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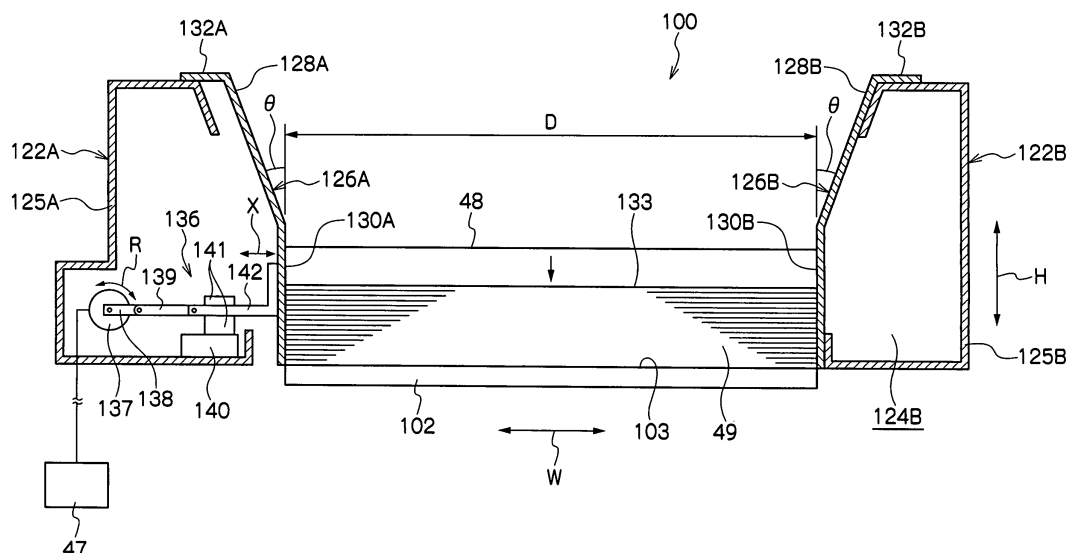
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(54) **Sheet material stacking apparatus and method of stacking sheet material**

(57) The present invention provides a sheet material stacking apparatus (100) that includes a sheet material stacking base (102) on which sheet materials (49) induced by a sheet material conveying unit (36) are stacked, a first guide member (122A) disposed along the conveyance direction of the sheet materials to the sheet material stacking base (102) and sorts the end surfaces at one end with respect to the width direction (W) thereof, a second guide member (122B) which is disposed in parallel and opposite to the first guide member (122A) having

the sheet material stacking base (102) therebetween, a pusher (126A) that constitutes at least a portion of the first guide member (122A) and is displaced between a reference position in which the distance (D) to the second guide member (122B) is equal to the width of the sheet material and a separating position in which the distance to the second guide member is larger than the width of the sheet material, and a driving unit (136) that displaces the pusher (126A) and places side by side both ends of the sheet materials (49) in the axis direction.

FIG. 4



Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates a sheet material stacking apparatus and a method of stacking the sheet material.

Description of the Related Art

[0002] In a planographic printing plate-manufacturing line, a heat- or photo-sensitive plate making layer is formed on roughened surface(s) of a support strip, which is manufactured by roughening one or both surfaces of an aluminum strip, to obtain a planographic printing plate strip, then, the resulting planographic printing plate strip is slit in a predetermined width and then cut in a predetermined length to produce a planographic printing plate.

[0003] A sheet material such as a planographic printing plate obtained in the above-mentioned manner or recording paper is stacked by means of a sheet material stacking apparatus in a manufacturing step.

[0004] There is an example of the sheet material stacking apparatus wherein a pair of leaf spring members are disposed in parallel to the conveyance direction of printing plates to be stacked at a distance from +0 to -5 mm wider than the width of the planographic printing plate so as to form side walls and the printing plates are guided at the central position by urging force of the leaf spring members (see, e.g., Japanese Patent Application Laid-Open (JP-A) No. 2002-308513).

[0005] There is the other example of the sheet material stacking apparatus comprising first and second side guides that are provided at a sheet material stacking portion so as to be movable in a direction crossing the conveyance direction, the first side guide being a rigid position adjusting member provided with a convex-like, arch-shaped face and the second side guide being a flexible position adjusting member (see, e.g., JP-A No. 10-120280).

[0006] However, in the sheet material stacking apparatus described in JP-A No. 2002-308513, in case when the planographic printing plate is conveyed in a wobbling manner and induced in a position leaning along the width direction thereof from the normal position or in a position inclining with respect to the traveling direction thereof, the position of the planographic printing plate is not sufficiently corrected by the spring members and thus the planographic printing plate is sometimes caught between the plate spring members if the leaning or inclination of the planographic plate is large.

[0007] In a sheet member stacking apparatus described in JP-A No. 10-120280, when the end surfaces of a bundle of sheets being stacked in a large number and becoming heavy are sorted by means of the first and second side guides, sheets are insufficiently pushed

thereinto and sometimes not sorted because of the formation of a flexible face on one side.

SUMMARY OF THE INVENTION

[0008] The present invention is objected to provide a sheet material stacking apparatus and a method of stacking a sheet material that can solve the problems and its first aspect relates to a sheet material stacking apparatus comprising: a sheet material stacking base on which sheet materials induced from a sheet material conveying unit conveying the sheet materials are stacked, a first guide member disposed along the conveyance direction of the sheet materials toward the sheet material stacking base so as to sort one end-surfaces of the sheet materials located at the end with respect to the width direction thereof, a second guide member which is disposed in parallel to and also opposite to the first guide member with the sheet material stacking base being configured therebetween, a pusher that constitutes at least a portion of the first guide member and is displaced between a reference position in which the distance to the second guide member is equal to the width of the sheet materials and a separating position in which the distance to the second guide member is larger than the width of the sheet materials, and a driving unit that displaces the pusher so as to sort both ends of the sheet materials in the axis direction.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] FIG. 1 is a whole diagram of a processing line of a planographic printing plate according to exemplary embodiment 1 of the present invention.

FIG. 2 is a partial block diagram of the processing line according to exemplary embodiment 1 of the present invention.

FIG. 3 is a block diagram of a stacking apparatus according to exemplary embodiment 1 of the present invention.

FIG. 4 is a cross sectional view in the width direction of the stacking apparatus according to exemplary embodiment 1 of the present invention.

FIG. 5A is a depiction diagram indicating a support state of a guide plate according to exemplary embodiment 1 of the present invention; FIG 5B is a depiction diagram indicating a support state of a guide plate according to a comparative example.

FIGS. 6A to 6D are depiction diagrams indicating a procedure that moves guide plates according to exemplary embodiment 1 of the present invention and places side by side the end surfaces of planographic printing plates.

FIG. 7A is a partial block diagram of a processing line according to exemplary embodiment 2 of the present invention; FIG 7B is a partial cross sectional view along the width direction of a stacking apparatus.

tus included by the processing line.

FIGS. 8A to 8D are depiction diagrams indicating a procedure that moves guide plates according to exemplary embodiment 2 of the present invention and places side by side the end surfaces of planographic printing plates.

FIG. 9 is a cross sectional view in the width direction of the stacking apparatus according to exemplary embodiment 3 of the present invention.

FIGS. 10A to 10D are depiction diagrams indicating a procedure that moves guide plates according to exemplary embodiment 3 of the present invention and places side by side the end surfaces of planographic printing plates.

FIG. 11 is a cross sectional view in the width direction of the stacking apparatus according to exemplary embodiment 4 of the present invention.

FIGS. 12A and 12B are side and front views indicating the movement of a pusher when (N-1)th to (N+1)th planographic printing plates are induced in the stacking apparatus according to exemplary embodiment 4 of the present invention.

FIGS. 13A and 13B are side and front views indicating the movement of a pusher when (N-1)th to (N+1)th planographic printing plates are induced in the stacking apparatus according to exemplary embodiment 4 of the present invention.

FIGS. 14A and 14B are side and front views indicating the movement of a pusher when (N-1)th to (N+1)th planographic printing plates are induced in the stacking apparatus according to exemplary embodiment 4 of the present invention.

FIG.15 is a sectional view sectioned in a width direction of a sheet material stacking apparatus of a fifth embodiment of the present invention.

FIG.16 is an expanded sectional view showing a detailed configuration of an oscillating mechanism of the sheet stacking apparatus of the fifth embodiment of the present invention.

FIGS.17A and 17B are explanatory views showing motions of guide plates of the sheet material stacking apparatus of the fifth embodiment of the present invention.

FIGS.18A to 18C are side views showing motions of the guide plate when the(N-1)th to the (N+!)th planographic printing plates are induced to the sheet material stacking apparatus of the fifth embodiment of the present invention.

FIGS.19A to 19C are front views showing motions of the guide plate when the(N-1)th to the (N+!)th planographic printing plates are induced to the sheet material stacking apparatus of the fifth embodiment of the present invention.

FIGS.20A to 20C are side views showing motions of the guide plate when the(N-1)th to the (N+!)th planographic printing plates are induced to the sheet material stacking apparatus of the fifth embodiment of the present invention.

FIGS.21A to 21C are front views showing motions of the guide plate when the(N-1)th to the (N+!)th planographic printing plates are induced to the sheet material stacking apparatus of the fifth embodiment of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

1. Exemplary Embodiment 1

[0010] There is set forth one example of the sheet material stacking apparatus of the present invention wherein the entire first guide member functions as the pusher.

[0011] FIGS. 1 and 2 show a planographic printing plate processing line 10 wherein a stacking apparatus 100 according to a first exemplary embodiment is included.

[0012] As shown in FIG. 1, a strip-conveying device 16 is disposed upstream (right-hand upper side in FIG. 1) of the processing line 10.

[0013] The strip-conveying device 16 is detachably provided with a web roll 14 in which a strip 12 of the material of a planographic printing plate is rolled in a roll-like fashion. In addition, the strip-conveying device 16 continuously conveys the strip 12 downstream from the web roll 14 at a speed corresponding to the line speed of the processing line 10.

[0014] The strip 12 is conveyed to a pressure roller 20 disposed downstream after correcting the curl is by a leveler 18.

[0015] The pressure roller 20 crimps band-like protecting paper 24 conveyed from an protecting paper conveying device 22 to the upper surface of the strip 12 (photo-sensitive layer surface). At this time, the protecting paper 24 crimped to the strip 12 is charged by a charging apparatus (not shown) to be electrostatically crimped to the strip 12. A notcher 26 is disposed downstream of the pressure roller 20.

[0016] Although the case where the protecting paper 24 is used is described in the exemplary embodiment, the protecting paper 24 may not be used.

[0017] When changing the slit width of the strip 12, the notcher 26 punches at the central portion and at side portions close to both edges with respect to the width of the strip 12 to form a notch portion of a predetermined shape at each of the central and side portions of the strip 12. Thus, changing of the width of the strip 12 is possible while simultaneously and continuously cutting the strip 12 and protecting paper 22.

[0018] A slitter 28 that cuts the strip 12 in a predetermined slit width is placed downstream of the notcher 26. Additionally, downstream of the slitter 28, a length measuring apparatus 30 is placed that counts a conveyance length.

[0019] Here, after being cut in a predetermined slit width by the slitter 28, the conveyance length of the strip 12 is counted by means of the length measuring apparatus 30 and the strip 12 is cut by a cutter 32 in a syn-

chronous manner along the width direction of the strip 12 when a count value counted by the length measuring apparatus 30 reaches a predetermined count. Thereby, a planographic printing plate 48 with a predetermined size is produced.

[0020] As shown in FIG. 2, downstream of the cutter 32, a conveying apparatus 36 constituted by a plurality of belt conveyers 34, 42 is placed.

[0021] In the belt conveyor 34, a belt is stretched between a pair of rollers 33 that are rotatably disposed and the belt is movable in the arrow F direction. Also in the belt conveyor 42, a belt is stretched between a pair of rollers 41 that are rotatably disposed and the belt is movable in the arrow F direction.

[0022] The planographic printing plate 48 cut from the strip 12 is conveyed downstream by means of the belt conveyers 34, 42.

[0023] In some case, the strip 12 can be separated into two in the width direction by the slit 28 (see FIG. 1) and cut by the cutter 32 into two planographic printing plates 48 simultaneously. Each of the two planographic printing plates 48 is distributed onto the different belt conveyers 42 by means of a sorting gate or the like (not shown) disposed half way to the stacking apparatus(es) and then induced to the two stacking apparatuses 100 disposed in different positions.

[0024] On the other hand, a sorting gate 40 for changing the conveyance destinations of the planographic printing plates 48 is disposed between the belt conveyor 34 and the belt conveyor 42.

[0025] In case when the planographic printing plate 48 cut from the strip 12 is a sample, a rejected product, or the like, the sorting gate 40 distributes the corresponding planographic printing plate 48 onto the belt conveyor for line-out 38.

[0026] The belt conveyor 38 has a constitution in which a belt is stretched by a pair of rollers 37 that are rotatably placed, and conveys the planographic printing plate 48 that is a sample, rejected product, or the like to a retrieving box 44 disposed downstream.

[0027] In the terminal of the conveying apparatus 36 is placed a stacking apparatus 100 of stacking a plurality of the planographic printing plates 48.

[0028] Just in front of the stacking apparatus 100 and above the belt conveyor 42, a sensor 45 detecting the passage of the tip of the planographic printing plate 48 that has been conveyed is disposed.

[0029] The sensor 45 is a reflection-type optical sensor and detects the passage of the tip of the planographic printing plate 48 on the basis of the amount of reflection light received. In addition, the sensor 45 is connected to a control apparatus 47 controlling the driving of each portion of the stacking apparatus 100 on the basis of a detecting signal from the sensor 45.

[0030] Next, the stacking apparatus 100 will be described.

[0031] As indicated in FIG. 2, the stacking apparatus 100 has a flat planar stacking base 102 (sheet material

stacking base).

[0032] The top face of the stacking base 102 is a flat planar stacking face 103 on which the planographic printing plates 48 are stacked. Additionally, the stacking base 102 is supported by a lifter 104.

[0033] The lifter 104 lifts the stacking base 102 along the thickness direction of the planographic printing plate 48 in such a way that the height of the uppermost surface of the planographic printing plate 48 is always constant in accordance with a signal from a level sensor (not shown) for detecting the height of the uppermost surface of the planographic printing plates 48 stacked on the stacking face 103.

[0034] A back stopper 106 is disposed downstream of the stacking base 102 with respect to the conveyance direction of the planographic printing plate 48, and a front stopper 146 is placed upstream of the stacking base 102.

[0035] In the back stopper 106, a stopper plate 108 is disposed so as to face the end surface of the planographic printing plates 48 stacked on the stacking face 103.

[0036] The stopper plate 108 is constituted of a base portion 110 formed of a metal plate or plastic plate and a cushion pad 114 foamed in the base portion 110. The cushion pad 114 is disposed so as to be in contact with the end surface of the planographic printing plate 48.

[0037] On the surface of the cushion pad 114 of the stopper plate 108 a receiving plate 112 projects so as to temporarily receive the end portion of the planographic printing plate 48.

[0038] The receiving plate 112 is a planar member that is inclined downward toward the stacking base 102. The angle of inclination of the receiving plate 112 relative to the horizontal face is preferably from about 15 to 30 degrees, and is arbitrarily set in accordance with the properties and induction speed of the planographic printing plate 48.

[0039] The surface of the receiving plate 112 that is on the side that the planographic printing plates contact can be covered with a soft material such as a polyamide resin (trade name: MC NYLON), high-density polyethylene resin, polypropylene resin or fluorine resin.

[0040] On the back side (opposite side to the cushion pad 114) of the base portion 110 of the stopper plate 108, a cylinder 116 is placed for supporting the stopper plate 108 and declining the impact from the planographic printing plate 48.

[0041] The cylinder 116 is fixed to the frame or floor of the processing line 10 or the like via a bracket (not shown) so that the positional relation of the cylinder 116 to the belt conveyor 42 is not varied.

[0042] The cylinder 116 slidably supports a rod 118 along the conveyance direction and the tip of the rod 118 is connected and fixed to the base portion 110.

[0043] On the outer periphery of the rod 118, a coil spring 120 in a compressed state is disposed. The coil spring 120 urges the stopper plate 108 in the direction opposite to the conveyance direction of the stopper plate 108.

[0044] Here, the position of the cylinder 116 is adjustable along the conveyance direction. Thus, the position of the stopper plate 108 in the conveyance direction can be adjusted according to the length along the conveyance direction of the planographic printing plates 48 that are to be stacked on the stacking base 102.

[0045] On the other hand, as shown in FIGS. 2 and 3, the front stopper 146 is substantially rectangular parallelepiped-shaped and hollow and is disposed such that the thickness direction thereof is according to the conveyance direction and the longitudinal direction thereof is according to the width direction of the stacking base 102.

[0046] The top end of the front stopper 146 is slightly lower than the top surface of the belt conveyer 42 and the end of the downstream side thereof is processed in an R-shaped manner. In addition, on the inner side face of the downstream side of the front stopper 146 positions the planographic printing plate 48 induced onto the stacking base 102 along the conveyance direction.

[0047] A plurality of slit-like nozzles 140 narrowly elongated in the width direction are formed at the top portion of the inner face of the front stopper 146. Inside of the front stopper 146, air piping (not shown) for supplying air to each of the nozzles 140 is placed, and air is blasted from the plurality of the nozzles 140 during stacking the planographic printing plates 48.

[0048] Accordingly, an air layer is formed between the planographic printing plate 48 and the stacking face 103 or between the consecutive tow planographic printing plates 48 just after the induction of the planographic printing plate 48 from the belt conveyer 42, and the movement resistance of the planographic printing plate 48 that moves (slides) on the stacking face 103 by the inertia force is restrained.

[0049] Below the nozzle 140, a receiving plate 144 temporarily supporting from below the end of the planographic printing plate 48 induced by the belt conveyer 42 is provided.

[0050] As the receiving plate 112, the receiving plate 144 is a planar member inclined downward toward the stacking base 102. The inclination angle of the receiving plate 144 with respect to the horizontal surface, as in the receiving plate 112, is preferably from about 15 to 30 degrees. However the inclination angle may be set according to the properties and induction speed of the planographic printing plate 48.

[0051] As the receiving plate 112, the upper surface of the receiving plate may be covered with a soft material such as AC NYLON, high molecular weight polyethylene resin, polypropylene resin or fluorine resin, and the tip thereof may be bent downward.

[0052] As shown in FIGS. 3 and 4, the stacking apparatus 100 comprises side guides 122A, 122 disposed beside the end surfaces of both (left and right-hand) sides of the stacking base 102.

[0053] The side guide 122A is constituted of a case 125A having hollow portion 124A inside thereof, a guide

plate 126A forming one side wall of the case 125A and face the left end surface of the stacked planographic printing plates 48, and a guide plate driving portion 136 motioning the guide plate 126A to contact or separate from the planographic printing plates 48.

[0054] The guide plate 126A comprises a vertical portion 130A facing an end surface of a bundle 49 (sheet bundle) of the planographic printing plates 48, an inclined portion 128A disposed on top of the vertical portion 130A so as to be inclined at an angle θ with respect to the vertical direction, and a flat portion 132A protruding outward from the top of the inclined portion 128A. The angle θ is preferably from 0 degree to 60 degrees, more preferably from 0 degree to 40 degrees, from the vertical face.

[0055] The guide plate 126A is formed of a stainless steel plate, and accordingly, has a sufficient strength so as not to be distorted by impact load from the planographic printing plates 48.

[0056] The guide plate driving portion 136 comprises a rotator 137, a first link member 138, a second link member 139, a support member 142, a holding member 141, and a base 140.

[0057] The rotator 137 is rotatably supported by a bracket or the like (not shown) and reciprocally rotated in the arrow R direction by means of a motor (not shown) driven by the control apparatus 47 disposed in the proximity of the stacking apparatus 100. In addition, the above-mentioned sensor 45 (see FIG. 2) is connected to the control apparatus 47 and the control apparatus 47 drives the motor upon counting a predetermined time when a detecting signal is sent from the sensor 45.

[0058] The first link member 138 is fixed to the rotator 137 by adhesion or welding, and reciprocally rotated together with the rotator 137.

[0059] One end the second link member 139 is rotatably connected to the end of the first link member 138 by a pin and the other end thereof is rotatably connected to the end of the support member 142 by a pin.

[0060] The support member 142 is constituted of a substantially L-shaped steel plate and a portion thereof that is bent in the vertical direction is fixed to the back side of the vertical portion 130A of the guide plate 126A by welding or the like.

[0061] The holding member 141 is fixed on the base 140 fixed on the inner side of the housing 125A and its arm portion horizontally protruded in a predetermined interval supports the support member 142 movably in the horizontal direction (sliding).

[0062] Here, when the rotator 137 and first link member 138 rotate counterclockwise, the left-hand end of the second link member 139 moves upper leftward and also the right-hand end of the second link member 139 moves to the left. Thus, the support member 142 moves leftward and accordingly, the guide plate 126A moves leftward so as to separate from the left end surface of the planographic printing plate 48.

[0063] When the rotator 137 and first link member 138 rotate clockwise, the left end of the second link member

139 moves lower rightward and also the right-hand end of the second link member 139 moves rightward. Thus the support member 142 moves rightward and accordingly, the guide plate 126A moves rightward so as to contact the left end surface of the planographic printing plate 48.

[0064] On the other hand, the side guide 122B is constituted of a housing 125B having formed therein a hollow portion 124B and a guide plate 126B that forms one side wall of the housing 125B and faces the right-hand end surface of the stacked planographic printing plates 48.

[0065] The guide plate 126B is placed in the vertical direction and constituted of a vertical portion 130B oppose the end surface of a bundle of the planographic printing plates 48, an inclined portion 128B inclined at an angle θ with respect to the vertical direction on top of the vertical portion 130B, and a flat portion 132B protruded outward from the top of the inclined portion 128B. The angle θ is, as in the above-mentioned guide plate 126A, preferably from 0 degree to 40 degrees from the vertical face.

[0066] The guide plate 126B is formed of a stainless steel plate and has a sufficient strength so as not to be distorted even when receiving impact load from the planographic printing plates 48.

[0067] A hard coat is formed on the inner surfaces of the guide plates 126A, 126B, which are the surfaces on which the planographic printing plates 48 abut.

[0068] The surface hardness of the hard coat is higher than that of stainless steel that is a base material of the guide plates 126A, 126B, preferably 2000 or higher in Vickers hardness. In addition, the friction resistance between the hard coat and the planographic printing plate 48 is smaller than the friction resistance between the base material and the planographic printing plate 48, specifically preferably 0.2 or smaller.

[0069] The hard coat includes a rigid chromium plated coat, diamond-like carbon (DLC) coat, and the like. The diamond-like carbon coat (DLC coat) may be formed by, for example, treating the guide plates 126A, 126B with plasma of a hydrocarbon-based gas in a plasma CVD apparatus.

[0070] Here, in the present exemplary embodiment, the guide plate 126B is fixed to the housing 125B with a not-shown bolt. In addition, the housings 125A, 125B are fixed by means of a fixing unit such as a bolt (not shown).

[0071] The guide plate driving portion 136, as depicted in FIG. 5A, is disposed in two sites along the width direction of the guide plate 126A; the guide plate 126A is supported by support members 142A, 142B. As described above, the support of the guide plate 126A is supported at a plurality of points and accordingly, deformation of the guide plate 126A can be prevented and the vertical portion 130A is kept flat.

[0072] As a comparative example, FIG. 5B shows an embodiment wherein the guide plate 126A is supported at one point by the support member 135. Since the guide plate 126A is supported only at one point in the above

embodiment, the guide plate 126A can be deformed at the end portions thereof, and thus, the guide plate 126A is preferably supported at a plurality of points.

[0073] Next, the operation of exemplary embodiment 1 of the present invention will be described.

[0074] First, the positioning (sorting end surfaces side by side) of the conveyance direction of the planographic printing plate 48 induced into the accumulation base 102 along the conveyance direction thereof is described.

[0075] As shown in FIG. 3, firstly, the planographic printing plate 48 is induced onto the accumulation base 102 by the belt conveyer 42. At the time of induction of the planographic printing plate 48, air is blasted from the nozzle 140 of the front stopper 146 and the friction resistance of the newly induced planographic printing plates 48 and the stacking face 103 or the planographic printing plates 48 already stacked is reduced.

[0076] The stacking face 103 or the planographic printing plates 48 already stacked are maintained at a constant height by the lifter 104. Thus, each planographic printing plate 48 that is induced one by one via the belt conveyer 42 lands at substantially a same position regardless of the number of sheets of the planographic printing plates 48 on the stacking face 103.

[0077] The planographic printing plate 48 induced onto the stacking face 103 contacts the back stopper 106 on the tip faces thereof. The stopper plate 108 receiving impact caused by contact of the planographic printing plate 48 moves in the conveyance direction while compression deforming the coil spring 120 and at the same time receives a damping force from the cylinder 116. Thus, the movement of the planographic printing plate 48 to the conveyance direction ceases.

[0078] At the back stopper 106, the rod 118 elongates by recovering force of the coil spring 120 so as to urge the planographic printing plate 48 toward the front stopper 146 through the stopper plate 108. Accordingly, the back end surface of the planographic printing plate 48 contacts the front stopper 146.

[0079] Thus, the planographic printing plate 48 is positioned along the conveyance direction.

[0080] The planographic printing plate 48 positioned in the conveyance direction drops toward the stacking face 103. At this time, the planographic printing plate 48 drops onto the stacking face 103 in a state of being supported from below by the receiving plates 112, 144 and deformed downward. The dropping planographic printing plate 48 contacts the planographic printing plates 48 that are already stacked, at the central portion and then, at the end portion, due to the weight thereof.

[0081] Next, the positioning in the width direction (direction orthogonal to the conveyance direction) of the planographic printing plates 48 (end surface-sorting) will be described.

[0082] As shown in FIG. 6A, before the planographic printing plate 48 is induced (see FIG. 3), the guide plates 126A, 126B are in contact with both end surfaces of the bundle 49 of the planographic printing plates 48 locating

at both ends with respect to the width direction thereof and both end surfaces of the planographic printing plates 48 are sorted. In the above state, the distance between the guide plate 126A and the guide plate 126B is the same as the width of the planographic printing plate 48, and is set as the reference position. Here, the bundle 49 corresponds to the sheet bundle of the present invention.

[0083] Subsequently, as shown in FIGS. 2, 4 and 6B, the sensor 45 detects the passage of the tip of the planographic printing plate 48 on the belt conveyer 42. On the basis of the detecting signal, the above mentioned control apparatus 47 drives the guide plate driving portion 136 and the guide plate 126A moves in the arrow X direction. The position at which the guide plate 126A is in non-contact with the end surface of the planographic printing plate 48 (left side in the drawing) is set to be the separating position.

[0084] Here, given the reference position is 0, the range of the displacement of the guide plate 126A is preferably from 0 to +10 mm or less. In addition, as the correction, the displacement may be preferably changed in a length of about -2 to -3 mm.

[0085] Subsequently, in a state in which the guide plate 126A is at the separating position and disposed at an interval of the distance d1 from the end surface of the bundle 49, the planographic printing plate 48 is induced. Thus, the planographic printing plate 48 is not caught by the guide plates 126A, 126B.

[0086] Here, when the planographic printing plate 48 drops in a condition that the central position thereof is consistent with the central position of the bundle 49, each end surface of the planographic printing plate 48 would be consistent with each of the end surfaces of the bundle 49. However, when the planographic printing plate 48 drops in a condition that the central positions are displaced, as shown in FIG. 6C, it is stacked in a state in which the planographic printing plate 48 protrudes in a distance of d2 from the other end-surface of the bundle 49 (left side in the drawing).

[0087] Subsequently, as shown in FIG. 6D, the control apparatus 47 drives the guide plate driving portion 136 in a predetermined time passage from the detection of the planographic printing plate 48 and the guide plate 126A moves to the arrow +X direction. The guide plate 126A contacts the other end-surface (left side in the drawing) of the planographic printing plate 48 and moves the planographic printing plate 48 toward the guide plate 126B.

[0088] In the planographic printing plate 48, the other end-surface (left side in the drawing) is urged by the guide plate 126A and the one end-surface (right-hand side in the drawing) contacts the guide plate 126B. Thus the end surfaces of the planographic printing plate 48 are sorted with the end surfaces of the bundle 49.

[0089] The period of the movement of the X direction of the guide plate 126A is set at 0.1 second to 1 second (10 Hz or less in frequency).

[0090] As described above, when the planographic

printing plate 48 is induced from the belt conveyer 42, the guide plate driving portion 136 drives the guide plate 126A, thereby displacing the guide plate 126A to the separating position. The planographic printing plate 48 stacks onto the stacking base 102 without being caught by the guide plates 126A, 126B.

[0091] Thereafter, the guide plate 126A varies to the reference position, at which position, the guide plate 126A contacts the other end-surface of the planographic printing plate 48 (left side in the drawing) so as to sort both end surfaces extending at the ends of the planographic printing plate 48 stacked on the stacking base 102 with respect to the width direction thereof.

[0092] Because the inclined portions 128A, 128B are formed in the guide plates 126A, 126B, even when the planographic printing plate 48 sometimes contacts the guide plate 126A or guide plate 126B, the planographic printing plate 48 contacts the inclined portion 128A or 128B and is guided to the stacking base 102. Consequently, the planographic printing plate 48 is not caught on the way.

[0093] Since the control apparatus 47 synchronizes the timing of the detection in the sensor 45 and drives the guide plate driving portion 136 thereby varying the guide plate 126A, the planographic printing plate 48 can be induced onto the stacking base 102 when the guide plate 126A and guide plate 126B separate from each other.

[0094] The guide plate 126A is driven by the guide plate driving portions 136A, 136B at the same time so as to uniformly contact the end surfaces of the planographic printing plates 48 without the deformation of the guide plate 126A, whereby the end surfaces of the planographic printing plates 48 are sorted.

[0095] Vibration is given to the inclined portion 128B of the guide plate 126B of the reference guide (fixed guide) by means of a vibrator or the like, whereby the planographic printing plate 48 may not be caught by the guide plate 126B.

2. Exemplary Embodiment 2

[0096] Next, another example of the sheet material stacking apparatus of the present invention wherein the whole part of the first guide member functions as a pusher will be described. In addition, to the components that are basically the same as those in the exemplary embodiment 1, the same numerals as given in exemplary embodiment 1 are given and the descriptions thereof will be omitted.

[0097] As shown in FIGS. 7A and 7B, upward of the belt conveyer 42, a sensor 150 is disposed so as to detect the speed of the planographic printing plate 48 conveyed by the belt conveyer 42.

[0098] The sensor 150 is an optical sensor similar to the sensor 45 (see FIG. 2) in exemplary embodiment 1 and connected to a control apparatus 152 of determining the speed of the planographic printing plate 48 and mov-

ing the guide plate 126A.

[0099] The control apparatus 152 counts the passage time that is a time from the passage of the tip of the planographic printing plate 48 to the passage of the rear end thereof on the basis of detection signals from the sensor 150 and divides a length of the planographic printing plate 48 by the passage time to obtain the passage speed (conveyance speed).

[0100] On the other hand, a stacking apparatus 160 is disposed downstream of the belt conveyer 42.

[0101] The stacking apparatus 160 comprises the above mentioned back stopper 106 and front stopper 146 in the conveyance direction of the planographic printing plate 48.

[0102] In addition, the stacking apparatus 160 also comprises a pair of side guides 162 facing end surfaces of the planographic printing plate 48 locating at both ends with respect to the width direction thereof. In addition, among the side guides 162 provided at the both sides of the bundle 49 of the planographic plates 48, the side guide 162 sitting in the right side of the bundle 49 has the same constitution as the above mentioned side guide 122B (see FIG. 3), and accordingly, the description of the constitution of the right-hand side guide 162 is omitted.

[0103] The side guide 162 sitting in the left side of the bundle 49 is constituted of a housing 164 having a hollow portion 166 formed therein, the above mentioned guide plate 126A (see FIG. 4), and a guide plate driving portion 168 contacting the guide plate 126A with planographic printing plates 48 or separating it therefrom.

[0104] The guide plate driving portion 168 is a piston-type air vibrator and comprises a base 170 fixed inside of the housing 164, a piston portion 172 disposed on the base 170 toward the guide plate 126A and a support plate 174 fixed to one end of the piston portion 172.

[0105] The support plate 174 is fixed to the backside of the guide plate 126A by adhesion or the like.

[0106] The piston portion 172 may be supplied with air by an air supplying portion (including a regulator and electromagnetic valve, not shown) and is connected to the control apparatus 152.

[0107] The control apparatus 152 selects one frequency according to the velocity of the planographic printing plate 48 detected by the sensor 150 from a group of predetermined different frequencies and vibrates the guide plate 126A according to the selected frequency. In the present exemplary embodiment, the frequency of the guide plate 126A is set at about 50 Hz.

[0108] A speed matrix that is a relation between a conveyance speed of the planographic printing plate 48 and a timing of displacement of the guide plate 126A may be memorized in the control apparatus 152 in advance to determine the timing of the displacement of the guide plate 126A from a measured conveyance speed of the planographic printing plate 48 on the basis of the matrix speed.

[0109] Thus, when the control apparatus 152 drives

the air supplying portion, air is supplied to the piston portion 172, whereby the guide plate 126A vibrates in the arrow X direction.

[0110] Next, the operation of exemplary embodiment 2 of the present invention will be described. However, the positioning of the planographic printing plate 48 in the conveyance direction (sorting end surfaces of the planographic printing plate 48) induced into the stacking base 102 is performed in the same manner as the exemplary embodiment 1, and thus, the explanation of the positioning is omitted.

[0111] As shown in FIG. 8A, before the planographic printing plate 48 is induced (see FIG. 3), the guide plates 126A, 126B are in contact with both end surfaces of the bundle 49 of the planographic printing plates 48 located at the end with respect to the width direction thereof, and thus, both end surfaces of the planographic printing plates 48 are sorted. The position in this state is referred to the reference position.

[0112] Subsequently, as shown in FIG. 7, the sensor 150 detects the passages of the tip and back end portion of the planographic printing plate 48 on the belt conveyer 42. On the basis of the detecting signals, the control apparatus 152 drives the guide plate driving portion 168 and starts to vibrate the guide plate 126A.

[0113] The guide plate 126A vibrates synchronously with the conveyance speed of the planographic printing plate 48 and, as shown in FIG. 8B, the planographic printing plate 48 is induced when the guide plate 126A moves by a distance of d3 in the arrow -X direction. The position of the state is referred to the separating position. In addition, the distance of displacement of the distance d3 is the same as the distance d1 in the exemplary embodiment 1.

[0114] Subsequently, as shown in FIG. 8C, the guide plate 126A moves in the arrow +X direction. The guide plate 126A contacts the other end-surface of the planographic printing plate 48 (left side in the drawing) and moves the planographic printing plate 48 toward the guide plate 126B.

[0115] Subsequently, as shown in FIG. 8D, the other end-surface of the planographic printing plate 48 (left side in the drawing) is urged by the guide plate 126A and the one end-surface (right side in the drawing) contacts the guide plate 126B. Thus, both end surfaces of the planographic printing plate 48 are sorted with the end surfaces of the bundle 49.

[0116] The step is repeated and the guide plate 126A continuously vibrates between the reference and separating positions, and accordingly, the planographic printing plate 48 drops without being caught between the guide plates 126A, 126B. Additionally, when the next planographic printing plate 48 is induced, both end surfaces of the next planographic printing plate 48 are similarly sorted.

[0117] As described above, the control apparatus 152 selects a frequency of the displacement of the guide plate 126A synchronously with the conveyance speed of the

planographic printing plate 48 on the belt conveyer 42, controls the driving of the guide plate driving portion 168 according to the selected frequency, and vibrates the guide plate 126A.

[0118] Thus, even when the planographic printing plates 48 are continuously induced onto the stacking base 102, the planographic printing plate 48 can be induced when the guide plate 126A is separated from the guide plate 126B, and thus, both end surfaces of the planographic printing plates 48 can be sorted without the planographic printing plates 48 being caught by the guide plate 126A or 126B.

3. Exemplary Embodiment 3

[0119] Next, still another example of the sheet material stacking apparatus of the present invention in which the whole part of the first guide member serves as a pusher will be described. To the components that are basically the same as those in the exemplary embodiment 1, the same numerals as given in the exemplary embodiment 1 are given, and the explanation of the components are omitted.

[0120] In the exemplary embodiment, a stacking apparatus 180 instead of the stacking apparatus 100 is disposed downstream of the belt conveyer 42 that is indicated in FIG. 2.

[0121] As shown in FIG. 9, the stacking apparatus 180 has placed therein side guides 182A, 182B outside both sides of the end surfaces of the stacking base 102 (left and right-hand), respectively.

[0122] Here, the side guides 182A, 182B have a configuration having the same members symmetrically disposed, and therefore, the descriptions of the right-hand side guide 182B are omitted. However, as required in description, the letter 'B' is attached to the numerals of the components of the right side guide 182B.

[0123] The side guide 182A comprises a housing 184A having a hollow portion 186A formed therein, the above mentioned guide plate 126A that forms one side wall of the housing 184A and is displaced so as to oppose the left surface of the stacked planographic printing plates 48 and the above mentioned guide plate driving portion 136 for contacting or separating the guide plate 126A from the planographic printing plates 48.

[0124] Next, the operation of exemplary embodiment 3 of the present invention will be described. However, the positioning of the planographic printing plate 48 in the conveyance direction (sorting end surfaces) induced into the stacking base 102 is performed in the same manner as the exemplary embodiment 1, and therefore, the description of the positioning is omitted.

[0125] Before the planographic printing plate 48 is induced (see FIG. 3), the guide plates 126A, 126B are in contact with both end surfaces of the bundle 49 of the planographic printing plates 48 located at the ends with respect to the width direction thereof and both end surfaces of the planographic printing plates 48 are sorted.

[0126] Subsequently, as shown in FIGS. 2, 9, 10A, the sensor 45 detects the passage of the tip of the planographic printing plate 48 on the belt conveyer 42. On the basis of the detecting signal, the above mentioned control apparatus 47 drives the guide plate driving portion 136A and moves the guide plate 126A by the distance d4 in the arrow -X direction. Additionally, the distance d4 is the same as the above mentioned distance d1.

[0127] The planographic printing plate 48 is induced in a state wherein the guide plate 126A is separated from the end surface in a distance of the bundle, so that the planographic printing plate 48 is not caught by the guide plates 126A, 126B.

[0128] Subsequently, as shown in FIGS. 9 and 10B, the control apparatus 47 drives the guide plate driving portion 136A in a predetermined time after the detection of the planographic printing plate 48 and moves the guide plate 126A in the arrow +X direction. The guide plate 126A contacts the other end-surface of the planographic printing plate 48 (left side in the drawing) and moves the planographic printing plate 48 toward the guide plate 126B.

[0129] The other end-surface (left side in the drawing) of the planographic printing plate 48 is urged by the guide plate 126A and the one end-surface (right-hand in the drawing) thereof contacts the guide plate 126B. Thus both end surfaces of the planographic printing plate 48 are sorted with those of the bundle 49. In addition, the period of the movement of the X direction of the guide plate 126A is set at 0.1 to 1 second (10 Hz or less in frequency).

[0130] Subsequently, as shown in FIGS. 2, 9 and 10C, the sensor 45 detects the passage of the tip of the planographic printing plate 48 on the belt conveyer 42. On the basis of the detecting signal, the above mentioned control apparatus 47 drives the guide plate driving portion 136B and moves the guide plate 126B in the arrow +X direction.

[0131] When the guide plate 126B separated from the end surface of the bundle 49 (right-hand side in the drawing) in the distance d4, the planographic printing plate 48 is induced.

[0132] Subsequently, as shown in FIGS. 9 and 10D, the above mentioned control apparatus 47 drives the guide plate driving portion 136B in a predetermined time after the detection of the planographic printing plate 48 and moves the guide plate 126B in the arrow -X direction. The guide plate 126B contacts one end-surface of the planographic printing plate 48 (right-hand side in the drawing) and moves the planographic printing plate 48 toward the guide plate 126A.

[0133] In the planographic printing plate 48, the one end-surface (right side in the drawing) is urged by the guide plate 126B, and the other end-surface (left side in the drawing) contacts the guide plate 126A. Thus, both end surfaces of the planographic printing plate 48 are sort with the bundle 49.

[0134] The sheet material stacking apparatus of the

exemplary embodiment 3 can be used for stacking sheet materials other than the planographic printing plates 48, such as recording paper.

[0135] The guide plate driving portion 136 may also be a motor driven cam system.

[0136] The guide plate driving portion 168 may also be a turbine-type air vibrator. When employing a turbine-type air vibrator, the frequency can be from 100 to 300 Hz.

4. exemplary embodiment 4

[0137] An example of the sheet material stacking apparatus of the present invention having a configuration that the first geode member is separated into a guide portion that is fixed at a separating position and a pusher located below the guide portion. To the components basically the same as those in exemplary embodiment 1 are given the same numerals as given in exemplary embodiment 1 and the descriptions of the components are omitted.

[0138] As shown in FIG. 11, in a sheet material stacking apparatus 200 according to exemplary embodiment 4, the first guide member is separated into a guide plate 126A corresponding to a guide member of the present invention and a pusher 226 located below the guide plate 126A. The height of the stacking base 102 is controlled in such a manner that both the lower edge of the guide plate 126A and the upper edge 226A of the pusher 226 are higher than the top face 133 of the bundle 49.

[0139] Cushion pads 127A and 127B are inserted, respectively, between the guide plate 126A and the housing 125A and between the guide plate 126B and the housing 125B.

[0140] The pusher 226 reciprocally moves the separating position indicated by a solid line in FIG. 11 and the reference position indicated by a two-dot chain line by means of a pusher driving portion 236 accommodated inside of the housing 125A. The distance between the pusher 226 and the guide plate 126B corresponding to the second guide portion of the present invention is equal to the width D of the planographic printing plate 48 at the reference position and equal to the length that is an addition of the displacement A of the pusher 226 to the width D of the planographic printing plate 48 at the separating position.

[0141] The pusher driving portion 236 has a construction similar to that of the guide driving portion 136 in exemplary embodiment 1 to 3 and is driven by a control apparatus 147. To the control apparatus 147, the sensor 45 (see FIG. 2) is connected. When a detecting signal is sent from the sensor 45, the control apparatus counts a predetermined time and drives a motor for driving the pusher driving portion 236.

[0142] Except the respects mentioned above, the stacking apparatus 200 has a construction similar to that of the stacking apparatus 100 of exemplary embodiment 1.

[0143] Hereinafter, the operation of the stacking appa-

ratus 200 will be set forth by way of example when the (N-1)th planographic printing plate 48, the Nth planographic printing plate 48 and the (N+1)th planographic printing plate 48 are induced.

[0144] As shown in FIGS. 12A and 12B, the Nth planographic printing plate 48 that is induced next to the (N-1)th planographic printing plate 48 is conveyed by the belt conveyer 42 along the conveyance direction 'a'. When the tip of the Nth planographic printing plate 48 is detected by the sensor 45, the motor 137 is switched on T second(s) after the detection time and starts to rotate.

[0145] At a time when the time 't' elapses from the time point when the sensor 45 detects the tip of the Nth planographic printing plate 48 and, as shown in FIGS. 13A and 13B, the (N-1)th planographic printing plate 48 contacts the surface of the cushion pad 114 of the back stopper 106. At the same time, the pusher 226 is located at the reference position and guides the (N-1)th planographic printing plate 48 that is to be induced onto the bundle 49 upward of the bundle 49. In addition, the time t may be obtained a priori as a time from the time when the sensor 45 detects the tip of the Nth planographic printing plate 48 to the time when the tip of the (N-1)th planographic printing plate 48 contacts the cushion pad 114 of the back stopper 106. Additionally, the time T is determined so that the equation $t = T + t_m$ is satisfied, wherein t_m is the time of the motor 137 traveling halfway around and that is, the time needed for the pusher 226 to move from the separating position to the reference position.

[0146] The motor 137 continues rotating and, as shown in FIGS. 14A and 14B, the pusher 226 returns to the separating position. At the time when the pusher returns to the separating position, the (N-1)th planographic printing plate 48 is stacked on the bundle 49, the Nth planographic printing plate 48 is being induced toward the bundle of the planographic printing plates 49, and the tip of the next (N+1)th planographic printing plate 48 is detected by the sensor 45.

5. Exemplary Embodiment 5

[0147] An example of the sheet material stacking apparatus of the present invention wherein the first and second guide members are in an open position, that is, both guide members separate away, or a closed position, that is, the both guide members come closer to each other is described in the following example embodiment. To the component basically similar to those of Exemplary Embodiment 2, the same numerals as those in Exemplary Embodiment 2 are given and explanation of the components are omitted.

[0148] As shown in FIG. 15, in a sheet material stacking apparatus 202 relating to Exemplary 5, guide plates 126A, 126B (corresponding to the first and second guide members, respectively) comprise perpendicular portions 131A, 131B and inclined portions 128A, 128B that are disposed continuously on top of the perpendicular portions 131A, 131B, respectively so as to be inclined out-

ward. The angle θ between the perpendicular portions 131A, 131B and inclined portions 128A, 128B is preferably 10 to 60 degrees, more preferably 20 to 40 degrees.

[0149] The guide plates 126A and 126B are attached onto the lowermost portions of the inward facing walls of the housings 125A, 125B of the side guides 122A, 122B so as to pivot from the root portions of the perpendicular portions 131 A, 131B. In addition, as shown in a solid line in FIG. 15, the guide plates 126A, 126B are formed so that the perpendicular portions 131 A, 131B are vertical when pivoting into a closed position. Further, the guide plates 126A, 126B are provided so that the root portions of the perpendicular portions 131 A, 131B are separated in a controlling width, which is equal to an addition of the width of the planographic printing plate 48 that is a measurement thereof in a direction perpendicular to the conveyance direction and a sheet-sorting tolerance that is a tolerable amount of protrusion in the width direction of the planographic printing plates 48 upon stacking. The controlling width is generally set at a length about 1mm wider than the width of the planographic printing plate 48.

[0150] Inside of the housings 125A, 125B, oscillating mechanisms 336A, 336B are provided.

[0151] As shown in FIGS.15 and 16, each of the oscillating mechanisms 226, 336B comprises a motor 337, crank 338 rotated by the motor 337, rockers 339, 340 that are follower links driven by the crank 338, and a transmission rod 341 that transmits the movement of the rocker 340 to the guide plates 126A, 126B. Each transmission rod 341 is attached pivotably onto the backside surfaces of the inclined portions 128A, 128B of the guide portions 126A, 126B, that is the surfaces of the inclined portions 128A, 128B at the side opposite to the side that the planographic printing plates 48 contact. The crank 338 and the rocker 339 are connected with each other by a pin 342, the rocker 339 and the rocker 340 are connected with each other by a pin 343, and the rocker 340 and the transmission rod 341 are connected with each other by a pin 344. The rocker 340 is also connected with the inside wall of the housing 125A or 125B by a pin 345.

[0152] As shown by an arrow 'a' in FIGS. 15 and 16, when the crank 338 rotate around an axis 337A of the motor 337, the rocker 339 makes a reciprocal motion to an extent shown by the solid line and the alternate long and two short dash line. Accordingly, the rocker 340 pivots around the pin 345 as shown by arrows 'b' and 'c', and thus, the transmission rod 341 makes a reciprocal movement. Consequently, the guide plates 126A 126B are pulled or pushed at the inclined portions 128A, 128B by the transmission rod 341 so as to oscillates pivotally as shown by the solid line and the alternate long and two short dash line in FIG.15. Additionally, in the oscillating mechanisms 336A, 336B, the motor 337 is controlled by the control apparatus 147 so that the guide plates 126A and 126B oscillate in a synchronized manner.

[0153] As shown in FIG.17A, the guide plates 126A, 126B can be motioned in a motion scheme of closed, open, and then closed. That is, just at the time when the

belt conveyer 42 throws the planographic printing plate 48 onto the stacking base 102, the guide plates 126 and 126B are in a closed position, wherein the guide plates 126 and 126B are close to each other, then, during the time when the planographic printing plate 48 is dropping between the guide plates 126A and 126B, the guide plates 126A and 126B oscillate to an open position wherein the guide plates 126 and 126B separated from each other so as to prevent the planographic printing plate 48 from being stuck between the perpendicular portions 131 A and 131B. And then, during the time when the planographic printing plate 48 is dropping between the perpendicular portions 131A and 131B, the guide plates 126A and 126 return to the close position so as to guide the planographic printing plates 48 to a predetermined point above the stacking base 102.

[0154] As shown in FIG. 17B, the guide plates 126A and 126B also can be motioned in a motion scheme of open, closed, and then open, that is, That is, at the time when the belt conveyer 42 throws the planographic printing plate 48 onto the stacking base 102, the guide plates 126 and 126B are in an open position, wherein the guide plates 126 and 126B are open from each other, then, during the time when the planographic printing plate 48 is dropping between the guide plates 126A and 126B, the guide plates 126A and 126B oscillate to an closed position wherein the guide plates 126 and 126B are close to each other so as to guide the planographic printing plates 48 to a predetermined point above the stacking base 102. Finally, when the planographic printing plate 48 is stacked on the stacking base 102, the guide plates 126A and 126 return to the open position.

[0155] Except the above respects, the shacking apparatus 202 has the same constitution as that of the stacking apparatus 180 of Exemplary Embodiment 3.

[0156] In the following, the function of the stacking apparatus 202 is described by explaining the operation thereof in the case when (N-1)th, Nth and (N+1)th planographic printing plates 48 are induced consecutively. Firstly, the operation of the stacking apparatus 202 wherein the guide plates 126A and 126 are oscillated in the motion scheme of closed, open, and then closed when the planographic printing plate 48 is induced is described.

[0157] As shown in FIGS.18A, 18B, 19A, 19B, the Nth planographic printing plate 48, which is the next to the (N-1)th planographic printing plate 48, is conveyed by the belt conveyer 42 in the conveyance direction 'a' and the tip thereof is detected by the sensor 45, then, the motor 337 initiates rotation and the guide plates 126A and 126B oscillate in a direction toward the open position.

[0158] Therefore, when the sensor 45 detects the tip of the Nth planographic printing plate 48, as shown in FIGS. 18A and 19A, the guide plates 126A and 126B are in the closed position, then, while the Nth planographic printing plate 48 is dropping between the inclined portions 128A and 128B, as shown in FIGS, 18B and 19B, the guide portions pivots toward the open position, and then,

while the Nth planographic printing plate 48 is dropping between the perpendicular portions 131A and 131B close to the bundle 49, as shown in FIGS. 18C and 19C, the guide plates 126A and 126B oscillate to the closed position. Thus, the Nth planographic printing plate 48 is guide toward a predetermined position on the stacking base 102 and sorted.

[0159] Secondly, the operation of the stacking apparatus 202 wherein the guide plates 126A and 126 are oscillated in the motion scheme of open, closed, and then open when the planographic printing plate 48 is induced is described.

[0160] As shown in FIGS 20A, 20B, 21A, and 21B, the Nth planographic printing plate 48, which is the next to the (N-1)th planographic printing plate 48, is conveyed by the belt conveyer 42 in the conveyance direction 'a' and the tip thereof is detected by the sensor 45, then, the motor 337 initiates rotation and the guide plates 126A and 126B oscillate in a direction toward the closed position.

[0161] Thus, when the sensor 45 detects the tip of the Nth planographic printing plate 48, as shown in FIGS. 20A and 21A, the guide plates 126A and 126B are in the open position, then, while the Nth planographic printing plate 48 is dropping between the inclined portions 128A and 128B, as shown in FIGS. 20B and 21B, the guide portions pivots toward the closed position, and then, while the Nth planographic printing plate 48 is dropping between the perpendicular portions 131A and 131B close to the bundle 49, as shown in FIGS. 20C and 21C, the guide plates 126A and 126B again oscillate to the open position..

[0162] As described above, according to a sheet material stacking apparatus of the present invention, both end surfaces of a sheet material at the ends thereof with respect to the width direction may be sorted while stacking the sheet material on the sheet material stacking base.

[0163] Generally, when a sheet material is induced onto a sheet material stacking base by means of a sheet material conveying unit,

[0164] Now, in a sheet stacking apparatus of the present invention, when a sheet is induced, the driving unit is driven, whereby the pusher is displaced until it reaches a separating position untouched with the other end-surface of the sheet material.

[0165] This accumulates the sheet material on the sheet material stacking base without being caught by the first and second guide members.

[0166] Thereafter, the displacement of the pusher to the reference position at which the pusher contacts the other end-surface of the sheet material in the width direction causes one end-surface of the sheet material in the width direction to contact the second guide member, thereby being capable of placing side by side both end surfaces located at the end of the sheet materials with respect to the width direction thereof stacked on the sheet material stacking base.

[0167] A second aspect of the present invention relates to the sheet material stacking apparatus according to the first aspect wherein the height of the sheet material stacking base is controlled such that the height of the top face of a sheet bundle formed by accumulation of sheet materials on the sheet stacking base is lower than the height of the top edge of the pusher.

[0168] In the sheet material stacking apparatus of the second aspect, a sheet material induced onto the sheet stacking base is definitely positioned by means of the pusher and the first guide member, and then placed on a sheet bundle.

[0169] A third aspect of the present invention relates to the sheet material stacking apparatuses according to the first or second aspects, wherein the first guide member is formed such that the whole part of the first guide member serves as a pusher.

[0170] According to the sheet material stacking apparatus of the third aspect, since the whole part of the first guide member is a pusher, the construction of the sheet material stacking apparatus is simple.

[0171] A forth aspect of the present invention relates to the sheet material stacking apparatus according to the first or second aspect, wherein the first guide member is separated into a guide portion fixed at a separating position in which the distance between the first and second guide members is larger than the width of the sheet material and a pusher located downward of the guide portion.

[0172] In the sheet material stacking apparatus of the forth aspect, a sheet stacking frame is formed of the guide portion included in the first guide member and the second guide member. Accordingly, the width of the sheet stacking frame is larger than the width of the sheet material by a movement distance of the pusher, a larger margin can be left as a wobbling allowance that is necessary for inducing a sheet material wobbling on the sheet material conveying unit that in a sheet material stacking apparatus having a sheet stacking frame width equal to the width of the sheet material that is to be stacked..

[0173] Therefore, when a sheet material is induced at short intervals, it is prevented that a previously induced sheet material is caught between the first and second guide members and may not be fallen and interfered with a next induced sheet material.

[0174] In addition, because a sheet material induced onto the sheet stacking base is positioned by the pusher, sorting precision in the width direction similar to that of an apparatus having the first or second guide member functions as a pusher as a whole can be obtained.

[0175] A sheet material stacking apparatus according to a fifth aspect of the present invention relates to the sheet material stacking apparatus according to any one of the first to forth aspects, wherein an inclined surface guiding the sheet material to the sheet material stacking base is formed on the upper portions of the first and second guide members.

[0176] In a sheet material stacking apparatus having

first and second guide members, there is a possibility that an induced sheet material touches the upper portion of the first or second guide member when the sheet material is induced by a sheet material conveying unit into a sheet material stacking base.

[0177] However, since the inclined surfaces are formed on the upper portions of the first and second guide members of the present aspect, the sheet material contacts the inclined surfaces, and thus, is guided to the sheet material stacking base.

[0178] Accordingly, the sheet material is not caught by the upper portion of the first or second guide members, and therefore, both end surfaces of each sheet material can be sorted more neatly.

[0179] A sixth aspect of the present invention relates to the sheet material stacking apparatus according to any one of the first to fifth aspects, further comprising: a detecting unit of detecting the tip of the sheet material that is to be induced onto the sheet material stacking base, and a controlling unit initiating the driving of the driving unit synchronously with the timing when the detecting unit detects the sheet material and then displacing the pusher to the separating position.

[0180] In the above sheet material stacking apparatus, the detecting unit detects the tip of a sheet material induced into the sheet material stacking base.

[0181] The controlling unit drives the driving unit synchronously with the timing detected by the detecting unit and displaces the second guide member to the separating position, thereby being capable of inducing a sheet material onto the sheet material stacking base in a state in which the distance between the first and second guide members is increased.

[0182] Accordingly, it can be prevented that the sheet material induced into the sheet material stacking base is caught on half way.

[0183] A seventh aspect of the present invention relates to the sheet material stacking apparatus according to sixth aspect, to a sheet material stacking apparatus wherein the controlling unit selects the period of displacement of the pusher according to the conveyance speed of the sheet materials, controls the driving of the driving unit on the basis of the period, and vibrates the pusher.

[0184] In the above sheet material stacking apparatus, the controlling unit selects the period of displacement of the pusher according to the conveyance speed of the sheet material in the sheet material conveying unit, controls the driving of the driving unit on the basis of the period, and vibrates the pusher.

[0185] Thus, even when the sheet materials are induced consecutively into the sheet material stacking base, the sheet materials can be induced at a time when the second guide member is in the separating position, and accordingly, it can be prevented that the sheet materials are stuck between the first and second guide members.

[0186] An eighth aspect of the present invention relates to the sheet material stacking apparatus according

to any one of the first to seventh aspects, wherein the driving units are placed at a plurality of sites and drive the pusher in the plurality of the sites at the same time.

[0187] In the above sheet material stacking apparatus, the pusher is driven at a plurality of sites simultaneously, and thus, the pusher contacts the end surfaces of sheet materials uniformly without any deformation of the pusher. Thus, side the end surfaces of the sheet materials can be sorted further uniformly.

[0188] A ninth aspect of the present invention relates to the sheet material stacking apparatus according to any one of the second to eighth aspects, wherein the whole part of the first guide member serves as a pusher, the second guide member is displaceably placed in the separating position or the reference position by the driving unit, and the first and second guide members are alternately displaced.

[0189] In the above sheet material stacking apparatus, the first guide member is displaced to a separating position and a sheet material is induced onto the sheet material stacking base.

[0190] Then, the first guide member is displaced to the reference position and one side of end surfaces of sheet materials is sorted.

[0191] Subsequently, the second guide member is displaced to a separating position and then is displaced to the reference position.

[0192] Thus, both end surfaces of sheet materials in the width direction can be sorted.

[0193] The tenth aspect of the present invention relates to a sheet material stacking apparatus comprising; a sheet material stacking base on which sheet materials conveyed by a sheet material conveying unit conveying the sheet materials; a first guide member that is erected in parallel to the side edge of the sheet material stacking base along the conveyance direction of the sheet materials conveyed by the sheet material conveying unit and sorts one end-surface of the sheet materials located at the ends with respect to the width direction thereof; a second guide member erected so as to oppose the first guide member having the sheet material stacking base therebetween; an oscillating unit oscillating the first and second guiding so as to pivot from the lower ends thereof so as to get closer or apart from each other to sort both end surfaces of the sheet materials located at the ends with respect to the width direction.

[0194] In the above sheet material stacking apparatus, sheet materials are induced between the first and second guide members. Then, while the induced sheet materials are dropping between the first and the second guide members, the induced sheet materials are guided to a predetermined position on the sheet material stacking base by oscillating the first and second guide members. Thus, both end surfaces at the end of each sheet material with respect to the width direction thereof can be sorted.

[0195] The eleventh aspect of the present invention relates to the sheet material stacking apparatus of the tenth aspect, wherein each of the first and second guide

members comprises; a perpendicular portion that is formed to be perpendicular to the sheet material stacking base when the first and the second guide members get closer to each other; and an inclined portion extending above the perpendicular portion so as to incline outward, the first and second guide members being configured so that when the first and second guide members get closer, the distance between each perpendicular portion thereof is in a length that is an addition of the width of the sheet materials that are to be stacked and a stacking tolerance of the sheet materials.

[0196] In the above sheet material stacking apparatus, each of the first and the second guide members comprises a perpendicular portion and inclined portion extending upward and inclining outward. The sheet material can be induced between the first and second guide member at a closed position with being stuck by neither the first guide member nor the second guide member even if there is some positional error of the sheet material- inducing position in the width direction.

[0197] While the sheet material induced between the first and the second guide member is dropping between the perpendicular portion thereof, by oscillating the first and the second guide members to the closed position, the sheet is guided to a predetermined stacking position, and then, stacked on the sheet material stacking base. The distance between the perpendicular portions are set so as to be equal to an addition of the sheet material width and a sorting tolerance, and thus, the sheet material drops without being stuck at the perpendicular portions in spite of width error of the sheet material to some extent.

[0198] The twelfth embodiment of the present invention relates to the sheet material stacking apparatus of the eleventh embodiment, wherein the first and the second guide member oscillate synchronously.

[0199] In the above sheet material stacking apparatus, when oscillating toward the open position, the first and second guide members oscillates in a synchronized motion, and accordingly, compared with a sheet shacking apparatus wherein the first and second guide members oscillate non-synchronously, it can be more effectively prevented that the induced sheet materials are stuck on the first or the second guide member.

[0200] The thirteenth aspect of the present invention relates to the sheet material stacking apparatus of the twelfth aspect, wherein the first and the second guiding members are in a closed position before a sheet materials is induced, and when the sheet materials is induced, the first and second guiding members pivot from the closed position to an open position by the oscillating unit, and then, during the time when the induced sheet material is dropping between the perpendicular portions of the first and second guiding members, the first and second members pivot toward the open position to the closed position by the oscillating unit

[0201] In the above sheet staking apparatus, while the induced sheet material is dropping between the perpendicular portions of the first and the second guide mem-

bers, the first and second guide members oscillate in a closing direction, and therefore, the sheet material is stacked on the stacking base while being positioned by the first and second guide members.

[0202] Consequently, the sheet materials are stacked on the stacking base with depressing irregularity of the position of the side edge of each sheet material to the least.

[0203] The fourteenth aspect of the present invention relates to the sheet material stacking apparatus of the twelfth aspect, wherein The sheet material stacking apparatus of claim 24, wherein the first and the second guiding members are in an open position before a sheet materials is induced, and when the sheet materials is induced and dropping between the perpendicular portions of the first and second guiding members, the first and second guiding members pivot from the open position to a closed position by the oscillating unit, and then pivot toward the open position by the oscillating unit.

[0204] In the above sheet material stacking apparatus, the sheet material is induced while the first and second guide members are in the open position, and then, positioned by the first and second guide members.

[0205] Consequently, compared with the sheet material stacking apparatus of the thirteenth aspect, it can be more effectively prevented that the sheet materials are caught by the first and second guide members when stacking sheet materials having a large dispersion of the width thereof.

[0206] The fifteenth aspect of the present invention relates to the sheet stacking apparatus of the thirteenth or fourteenth aspect further comprising a sheet material detecting sensor for detecting the sheet materials induced by the sheet material conveying unit, the oscillating unit sets the timing for oscillating the first and second guide members on the basis of the timing when the sheet material detecting sensor detects the sheet materials.

[0207] In the above sheet material stacking apparatus, the oscillating unit determines the timing for oscillating the first and the second guide members. Accordingly, fluctuation of timing for inducing does not cause the induced sheet material to be caught by the first and second guide members, and thus, sheet material stacking can be continued without interruption.

[0208] A sixteenth aspect of the present invention relates to a sheet material stacking method of stacking sheet materials by using the sheet material stacking apparatus of any one of claims 1 to 21, comprising the steps of: displacing the pusher to the separating position and then inducing the sheet onto the sheet stacking base, and displacing the pusher to the reference position so as to sort both end surfaces of the sheet material in the width direction.

[0209] In the above sheet material stacking method, sheet materials are induced from the sheet material conveying unit onto the sheet material stacking base and the pusher is displaced to the separating position. Thus, the sheet materials are stacked on the sheet material stack-

ing base without being caught by the first guide member or the pusher.

[0210] Then, when the pusher is displaced toward the reference position at which the pusher contacts the other end surfaces of the sheet materials, one end surfaces of the sheet materials contacts the first guide member and both end surfaces of the sheet materials stacked on the sheet material stacking base are sorted.

[0211] A seventeenth aspect of the present invention is a sheet material stacking method of stacking sheet materials by using the sheet material stacking apparatus of claim 22, comprising the steps of: displacing the first guide member to the separating position and then inducing the sheet material onto the sheet material stacking base, displacing the first guide member to the reference position so as to sort the end surfaces at one end of sheet materials, displacing the second guide member to the separating position, and then, displacing the second guide member to the reference position so as to sort the end surfaces at the other end of the sheet materials.

[0212] In the above method for stacking sheet materials, the first guide member is displaced to the separating position, and then, a sheet material is induced onto the sheet material stacking base.

[0213] Subsequently, the first guide member is displaced to the reference position and one side of the end surfaces of sheet materials is sorted. Then the second guide member is displaced to the separating position and then to the reference position. Thus, both end surfaces of the sheet materials are sorted.

[0214] An eighteenth aspect of the present invention relates to a sheet material stacking method of stacking sheet materials by using the sheet material stacking apparatus of one of claim 22 to 28, comprising the steps of: oscillating the first and second guiding members in a direction of getting apart from each other and then, inducing the sheet materials into the sheet material stacking base; oscillating the first and the second guiding members in a direction of getting closer to each other so as to sort the both end surface of the sheet surface extending along the conveyance direction thereof.

[0215] In the above method for stacking sheet materials, when the sheet material is induced, the first and second guide members oscillate to sort the sheet materials.

[0216] Accordingly, regardless of a positional error in inducing position in the width direction of the sheet materials, the sheet materials can be induced just above the sheet material stacking base without being caught by the first and second guide members and both end surfaces of the sheet materials can be effectively sorted.

[0217] The foregoing description of the embodiment of the present invention has been provided for the purpose of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise forms disclosed. Obviously, many modifications and variations will be apparent to practitioners skilled in the art. The embodiments are chosen and described in order to best explain the principles of the invention and its practical

applications, thereby enabling others skilled in the art to understand the invention for various embodiments and with the various modifications as are suited to the particular use contemplated. It is intended that the scope of the invention be defined by the following claims and their equivalents.

Claims

1. A sheet material stacking apparatus comprising:

a sheet material stacking base on which sheet materials induced from a sheet material conveying unit conveying the sheet materials are stacked,

a first guide member disposed along the conveyance direction of the sheet materials toward the sheet material stacking base so as to sort one end-surfaces of the sheet materials located at the end with respect to the width direction thereof,

a second guide member which is disposed in parallel to and also opposite to the first guide member with the sheet material stacking base being configured therebetween,

a pusher that constitutes at least a portion of the first guide member and is displaced between a reference position in which the distance to the second guide member is equal to the width of the sheet materials and a separating position in which the distance to the second guide member is larger than the width of the sheet materials, and

a driving unit that displaces the pusher so as to sort both ends of the sheet materials in the axis direction.

2. The sheet material stacking apparatus of claim 1, wherein

the height of the sheet material stacking base is controlled such that the height of the top face of a sheet bundle formed by accumulation of sheet materials on the sheet stacking base is lower than the height of the top edge of the pusher.

3. The sheet material stacking apparatus of claim 1, wherein

the first guide member is formed such that the whole part of the first guide member serves as a pusher.

4. The sheet material stacking apparatus of claim 2, wherein

the first guide member is formed such that the whole part of the first guide member serves as a pusher.

5. The sheet material stacking apparatus of claim 1, wherein

the first guide member is separated into a guide portion fixed at a separating position in which the distance between the first and second guide members is larger than the width of the sheet material and a pusher located downward of the guide portion.

6. The sheet material stacking apparatus of claim 2, wherein
the first guide member is separated into a guide portion fixed at a separating position in which the distance between the first and second guide members is larger than the width of the sheet material and a pusher located downward of the guide portion. 10
7. The sheet material stacking apparatus of claim 1, wherein
an inclined surface guiding the sheet material to the sheet material stacking base is formed on the upper portions of the first and second guide members. 15
8. The sheet material stacking apparatus of claim 2, wherein
an inclined surface guiding the sheet material to the sheet material stacking base is formed on the upper portions of the first and second guide members. 20 25
9. The sheet material stacking apparatus of claim 3, wherein
an inclined surface guiding the sheet material to the sheet material stacking base is formed on the upper portions of the first and second guide members. 30
10. The sheet material stacking apparatus of claim 4, wherein
an inclined surface guiding the sheet material to the sheet material stacking base is formed on the upper portions of the first and second guide members. 35
11. The sheet material stacking apparatus of claim 5, wherein
an inclined surface guiding the sheet material to the sheet material stacking base is formed on the upper portions of the first and second guide members. 40
12. The sheet material stacking apparatus of claim 6, wherein
an inclined surface guiding the sheet material to the sheet material stacking base is formed on the upper portions of the first and second guide members. 45 50
13. The sheet material stacking apparatus of claim 1, further comprising:

a detecting unit of detecting the tip of the sheet material that is to be induced onto the sheet material stacking base, and
a controlling unit initiating the driving of the driving unit synchronously with the timing when the

detecting unit detects the sheet material and then displacing the pusher to the separating position.

- 5 14. The sheet material stacking apparatus of claim 2, further comprising:

a detecting unit of detecting the tip of the sheet material that is to be induced onto the sheet material stacking base, and
a controlling unit initiating the driving of the driving unit synchronously with the timing when the detecting unit detects the sheet material and then displacing the pusher to the separating position.

15. The sheet material stacking apparatus of claim 3, further comprising:

a detecting unit of detecting the tip of the sheet materials that are to be induced onto the sheet material stacking base, and
a controlling unit initiating the driving of the driving unit synchronously with the timing when the detecting unit detects the sheet material and then displacing the pusher to the separating position.

16. The sheet material stacking apparatus of claim 4, further comprising:

a detecting unit of detecting the tip of the sheet materials that are to be induced onto the sheet material stacking base, and
a controlling unit initiating the driving of the driving unit synchronously with the timing when the detecting unit detects the sheet material and then displacing the pusher to the separating position.

17. The sheet material stacking apparatus of claim 5, further comprising:

a detecting unit of detecting the tip of the sheet materials that are to be induced onto the sheet material stacking base, and
a controlling unit initiating the driving of the driving unit synchronously with the timing when the detecting unit detects the sheet material and then displacing the pusher to the separating position.

18. The sheet material stacking apparatus of claim 6, further comprising:

a detecting unit of detecting the tip of the sheet materials that are to be induced onto the sheet material stacking base, and

- a controlling unit initiating the driving of the driving unit synchronously with the timing when the detecting unit detects the sheet materials and then displacing the pusher to the separating position.
19. The sheet material stacking apparatus of claim 13, wherein the controlling unit selects the period of displacement of the pusher according to the conveyance speed of the sheet materials, controls the driving of the driving unit on the basis of the period, and vibrates the pusher.
20. The sheet material stacking apparatus of claim 1, wherein the driving units are placed at a plurality of sites and drive the pusher in the plurality of the sites at the same time.
21. The sheet material stacking apparatus of claim 3, wherein the whole part of the first guide member serves as a pusher, the second guide member is displaceably placed in the separating position or the reference position by the driving unit, and the first and second guide members are alternately displaced.
22. A sheet material stacking apparatus comprising;
a sheet material stacking base on which sheet materials conveyed by a sheet material conveying unit conveying the sheet materials;
a first guide member that is erected in parallel to the side edge of the sheet material stacking base along the conveyance direction of the sheet materials conveyed by the sheet material conveying unit and sorts one end-surface of the sheet materials located at the ends with respect to the width direction thereof;
a second guide member erected so as to oppose the first guide member having the sheet material stacking base therebetween;
an oscillating unit oscillating the first and second guiding so as to pivot from the lower ends thereof so as to get closer or apart from each other to sort both end surfaces of the sheet materials located at the ends with respect to the width direction.
23. The sheet material stacking apparatus of claim 22, wherein each of the first and second guide members comprises;
a perpendicular portion that is formed to be perpendicular to the sheet material stacking base when the first and the second guide members get closer to each other; and
an inclined portion extending above the perpendicular portion so as to incline outward,
the first and second guide members being configured so that when the first and second guide mem-
- bers get closer, the distance between each perpendicular portion thereof is in a length that is an addition of the width of the sheet materials that are to be stacked and a stacking tolerance of the sheet materials.
24. The sheet material stacking apparatus of claim 23, wherein the first and the second guide member oscillate synchronously.
25. The sheet material stacking apparatus of claim 24, wherein the first and the second guiding members are in a closed position before a sheet materials is induced, and when the sheet materials is induced, the first and second guiding members pivot from the closed position to an open position by the oscillating unit, and then, during the time when the induced sheet material is dropping between the perpendicular portions of the first and second guiding members, the first and second members pivot toward the open position to the closed position by the oscillating unit.
26. The sheet material stacking apparatus of claim 24, wherein the first and the second guiding members are in an open position before a sheet materials is induced, and when the sheet materials is induced and dropping between the perpendicular portions of the first and second guiding members, the first and second guiding members pivot from the open position to a closed position by the oscillating unit, and then pivot toward the open position by the oscillating unit.
27. The sheet material stacking apparatus of claim 25, further comprising a sheet material detecting sensor for detecting the sheet materials induced by the sheet material conveying unit, the oscillating unit sets the timing for oscillating the first and second guide members on the basis of the timing when the sheet material detecting sensor detects the sheet materials.
28. The sheet material stacking apparatus of claim 26, further comprising a sheet material detecting sensor for detecting the sheet materials induced by the sheet material conveying unit, the oscillating unit sets the timing for oscillating the first and second guide members on the basis of the timing when the sheet material detecting sensor detects the sheet materials.
29. A sheet material stacking method of stacking sheet materials by using the sheet material stacking apparatus of any one of claims 1 to 21, comprising the steps of:

displacing the pusher to the separating position and then inducing the sheet onto the sheet

stacking base, and
displacing the pusher to the reference position
so as to sort both end surfaces of the sheet ma-
terial in the width direction.

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- 30.** A sheet material stacking method of stacking sheet materials by using the sheet material stacking apparatus of claim 22, comprising the steps of:

displacing the first guide member to the sepa- 10
rating position and then inducing the sheet ma-
terial onto the sheet material stacking base,
displacing the first guide member to the refer-
ence position so as to sort the end surfaces at
one end of sheet materials, 15
displacing the second guide member to the sep-
arating position, and then,
displacing the second guide member to the refer-
ence position so as to sort the end surfaces
at the other end of the sheet materials. 20

- 31.** A sheet material stacking method of stacking sheet materials by using the sheet material shacking apparatus of one of claim 22 to 28, comprising the steps of: 25

oscillating the first and second guiding members
in a direction of getting apart from each other
and then, inducing the sheet materials into the
sheet material stacking base; 30
oscillating the first and the second guiding mem-
bers in a direction of getting closer to each other
so as to sort the both end surface of the sheet
surface extending along the conveyance direc-
tion thereof. 35

40

45

50

55

FIG. 1

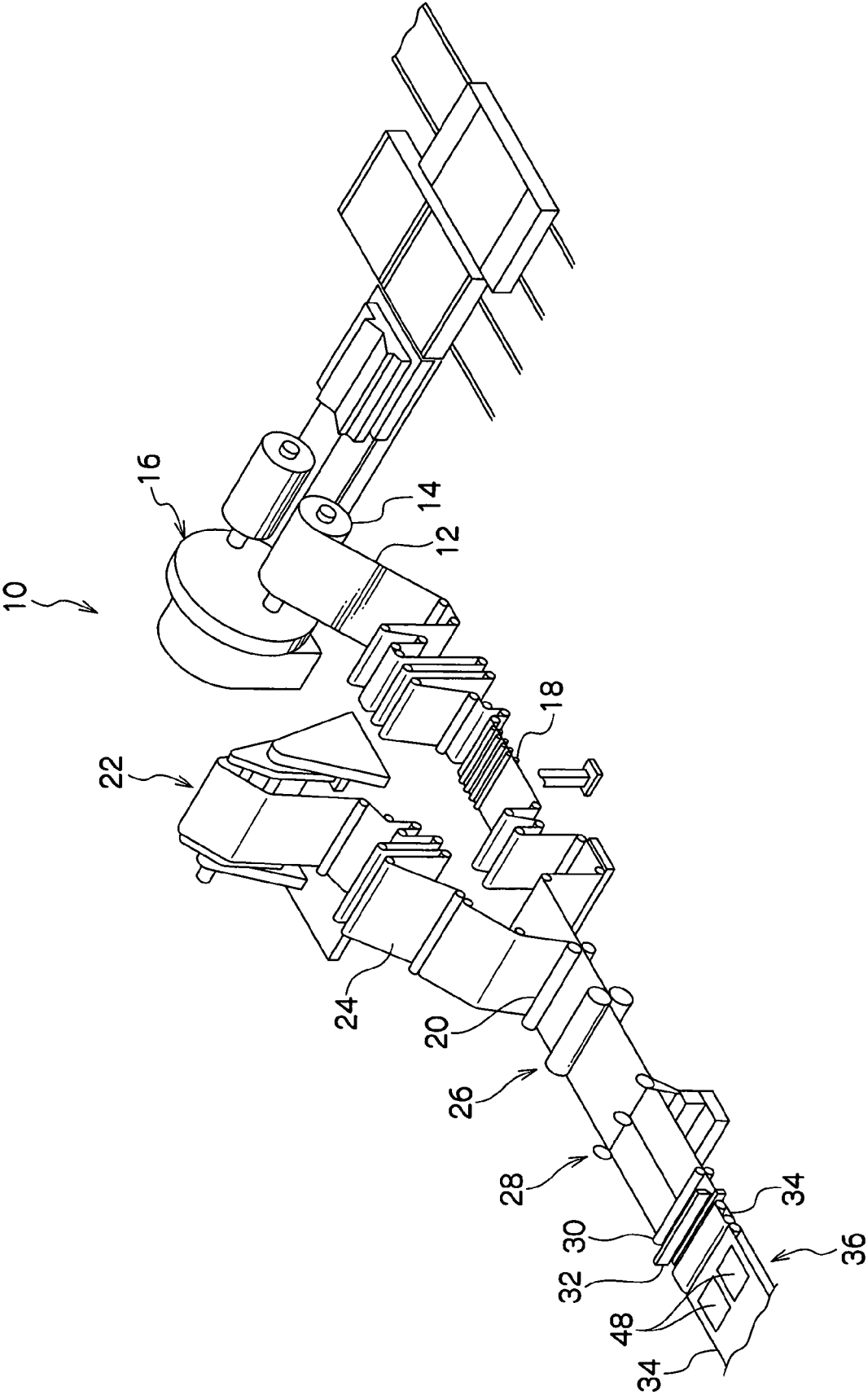


FIG. 2

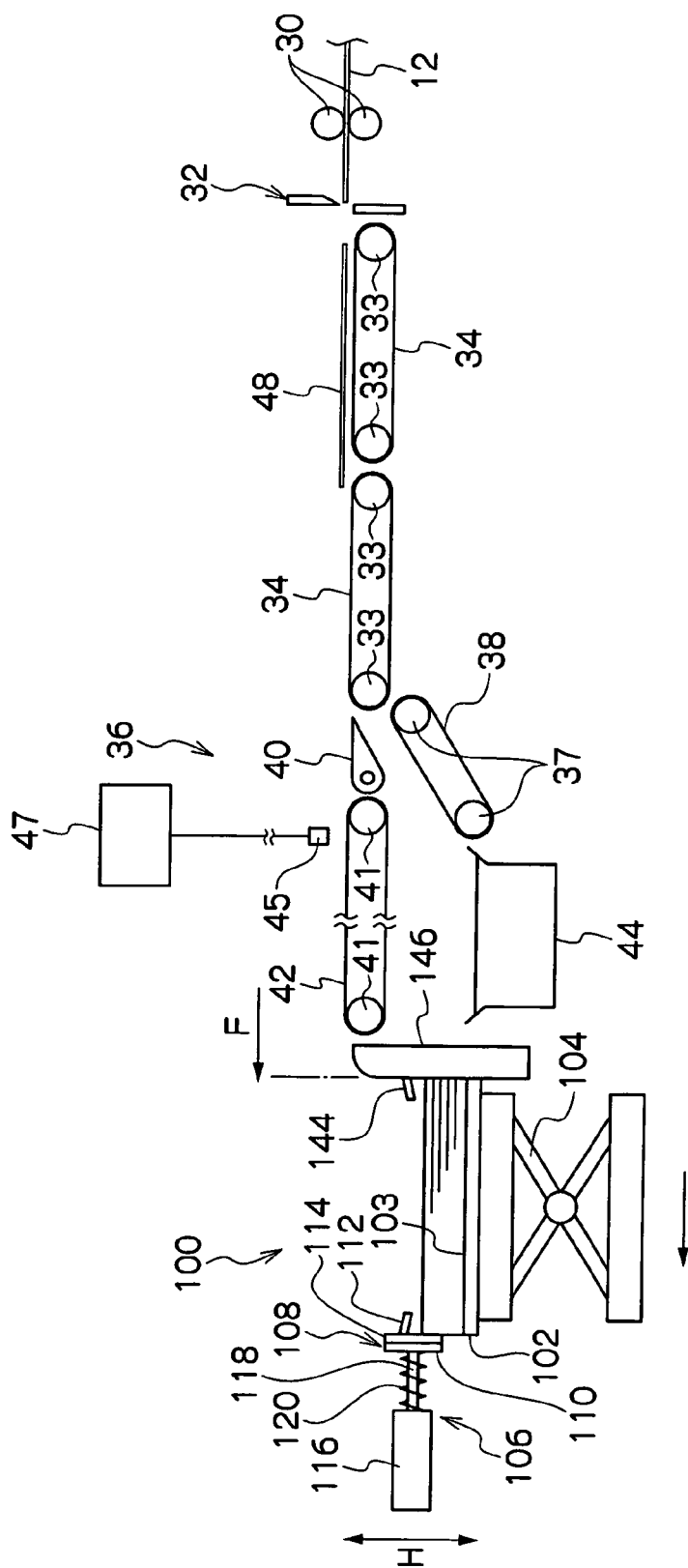


FIG. 3

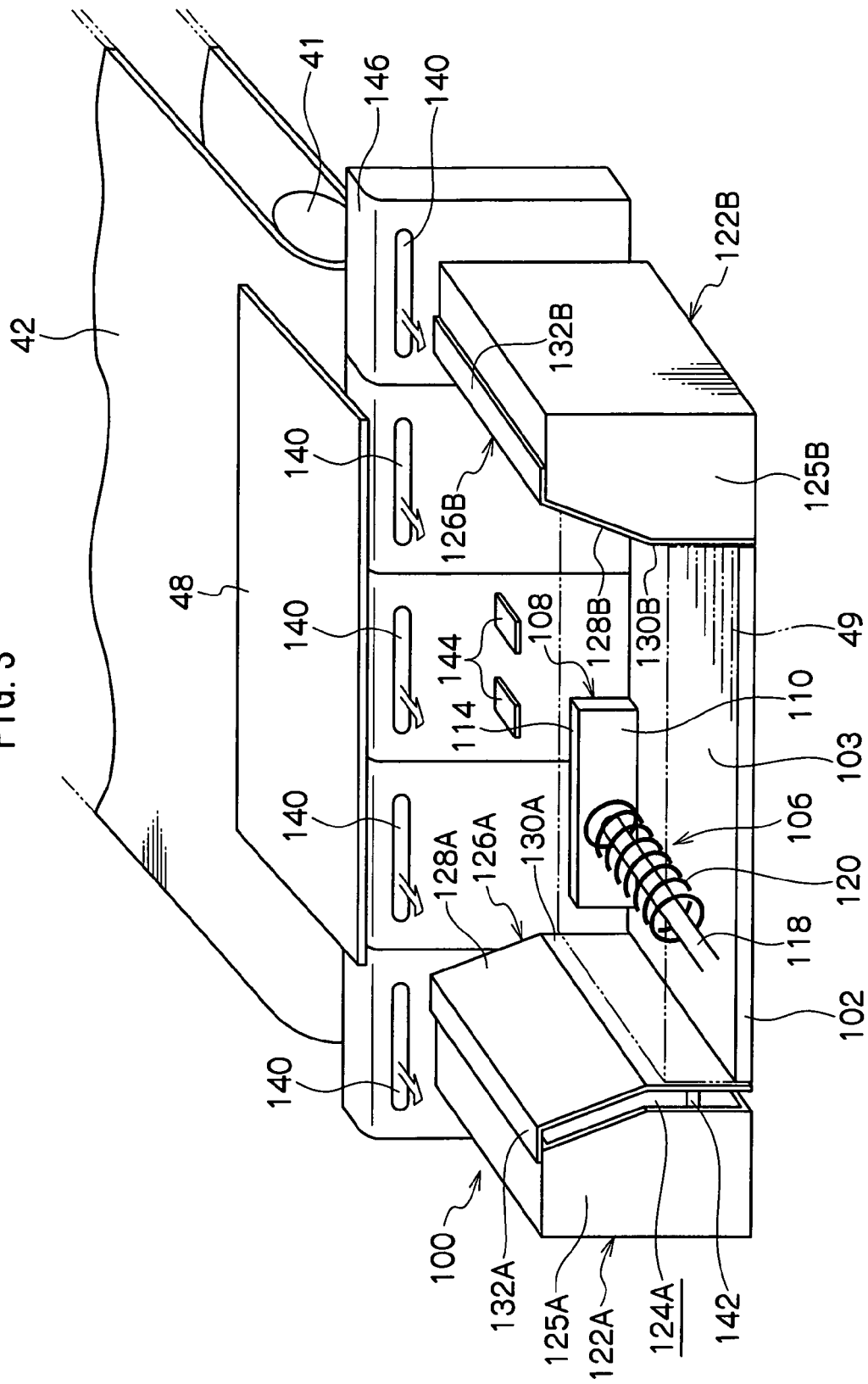


FIG. 4

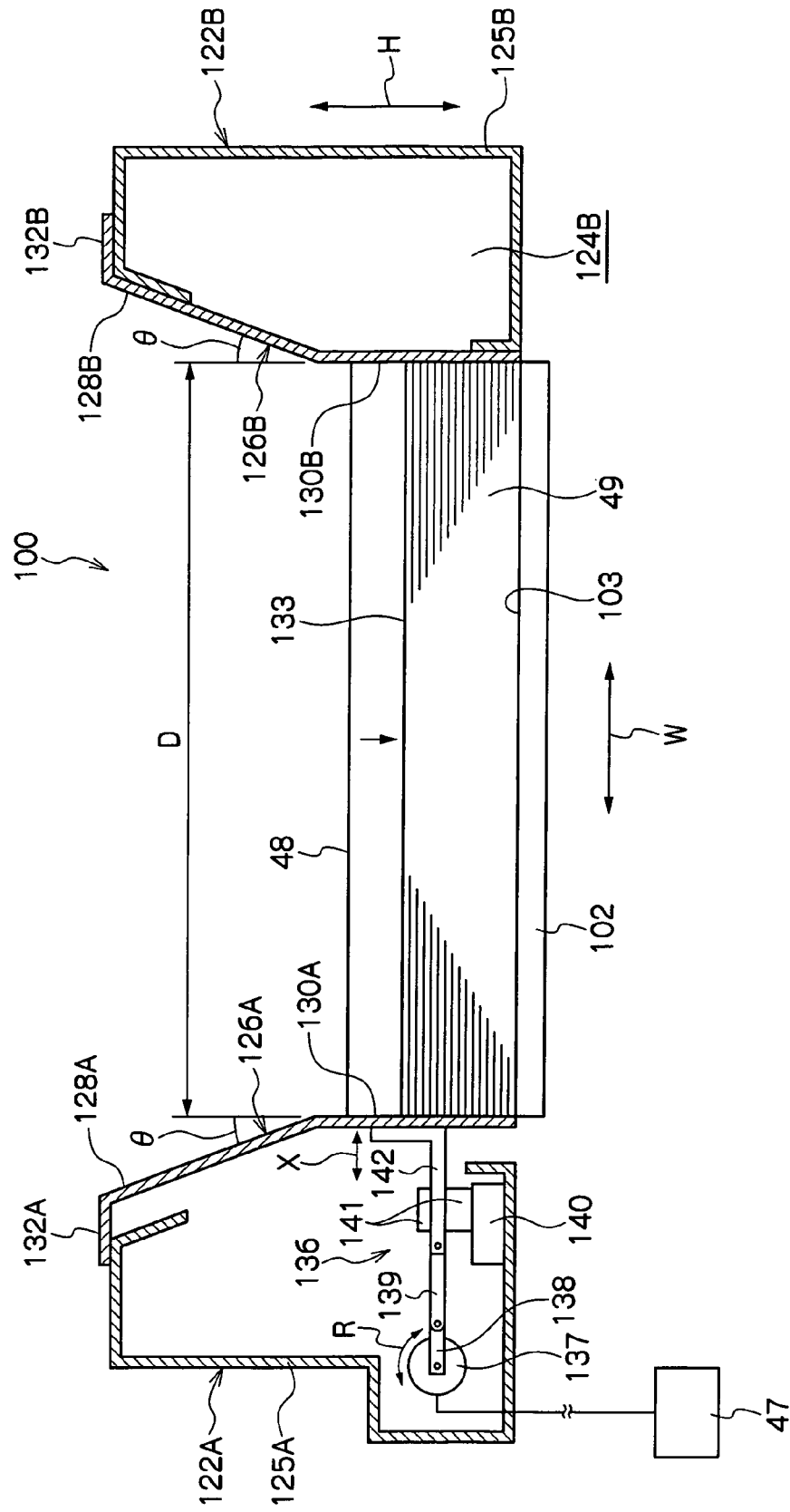


FIG. 5A

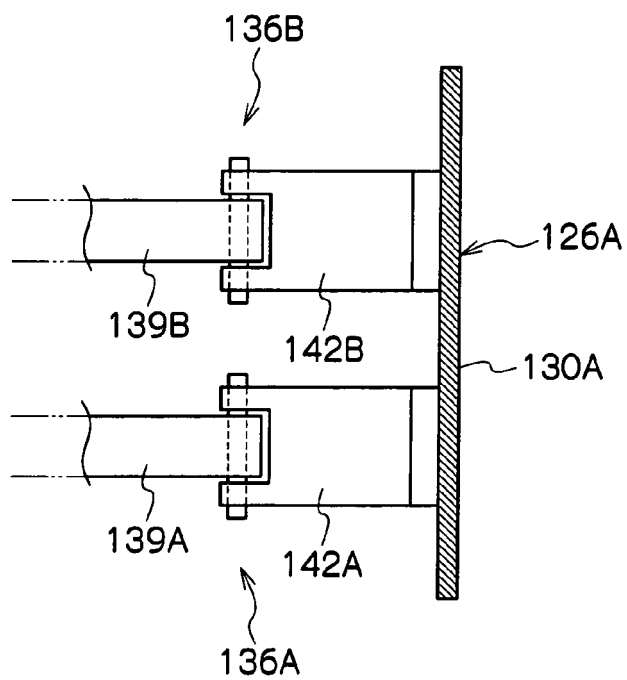


FIG. 5B
COMPARISON

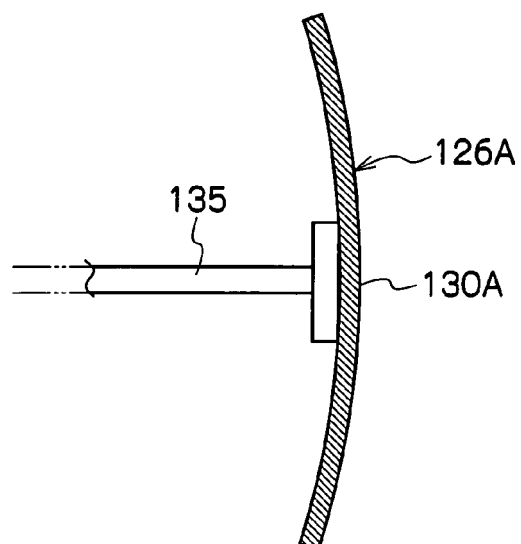


FIG. 6A

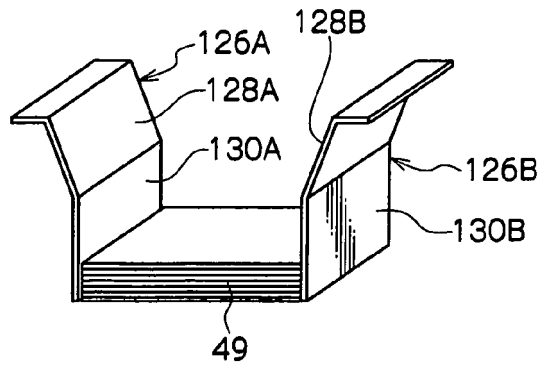


FIG. 6B

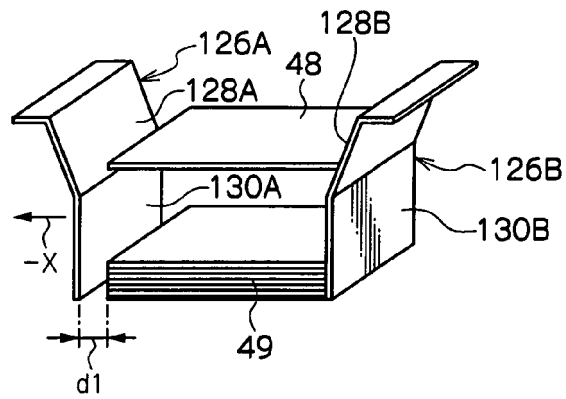


FIG. 6C

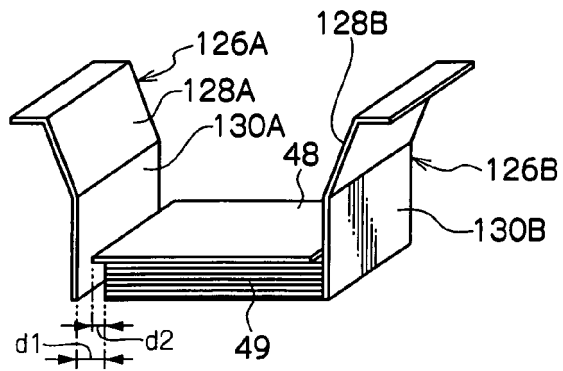


FIG. 6D

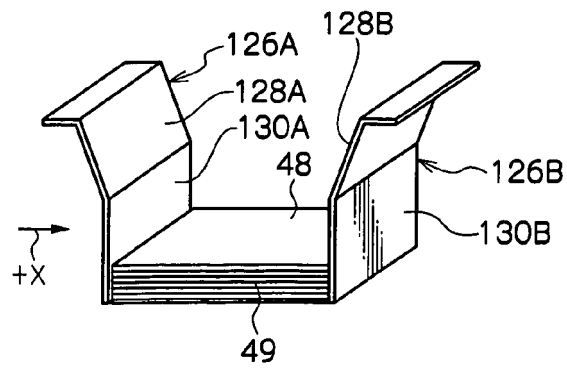


FIG. 7A

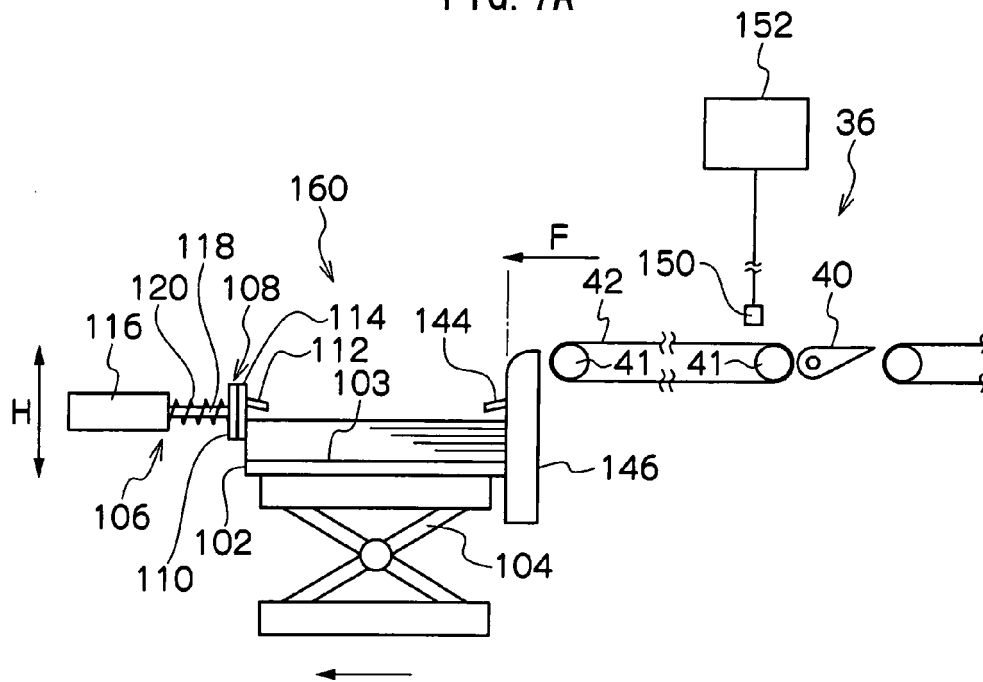


FIG. 7B

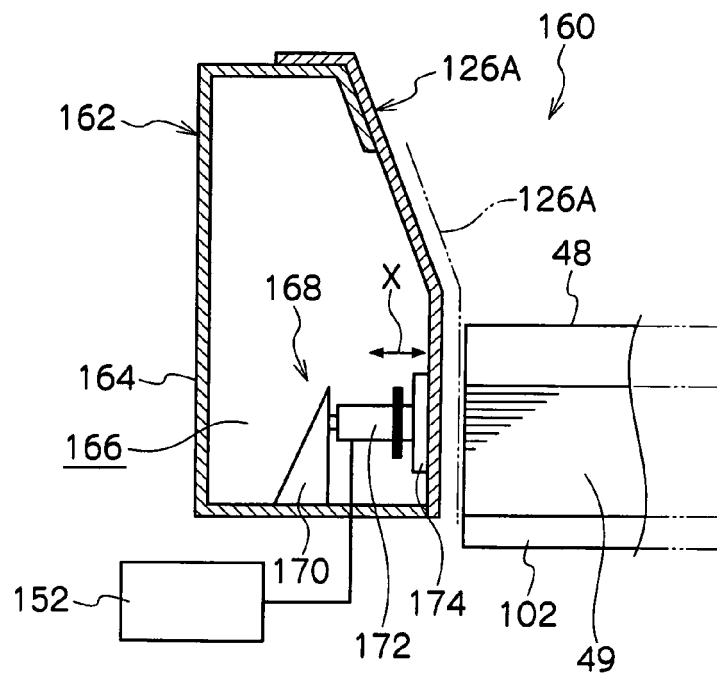


FIG. 8A

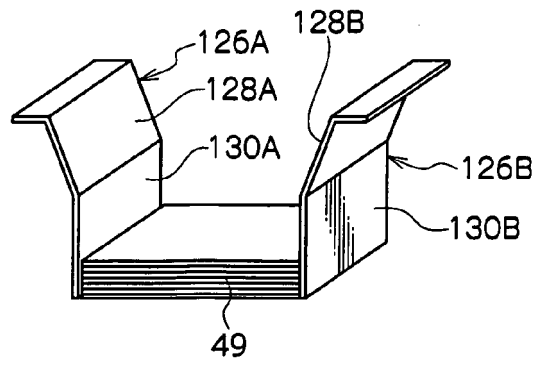


FIG. 8B

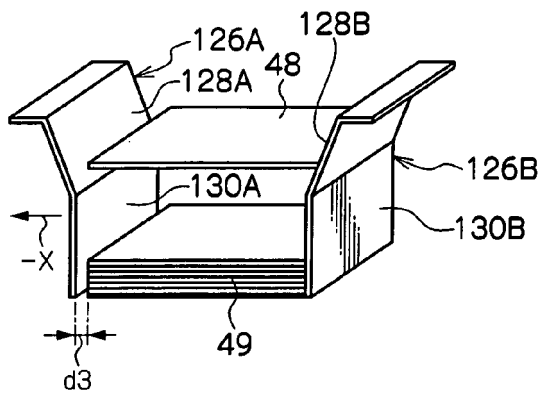


FIG. 8C

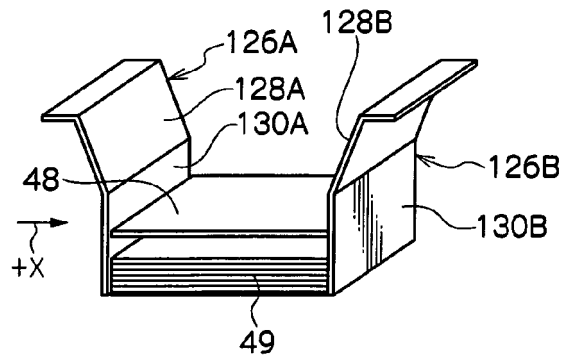


FIG. 8D

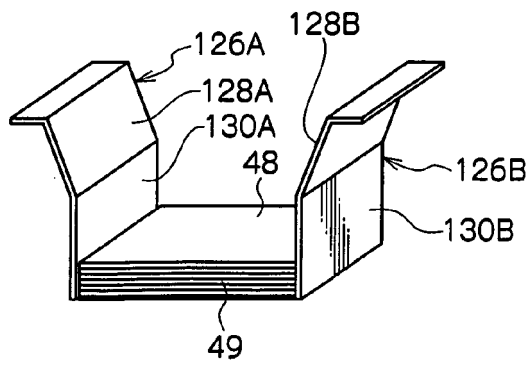


FIG. 9

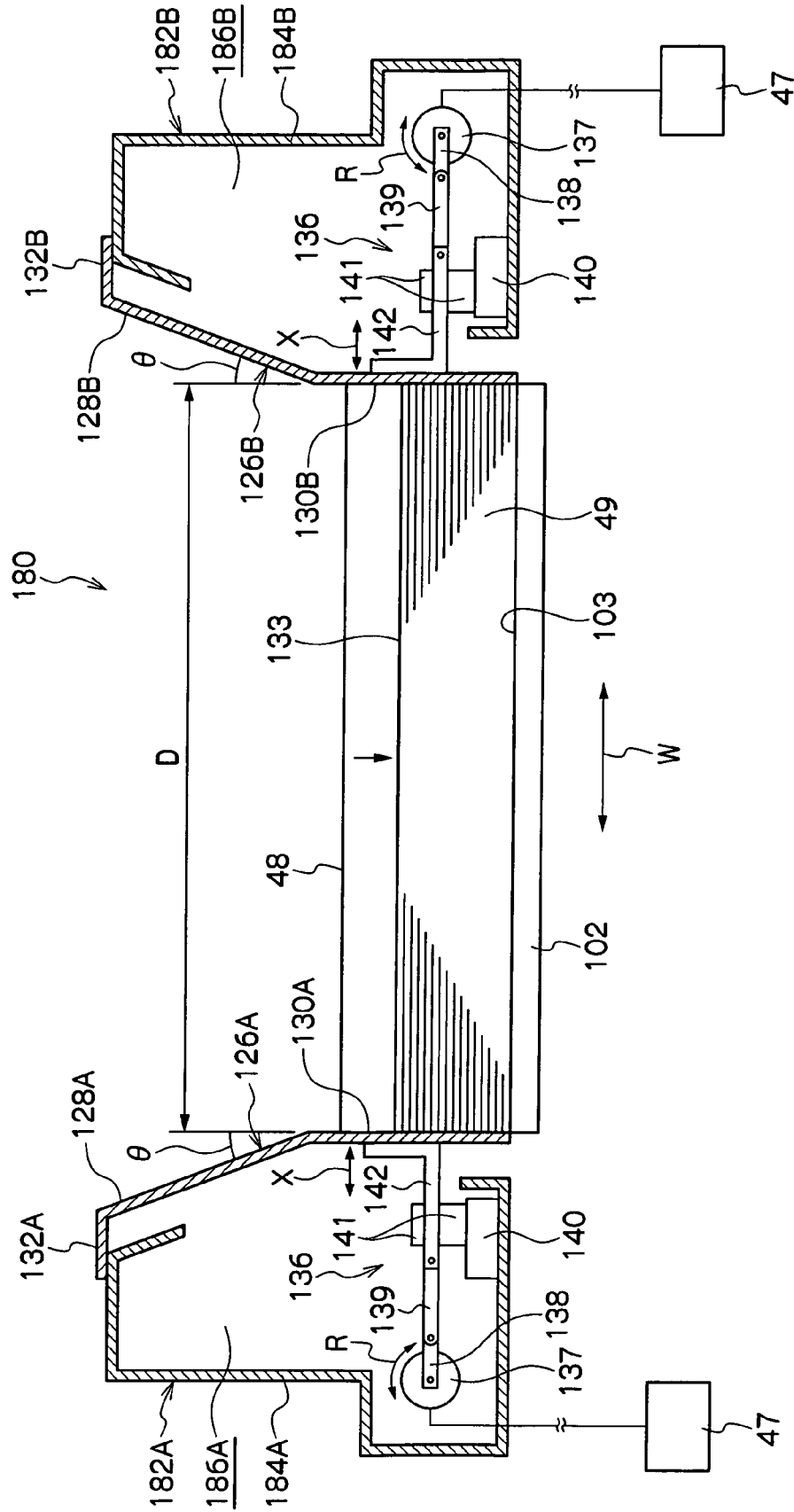


FIG. 10A

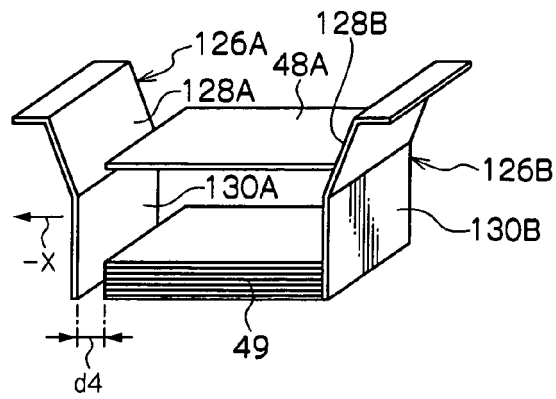


FIG. 10B

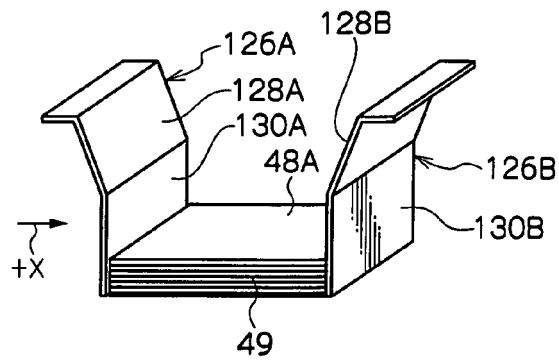


FIG. 10C

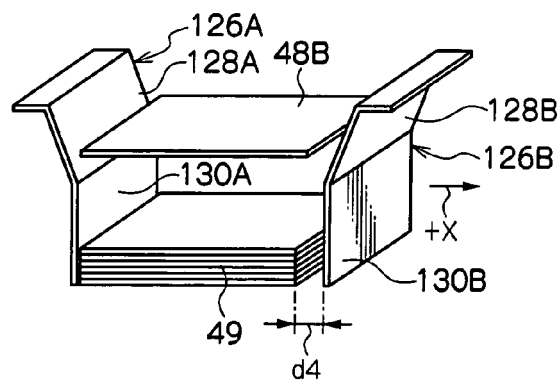


FIG. 10D

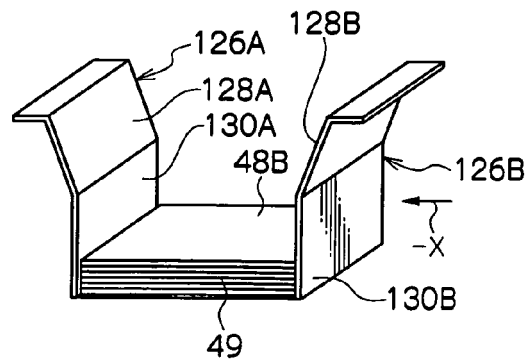


FIG. 11

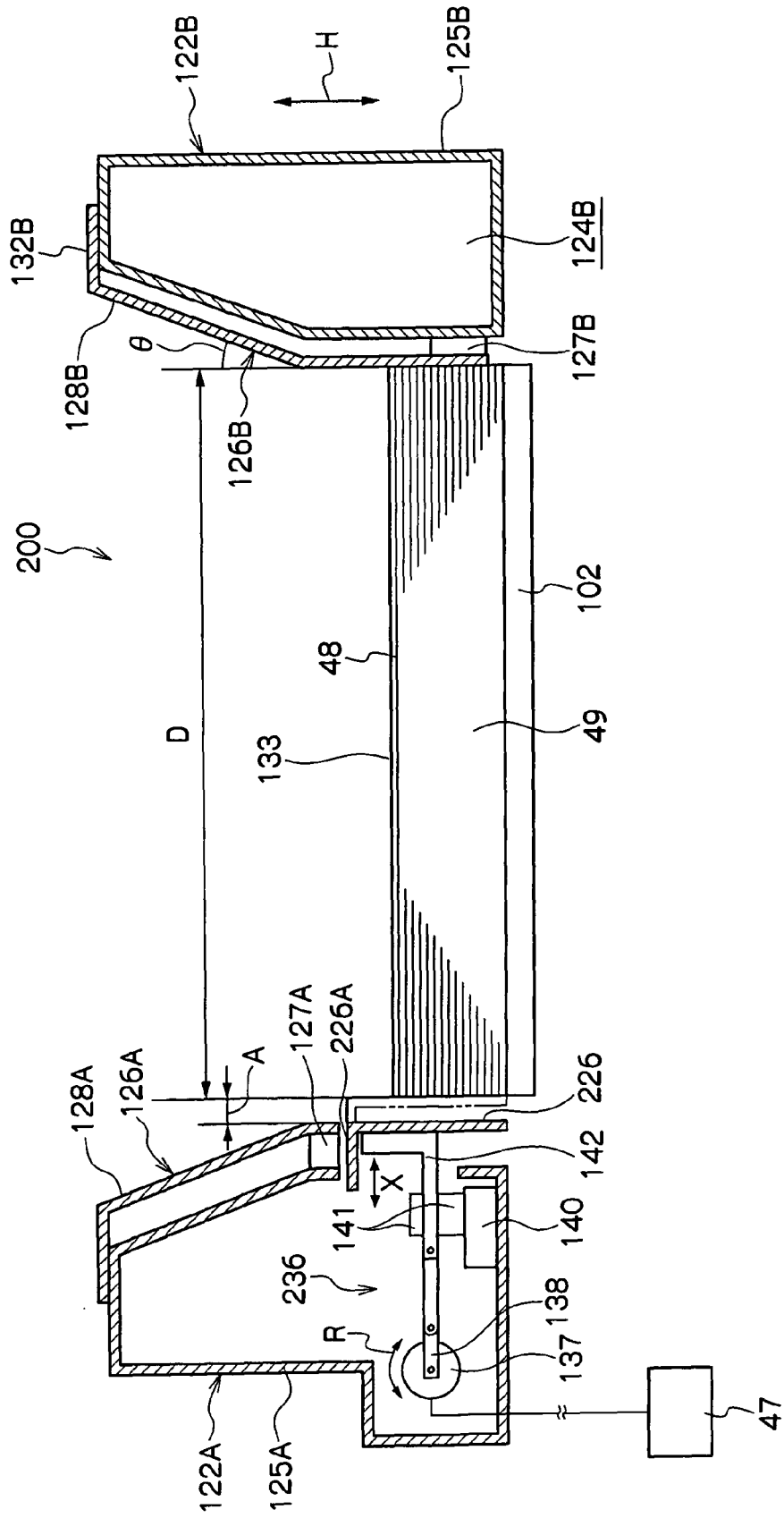


FIG. 12A

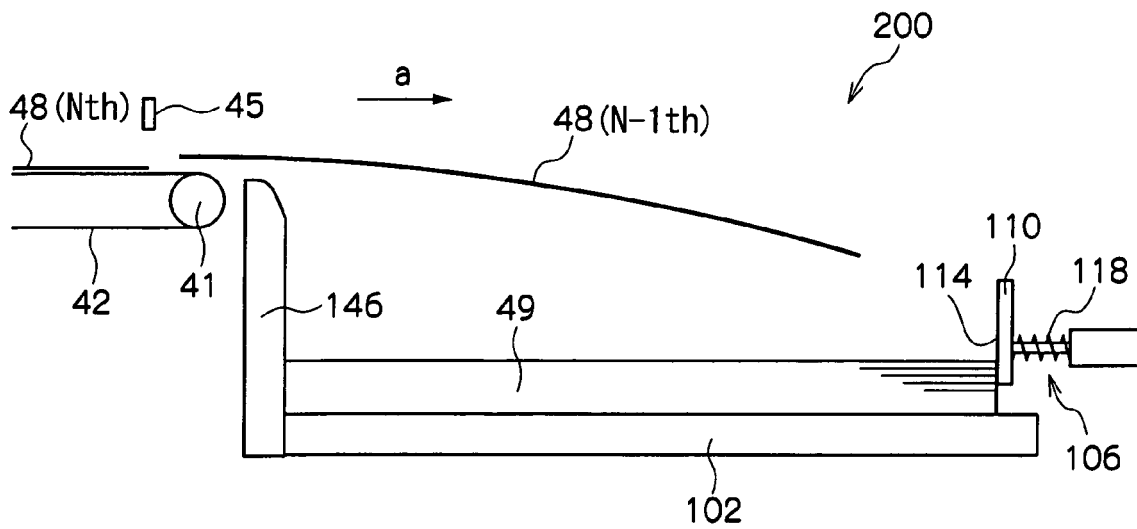


FIG. 12B

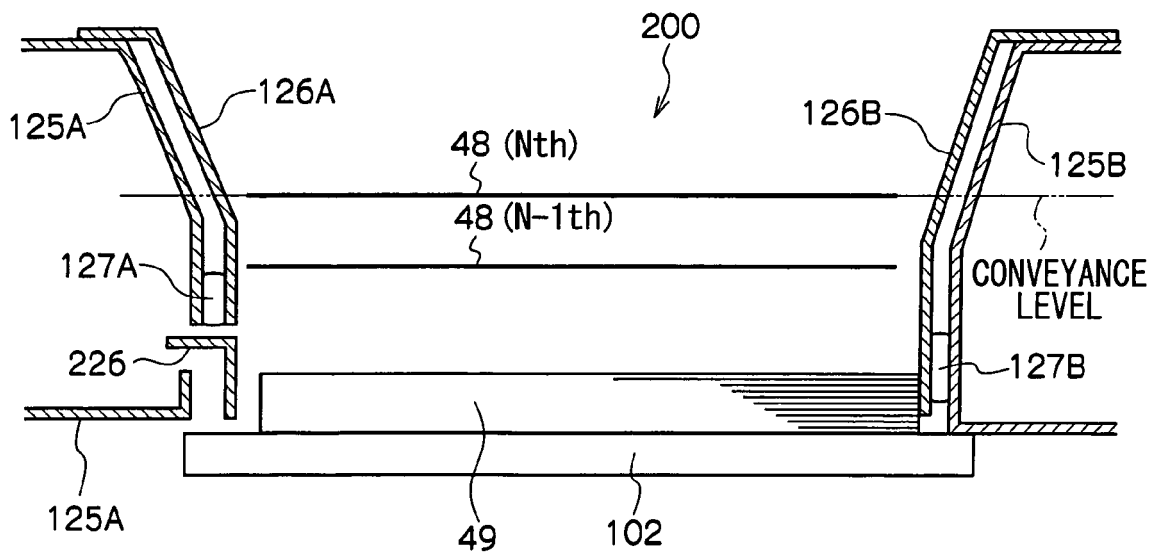


FIG. 13A

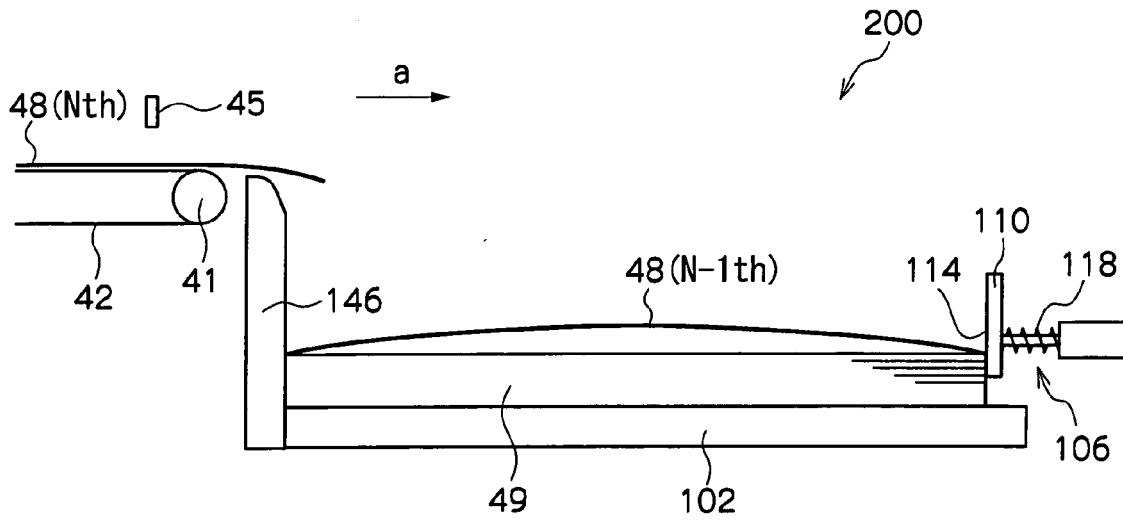


FIG. 13B

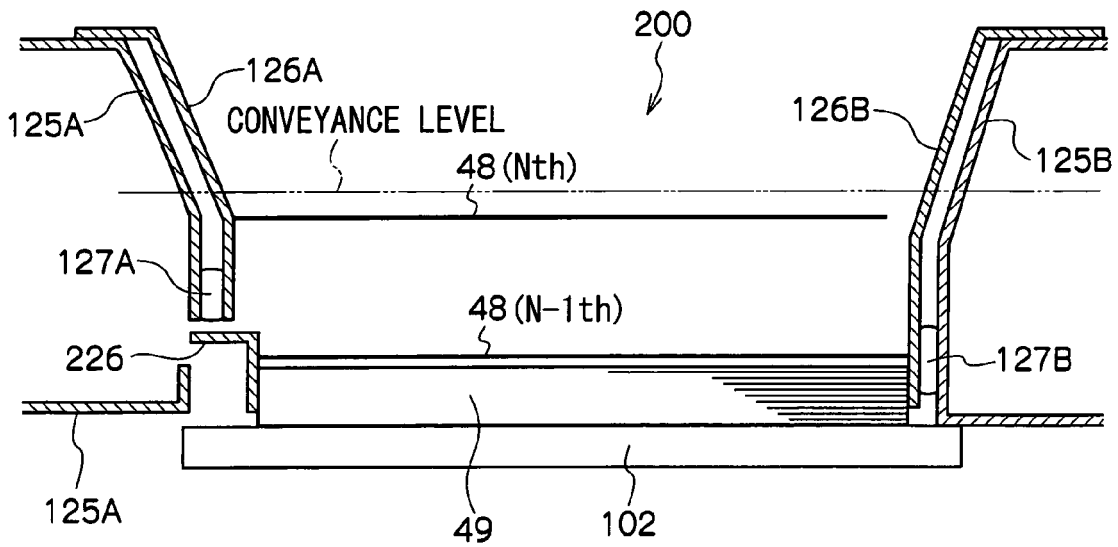


FIG. 14A

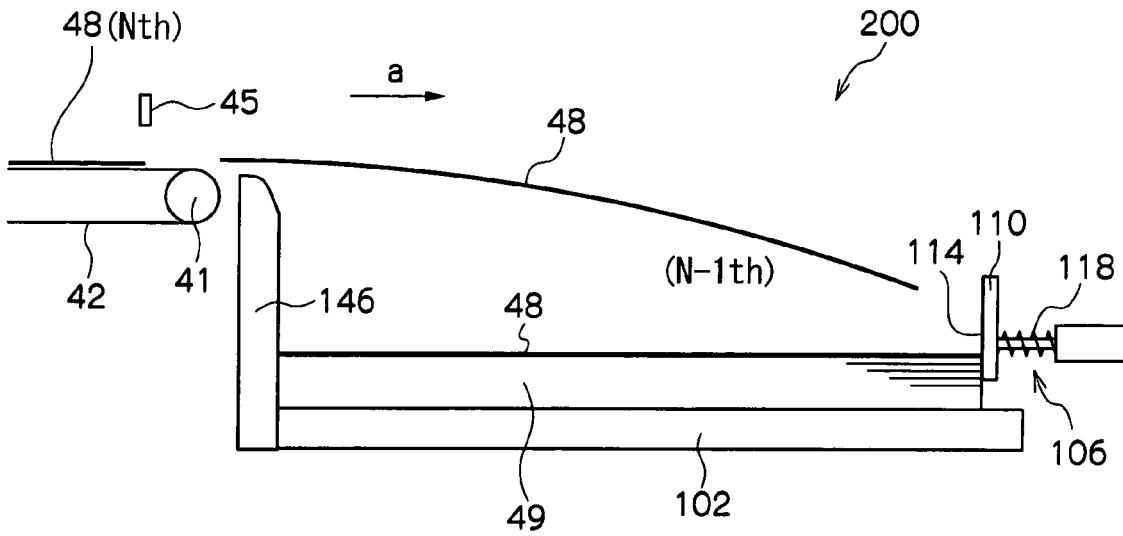


FIG. 14B

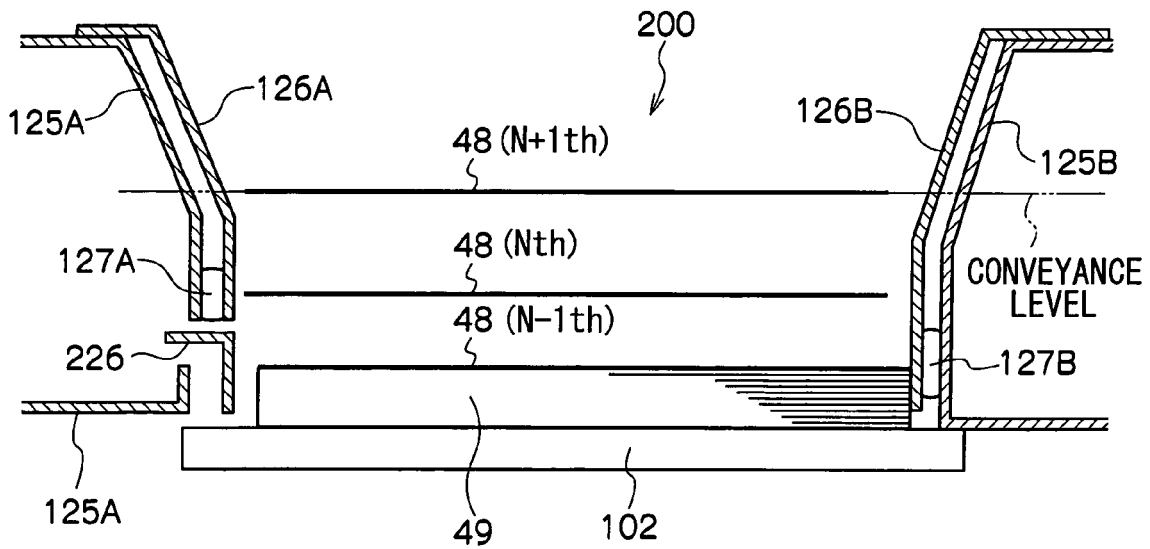


FIG. 15

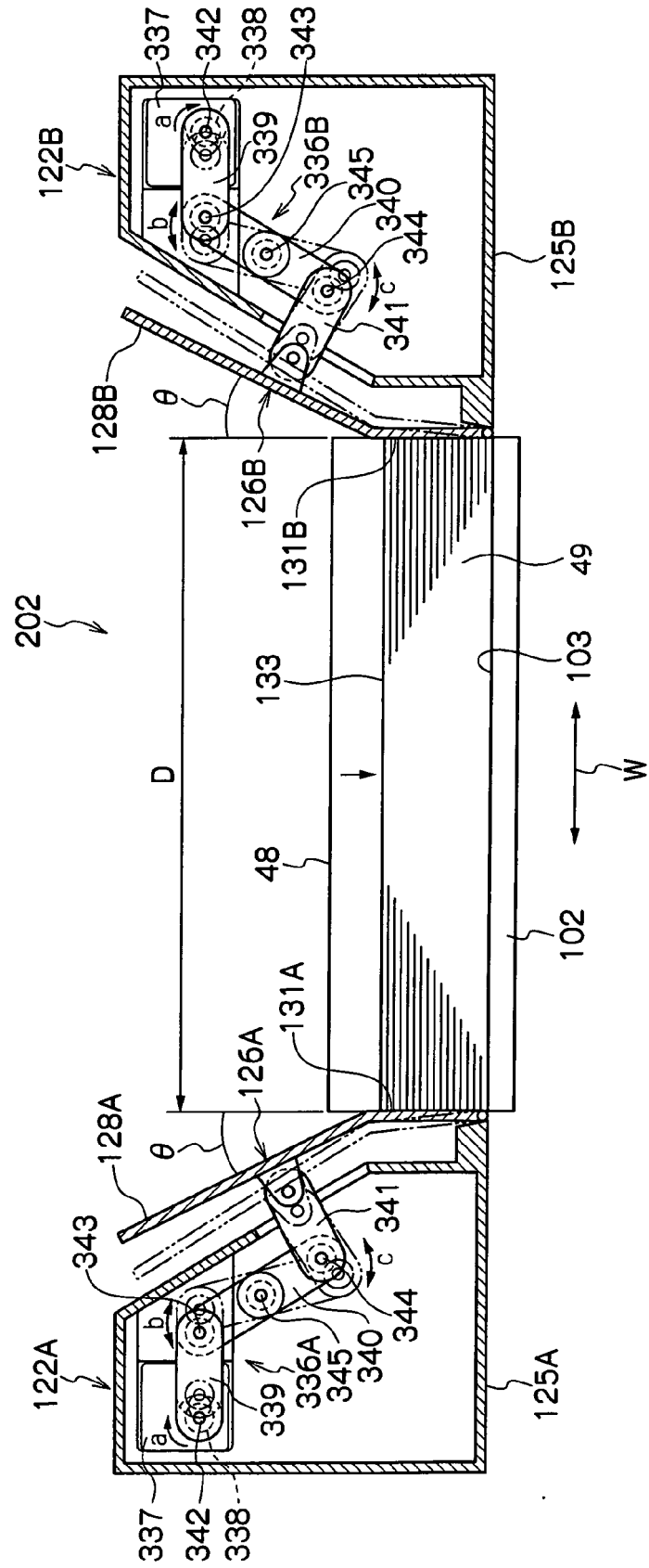


FIG. 16

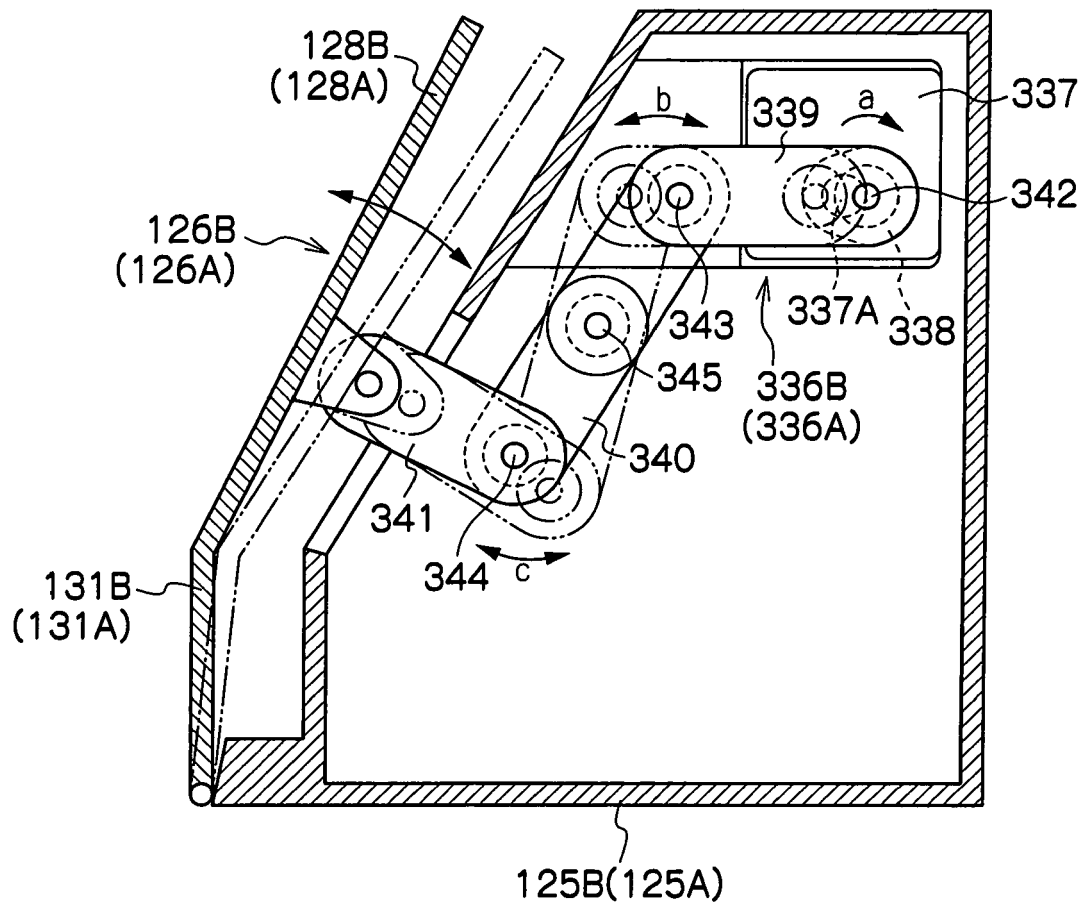


FIG. 17A

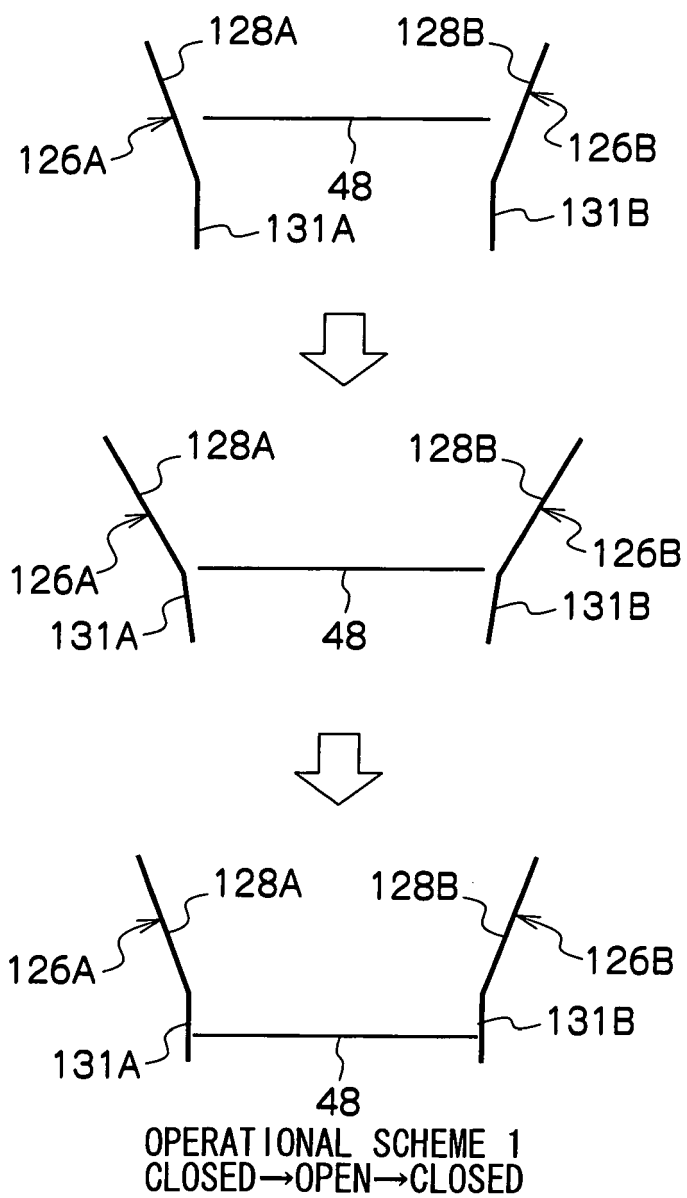
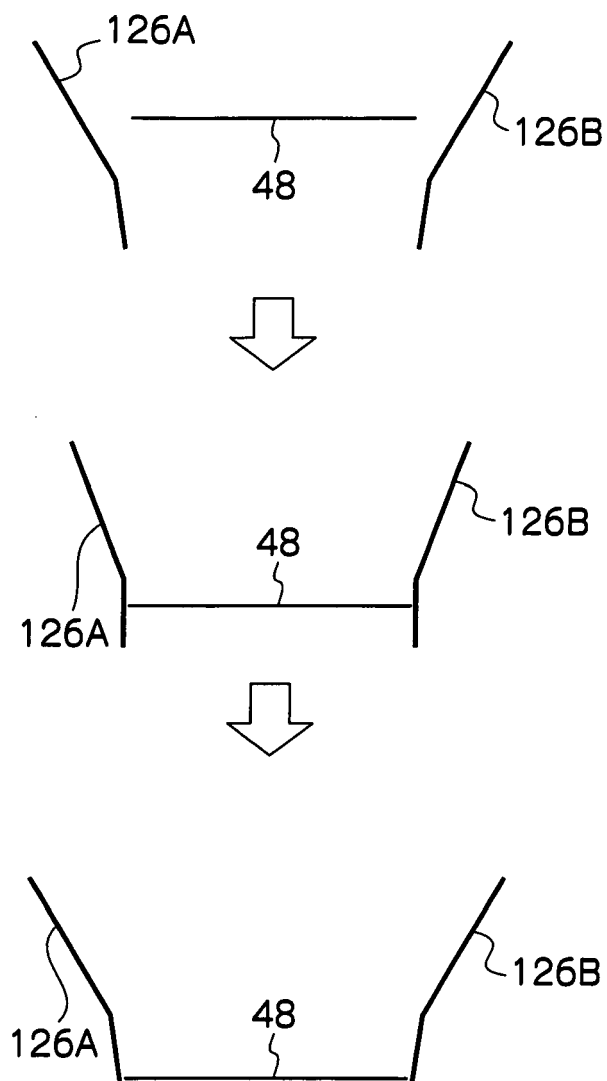


FIG. 17B



OPERATIONAL SCHEME 2
OPEN → CLOSED → OPEN

OPERATIONAL SCHEME 1: CLOSED→OPEN→CLOSED

FIG. 18A

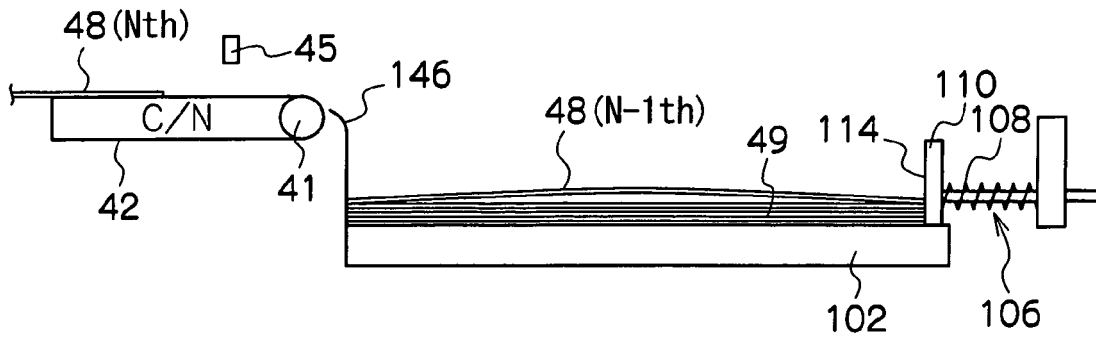


FIG. 18B

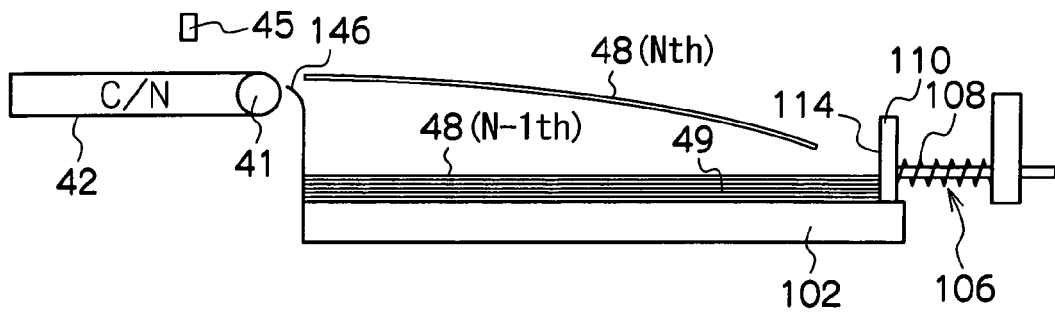


FIG. 18C

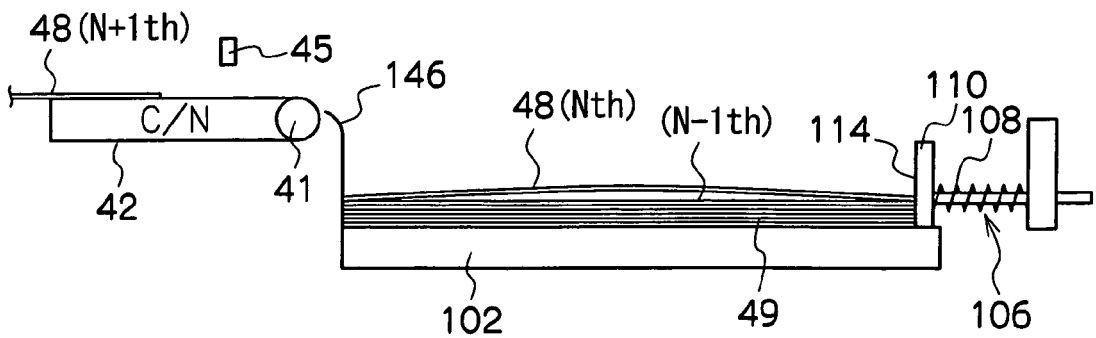


FIG. 19A

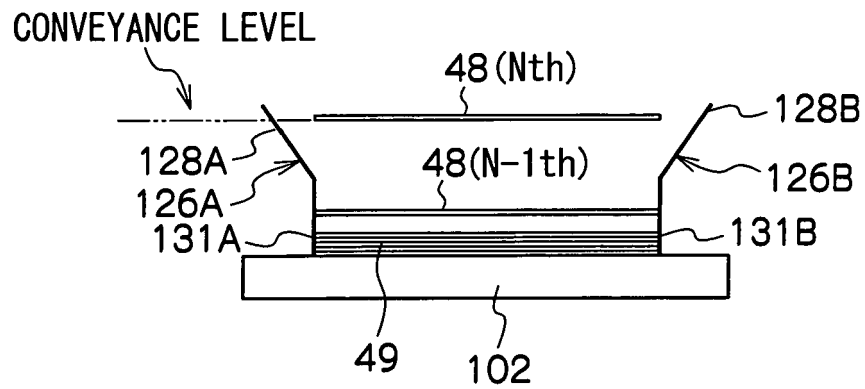


FIG. 19B

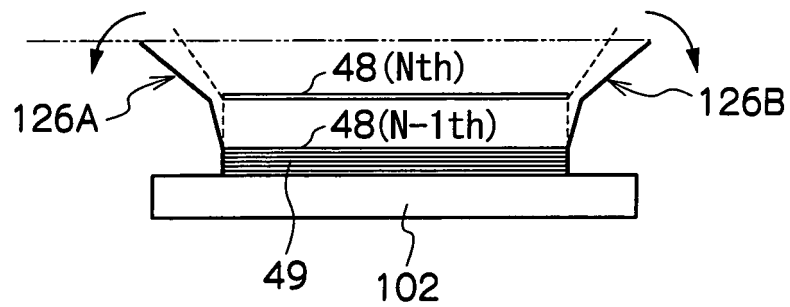
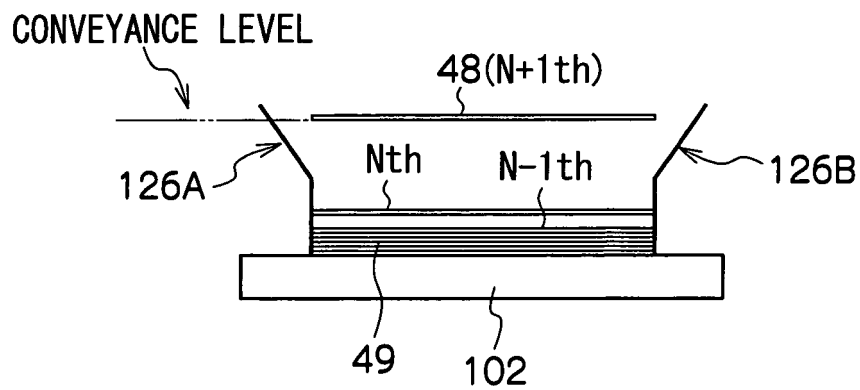


FIG. 19C



OPERATIONAL SCHEME 2: OPEN→CLOSED→OPEN

FIG. 20A

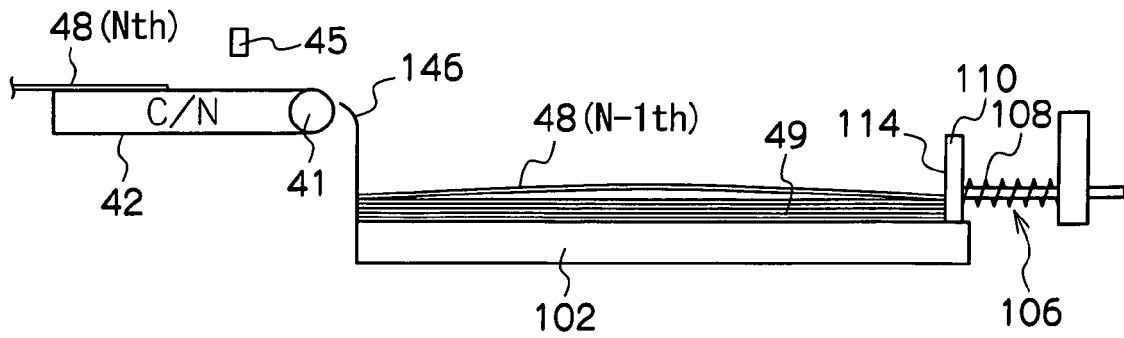


FIG. 20B

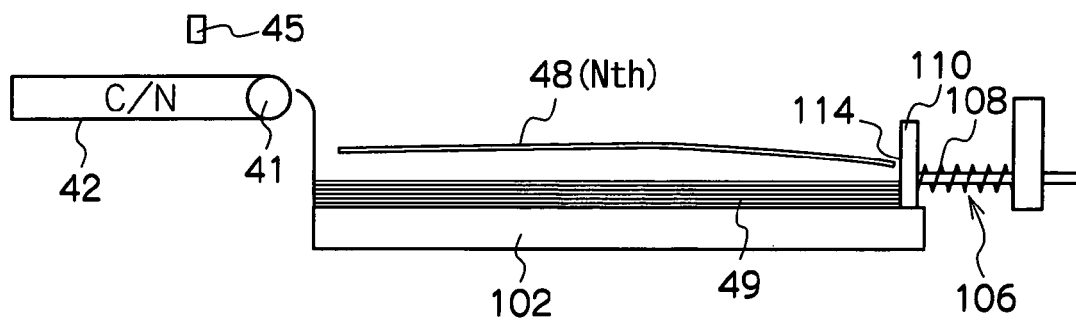


FIG. 20C

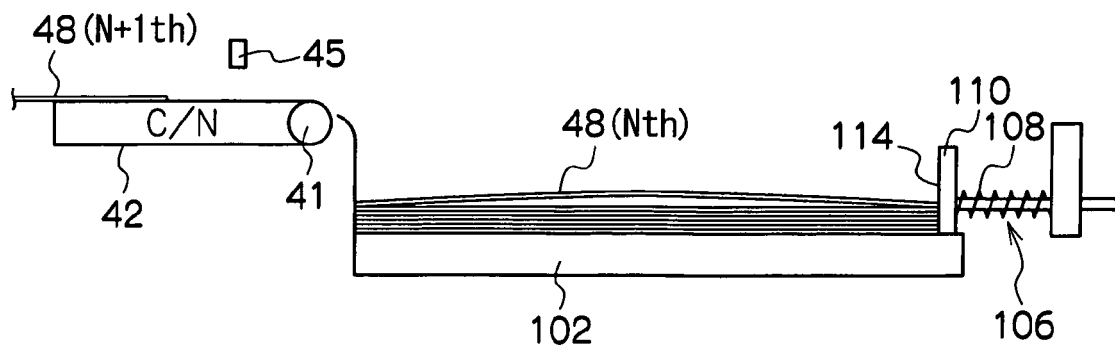


FIG. 21A

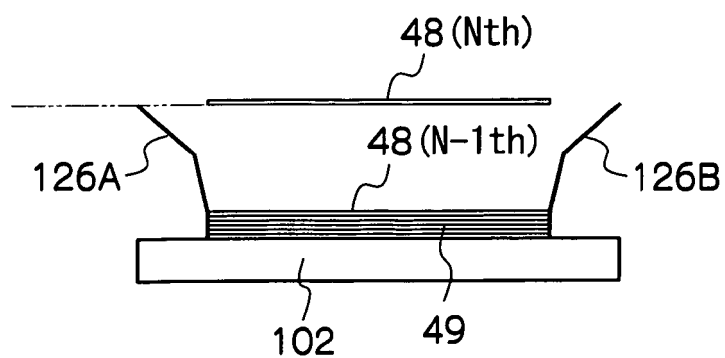


FIG. 21B

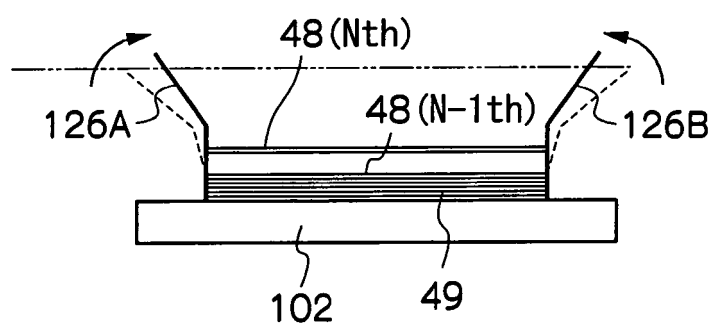
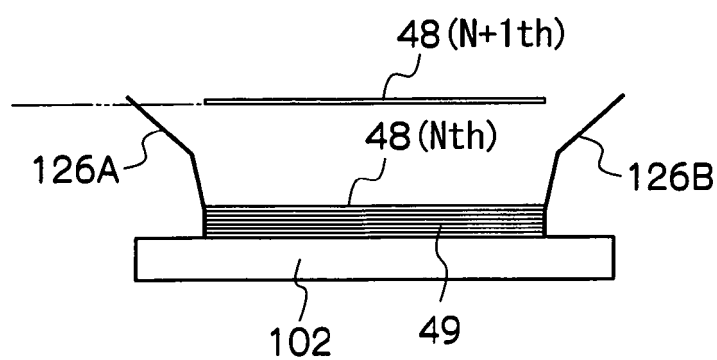


FIG. 21C



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2002308513 A [0004] [0006]
- JP 10120280 A [0005] [0007]