in the width direction of the transport path.

**[0004]** Furthermore, Japanese Laid-Open Patent Publication No. 2015-027912 (JP2015-027912A) discloses a sheet transport apparatus in which a sliding-type trans-

port mechanism implemented by a combination set of rollers and a guiding member is slidable along the width direction of the transport path. In such a sheet transport apparatus, when a sheet is transported by the rollers of the sliding-type transport mechanism, the sliding-type transport mechanism itself slides along the width direction of the transport path, thereby shifting the sheet in the width direction.

### 10 SUMMARY OF THE INVENTION

**[0005]** In the banknote-position shifting device disclosed in Japanese Patent No. 4297855 and the orientation correction device disclosed in Japanese Laid-Open Patent Publication No. 2002-308472, since the banknote is shifted in the width direction by the rollers which are skewed relative to the extending direction of the transport path, a transport speed can be made relatively high. However, a problem arises that the banknote cannot be accurately shifted to a predetermined position in the width direction. Meanwhile, in the sheet transport apparatus disclosed in Japanese Laid-Open Patent Publication No. 2015-027912, although a sheet can be accurately shifted to a predetermined position in the width direction, a transport speed cannot be easily increased in some cases. Specifically, when the transport speed is increased, a shift amount of the sheet shifted by a single sliding-type transport mechanism is reduced. Therefore, a problem arises that multiple sliding-type transport mechanisms need to be disposed in order to increase the transport speed, and the configuration of the entirety of the apparatus thus becomes complicated and expensive.

**[0006]** The present invention has been made in view of such circumstances, and an object of the present invention is to provide a sheet handling apparatus that can accurately shift a sheet to a predetermined position in the width direction of a transport path, and simultaneously allows a transport speed for the sheet to be increased.

**[0007]** A sheet handling apparatus of the present invention for transporting a sheet along a transport path includes a plurality of kinds of sheet shifting mechanisms disposed along an extending direction of the transport path, and configured to shift a transported sheet in a width direction of the transport path, the plurality of kinds of sheet shifting mechanisms include a first sheet shifting mechanism disposed in a sheet transporting direction, and a second sheet shifting mechanism disposed downstream of the first sheet shifting mechanism, and each of the first sheet shifting mechanism and the second sheet shifting mechanism has a different mechanism to shift the sheet in the width direction.

**[0008]** In the sheet handling apparatus of the present invention, a shift amount of the sheet shifted by the first sheet shifting mechanism may be constant, and a shift amount of the sheet shifted by the second sheet shifting mechanism may be adjustable.

**[0009]** The sheet handling apparatus of the present

invention may further include a first sheet detector disposed on an upstream side of the first sheet shifting mechanism in the sheet transporting direction and configured to detect a position of the sheet in the width direction, and a shift amount by the first sheet shifting mechanism may be determined based on a detection result by the first sheet detector.

**[0010]** In this case, the first sheet shifting mechanism selectively may shift the transported sheet in the width direction, and whether or not the sheet is to be shifted by the first sheet shifting mechanism may be determined based on the detection result by the first sheet detector.

**[0011]** Further, the first sheet detector may include a recognition unit for recognizing the sheet.

**[0012]** Further, a shift amount of the sheet to be shifted by the second sheet shifting mechanism may be determined based on the detection result by the first sheet detector.

**[0013]** The sheet handling apparatus of the present invention may further include a second sheet detector disposed between the first sheet shifting mechanism and the second sheet shifting mechanism in the sheet transporting direction and configured to detect a position of the sheet in the width direction, and a shift amount of the sheet to be shifted by the second sheet shifting mechanism may be determined based on a detection result by the second sheet detector.

**[0014]** In the sheet handling apparatus of the present invention, the second sheet shifting mechanism may have a transporting member that is slidable along the width direction, and that transports the sheet along the transport path, and the sheet transported by the transporting member may be shifted in the width direction by sliding the transporting member along the width direction.

**[0015]** In this case, a number of the transporting members in the second sheet shifting mechanism may be one.

**[0016]** Further, the transporting member may have a pair of upper and lower rollers for gipping and transporting the sheet.

**[0017]** Further, a guide member that forms the transport path may have the transporting member, and the guide member and the transporting member may be integrally slidable along the width direction.

**[0018]** Alternatively, a guide member that forms the transport path may have the transporting member, and the guide member may be disposed so as to be fixed relative to the sheet handling apparatus, and the transporting member is slidable relative to the guide member along the width direction.

**[0019]** In the sheet handling apparatus of the present invention, the first sheet shifting mechanism may have a skew roller that is skewed relative to the extending direction of the transport path.

**[0020]** In the sheet handling apparatus of the present invention, the sheet may be transported in the transport path also in a direction from the second sheet shifting mechanism toward the first sheet shifting mechanism.

**[0021]** In this case, the plurality of kinds of sheet shift-

ing mechanisms may further include a third sheet shifting mechanism, and the second sheet shifting mechanism is disposed between the first sheet shifting mechanism and the third sheet shifting mechanism with respect to a direction that the transport path transports the sheet.

**[0022]** Further, the third sheet shifting mechanism may have the same configuration as the first sheet shifting mechanism.

## 10 BRIEF DESCRIPTION OF THE DRAWINGS

### [0023]

FIG. 1 is a top view of a schematic configuration of a sheet transport apparatus according to an embodiment of the present invention;

FIG. 2 is a side view of the sheet transport apparatus shown in FIG. 1;

FIG. 3 is a top view illustrating in detail a configuration of a first sheet shifting mechanism of the sheet transport apparatus shown in FIG. 1 and the like;

FIG. 4 is a perspective view illustrating in detail a configuration of a second sheet shifting mechanism of the sheet transport apparatus shown in FIG. 1 and the like;

FIG. 5 is a functional block diagram illustrating a configuration of a control system of the sheet transport apparatus shown in FIG. 1 and the like;

FIG. 6 is a top view of another configuration of the first sheet shifting mechanism of the sheet transport apparatus according to an embodiment of the present invention;

FIG. 7 is a perspective view of another configuration of the second sheet shifting mechanism of the sheet transport apparatus according to an embodiment of the present invention;

FIG. 8 is a top view of the second sheet shifting mechanism shown in FIG. 7;

FIG. 9 is a side cross-sectional view of the second sheet shifting mechanism shown in FIG. 8 as viewed from the direction of arrows A-A;

FIG. 10 is a top view of a schematic configuration of another sheet transport apparatus according to an embodiment of the present invention;

FIG. 11 is a top view of a schematic configuration of still another sheet transport apparatus according to an embodiment of the present invention;

FIG. 12 is a top view of still another configuration of the second sheet shifting mechanism of the sheet transport apparatus according to an embodiment of the present invention; and

FIG. 13 is a side view of still another configuration of the sheet transport apparatus according to an embodiment of the present invention.

## DESCRIPTION OF THE PREFERRED EMBODIMENTS

**[0024]** An embodiment of the present invention will be

described below with reference to the drawings. In FIG. 1 to FIG. 13, reference character P represents a sheet transported by a sheet transport apparatus according to the present embodiment, and an outline arrow represents a sheet transporting direction.

**[0025]** A sheet transport apparatus 1 (sheet handling apparatus) according to the present embodiment transports sheets such as banknotes one by one, and shifts the transported sheets to a predetermined position such as the center position in the width direction (the left-right direction in FIG. 1) of a transport path 2. The sheet transport apparatus 1 having such a configuration is used as, for example, a banknote transport device which is mounted in a banknote depositing and dispensing machine, such as an ATM installed in a financial facility including a bank, which performs depositing and dispensing of banknotes. The sheet transport apparatus 1 is used to adjust positions of banknotes in the width direction to predetermined positions in order to, for example, assuredly send the banknotes into various kinds of storage cassettes disposed in the banknote depositing and dispensing machine. Furthermore, the sheet transport apparatus 1 is used to adjust positions of banknotes in the width direction to predetermined positions in order to, for example, assuredly recognize the banknotes deposited in the banknote depositing and dispensing machine. A schematic configuration of such a sheet transport apparatus 1 will be described below.

**[0026]** As shown in FIG. 1 and FIG. 2, the sheet transport apparatus 1 according to the present embodiment includes a sheet transport mechanism 10 that transports a sheet along the transport path 2, and a plurality of kinds of sheet shifting mechanisms 20, 30 which are disposed along an extending direction of the transport path 2, and which shift the transported sheet in the width direction. As shown in FIG. 1, the transport path 2 in which the sheet is transported is formed between paired side edge portions 16. The plurality of kinds of sheet shifting mechanisms 20, 30 include a first sheet shifting mechanism 20 disposed in the sheet transporting direction, and a second sheet shifting mechanism 30 disposed downstream of the first sheet shifting mechanism 20. Each of the first sheet shifting mechanism 20 and the second sheet shifting mechanism 30 has a different mechanism to shift the sheet in the width direction. In FIG. 1, the sheet transport apparatus 1 transports the sheets one by one from the upper side in the downward direction along the transport path 2 that extends in the up-down direction in FIG. 1. That is, in FIG. 2, the sheet transport apparatus 1 transports the sheets one by one from the right side in the leftward direction along the transport path 2 that extends in the left-right direction in FIG. 2. At this time, the sheets are transported along the short edge direction thereof. The sheet transport apparatus 1 of the present embodiment is not limited thereto. In another example, the sheets may be transported along the long edge direction thereof. Components of the sheet transport apparatus 1 having such a configuration will be de-

scribed below in detail.

**[0027]** In the present embodiment, the sheet shifting mechanisms each of which has a different mechanism to shift the sheet in the width direction may shift the sheet by using different mechanisms. Alternatively, the sheet shifting mechanisms each of which has a different mechanism to shift the sheet in the width direction may shift the sheet with different accuracies. Furthermore, the sheet shifting mechanisms each of which has a different mechanism to shift the sheet in the width direction may be able to shift the sheet by different shift amounts. Moreover, the sheet shifting mechanisms each of which has a different mechanism to shift the sheet in the width direction may shift the sheet at different speeds.

**[0028]** As shown in FIG. 1 and FIG. 2, the sheet transport mechanism 10 includes a pair of upper and lower endless belts 12, 13, and the sheets are transported one by one along the transport path 2 in a state of being gripped between the endless belts 12 and 13. More specifically, the lower endless belt 12 is extended on and between a plurality of pulleys 14, and a driving motor (not shown) is connected to one pulley 14 among the plurality of pulleys 14. The pulley 14 is driven to rotate by the driving motor, whereby the lower endless belt 12 circulates in the counterclockwise direction in FIG. 2. Similarly, the upper endless belt 13 is extended on and between a plurality of pulleys 15, and a driving motor (not shown) is connected to one pulley 15 among the plurality of pulleys 15. The pulley 15 is driven to rotate by the driving motor, whereby the upper endless belt 13 circulates in the clockwise direction in FIG. 2. FIG. 1 shows configurations of the lower endless belt 12 and each pulley 14 in a state where the upper endless belt 13 and the pulleys 15 on and between which the upper endless belt 13 is extended are dismantled from the sheet transport mechanism 10.

**[0029]** Next, a configuration of the first sheet shifting mechanism 20 will be described in detail with reference to FIG. 1 to FIG. 3. The first sheet shifting mechanism 20 shifts, in the width direction, the sheet which is transported in a state of being gripped between the paired upper and lower endless belts 12 and 13 of the sheet transport mechanism 10. More specifically, as shown in FIG. 1 and FIG. 2, the first sheet shifting mechanism 20 includes skew rollers 22, 24 that are skewed relative to the extending direction (that is, the up-down direction in FIG. 1) of the transport path 2. When the sheet that is transported in a state of being gripped between the paired upper and lower endless belts 12 and 13 contacts with the skew rollers 22, 24, the sheet is shifted in the width direction. As shown in FIG. 1, in the plurality of skew rollers 22 and 24, the direction in which each first skew roller 22 is skewed relative to the extending direction of the transport path 2 and the direction in which each second skew roller 24 is skewed relative thereto, are different from each other. As shown in FIG. 1, the pair of left and right first skew rollers 22 are disposed so as to be aligned along the width direction, and the pair of left and right

second skew rollers 24 are disposed so as to be aligned along the width direction. The second skew rollers 24 are disposed downstream of the first skew rollers 22 in the sheet transporting direction in the transport path 2. The first skew rollers 22 are rotated in synchronization with each other by a driving motor 23m described below. The second skew rollers 24 are rotated in synchronization with each other by a driving motor 25m described below.

**[0030]** As described below, each first skew roller 22 and each second skew roller 24 are movable in the up-down direction in FIG. 2 independently of the skew rollers oriented in the other directions. Specifically, each first skew roller 22 and each second skew roller 24 are movable between a shift position (indicated by a solid line in FIG. 2) at which the roller contacts with the surface of the sheet transported along the transport path 2, and a retracted position (indicated by an alternate long and two short dashes line in FIG. 2) at which the roller is retracted upward from the transport path 2 and does not contact with the surface of the sheet transported along the transport path 2. Furthermore, a friction member such as rubber is disposed on the outer circumferential surface of each of the skew rollers 22, 24. When each of the skew rollers 22, 24 contacts with the surface of the sheet transported along the transport path 2, a friction force caused between the sheet and each of the skew rollers 22, 24 is higher than a friction force caused between the sheet and the pair of upper and lower endless belts 12 and 13. Therefore, the sheet is moved along the orientation (that is, the orientation of the skew relative to the extending direction of the transport path 2) of the skew rollers 22, 24 due to the friction force caused between the sheet and each of the skew rollers 22, 24. Thus, in a case where the sheet transported along the transport path 2 contacts with the first skew rollers 22 when the first skew rollers 22 are each positioned at the shift position and the second skew rollers 24 are each positioned at the retracted position, the sheet is shifted in the leftward direction in FIG. 1. Meanwhile, in a case where the sheet transported along the transport path 2 contacts with the second skew rollers 24 when the first skew rollers 22 are each positioned at the retracted position and the second skew rollers 24 are each positioned at the shift position, the sheet is shifted in the rightward direction in FIG. 1. In the present embodiment, in the first sheet shifting mechanism 20, the first skew rollers 22 and the second skew rollers 24 can be each positioned at the retracted position. In this case, the sheet transported by the sheet transport mechanism 10 is not shifted along the width direction by the first sheet shifting mechanism 20. That is, the first sheet shifting mechanism 20 can selectively shift the sheet transported by the sheet transport mechanism 10 along the width direction. The first skew rollers 22 and the second skew rollers 24 are each skewed relative to the extending direction of the transport path 2 at a constant angle. Therefore, when the first skew rollers 22 and the second skew rollers 24 each contact with the sheet, a distance (hereinafter, also referred to as shift amount)

over which the sheet is moved in the width direction is constant.

**[0031]** As shown in FIG. 2, a solenoid 26 is disposed at each first skew roller 22, and each first skew roller 22 is moved by means of the solenoid 26 between the shift position (indicated by the solid line in FIG. 2) and the retracted position (indicated by the alternate long and two short dashes line in FIG. 2) as described above in the up-down direction in FIG. 2. A solenoid 28 is disposed at each second skew roller 24, and each second skew roller 24 is moved by means of the solenoid 28 between the shift position (indicated by the solid line in FIG. 2) and the retracted position (indicated by the alternate long and two short dashes line in FIG. 2) as described above in the up-down direction in FIG. 2. The skew rollers 22, 24 are moved in the up-down direction in FIG. 2 by means of the solenoids 26, 28, respectively, according to a control signal transmitted from a controller 40 described below.

**[0032]** As shown in FIG. 3, in the pair of left and right skew rollers 22, the left skew roller 22 has a rotating shaft 22a mounted thereto, and the skew roller 22 rotates about the rotating shaft 22a. A rotation shaft 23a is connected to one end portion (end portion on the left side in FIG. 3) of the rotating shaft 22a via a screw gear 23b, and the driving motor 23m is connected to the rotation shaft 23a. When the rotation shaft 23a is rotated by the driving motor 23m, the rotating shaft 22a is also rotated to rotate the left skew roller 22. A gear 23c is mounted to the other end portion (end portion on the right side in FIG. 3) of the rotating shaft 22a, and a gear 23e disposed at the right skew roller 22 of the pair of left and right skew rollers 22 is coupled to the gear 23c via a gear 23d. Therefore, when the rotating shaft 22a is rotated, the right skew roller 22 is also rotated via the gears 23c, 23d, 23e. Thus, the pair of left and right skew rollers 22 are rotated in synchronization with each other by the driving motor 23m.

**[0033]** In the pair of left and right skew rollers 24, the right skew roller 24 has a rotating shaft 24a mounted thereto, and the skew roller 24 rotates about the rotating shaft 24a. A rotation shaft 25a is connected to one end portion (end portion on the right side in FIG. 3) of the rotating shaft 24a via a screw gear 25b, and the driving motor 25m is connected to the rotation shaft 25a. When the rotation shaft 25a is rotated by the driving motor 25m, the rotating shaft 24a is also rotated to rotate the right skew roller 24. A gear 25c is mounted to the other end portion (end portion on the left side in FIG. 3) of the rotating shaft 24a, and a gear 25e disposed at the left skew roller 24 of the pair of left and right skew rollers 24 is coupled to the gear 25c via a gear 25d. Therefore, when the rotating shaft 24a is rotated, the left skew roller 24 is also rotated via the gears 25c, 25d, 25e. Thus, the pair of left and right skew rollers 24 are rotated in synchronization with each other by the driving motor 25m.

**[0034]** Next, a configuration of the second sheet shifting mechanism 30 will be described in detail with reference to FIG. 1, FIG. 2, and FIG. 4. As shown in FIG. 1

and FIG. 2, the second sheet shifting mechanism 30 includes an upper guide portion 32 and a lower guide portion 34 that are spaced from each other over a short distance in the up-down direction. The transport path 2 for transporting the sheet is formed between the upper guide portion 32 and the lower guide portion 34. The upper guide portion 32 and the lower guide portion 34 are coupled to each other, and the upper guide portion 32 and the lower guide portion 34 are integrally slidable along the width direction. In the lower guide portion 34, a pair of left and right driving rollers 36 are disposed along the width direction. In the upper guide portion 32, a pair of left and right driven rollers 38 are disposed along the width direction so as to oppose the driving rollers 36. FIG. 1 shows configurations of the lower guide portion 34 and the driving rollers 36 in a state where the upper guide portion 32 and the driven rollers 38 are dismounted from the second sheet shifting mechanism 30.

**[0035]** In the second sheet shifting mechanism 30 having such a configuration, for example, a friction member such as rubber is disposed on the outer circumferential surface of each driving roller 36. The driving roller 36 is rotated in the counterclockwise direction in FIG. 2 by a driving motor 36m (see FIG. 5) described below via a drive shaft 36a (see FIG. 4). A metal member is disposed on the outer circumferential surface of each driven roller 38. The driven rollers 38 are disposed at the upper guide portion 32 so as to be brought into contact with the driving rollers 36 and rotate in conjunction with the driving rollers 36. The sheet is sent into a nip portion formed between the driving rollers 36 and the driven rollers 38, and the sheet is thus transported along the transport path 2 in the leftward direction in FIG. 2. In the present embodiment, a transporting member is configured, by the driving rollers 36 and the driven rollers 38, to be slidable along the width direction and to transport the sheet along the transport path 2. In the present embodiment, a guide member is configured, by the upper guide portion 32 and the lower guide portion 34, to have the transport path 2 formed therebetween.

**[0036]** Next, a mechanism for integrally sliding the upper guide portion 32 and the lower guide portion 34 along the width direction in the second sheet shifting mechanism 30, will be described with reference to FIG. 4. As shown in FIG. 4, two guide rails 34e, 34f are disposed below the lower guide portion 34 so as to extend parallel to each other along the width direction. A first lower member 34a is mounted at the center position of the lower portion of the lower guide portion 34, and a second lower member 34b and a third lower member 34c are mounted at both end positions, respectively, of the lower portion of the lower guide portion 34. The first lower member 34a has a tubular member, and the guide rail 34e penetrates through the tubular member to guide the first lower member 34a along the guide rail 34e in the horizontal direction. Each of the second lower member 34b and the third lower member 34c has a tubular member, and the guide rail 34f penetrates through the tubular members, to guide

the second lower member 34b and the third lower member 34c along guide rail 34f in the horizontal direction.

**[0037]** An endless driving belt 39a is disposed below the guide rails 34e, 34f along the horizontal direction, and the driving belt 39a is extended on and between a plurality of pulleys including a driving pulley 39b (pulleys other than the driving pulley 39b are not shown in FIG. 4). In the second sheet shifting mechanism 30, for example, a driving motor 39m such as a stepping motor for rotating the driving pulley 39b in the forward and reverse directions, is disposed. The second lower member 34b mounted at the lower portion of the lower guide portion 34 has a belt mounting portion 34d, and the belt mounting portion 34d is mounted to the driving belt 39a. In such a configuration, when the driving motor 39m rotates the driving pulley 39b, the driving belt 39a extended on the driving pulley 39b circulates, so that the belt mounting portion 34d is moved in the horizontal direction. Therefore, the second lower member 34b and the third lower member 34c are moved along the guide rail 34f. In this case, the first lower member 34a is also moved along the guide rail 34e, and the upper guide portion 32 and the lower guide portion 34 integrally slide along the width direction. In the present embodiment, the controller 40 described below performs control such that the driving pulley 39b is driven to rotate by the driving motor 39m.

**[0038]** In the present embodiment, the upper guide portion 32 and the lower guide portion 34 integrally slide along the width direction. At this time, the distance of the sliding is adjusted, whereby a distance (shift amount) over which the sheet is moved, by the second sheet shifting mechanism 30, in the width direction can be adjusted.

**[0039]** As shown in FIG. 1, in the sheet transport apparatus 1, an inlet-side sheet detection sensor 50 (first sheet detector) is disposed on the upstream side of the first sheet shifting mechanism 20 (specifically, the skew rollers 22, 24) in the sheet transporting direction. For example, the inlet-side sheet detection sensor 50 detects a position, in the width direction, of the sheet transported along the transport path 2 by the sheet transport mechanism 10. An intermediate sheet detection sensor 52 (second sheet detector) may be disposed between the first sheet shifting mechanism 20 and the second sheet shifting mechanism 30. For example, the intermediate sheet detection sensor 52 detects a position, in the width direction, of the sheet having been shifted along the width direction by the first sheet shifting mechanism 20. Furthermore, an outlet-side sheet detection sensor 54 may be disposed downstream of the second sheet shifting mechanism 30 (specifically, the upper guide portion 32 and the lower guide portion 34) in the sheet transporting direction. For example, the outlet-side sheet detection sensor 54 detects a position, in the width direction, of the sheet having been shifted along the width direction by the second sheet shifting mechanism 30. The sheet detection sensors 50, 52, 54 may also detect the length, in the width direction, of the sheet transported along the transport path 2, or the length thereof in the transporting

direction. The sheet detection sensors 50, 52, 54 may detect a degree of tilting of the sheet transported along the transport path 2 relative to the transporting direction. The sheet detection sensors 50, 52, 54 are each implemented by, for example, a line sensor. Information on detection of the sheet by the sheet detection sensors 50, 52, 54 is transmitted to the controller 40 described below.

**[0040]** As shown in FIG. 5, the sheet transport apparatus 1 of the present embodiment includes the controller 40. The controller 40 controls the components of the sheet transport apparatus 1. More specifically, the sheet transport mechanism 10, the first sheet shifting mechanism 20 (specifically, the driving motors 23m, 25m and the solenoids 26, 28), and the second sheet shifting mechanism 30 (specifically, the driving motor 39m and the driving motor 36m) are connected to the controller 40. The controller 40 transmits instruction signals to the components of the sheet transport mechanism 10, the first sheet shifting mechanism 20, and the second sheet shifting mechanism 30, to control the components. The inlet-side sheet detection sensor 50 is connected to the controller 40. Furthermore, the intermediate sheet detection sensor 52 and the outlet-side sheet detection sensor 54 may be connected to the controller 40. The information on detection by the sheet detection sensors 50, 52, 54 is transmitted to the controller 40. The controller 40 determines whether or not the sheet has been correctly shifted to a predetermined position in the width direction by the first sheet shifting mechanism 20 and the second sheet shifting mechanism 30, based on the information on detection of the transmitted sheet from the outlet-side sheet detection sensor 54.

**[0041]** The controller 40 operates to position the skew rollers 22, 24 of the first sheet shifting mechanism 20 at the retracted position indicated by the alternate long and two short dashes line in FIG. 2 when the sheet transport apparatus 1 is in a waiting state. The controller 40 operates to position the upper guide portion 32 and the lower guide portion 34 of the second sheet shifting mechanism 30 at the center position in the width direction when the sheet transport apparatus 1 is in the waiting state.

**[0042]** The controller 40 calculates a distance (hereinafter, also referred to as shift amount) over which the sheet is to be moved in the width direction by each of the first sheet shifting mechanism 20 and the second sheet shifting mechanism 30, based on a position of the sheet, in the width direction, which is detected by the inlet-side sheet detection sensor 50 before the sheet is sent to the first sheet shifting mechanism 20, and on a predetermined position (for example, the center position), in the width direction, which is preset for the sheet. Specifically, for example, when the position of the sheet, in the width direction, which is detected by the inlet-side sheet detection sensor 50 before the sheet is sent to the first sheet shifting mechanism 20, deviates by 10 mm from the predetermined position (for example, the center position) for the sheet in the width direction, the controller 40 calculates, as 10 mm, the total distance (that is, a shift amount

of the sheet to be shifted by the first sheet shifting mechanism 20 and a shift amount of the sheet to be shifted by the second sheet shifting mechanism 30) over which the sheet is to be moved in the width direction by the first sheet shifting mechanism 20 and the second sheet shifting mechanism 30.

**[0043]** In the present embodiment, as described above, the shift amount of the sheet shifted by the first sheet shifting mechanism 20 is constant, whereas the shift amount of the sheet shifted by the second sheet shifting mechanism 30 is adjustable. The first sheet shifting mechanism 20 selectively shifts the transported sheet in the width direction. The upper limit value of the shift amount of the sheet shifted by the second sheet shifting mechanism 30 is predetermined. That is, a distance over which the upper guide portion 32 and the lower guide portion 34 are moved from the center position to the end position of the transport path 2 in the width direction is the upper limit value of the shift amount of the sheet shifted by the second sheet shifting mechanism 30. The controller 40 determines whether or not the shift amount of the sheet to be shifted by the first sheet shifting mechanism 20 and the second sheet shifting mechanism 30 as calculated based on the detection result by the inlet-side sheet detection sensor 50 is greater than the upper limit value of the shift amount of the sheet shifted by the second sheet shifting mechanism 30. When the shift amount of the sheet to be shifted by the first sheet shifting mechanism 20 and the second sheet shifting mechanism 30 as calculated based on the detection result by the inlet-side sheet detection sensor 50 is not greater than the upper limit value of the shift amount of the sheet shifted by the second sheet shifting mechanism 30, the controller 40 does not cause the first sheet shifting mechanism 20 to shift the sheet along the width direction, and merely causes the second sheet shifting mechanism 30 to shift the sheet along the width direction. Specifically, when the sheet is transported by the sheet transport mechanism 10, the skew rollers 22, 24 are left positioned at the retracted position indicated by the alternate long and two short dashes line in FIG. 2 in the first sheet shifting mechanism 20. Meanwhile, when the shift amount of the sheet to be shifted by the first sheet shifting mechanism 20 and the second sheet shifting mechanism 30 is greater than the upper limit value of the shift amount of the sheet shifted by the second sheet shifting mechanism 30, the controller 40 causes both the first sheet shifting mechanism 20 and the second sheet shifting mechanism 30 to shift the sheet along the width direction. Specifically, when the sheet is transported by the sheet transport mechanism 10, one kind of skew rollers among the skew rollers 22, 24 are moved to the shift position indicated by the solid line in FIG. 2 in the first sheet shifting mechanism 20, and the sheet is shifted along the width direction by the first sheet shifting mechanism 20, and, thereafter, the sheet is further shifted along the width direction by the second sheet shifting mechanism 30. Thus, a position, in the width direction, of the sheet which has passed

through the second sheet shifting mechanism 30 becomes almost the same as the predetermined position (for example, the center position), in the width direction, which is preset for the sheet.

**[0044]** Next, an operation (specifically, a method for transporting the sheet by the sheet transport apparatus 1) of the sheet transport apparatus 1 having such a configuration will be described. The operation of the sheet transport apparatus 1 as described below is performed by the controller 40 controlling the components of the sheet transport apparatus 1.

**[0045]** The sheet having been sent to the sheet transport apparatus 1 according to the present embodiment is transported from the upper side in the downward direction (that is, from the right side in the leftward direction in FIG. 2) in FIG. 1. Firstly, the inlet-side sheet detection sensor 50 detects, for example, a position of the sheet in the width direction. The information on the position of the sheet in the width direction may be, for example, a distance from one of the side edge portions 16 of the transport path 2 to the sheet, or may be a distance from the center of the transport path 2 in the width direction to the center of the sheet. The information on the position of the sheet may be any information by which the position of the sheet can be specified. The length of the sheet in the width direction may be detected by the inlet-side sheet detection sensor 50. The information on the detection by the inlet-side sheet detection sensor 50 is sent to the controller 40. The controller 40 calculates a shift amount of the sheet to be shifted by the first sheet shifting mechanism 20 and the second sheet shifting mechanism 30, based on the position of the sheet, in the width direction, which is detected by the inlet-side sheet detection sensor 50 before the sheet is sent to the first sheet shifting mechanism 20, and on the predetermined position (for example, the center position), in the width direction, which is preset for the sheet.

**[0046]** More specifically, the controller 40 determines whether or not the shift amount of the sheet to be shifted by the first sheet shifting mechanism 20 and the second sheet shifting mechanism 30 as calculated based on the detection result by the inlet-side sheet detection sensor 50 is greater than the upper limit value of the shift amount of the sheet shifted by the second sheet shifting mechanism 30. When the shift amount of the sheet to be shifted by the first sheet shifting mechanism 20 and the second sheet shifting mechanism 30 is greater than the upper limit value of the shift amount of the sheet shifted by the second sheet shifting mechanism 30, the controller 40 causes both the first sheet shifting mechanism 20 and the second sheet shifting mechanism 30 to shift the sheet along the width direction. Specifically, when the sheet is transported by the sheet transport mechanism 10, one kind of skew rollers among the skew rollers 22, 24 are moved to the shift position indicated by the solid line in FIG. 2 in the first sheet shifting mechanism 20, and the sheet is shifted along the width direction by the first sheet shifting mechanism 20. When the sheet is to be shifted

along the width direction in the leftward direction in FIG. 1 by the first sheet shifting mechanism 20, the first skew rollers 22 are moved from the retracted position to the shift position by means of the solenoids 26, and the second skew rollers 24 are left positioned at the retracted position. Thus, the sheet transported along the transport path 2 by the sheet transport mechanism 10 contacts with the first skew rollers 22, and the sheet is shifted in the leftward direction in FIG. 1. Meanwhile, when the sheet is to be shifted along the width direction in the rightward direction in FIG. 1 by the first sheet shifting mechanism 20, the second skew rollers 24 are moved from the retracted position to the shift position by means of the solenoids 28, and the first skew rollers 22 are left positioned at the retracted position. Thus, the sheet transported along the transport path 2 by the sheet transport mechanism 10 contacts with the second skew rollers 24, and the sheet is shifted in the rightward direction in FIG. 1. FIG. 1 shows an exemplary case where, when the inlet-side sheet detection sensor 50 detects that the sheet (indicated by reference character P1 in FIG. 1) is positioned near the left end of the transport path 2 in FIG. 1 before the sheet is sent to the first sheet shifting mechanism 20, the sheet is shifted in the rightward direction in FIG. 1 by the first sheet shifting mechanism 20, and moved to a position indicated by reference character P2 after having passed through the first sheet shifting mechanism 20.

**[0047]** Thereafter, when the sheet is delivered from the sheet transport mechanism 10 to the second sheet shifting mechanism 30, the sheet is continuously transported in the downward direction in FIG. 1 (that is, the leftward direction in FIG. 2) by the rollers 36, 38 of the second sheet shifting mechanism 30. At this time, the upper guide portion 32 and the lower guide portion 34 of the second sheet shifting mechanism 30 slide along the width direction. Therefore, even if the position of the sheet in the width direction deviates from the predetermined position (for example, the center position) before the sheet is sent to the second sheet shifting mechanism 30, the sheet is moved along the width direction by the second sheet shifting mechanism 30, and, therefore, the position, in the width direction, of the sheet discharged from the second sheet shifting mechanism 30 has been shifted to the predetermined position. Specifically, when the sheet delivered from the sheet transport mechanism 10 to the second sheet shifting mechanism 30 is sent into the nip portion between the driving rollers 36 and the driven rollers 38 of the second sheet shifting mechanism 30, the upper guide portion 32 and the lower guide portion 34 slide along the width direction. Thus, while the sheet is gripped between the driving rollers 36 and the driven rollers 38 of the second sheet shifting mechanism 30, the sheet is moved along the width direction so as to approach the predetermined position. When the shift amount of the sheet to be shifted by the first sheet shifting mechanism 20 and the second sheet shifting mechanism 30 is not greater than the upper limit value of the shift

amount of the sheet shifted by the second sheet shifting mechanism 30, the controller 40 merely causes the second sheet shifting mechanism 30 to shift the sheet along the width direction.

**[0048]** The shift amount of the sheet to be shifted by the second sheet shifting mechanism 30 is calculated based on the detection result by the inlet-side sheet detection sensor 50. Specifically, when the sheet is not shifted by the first sheet shifting mechanism 20, the shift amount of the sheet which is calculated based on the position, in the width direction, of the sheet detected before the sheet is sent to the first sheet shifting mechanism 20, and on the predetermined position (for example, the center position), in the width direction, which is preset for the sheet, is the shift amount of the sheet to be shifted by the second sheet shifting mechanism 30. Meanwhile, when the sheet is shifted by the first sheet shifting mechanism 20, a value obtained by subtracting the shift amount of the sheet shifted by the first sheet shifting mechanism 20, from the shift amount of the sheet to be shifted by the first sheet shifting mechanism 20 and the second sheet shifting mechanism 30 as calculated based on the detection result by the inlet-side sheet detection sensor 50, is the shift amount of the sheet to be shifted by the second sheet shifting mechanism 30.

**[0049]** FIG. 1 shows an exemplary case where the sheet (indicated by reference character P2 in FIG. 1) which has passed through the first sheet shifting mechanism 20 is further shifted in the rightward direction in FIG. 1 by the second sheet shifting mechanism 30, and moved to a position indicated by reference character P3 after having passed through the second sheet shifting mechanism 30.

**[0050]** In the sheet transport apparatus 1 according to the present embodiment, the first sheet shifting mechanism 20 roughly shifts the sheet along the width direction, and, thereafter, the second sheet shifting mechanism 30 capable of adjusting the shift amount of the sheet shifts the sheet to the predetermined position along the width direction, so that the sheet can be accurately shifted to the predetermined position in the width direction, and, even when a speed at which the sheet is transported is to be increased, the configuration of the entirety of the apparatus can be simplified and low-priced. More specifically, although the first sheet shifting mechanism 20 shifts the sheet to the predetermined position with lower accuracy than the second sheet shifting mechanism 30, the first sheet shifting mechanism 20 can transport the sheet at a high speed with a simple configuration by using the skew rollers 22, 24. Meanwhile, although the second sheet shifting mechanism 30 can adjust the shift amount of the sheet, and can accurately shift the sheet to the predetermined position in the width direction, the second sheet shifting mechanism 30 having such a configuration is expensive and the shift amount of the sheet is restricted. Therefore, the number of the second sheet shifting mechanisms 30 to be mounted needs to be increased if the first sheet shifting mechanism 20 is not disposed,

and, therefore, the configuration of the apparatus becomes complicated and expensive. Therefore, in the sheet transport apparatus 1 of the present embodiment, the first sheet shifting mechanism 20 and the second sheet shifting mechanism 30 are used in combination, thereby obtaining advantages from both the shifting mechanisms.

**[0051]** In the present embodiment, instead of the shift amount of the sheet to be shifted by the second sheet shifting mechanism 30 being calculated based on the detection result by the inlet-side sheet detection sensor 50, the shift amount may be calculated based on the detection result by the intermediate sheet detection sensor 52. In particular, when the first sheet shifting mechanism 20 has a simpler configuration at the cost of the accuracy with which the sheet is shifted to the predetermined position, the shift amount by the first sheet shifting mechanism 20 may vary. In this case, when the shift amount of the sheet is calculated based on the detection result by the intermediate sheet detection sensor 52 disposed immediately upstream of the second sheet shifting mechanism 30, the sheet can be more accurately shifted to the predetermined position in the width direction by the second sheet shifting mechanism 30. Furthermore, the outlet-side sheet detection sensor 54 for detecting a position, in the width direction, of the sheet discharged from the second sheet shifting mechanism 30, may be disposed. Information on detection by the outlet-side sheet detection sensor 54 is sent to the controller 40. The controller 40 determines whether or not the sheet has been accurately shifted to the predetermined position in the width direction by the first sheet shifting mechanism 20 and the second sheet shifting mechanism 30, based on the information, on detection of the sheet, which has been sent from the outlet-side sheet detection sensor 54.

**[0052]** In the present embodiment, in, for example, the banknote depositing and dispensing machine to which the sheet transport apparatus 1 is mounted, a recognition unit that recognizes the sheet may be disposed upstream of the sheet transport mechanism 10, and may detect a kind and a transport state (specifically, the length of the sheet in the width direction, the position of the sheet in the width direction, or the like) of the sheet before the sheet is sent to the sheet transport mechanism 10. Specifically, the recognition unit disposed upstream of the sheet transport mechanism 10 is implemented by, for example, an image sensor, and detects the length of the sheet in the width direction, the position of the sheet in the width direction, and the like, based on the image of the sheet taken by the image sensor. In this case, the shift amount of the sheet to be shifted by the first sheet shifting mechanism 20 and the second sheet shifting mechanism 30 is calculated based on the detection result for the sheet by the recognition unit instead of the detection result for the sheet by the inlet-side sheet detection sensor 50. Therefore, the inlet-side sheet detection sensor 50 may not be disposed upstream of the first sheet shifting mechanism 20. In the present embodiment, such

a recognition unit is also included in the sheet transport apparatus 1. Such a recognition unit functions as a first sheet detector that detects a position of the sheet in the width direction.

**[0053]** Among the plurality of kinds of the sheet shifting mechanisms, the first sheet shifting mechanism is not limited to one having the configuration shown in FIG. 1 to FIG. 3. The first sheet shifting mechanism may be configured as shown in FIG. 6. FIG. 6 is a top view of another configuration of the first sheet shifting mechanism of the sheet transport apparatus according to the present embodiment. The sheet transport apparatus shown in FIG. 6 has the sheet transport mechanism 10 having the same configuration as the sheet transport mechanism of the sheet transport apparatus 1 shown in FIG. 1, and components, in FIG. 6, of the sheet transport mechanism 10 having such a configuration are denoted by the same reference characters as in FIG. 1.

**[0054]** A first sheet shifting mechanism 60 of the sheet transport apparatus according to modification as shown in FIG. 6 includes skew rollers 62, 64 that are skewed relative to the extending direction (that is, the up-down direction in FIG. 6) of the transport path 2. When the sheet transported in a state of being gripped between the paired upper and lower endless belts 12 and 13 contacts with the skew rollers 62, 64, the sheet is shifted in the width direction. As shown in FIG. 6, in the plurality of the skew rollers 62, 64, the direction in which each first skew roller 62 is skewed relative to the extending direction of the transport path 2 and the direction in which each second skew roller 64 is skewed relative thereto, are different from each other. As shown in FIG. 6, the paired left and right first skew rollers 62 are aligned along the width direction and the paired left and right second skew rollers 64 are aligned along the width direction. The second skew rollers 64 are disposed downstream of the first skew rollers 62 in the sheet transporting direction in the transport path 2. Each first skew roller 62 and each second skew roller 64 are rotated by a not-illustrated driving motor.

**[0055]** As shown in FIG. 6, the paired left and right first skew rollers 62 are pivotally supported by a common rotating shaft 63, and, when the rotating shaft 63 rotates, the first skew rollers 62 rotate in synchronization with each other. A not-illustrated driving motor is connected to the rotating shaft 63, and the rotating shaft 63 is rotated by the driving motor. The rotating shaft 63 oscillates, about a pivot 63a disposed at the right side end portion of the rotating shaft 63 in FIG. 6, in the directions indicated by arrows in FIG. 6. More specifically, the rotating shaft 63 has an angle adjustment mechanism (not shown) that adjusts an angle of the rotating shaft 63 relative to the width direction. The angle adjustment mechanism having such a configuration causes the rotating shaft 63 to oscillate about the pivot 63a between a first position indicated by a solid line in FIG. 6 and a second position indicated by an alternate long and two short dashes line in FIG. 6. A friction member such as rubber is disposed on

the outer circumferential surface of each first skew roller 62. Thus, in a case where the rotating shaft 63 is positioned at the first position indicated by the solid line in FIG. 6, when each first skew roller 62 contacts with the surface of the sheet transported along the transport path 2, the sheet is moved along the orientation (that is, the orientation of the skew relative to the extending direction of the transport path 2) of the first skew rollers 62 due to a friction force caused between the sheet and each first skew roller 62. Thus, the transported sheet is shifted along the width direction in the leftward direction in FIG. 6. Meanwhile, in a case where the rotating shaft 63 is positioned at the second position indicated by the alternate long and two short dashes line in FIG. 6, the extending direction of the transport path 2 and the direction in which each first skew roller 62 is oriented are almost the same. Even when each first skew roller 62 contacts with the surface of the sheet transported along the transport path 2, the sheet is not shifted along the width direction. In the example shown in FIG. 6, the angle adjustment mechanism can stop the rotating shaft 63 at any position between the first position indicated by the solid line in FIG. 6 and the second position indicated by the alternate long and two short dashes line in FIG. 6. Therefore, an angle of the orientation of each first skew roller 62 relative to the extending direction of the transport path 2 can be adjusted, and, thus, the shift amount by the first sheet shifting mechanism 60 can also be adjusted.

**[0056]** As shown in FIG. 6, the paired left and right second skew rollers 64 are pivotally supported by a common rotating shaft 65, and, when the rotating shaft 65 rotates, the second skew rollers 64 rotate in synchronization with each other. A not-illustrated driving motor is connected to the rotating shaft 65, and the rotating shaft 65 is rotated by the driving motor. The rotating shaft 65 oscillates, about a pivot 65a disposed at the left side end portion of the rotating shaft 65 in FIG. 6, in the directions indicated by arrows in FIG. 6. More specifically, the rotating shaft 65 has an angle adjustment mechanism (not shown) that adjusts an angle of the rotating shaft 65 relative to the width direction. The angle adjustment mechanism having such a configuration causes the rotating shaft 65 to oscillate about the pivot 65a between a first position indicated by a solid line in FIG. 6 and a second position indicated by an alternate long and two short dashes line in FIG. 6. A friction member such as rubber is disposed on the outer circumferential surface of each second skew roller 64. Thus, in a case where the rotating shaft 65 is positioned at the first position indicated by the solid line in FIG. 6, when each second skew roller 64 contacts with the surface of the sheet transported along the transport path 2, the sheet is moved along the orientation (that is, the orientation of the skew relative to the extending direction of the transport path 2) of the second skew rollers 64 due to a friction force caused between the sheet and each second skew roller 64. Thus, the transported sheet is shifted along the width direction in the rightward direction in FIG. 6. Meanwhile, in a case

where the rotating shaft 65 is positioned at the second position indicated by the alternate long and two short dashes line in FIG. 6, the extending direction of the transport path 2 and the direction in which each second skew roller 64 is oriented are almost the same. Even when each second skew roller 64 contacts with the surface of the sheet transported along the transport path 2, the sheet is not shifted along the width direction. In the example shown in FIG. 6, the angle adjustment mechanism can stop the rotating shaft 65 at any position between the first position indicated by the solid line in FIG. 6 and the second position indicated by the alternate long and two short dashes line in FIG. 6. Therefore, an angle of the orientation of each second skew roller 64 relative to the extending direction of the transport path 2 can be adjusted, and, thus, the shift amount by the first sheet shifting mechanism 60 can be also adjusted.

**[0057]** In the sheet transport apparatus that includes the first sheet shifting mechanism 60 having such a configuration, the shift amount of the sheet shifted by the first sheet shifting mechanism 60 is adjusted based on the detection result for the sheet by the inlet-side sheet detection sensor 50. Therefore, when the first sheet shifting mechanism 60 in addition to the second sheet shifting mechanism 30 also adjusts the shift amount of the sheet, the sheet can be more accurately shifted to the predetermined position in the width direction.

**[0058]** The second sheet shifting mechanism disposed downstream among a plurality of kinds of the sheet shifting mechanisms is not limited to one having the configuration shown in FIG. 1, FIG. 2, and FIG. 4. The second sheet shifting mechanism may be configured as shown in FIG. 7 to FIG. 9. FIG. 7 is a perspective view of another configuration of the second sheet shifting mechanism of the sheet transport apparatus according to the present embodiment. FIG. 8 is a top view of the second sheet shifting mechanism shown in FIG. 7. FIG. 9 is a side cross-sectional view of the second sheet shifting mechanism shown in FIG. 8 as viewed from the direction of arrows A-A.

**[0059]** A second sheet shifting mechanism 70 shown in FIG. 7 to FIG. 9 is different from the second sheet shifting mechanism 30 shown in FIG. 1, FIG. 2, and FIG. 4 in that, in the second sheet shifting mechanism 70, an upper guide portion (not shown) and a lower guide portion 74 are not slidable and are disposed so as to be fixed relative to the sheet transport apparatus and a driven roller (not shown) and a driving roller 76 are slidable relative to the upper guide portion and the lower guide portion 74, respectively, along the width direction. Specifically, the second sheet shifting mechanism 70 includes the upper guide portion (not shown) and the lower guide portion 74 that are spaced from each other over a short distance in the up-down direction and are disposed so as to be fixed relative to the sheet transport apparatus. The transport path 2 in which the sheet is transported is formed between the upper guide portion and the lower guide portion 74. As shown in FIG. 7 to FIG. 9, a pair of

left and right driving rollers 76 are disposed at the lower guide portion 74 along the width direction, and a pair of left and right driven rollers (not shown) are disposed at the upper guide portion along the width direction so as to oppose the driving rollers 76. A drive shaft 79 for driving and rotating the driving rollers 76 is disposed at the driving rollers 76.

**[0060]** In the second sheet shifting mechanism 70 shown in FIG. 7 to FIG. 9, openings 74a each having an almost rectangular shape are formed in the lower guide portion 74 so as to correspond to the driving rollers 76, respectively. Each driving roller 76 projects upward through the corresponding opening 74a from the upper surface of the lower guide portion 74 (see FIG. 9). A driving roller support portion 75 for supporting each driving roller 76 is disposed below the lower guide portion 74. The driving roller support portion 75 is formed from a plate-like member having an almost rectangular shape, and is slidable along the width direction (that is, the left-right direction in FIG. 8) of the transport path 2. Thus, the driving rollers 76 supported by the driving roller support portion 75 are also slidable along the width direction.

**[0061]** Openings each having an almost rectangular shape are formed also in the upper guide portion so as to correspond to the driven rollers, respectively, which is not shown. Each driven roller projects downward through the corresponding opening from the lower surface of the upper guide portion. A driven roller support portion for supporting each driven roller is disposed above the upper guide portion. The driven roller support portion is formed from a plate-like member having an almost rectangular shape, and is slidable along the width direction. Thus, the driven rollers supported by the driven roller support portion are also slidable along the width direction.

**[0062]** In the second sheet shifting mechanism 70 shown in FIG. 7 to FIG. 9, the transporting member is configured, by the driving rollers 76 and the driven rollers, to be movable along the width direction and to transport the sheet along the transport path 2. A guide member is configured, by the upper guide portion and the lower guide portion 74, to have the transport path 2 formed therebetween. As described above, the guide member is disposed so as to be fixed relative to the sheet transport apparatus, and the transporting member formed from the driving rollers 76 and the driven rollers is slidable along the width direction relative to the guide member disposed so as to be fixed relative to the sheet transport apparatus.

**[0063]** Next, a mechanism for sliding the driving roller support portion 75 along the width direction will be described with reference to FIG. 7 to FIG. 9. As shown in FIG. 7 and FIG. 8, two guide rails 80, 81 are disposed below the lower guide portion 74 so as to extend parallel to each other along the width direction. A first lower member 75a is mounted at the center position of one of the side edge portions of the driving roller support portion 75, and a second lower member 75b and a third lower member 75c are mounted at both end positions, respectively, of the other of the side edge portions of the driving

roller support portion 75. The first lower member 75a has a tubular member, and the guide rail 80 penetrates through the tubular member, to guide the first lower member 75a along the guide rail 80 in the horizontal direction. Each of the second lower member 75b and the third lower member 75c also has a tubular member. The guide rail 81 penetrates through the tubular members, to guide the second lower member 75b and the third lower member 75c along the guide rail 81 in the horizontal direction.

**[0064]** An endless driving belt (not shown) is disposed below the guide rails 80, 81 along the horizontal direction, and the driving belt is extended on and between a plurality of pulleys (not shown) including a driving pulley (not shown). In the second sheet shifting mechanism 70, for example, a driving motor (not shown) such as a stepping motor for rotating the driving pulley in the forward and reverse directions, is disposed. The second lower member 75b mounted at the side edge portion of the driving roller support portion 75 has a belt mounting portion (not shown), and the belt mounting portion is mounted to the driving belt. In such a configuration, when the driving motor rotates the driving pulley, the driving belt extended on the driving pulley circulates, so that the belt mounting portion is moved in the horizontal direction. Therefore, the second lower member 75b and the third lower member 75c are moved along the guide rail 81. In this case, the first lower member 75a is also moved along the guide rail 80, and the driving roller support portion 75 slides along the width direction. Thus, each driving roller 76 supported by the driving roller support portion 75 also slides along the width direction in the opening 74a of the lower guide portion 74. In the second sheet shifting mechanism 70 shown in FIG. 7 to FIG. 9, the controller 40 performs control such that the driving pulley is driven to rotate by the driving motor.

**[0065]** A mechanism for sliding the driven roller support portion along the width direction, which is not shown, has the same configuration as the mechanism for sliding the driving roller support portion 75 described above along the width direction.

**[0066]** The second sheet shifting mechanism 70 shown in FIG. 7 to FIG. 9 is different from the second sheet shifting mechanism 30 shown in FIG. 1, FIG. 2, and FIG. 4 in that, in the second sheet shifting mechanism 70, the upper guide portion and the lower guide portion 74 themselves need not be slid along the width direction, and the driving roller support portion 75 for supporting each driving roller 76 and the driven roller support portion for supporting each driven roller may be merely slid along the width direction. Therefore, the weight of the member to be slid in the width direction is reduced, so that a load on the driving motors for driving the driving roller support portion 75 and the driven roller support portion is also reduced. Thus, response can be improved when each driving roller 76 and each driven roller are slid along the width direction, or the lifespan of each of the driving motors for driving the driving roller support portion 75 and the driven roller support portion can be elongated.

**[0067]** In the sheet transport apparatus 1 shown in FIG. 1 and the like, the number of combination sets each including the upper guide portion 32, the lower guide portion 34, the pair of left and right driving rollers 36, and the pair of left and right driven rollers 38 in the second sheet shifting mechanism 30 is one. However, the present invention is not limited thereto. As shown in FIG. 10, a sheet transport apparatus 1a that includes a second sheet shifting mechanism 30a in which the number of combination sets each including the upper guide portion 32, the lower guide portion 34, the pair of left and right driving rollers 36, and the pair of left and right driven rollers 38 is plural (two in the example shown in FIG. 10), may be used. In the sheet transport apparatus 1a shown in FIG. 10, the two lower guide portions 34 of the second sheet shifting mechanism 30a are coupled to each other, and the two combination sets each including the upper guide portion 32, the lower guide portion 34, the pair of left and right driving rollers 36, and the pair of left and right driven rollers 38 are integrally moved along the width direction. In the second sheet shifting mechanism 30a having such a configuration, the length of the second sheet shifting mechanism 30a in the sheet transporting direction can be increased, so that the shift amount of the sheet shifted by the second sheet shifting mechanism 30a can also be increased when the sheet is transported at a high speed. Also in the sheet transport apparatus 1a as shown in FIG. 10, one transporting member is regarded as being configured by the driving rollers 36 and the driven rollers 38 in the two combination sets.

**[0068]** In still another example, in a sheet transport apparatus 1b shown in FIG. 11, a second sheet shifting mechanism 30b has two first combination sets each of which includes the upper guide portion 32, the lower guide portion 34, the pair of left and right driving rollers 36, and the pair of left and right driven rollers 38, and has two second combination sets each of which includes an upper guide portion (not shown), a lower guide portion 35, a pair of left and right driving rollers 37, and a pair of left and right driven rollers (not shown), and which are disposed downstream of the two first combination sets. The upper guide portion (not shown), the lower guide portion 35, the pair of left and right driving rollers 37, and the pair of left and right driven rollers (not shown) in each second combination set have almost the same configurations as the upper guide portion 32, the lower guide portion 34, the pair of left and right driving rollers 36, and the pair of left and right driven rollers 38 in each first combination set. In the sheet transport apparatus 1b as shown in FIG. 11, the two lower guide portions 34 of the second sheet shifting mechanism 30b are coupled to each other, and the two first combination sets each including the upper guide portion 32, the lower guide portion 34, the pair of left and right driving rollers 36, and the pair of left and right driven rollers 38 are integrally moved along the width direction. The two lower guide portions 35 of the second sheet shifting mechanism 30b are also coupled to each other, and the two second com-

bination sets each including the upper guide portion (not shown), the lower guide portion 35, the pair of left and right driving rollers 37, and the pair of left and right driven rollers (not shown) are integrally moved along the width direction. The driving rollers 36 of the two first combination sets and the driving rollers 37 of the two second combination sets are rotated by a single driving motor in synchronization with each other. In the second sheet shifting mechanism 30b having such a configuration, the length of the second sheet shifting mechanism 30b in the sheet transporting direction can be further increased, so that the shift amount of the sheet shifted by the second sheet shifting mechanism 30b can also be further increased when the sheet is transported at a high speed.

**[0069]** Furthermore, the second sheet shifting mechanism may be configured as shown in FIG. 12. In a second sheet shifting mechanism 30c shown in FIG. 12, an upstream-side combination set 90 and a downstream-side combination set 95 are disposed on the upstream side and the downstream side, respectively, of the combination set including the upper guide portion 32, the lower guide portion 34, the pair of left and right driving rollers 36, and the pair of left and right driven rollers 38. The upstream-side combination set 90 includes an upper guide portion (not shown), a lower guide portion 91, a pair of left and right driving rollers 92, and a pair of left and right driven rollers (not shown). In the upstream-side combination set 90 having such a configuration, the upper guide portion (not shown) and the lower guide portion 91 are coupled to each other. As shown in FIG. 12, both side edges of the lower guide portion 91 in the width direction are mounted to the side edge portions 16 by springs 94, respectively. By such springs 94 being disposed, the upper guide portion (not shown) and the lower guide portion 91 are integrally movable along the width direction. In the waiting state, the upper guide portion (not shown) and the lower guide portion 91 are positioned at the center position in the width direction. The downstream-side combination set 95 includes an upper guide portion (not shown), a lower guide portion 96, a pair of left and right driving rollers 97, and a pair of left and right driven rollers (not shown). In the downstream-side combination set 95 having such a configuration, the upper guide portion (not shown) and the lower guide portion 96 are coupled to each other. As shown in FIG. 12, both side edges of the lower guide portion 96 in the width direction are mounted to the side edge portions 16 by springs 98, respectively. By such springs 98 being disposed, the upper guide portion (not shown) and the lower guide portion 96 are integrally movable along the width direction. In the waiting state, the upper guide portion (not shown) and the lower guide portion 96 are positioned at the center position in the width direction. The driving rollers 92 of the upstream-side combination set 90, the driving rollers 36 disposed in the lower guide portion 34 that slides along the width direction, and the driving rollers 97 of the downstream-side combination set 95 are rotated by a single driving motor in synchronization with each

other.

**[0070]** In the second sheet shifting mechanism 30c shown in FIG. 12, when the sheet gripped by the nip portion between the driving rollers 92 and the driven rollers of the upstream-side combination set 90 is delivered to the nip portion between the driving rollers 36 and the driven rollers 38, even if the upper guide portion 32 and the lower guide portion 34 slide in the width direction in a state where the leading end edge of the sheet in the transporting direction is gripped between the driving rollers 36 and the driven rollers 38, and the rear end edge of the sheet is gripped between the driving rollers 92 and the driven rollers of the upstream-side combination set 90, the upper guide portion and the lower guide portion 91 of the upstream-side combination set 90 integrally move along the width direction, thereby preventing the sheet from being skewed. That is, if the upper guide portion and the lower guide portion 91 of the upstream-side combination set 90 are disposed so as to be fixed relative to the sheet transport apparatus, and the driving rollers and the driven rollers of the upstream-side combination set 90 are also disposed so as to be fixed relative to the sheet transport apparatus, when the upper guide portion 32 and the lower guide portion 34 slide in the width direction in a state where the leading end edge of the sheet in the transporting direction is gripped between the driving rollers 36 and the driven rollers 38, and the rear end edge of the sheet is gripped between the driving rollers 92 and the driven rollers of the upstream-side combination set 90, the leading end edge of the sheet is moved along the width direction whereas the rear end edge of the sheet is not moved, so that the orientation of such a sheet relative to the extending direction of the transport path 2 is changed, and the sheet may be skewed. Meanwhile, in the second sheet shifting mechanism 30c shown in FIG. 12, in a case where the sheet gripped by the nip portion between the driving rollers 92 and the driven rollers of the upstream-side combination set 90 is delivered to the nip portion between the driving rollers 36 and the driven rollers 38, when the leading end edge of the sheet is moved along the width direction, the rear end edge of the sheet is also moved along the width direction, so that the orientation of the sheet relative to the extending direction of the transport path 2 can be inhibited from changing.

**[0071]** Similarly, in a case where the sheet gripped by the nip portion between the driving rollers 36 and the driven rollers 38 is delivered to the nip portion between the driving rollers 97 and the driven rollers of the downstream-side combination set 95, even if the upper guide portion 32 and the lower guide portion 34 are slid in the width direction so as to return to their original positions in a state where the leading end edge of the sheet in the transporting direction is gripped between the driving rollers 97 and the driven rollers of the downstream-side combination set 95, and the rear end edge of the sheet is gripped between the driving rollers 36 and the driven rollers 38, the upper guide portion and the lower guide por-

tion 96 of the downstream-side combination set 95 are integrally moved along the width direction, thereby preventing the sheet from being skewed.

**[0072]** The sheet transport apparatus according to the present embodiment is not limited to the above-described configuration, and various modifications can be made.

**[0073]** For example, the predetermined position, in the width direction, to which the sheet is shifted by the first sheet shifting mechanism and the second sheet shifting mechanism is not limited to the center position. The predetermined position to which the sheet is shifted by the first sheet shifting mechanism and the second sheet shifting mechanism may be any position in the width direction. For example, in a case where the sheet transport apparatus according to the present embodiment is used as a banknote transport device mounted in a banknote depositing and dispensing machine for performing depositing and dispensing of banknotes, and various storage cassettes are disposed in the banknote depositing and dispensing machine at end positions in the width direction of the transport path of the banknote transport device, the predetermined position to which the sheet is shifted by the first sheet shifting mechanism and the second sheet shifting mechanism may be an end position in the width direction. Furthermore, in a case where a large number of sheets are transported to the same transport destination, the predetermined position in the width direction may be changed in units of a predetermined number (for example, 100) of the sheets. In this case, the sheets stored in the same transport destination are grouped in units of the predetermined number of sheets, and each group of sheets are sorted and counted, thereby more efficiently executing a series of tasks.

**[0074]** In the above description, in the sheet transport apparatus according to the present embodiment, two kinds of sheet shifting mechanisms which are the first sheet shifting mechanism and the second sheet shifting mechanism are used. However, the present invention is not limited thereto. In the sheet transport apparatus according to the present embodiment, three or more kinds of sheet shifting mechanisms may be used. In this case, each of the sheet shifting mechanisms has a different mechanism to shift the sheet in the width direction.

**[0075]** Among a plurality of kinds of sheet shifting mechanisms, the first sheet shifting mechanism may not have a skew roller that is skewed relative to the extending direction of the transport path 2. When the sheet can be transported at a high speed with a simple configuration by roughly shifting the sheet along the width direction, the first sheet shifting mechanism may have a configuration other than the configuration in which a skew roller skewed relative to the extending direction of the transport path 2 is disposed. Among a plurality of kinds of the sheet shifting mechanisms, the second sheet shifting mechanism may not have a transporting member that is slidable along the width direction and that transports the sheet along the transport path 2. When the sheet can be accurately positioned at the predetermined position in the

width direction, the second sheet shifting mechanism may have a configuration other than the configuration where a transporting member that is slidable along the width direction is disposed.

**[0076]** In the sheet transport apparatuses 1, 1a, 1b shown in FIG. 1 to FIG. 12 described above, the sheet transporting direction is a single direction. However, the sheet transport apparatus according to the present embodiment is not limited thereto. A sheet transport apparatus 1c as shown in FIG. 13 may be used as the sheet transport apparatus according to the present embodiment. The sheet transport apparatus 1c shown in FIG. 13 is different from the sheet transport apparatus 1 shown in FIG. 2 in that, in the sheet transport apparatus 1c, an additional sheet transport mechanism 10 and a third sheet shifting mechanism 41 are disposed to the left of the second sheet shifting mechanism 30, and the sheet can be transported in both the leftward and rightward directions in FIG. 13. The third sheet shifting mechanism 41 has almost the same configuration as the first sheet shifting mechanism 20. Specifically, the third sheet shifting mechanism 41 has skew rollers 42, 44 that are skewed relative to the extending direction of the transport path 2, and, when the sheet that is transported in a state of being gripped between the paired upper and lower endless belts 12 and 13 of the additional sheet transport mechanism 10 contacts with the skew rollers 42, 44, the sheet is shifted in the width direction. Among the plurality of skew rollers 42, 44, the first skew rollers 42 have almost the same configuration as the first skew rollers 22 of the first sheet shifting mechanism 20, and the second skew rollers 44 have almost the same configuration as the second skew rollers 24 of the first sheet shifting mechanism 20. As shown in FIG. 13, a solenoid 46 is disposed at each first skew roller 42, and each first skew roller 42 is moved by means of the solenoid 46 between the shift position (indicated by a solid line in FIG. 13) and the retracted position (indicated by an alternate long and two short dashes line in FIG. 13) in the up-down direction in FIG. 13. A solenoid 48 is disposed at each second skew roller 44, and each second skew roller 44 is moved by means of the solenoid 48 between the shift position (indicated by a solid line in FIG. 13) and the retracted position (indicated by an alternate long and two short dashes line in FIG. 13) in the up-down direction in FIG. 13. The skew rollers 42, 44 are moved in the up-down direction in FIG. 13 by means of the solenoids 46, 48, respectively, according to a control signal transmitted from the controller 40.

**[0077]** An inlet-side sheet detection sensor 58 is disposed on the left side of the third sheet shifting mechanism 41 in FIG. 13. The inlet-side sheet detection sensor 58 detects, for example, a position, in the width direction, of the sheet that is transported along the transport path 2 in the rightward direction in FIG. 13. An intermediate sheet detection sensor 56 may be disposed between the second sheet shifting mechanism 30 and the third sheet shifting mechanism 41 in FIG. 13. When the sheet is

transported along the transport path 2 in the rightward direction in FIG. 13, the intermediate sheet detection sensor 56 detects, for example, a position, in the width direction, of the sheet that has been shifted along the width direction by the third sheet shifting mechanism 41. The sheet detection sensors 56, 58 are each implemented by, for example, a line sensor. Information on detection of the sheet by the sheet detection sensors 56, 58 is sent to the controller 40.

**[0078]** In the sheet transport apparatus 1c shown in FIG. 13, when the sheet is transported along the transport path 2 in the leftward direction in FIG. 13, the sheet is shifted to a predetermined position in the width direction by the first sheet shifting mechanism 20 and the second sheet shifting mechanism 30. Meanwhile, when the sheet is transported along the transport path 2 in the rightward direction in FIG. 13, the sheet is shifted to a predetermined position in the width direction by the third sheet shifting mechanism 41 and the second sheet shifting mechanism 30. Thus, in the sheet transport apparatus 1c shown in FIG. 13, the sheet is transported in the transport path 2 in the direction from the second sheet shifting mechanism 30 toward the first sheet shifting mechanism 20, in addition to the direction from the first sheet shifting mechanism 20 toward the second sheet shifting mechanism 30. Such a sheet that is transported in the direction from the second sheet shifting mechanism 30 toward the first sheet shifting mechanism 20 can be also shifted to the predetermined position in the width direction.

### Claims

1. A sheet handling apparatus for transporting a sheet along a transport path, the sheet handling apparatus comprising a plurality of kinds of sheet shifting mechanisms disposed along an extending direction of the transport path, and configured to shift a transported sheet in a width direction of the transport path, wherein the plurality of kinds of sheet shifting mechanisms include a first sheet shifting mechanism disposed in a sheet transporting direction, and a second sheet shifting mechanism disposed downstream of the first sheet shifting mechanism, and each of the first sheet shifting mechanism and the second sheet shifting mechanism has a different mechanism to shift the sheet in the width direction.
2. The sheet handling apparatus according to claim 1, wherein a shift amount of the sheet shifted by the first sheet shifting mechanism is constant, and a shift amount of the sheet shifted by the second sheet shifting mechanism is adjustable.
3. The sheet handling apparatus according to claim 1 or 2, further comprising a first sheet detector disposed on an upstream side of the first sheet shifting mechanism in the sheet transporting direction and configured to detect a position of the sheet in the width direction, wherein a shift amount by the first sheet shifting mechanism is determined based on a detection result by the first sheet detector.
4. The sheet handling apparatus according to claim 3, wherein the first sheet shifting mechanism selectively shifts the transported sheet in the width direction, and whether or not the sheet is to be shifted by the first sheet shifting mechanism is determined based on the detection result by the first sheet detector.
5. The sheet handling apparatus according to claim 3 or 4, wherein the first sheet detector includes a recognition unit for recognizing the sheet.
6. The sheet handling apparatus according to any one of claims 3 to 5, wherein a shift amount of the sheet to be shifted by the second sheet shifting mechanism is determined based on the detection result by the first sheet detector.
7. The sheet handling apparatus according to any one of claims 1 to 5, further comprising a second sheet detector disposed between the first sheet shifting mechanism and the second sheet shifting mechanism in the sheet transporting direction and configured to detect a position of the sheet in the width direction, wherein a shift amount of the sheet to be shifted by the second sheet shifting mechanism is determined based on a detection result by the second sheet detector.
8. The sheet handling apparatus according to any one of claims 1 to 7, wherein the second sheet shifting mechanism has a transporting member that is slidable along the width direction, and that transports the sheet along the transport path, and the sheet transported by the transporting member is shifted in the width direction by sliding the transporting member along the width direction.
9. The sheet handling apparatus according to claim 8, wherein a number of the transporting members in the second sheet shifting mechanism is one.
10. The sheet handling apparatus according to claim 8 or 9, wherein the transporting member has a pair of upper and lower rollers for gipping and transporting the sheet.
11. The sheet handling apparatus according to any one of claims 8 to 10, wherein

a guide member that forms the transport path has the transporting member, and the guide member and the transporting member are integrally slidable along the width direction.

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- 12.** The sheet handling apparatus according to any one of claims 8 to 10, wherein a guide member that forms the transport path has the transporting member, and the guide member is disposed so as to be fixed relative to the sheet handling apparatus, and the transporting member is slidable relative to the guide member along the width direction. 10
- 13.** The sheet handling apparatus according to any one of claims 1 to 12, wherein the first sheet shifting mechanism has a skew roller that is skewed relative to the extending direction of the transport path. 15
- 14.** The sheet handling apparatus according to any one of claims 1 to 13, wherein the sheet is transported in the transport path also in a direction from the second sheet shifting mechanism toward the first sheet shifting mechanism. 20
- 15.** The sheet handling apparatus according to claim 14, wherein the plurality of kinds of sheet shifting mechanisms further include a third sheet shifting mechanism, and the second sheet shifting mechanism is disposed between the first sheet shifting mechanism and the third sheet shifting mechanism with respect to a direction that the transport path transports the sheet. 25 30
- 16.** The sheet handling apparatus according to claim 15, wherein the third sheet shifting mechanism has the same configuration as the first sheet shifting mechanism. 35

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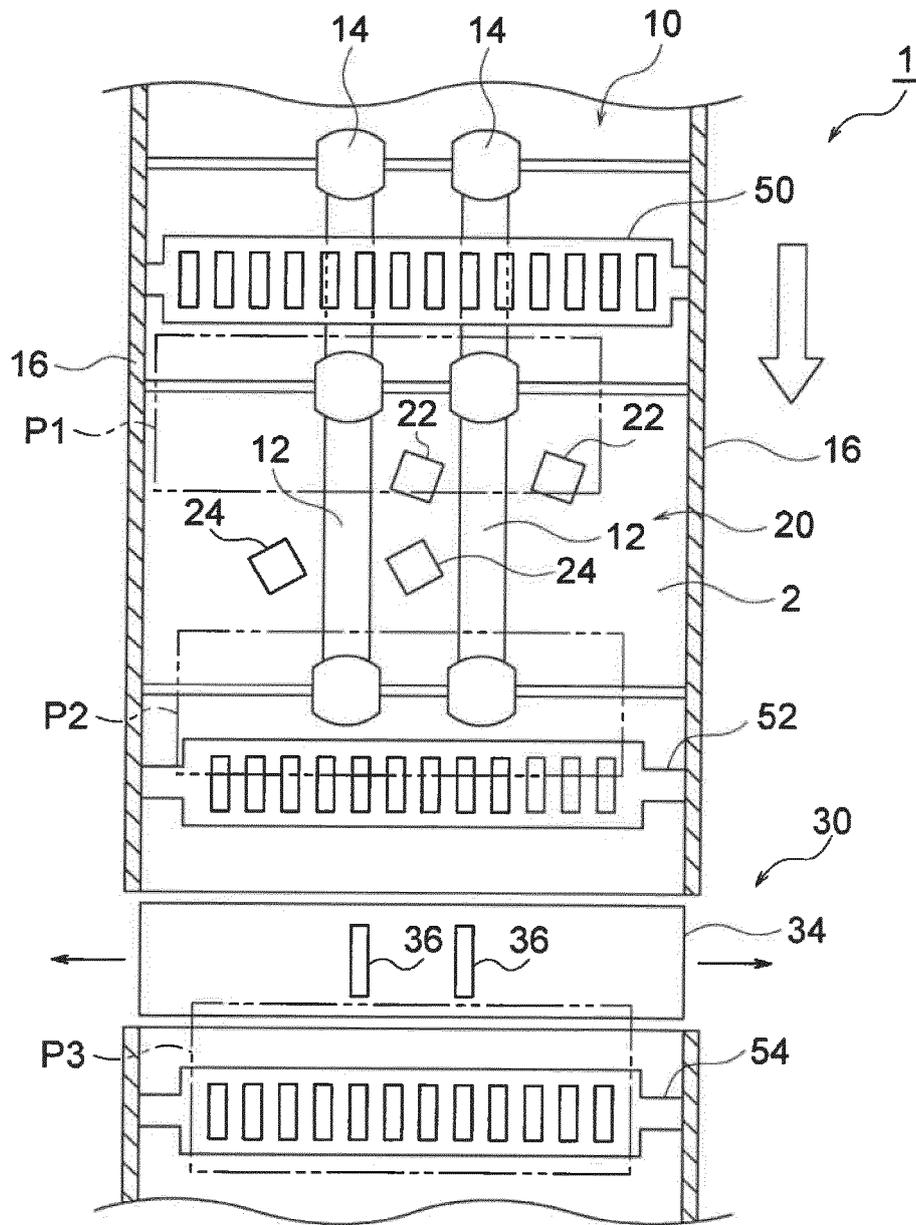


FIG. 1

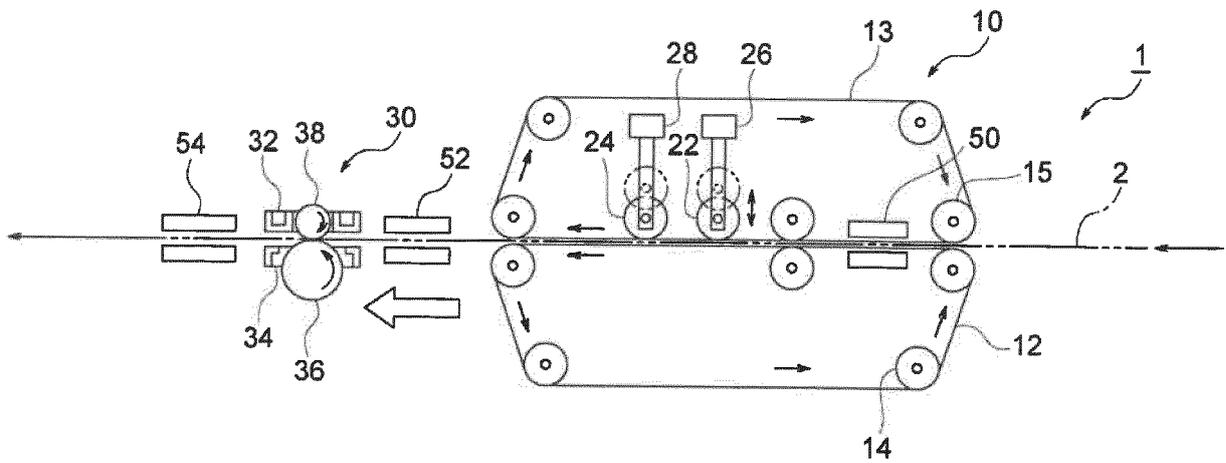


FIG. 2

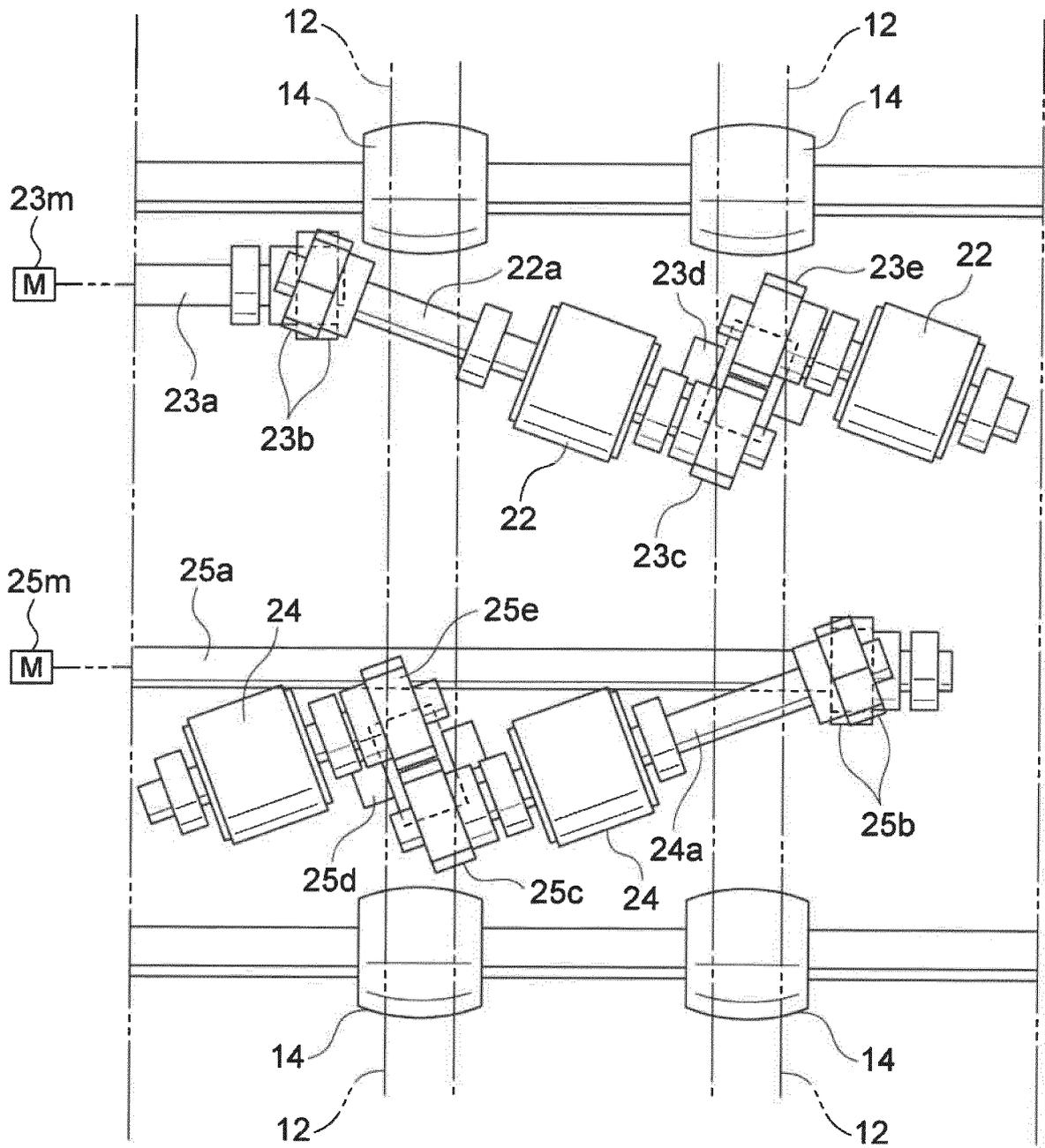


FIG. 3

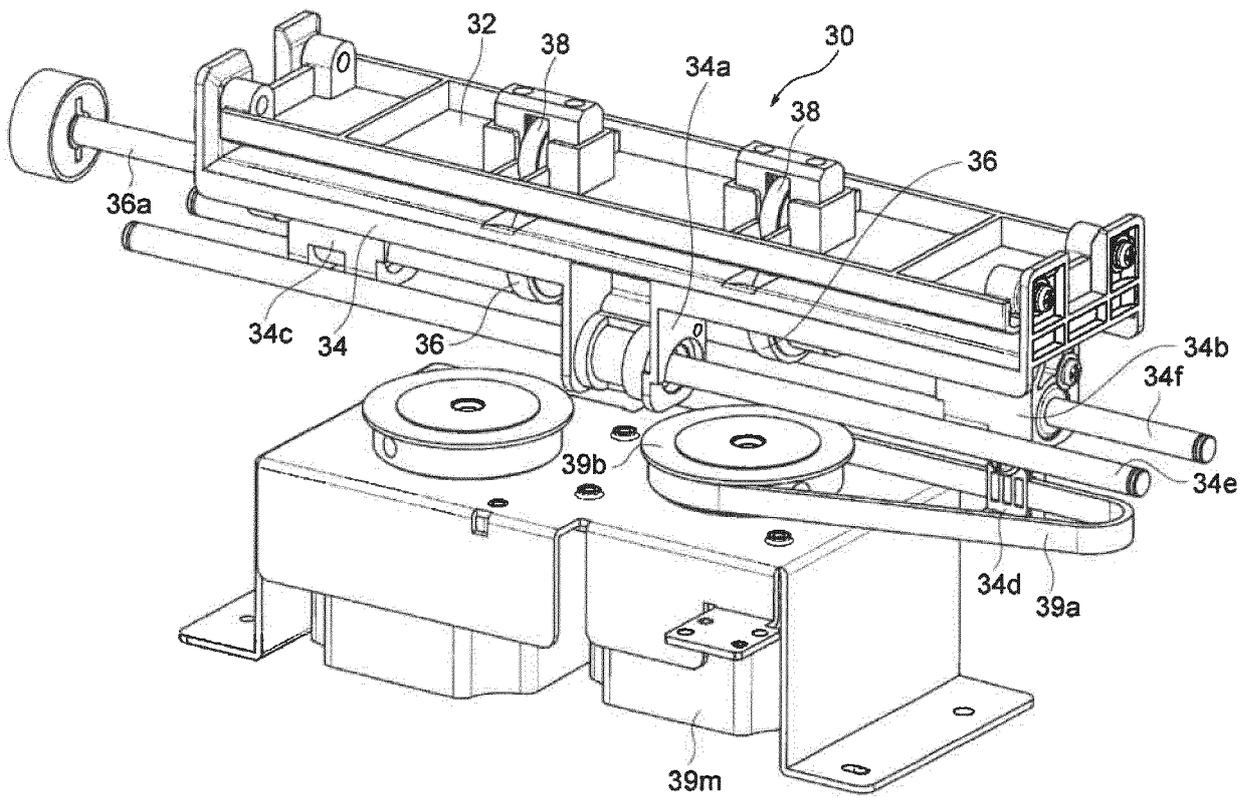


FIG. 4

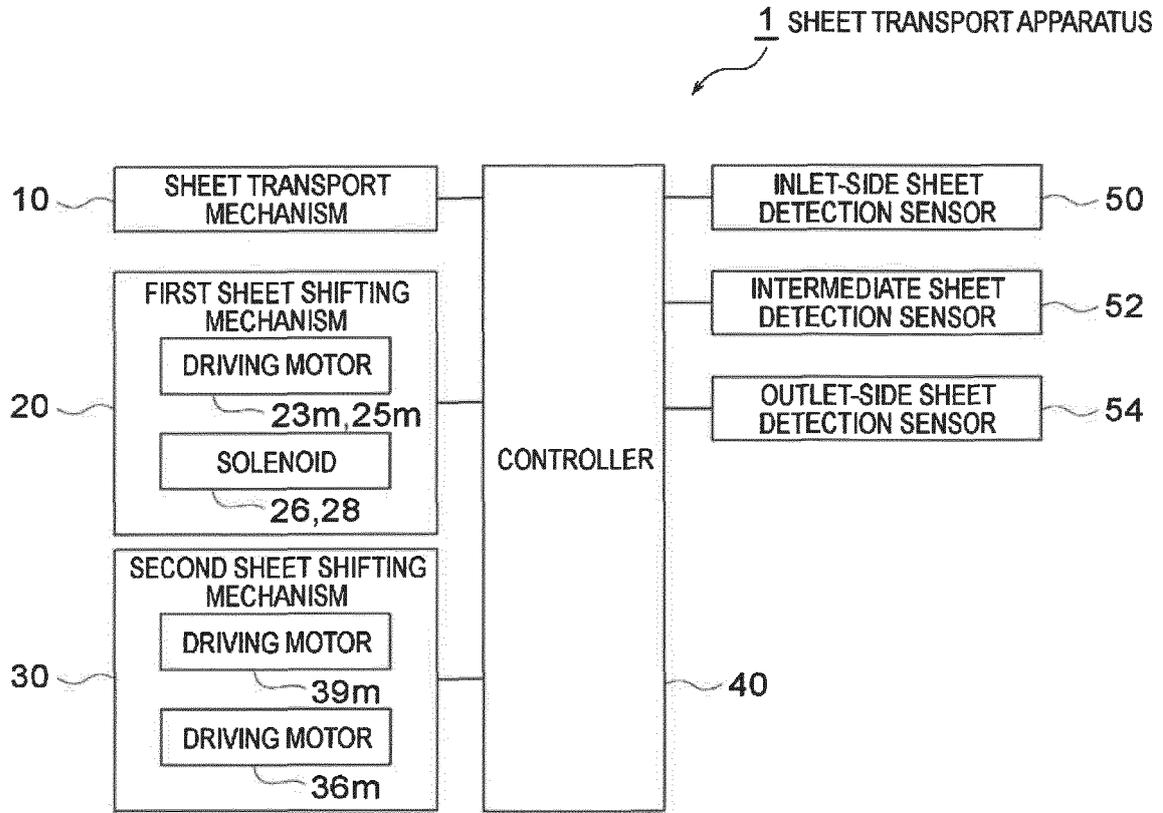


FIG. 5

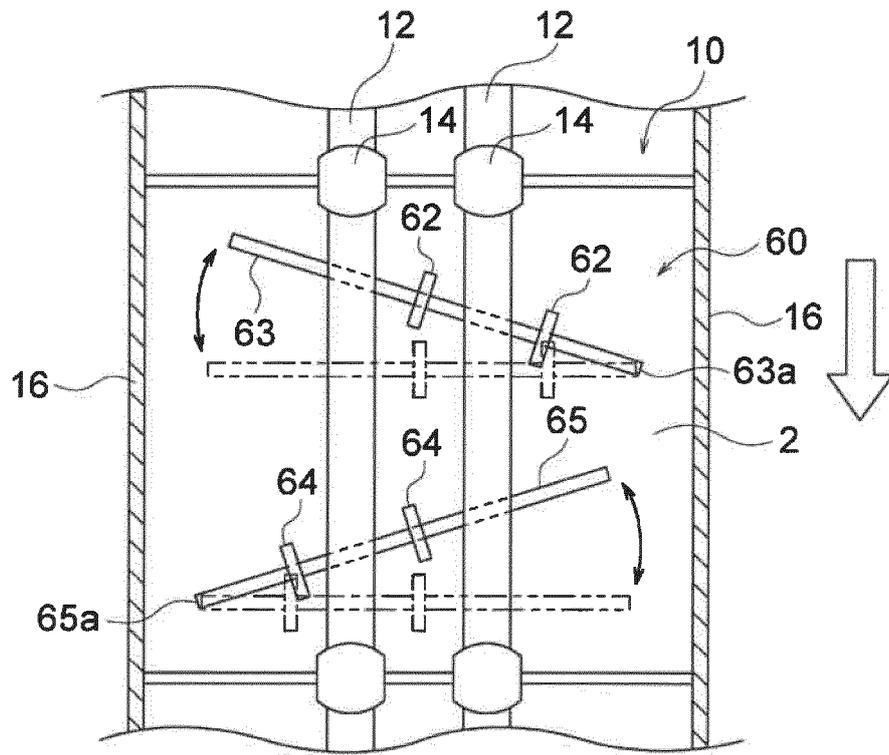


FIG. 6

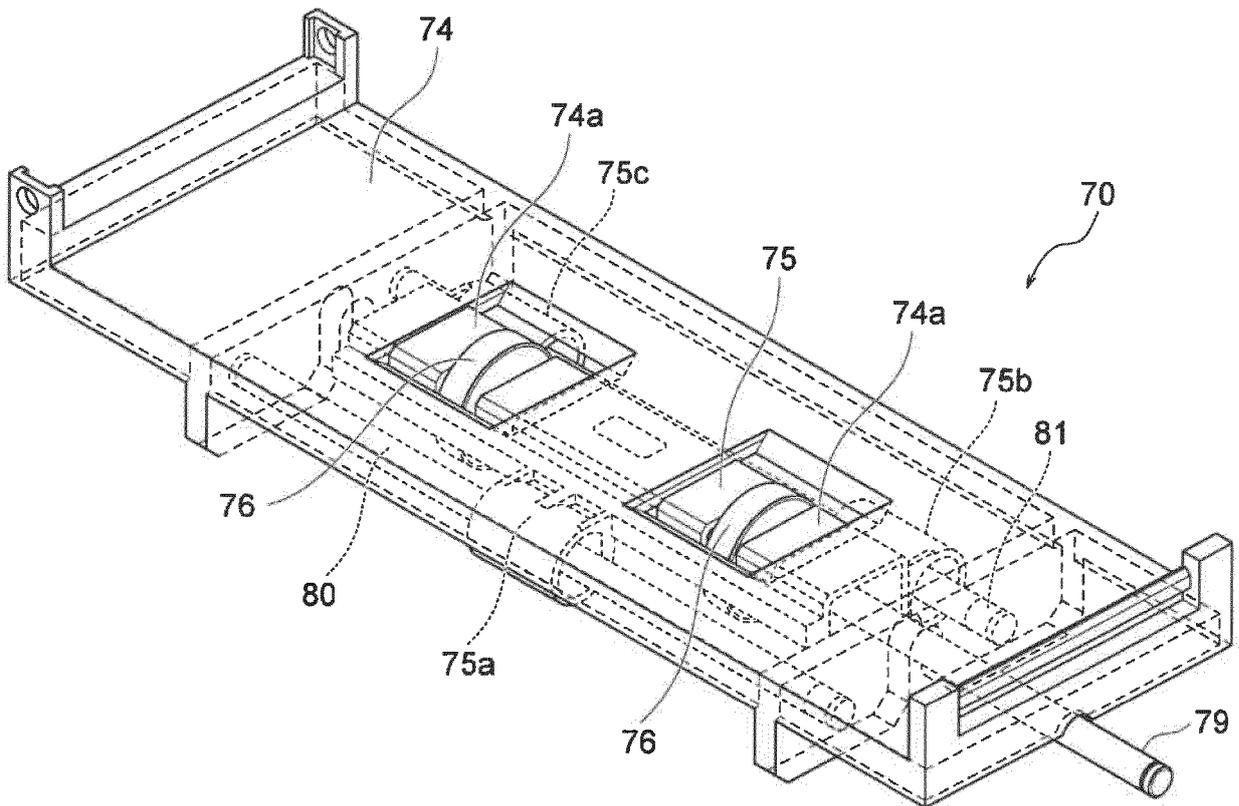


FIG. 7

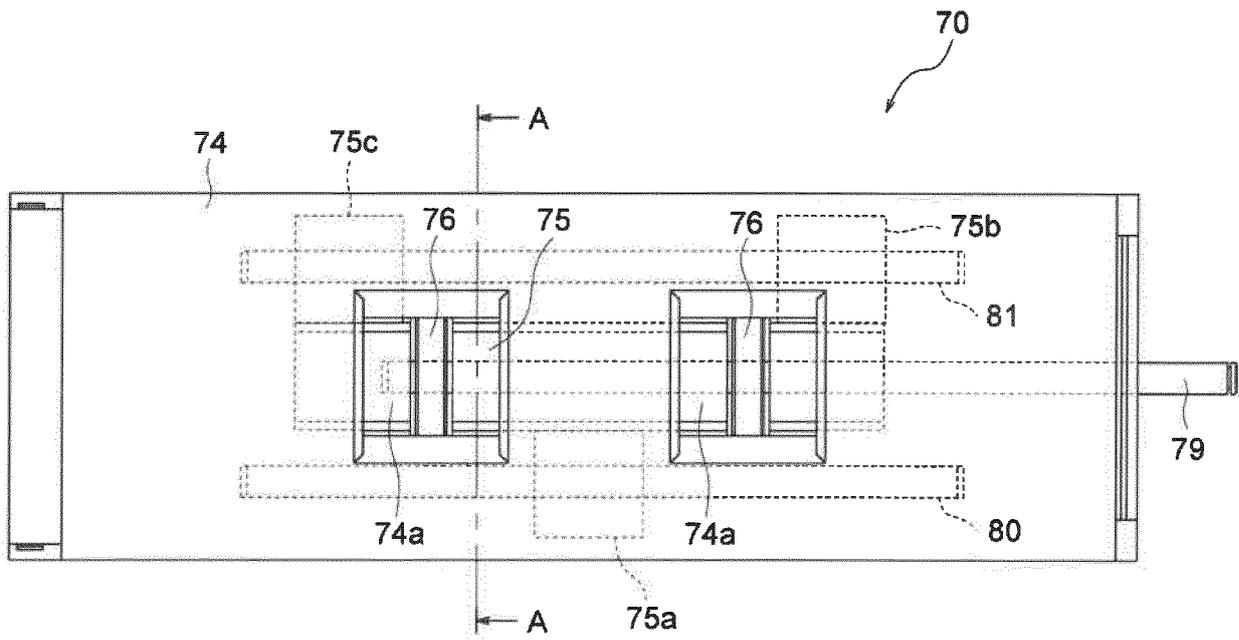


FIG. 8

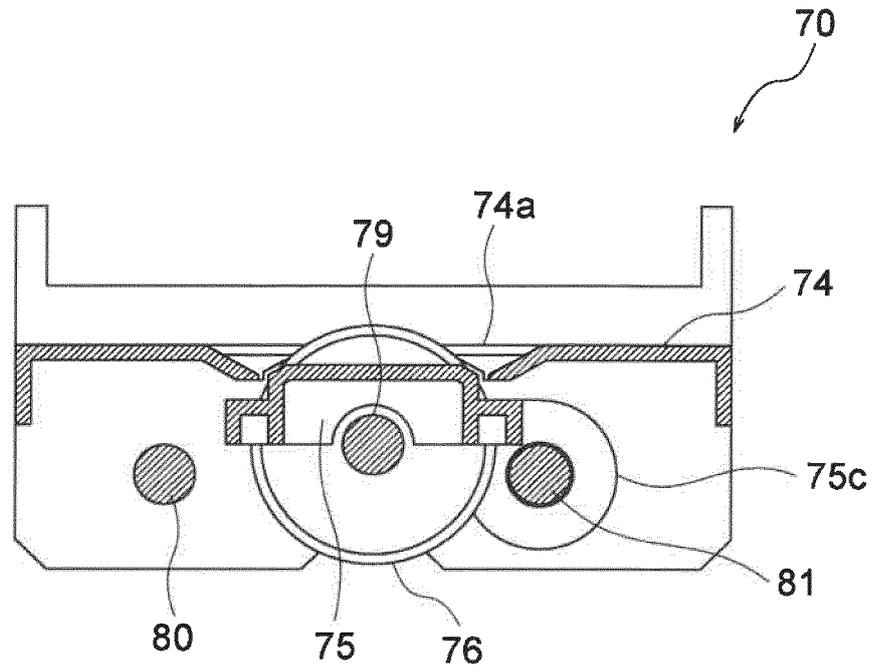


FIG. 9

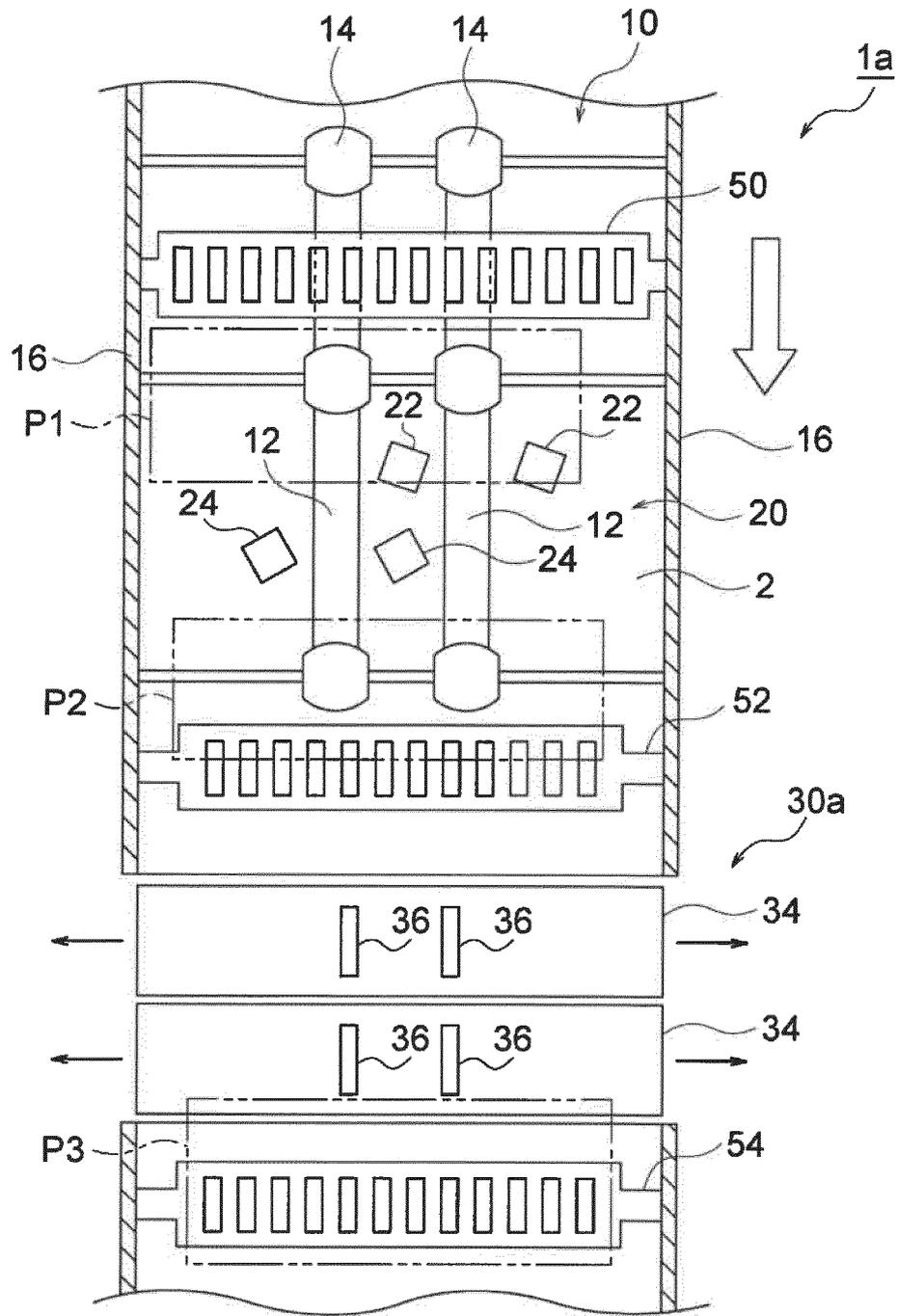


FIG. 10

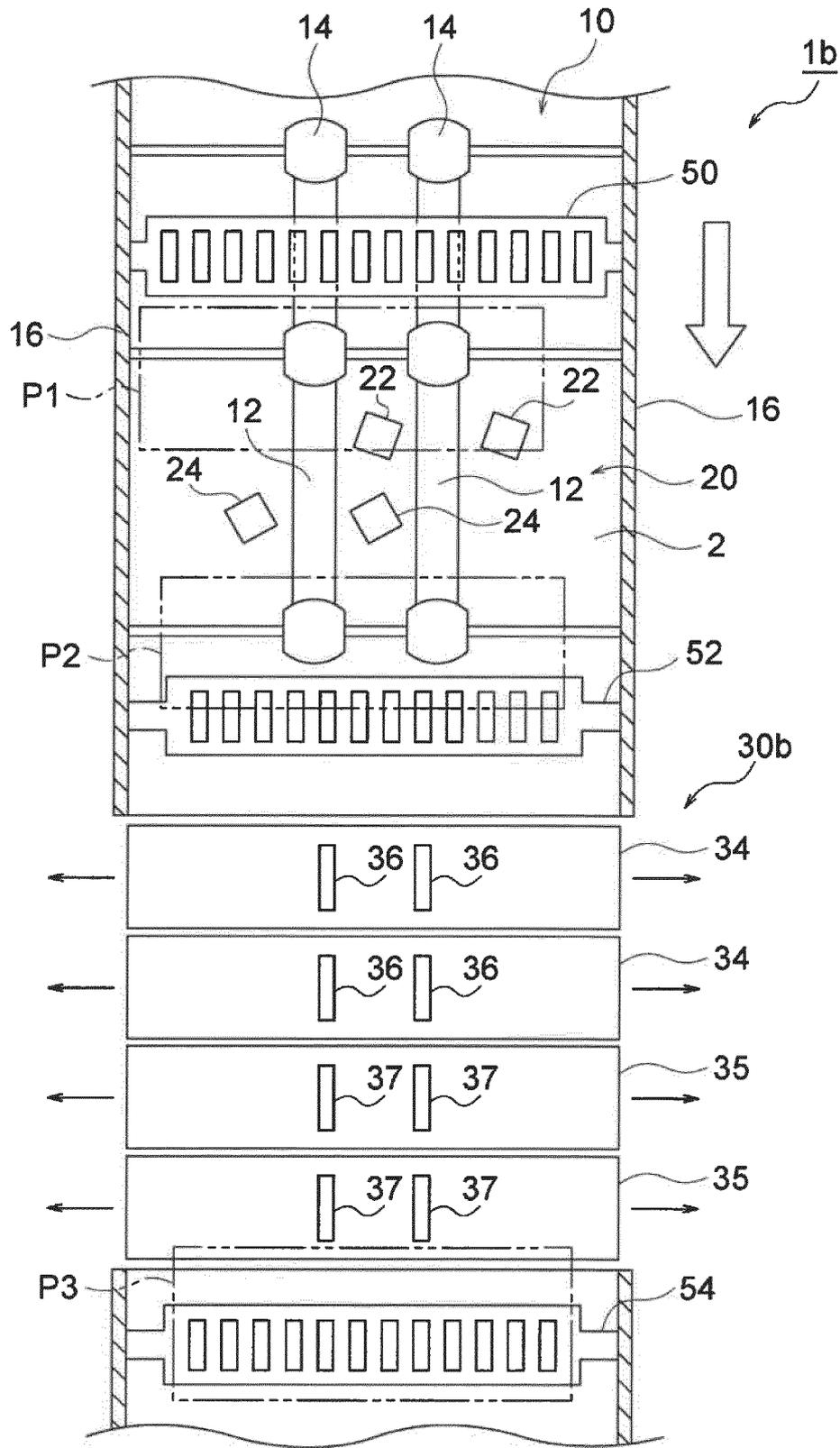


FIG. 11

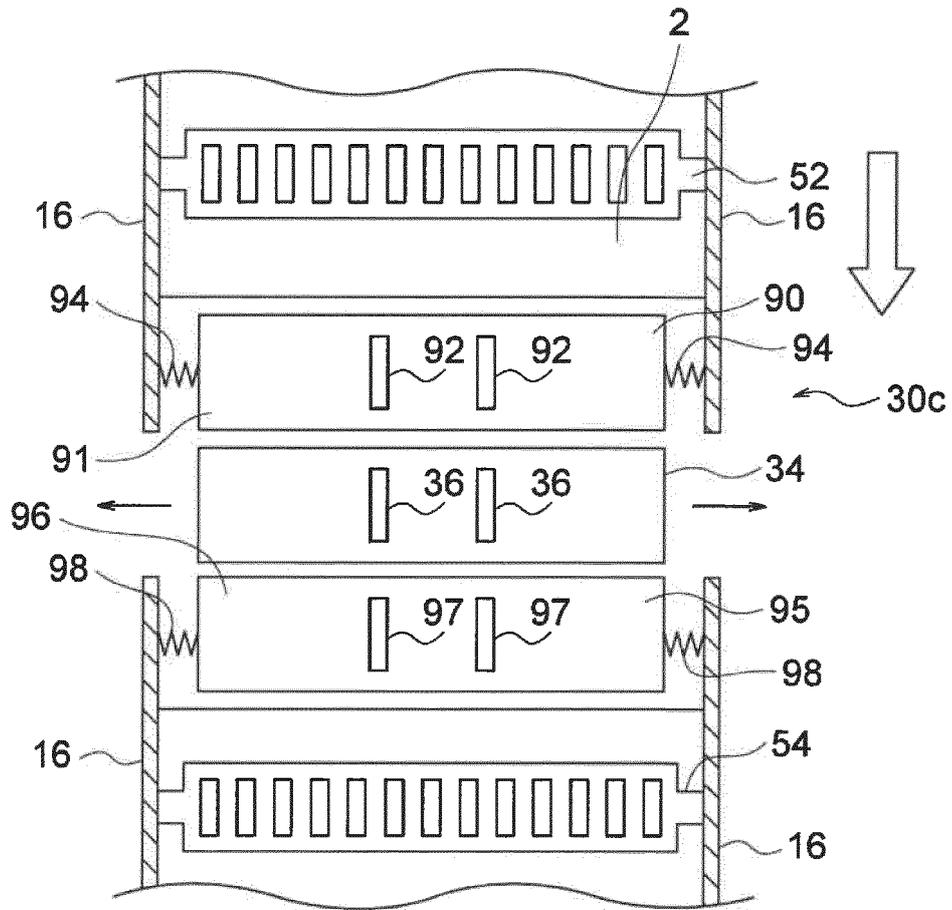


FIG. 12

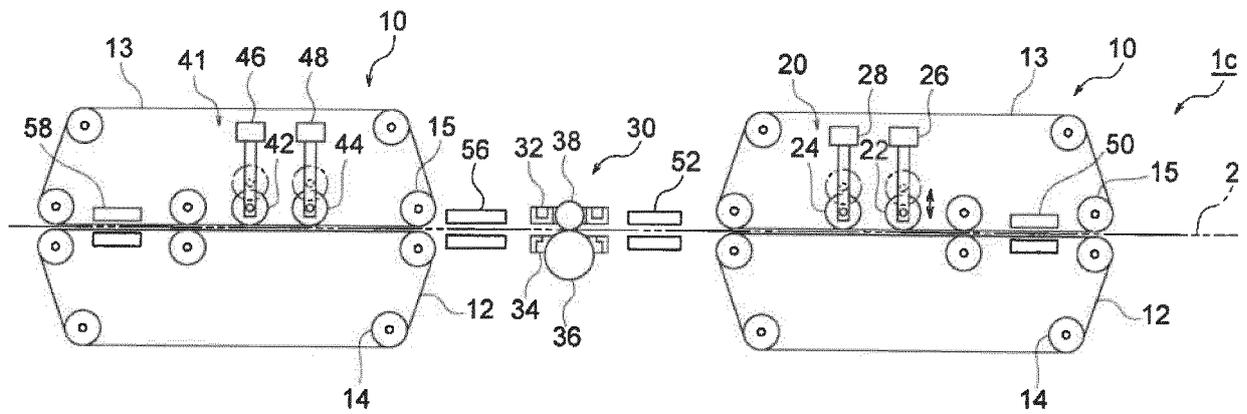


FIG. 13

INTERNATIONAL SEARCH REPORT

International application No.  
PCT/JP2018/002518

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A. CLASSIFICATION OF SUBJECT MATTER  
Int. Cl. B65H9/00 (2006.01) i, B65H9/16 (2006.01) i, G07D9/00 (2006.01) i

According to International Patent Classification (IPC) or to both national classification and IPC

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B. FIELDS SEARCHED  
Minimum documentation searched (classification system followed by classification symbols)  
Int. Cl. B65H9/00, B65H9/16, G07D9/00

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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched  
Published examined utility model applications of Japan 1922-1996  
Published unexamined utility model applications of Japan 1971-2018  
Registered utility model specifications of Japan 1996-2018  
Published registered utility model applications of Japan 1994-2018

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 4297855 B2 (HITACHI-OMRON TERMINAL SOLUTIONS, CORP.) 15 July 2009, paragraphs [0030]-[0201], fig. 1-21 (Family: none)	1-16
Y	JP 2017-37246 A (CANON INC.) 16 February 2017, paragraphs [0043]-[0053], fig. 7, 8 & US 2017/0045854 A1, paragraphs [0064]-[0077], fig. 7, 8	1-16
Y	JP 2004-323212 A (FUJI XEROX CO., LTD.) 18 November 2004, paragraphs [0034], [0035], [0051]-[0053], fig. 3, 14 (Family: none)	1-16

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

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

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Date of the actual completion of the international search  
07.03.2018

Date of mailing of the international search report  
20.03.2018

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Name and mailing address of the ISA/  
Japan Patent Office  
3-4-3, Kasumigaseki, Chiyoda-ku,  
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Authorized officer

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INTERNATIONAL SEARCH REPORT

International application No.  
PCT/JP2018/002518

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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2016-172619 A (GLORY LTD.) 29 September 2016, paragraphs [0027]-[0114], fig. 1-21 & WO 2016/147838 A1	1-16
Y	JP 2015-27912 A (GLORY LTD.) 12 February 2015, paragraphs [0099]-[0102], fig. 9 & US 2016/0272448 A1, paragraphs [0110]-[0113], fig. 9	14-16

Form PCT/ISA/210 (continuation of second sheet) (January 2015)

**REFERENCES CITED IN THE DESCRIPTION**

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**Patent documents cited in the description**

- JP 4297855 B [0003] [0005]
- JP 2015027912 A [0004] [0005]
- JP 2002308472 A [0003] [0005]