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(54) **SHEET TAKEOUT AND SEPARATION DEVICE AND SHEET PROCESSING APPARATUS**

(57) A sheet takeout and separation device of an embodiment has a takeout section (31), a sending section (32), a separation portion (33). The takeout section takes out a sheet. The sending section sends out the sheet taken out by the takeout section. The separation portion is provided so as to come in contact with the sheets taken out in an overlapping state by the takeout section, and separates the sheets one by one. In addition, the separation

portion has a separation portion main body (72) and a cover (78). The separation portion main body elastically deforms in accordance with a thickness of the sheet. The cover is provided on the separation portion main body so as to come in contact with the sheet. And, on a surface of the cover, a surface roughening treatment for enhancing a friction coefficient of the relevant surface is performed.

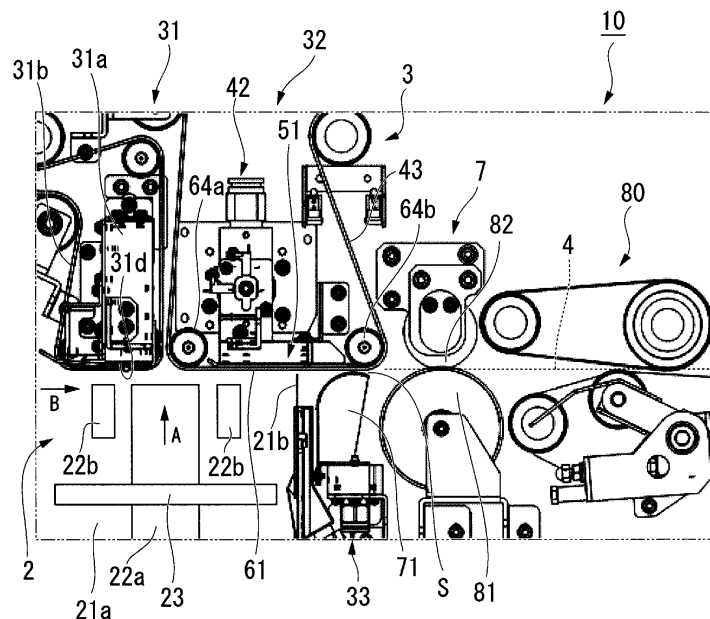


FIG. 2

Description

FIELD

[0001] Embodiments relate to a sheet takeout and separation device and a sheet processing apparatus.

BACKGROUND

[0002] Conventionally, a sheet takeout and separation device is known that is provided with a takeout section which sucks and sends out a sheet by the movement of a takeout belt formed with suction holes, and a separation section which is arranged opposite to the takeout section and separates a sheet which has been sent in an overlapping manner with the sucked sheet.

[0003] In the above-described takeout and separation device, in the case in which a sheet is made of a material through which air passes easily, when a takeout power is increased by enlarging a suction power, there has been a case that plural sheets may be taken out simultaneously, and in the case in which a sheet is soft or the separation operation by the separation section is strong, when a sheet is buckled between the takeout section and the separation section, there has been a case that conveying trouble such as a jam may occur. For this reason, in the sheet takeout and separation device, it has been desired to prevent the occurrence of conveying trouble of a sheet, while properly preventing that two sheets are sent out in an overlapping manner.

BRIEF DESCRIPTION OF THE DRAWINGS

[0004]

Fig. 1 is a perspective view showing a configuration of a sheet processing apparatus of an embodiment.
 Fig. 2 is a plan view of the sheet takeout and separation device of the embodiment.
 Fig. 3 is an enlarged perspective view of the feeding section of the embodiment and its periphery.
 Fig. 4 is a perspective view showing a state in which sheets are arranged in the feeding section of the embodiment.
 Fig. 5 is a perspective view of the double-sheet takeout preventing block of the embodiment.
 Fig. 6 is a side view of the double-sheet takeout preventing block of the embodiment.
 Fig. 7 is a plan view of the periphery of the suction holes in the protection cover of the embodiment.
 Fig. 8 is a plan view of the periphery of the suction holes in the protection cover of the embodiment.
 Fig. 9 is an explanation diagram showing a behavior of the double-sheet takeout preventing block of the embodiment.
 Fig. 10A, Fig. 10B, Fig. 10C are diagrams each showing a behavior of a sheet passing through the separation portion of the embodiment.

EMBODIMENT TO PRACTICE THE INVENTION

[0005] A sheet takeout and separation device of an embodiment has a takeout section, a sending section, a separation portion. The takeout section takes out a sheet. The sending section sends out the sheet taken out by the takeout section. The separation portion is provided so as to come in contact with the sheets taken out in an overlapping state by the takeout section, and separates the sheets one by one. In addition, the separation portion has a separation portion main body and a cover. The separation portion main body elastically deforms in accordance with a thickness of the sheet. The cover is provided on the separation portion main body so as to come in contact with the sheet. And, on a surface of the cover, a surface roughening treatment is performed.

[0006] Hereinafter, a sheet takeout and separation device and a sheet processing apparatus of an embodiment will be described with reference to the drawings.

[0007] Fig. 1 is a perspective view showing a sheet processing apparatus.

[0008] As shown in Fig. 1, a sheet processing apparatus 1 is provided with a controller 1a, a feeding section 2, a takeout and separation section 3, a main conveying path 4, an inspection section 5, a conveying and sorting section 6, gap correction sections 7, sorting boxes 8.

[0009] The controller 1a totally controls an operation of the sheet processing apparatus 1.

[0010] The feeding section 2 holds a plurality of sheets stacked in an upright position in an approximately vertical direction with respect to a horizontal plane, and moves the plurality of sheets toward a stacking direction. By this means, the feeding section 2 feeds the plurality of sheets to the takeout and separation section 3 existing at a front side of the stacking direction. The sheet is a letter, for example.

[0011] The takeout and separation section 3 sucks and takes out a front sheet in the stacking direction, out of the plurality of sheets fed by the feeding section 2, and sends out the taken-out sheet toward the main conveying path 4.

[0012] The inspection section 5 reads sorting information described on the sheet.

[0013] The conveying and sorting section 6 sorts sheets into four conveying paths which are provided at different positions in the vertical direction.

[0014] The gap correction sections 7 are respectively provided immediately after the takeout and separation section 3, at an upstream portion of the conveying and sorting section 6, and immediately after the conveying and sorting section 6. The gap correction section 7 corrects an interval (gap) between adjacent sheets in the conveying direction within a prescribed range.

[0015] The sorting box 8 has four steps in the vertical direction. The sorting box 8 sorts and collects a sheet in accordance with the sorting information of the sheet.

[0016] Here, the feeding section 2, the takeout and separation section 3, and the main conveying path 4 com-

pose a sheet takeout and separation device 10. In addition, the conveying and sorting section 6 and sorting boxes 8 compose a sorting processing section.

[0017] Fig. 2 is a plan view of the sheet takeout and separation device, Fig. 3 is an enlarged perspective view of the feeding section and a periphery thereof, Fig. 4 is a perspective view showing a state in which sheets are arranged in the feeding section.

[0018] As shown in Fig. 2 - Fig. 4, the feeding section 2 of the sheet takeout and separation device 10 is provided with a flat bottom wall 21a, and a guide wall 21b which is provided so as to rise approximately vertically from the bottom wall 21a. The feeding section 2 holds a plurality of stacked sheets which are loaded on the bottom wall 21a in an upright position in a feeding direction A toward the takeout and separation section 3. The guide wall 21b comes in contact with respective end portions of the plurality of sheets moving in the feeding direction A, to guide the movement of the plurality of sheets.

[0019] The feeding section 2 is further provided with a main belt 22a and sub belts 22b provided on the bottom wall 21a, and a backup plate 23 which moves on the bottom wall 21a in the feeding direction A. The main belt 22a and the sub belts 22b come in contact with respective end portions of the plurality of sheets loaded on the bottom wall 21a, and are independently driven in the feeding direction A. By this means, the main belt 22 moves the plurality of sheets loaded on the bottom wall 21a in the feeding direction A, and the sub belts 22b adjust a posture of each of the plurality of sheets.

[0020] The backup plate 23 comes in contact with a rearmost sheet in the feeding direction A, out of the plurality of sheets arranged on the bottom wall 21a, presses the plurality of sheets in the feeding direction A, and moves in synchronization with the driving of the main belt 22a. By this means, the backup plate 23 moves the plurality of sheets loaded on the bottom wall 21a in the feeding direction A.

[0021] As shown in Fig. 4, in the sheet takeout and separation device 10, the bottom wall 21a of the feeding section 2 forms a horizontal plane, and the guide wall 21b forms a vertical plane orthogonal to the horizontal plane. In each sheet having a surface of a rectangular shape, a side in the short direction is made approximately in parallel with the vertical direction. Each sheet is supported by the surface of the bottom wall 21a forming the horizontal plane, at lower side end portions in the vertical direction, out of the both end portions of sides in the short direction.

[0022] Each sheet is arranged such that a side in the long direction is made in parallel with the horizontal direction, and end portions in a sending direction B side of the takeout and separation section 3 described later, out of the both end portions of sides in the long direction, are butted against the guide wall 21b. By this means, the plurality of sheets are arranged in the feeding section 2 such that, regarding each sheet, the end portions of the side in the short direction at the lower side in the vertical

direction are aligned by the bottom walls 21a, and the end portions of the side in the long direction at the sending direction B side (that is, a forefront portion in the sending direction B) are aligned by the guide walls 21b.

[0023] The takeout and separation section 3 is provided with a sub takeout portion 31, a main takeout portion 32, a separation portion 33.

[0024] The sub takeout portion 31 is arranged at a more upstream side than the main takeout portion 32 in the sending direction B that is in parallel with the horizontal direction. The sub takeout portion 31 is provided with a sub air chamber 31a connected to a negative pressure generator (Not shown. a suction side of a blower or the like, for example), and a suction belt 31b driven by a drive motor (Not shown. a step motor or the like, for example).

[0025] The sub air chamber 31a is provided with a sub guide plate 31d formed with a plurality of openings 31c which are opened toward the feeding section 2. The sub guide plate 31d is of a rectangular plate shape, and the plurality of openings 31c are communicated with the inside of the sub air chamber 31a. By this means, a negative pressure (a pressure lower than the atmospheric pressure) is given to the openings 31c of the sub guide plate 31d. The sub guide plate 31d guides the movement of the suction belt 31 to the sending direction B.

[0026] The suction belt 31b is an endless belt formed with a plurality of suction holes 31e, and is arranged such that at least a part of the region thereof overlaps with a part of the sub guide plate 31d. At the region where the suction belt 31b overlaps with the sub guide plate 31c, a plurality of the suction holes 31e of the suction belt 31b communicate with at least a part of the plurality of openings 31c of the sub guide plate 31d. By this means, a negative pressure is given to a plurality of the suction holes 31e of the suction belt 31b by the sub air chamber 31a via a plurality of the openings 31c.

[0027] At the region where the suction belt 31b overlaps with the sub guide plate 31d, the suction belt 31b faces the plurality of sheets held in the feeding section 2 in the feeding direction A, and the suction belt 31b moves in the sending direction B, in a state that the suction belt 31b is arranged so as to extend in parallel with the sending direction B. By this means, when a negative pressure is given to the plurality of suction holes 31a, the suction belt 31b takes out, by suction, a front sheet in the feeding direction A from the plurality of sheets fed by the feeding section 2. And the suction belt 31b sends out the sheet taken out by suction, to the sending direction B at a prescribed speed.

[0028] The prescribed speed of the suction belt 31b is set slower than a speed of a takeout belt 43 described later. By this means, the sub takeout portion 31 takes out a first sheet from the feeding section 2 by suction, and sends out the first sheet to the main takeout portion 32, and in addition, takes out a second sheet by suction, after the back end of the first sheet has passed through the sub air chamber 31a.

[0029] And, the suction belt 31b sends out the second

sheet to the main takeout portion 32 at a speed slower than the speed at which the first sheet is sent out to the sending direction B by the main takeout portion 32. By this means, an interval not less than a prescribed interval value is provided between the first sheet and the second sheet in the sending direction B, to resolve the overlapping of the first sheet and the second sheet.

[0030] The main takeout portion 32 is arranged at a more downstream side than the sub takeout portion 31 in the sending direction B. The main takeout portion 32 is provided with a valve device 42, the takeout belt 43 which is driven by a drive motor (Not shown, a step motor or the like, for example).

[0031] The valve device 42 is provided with a main body block 51 formed with a main guide plate 61 on one surface thereof. The main guide plate 61 is arranged so as to face the plurality of sheets held in the feeding section 2 in the feeding direction A. The main guide plate 61 guides the movement of the takeout belt 43 to the sending direction B.

[0032] In the main body block 51 and the main guide plate 61, a plurality of through holes (not shown) which communicate with each other is formed. These through holes are connected to a vacuum pump (not shown) provided in the valve device 42. By this means, a negative pressure is given to the through holes of the main body block 51 and the main guide plate 61.

[0033] The takeout belt 43 is an endless belt in which a plurality of suction holes 43a is uniformly formed over the entire region thereof. The takeout belt 43 is wound around a plurality of pulleys (not shown) including two pulleys 64a, 64b which are respectively arranged at the both sides of the valve device 42 in the sending direction B. The takeout belt 43 is arranged so that at least a part of the region of the takeout belt 43 overlaps with the main guide plate 61. The plurality of suction holes 43a of the takeout belt 43 communicate with the through holes (not shown) formed in the main guide plate 61, at the region of the takeout belt 43 where it overlaps with the main guide plate 61. By this means, a negative pressure is given to a plurality of the suction holes 43a of the takeout belt 43.

[0034] In addition, the takeout belt 43 moves in the sending direction B, in the state that the region of the takeout belt 43 where it overlaps with the main guide plate 61 extends in parallel with the sending direction B. By this means, when a negative pressure is given to the plurality of suction holes 43a, the takeout belt 43 takes out a sheet by suction which is fed in the feeding direction A by the feeding section 2, and is sent out to the sending direction B by the sub takeout portion 31. And, the takeout belt 43 sends out the sheet taken out by suction to the sending direction B, at a speed higher than the sending speed by the sub takeout portion 31. At this time, the guide wall 21b of the feeding section 2 guides the sending of a sheet to the sending direction B by the takeout belt 43.

[0035] As shown in Fig. 2 and Fig. 3, the separation portion 33 is arranged at an opposite side of the main

takeout portion 32, with respect to a sheet sent out in the sending direction B by the main takeout portion 32, at a more downstream side than the guide wall 21b of the feeding section 2 in the sending direction B. The separation portion 33 is provided with a double-sheet takeout preventing block 71. The double-sheet takeout preventing block 71 is arranged so that the double-sheet takeout preventing block 71 may face the takeout belt 43 through a gap S therebetween, at a downstream side of the takeout belt 43 in the sending direction B. The gap S is set to about 0.5 mm, for example.

[0036] Fig. 5 is a perspective view of the double-sheet takeout preventing block. Fig. 6 is a side view of the double-sheet takeout preventing block. As shown in Fig. 6, when a plurality of sheets is taken out by the takeout belt 43 simultaneously, the double-sheet takeout preventing block 71 sucks a sheet at the double-sheet takeout preventing block 71 side to stop the relevant sheet, and thereby the double-sheet takeout preventing block 71 functions not to send a plurality of sheets into the gap correction portion 7 simultaneously.

[0037] The double-side takeout preventing block 71 has a main body portion 72 formed of elastic material such as urethane rubber (rubber material), for example. The main body portion 72 is formed of elastic material, and thereby the main body portion 72 can be lightened, and also it is possible to shorten a time for the main body portion 72 to return to the original shape, after the main body portion 72 has been deformed by the entering of a sheet.

[0038] An arc surface 72a is formed on the main body portion 72, at the takeout belt 43 side (tip side), and also at the entering side (an upstream side in the sending direction B) of a sheet.

[0039] A plurality of (6, for example) suction holes 73 is formed at a position closest to the takeout belt 43, out of the arc surface 72a, that is, at a tip of the arc surface 72a. These suction holes 73 are arranged along a direction orthogonal to the sending direction B with equal intervals. Each suction hole 73 is connected to a negative pressure generator (Not shown, a vacuum pump or the like, for example) provided in the separation portion 33. By this means, a negative pressure is given to each suction hole 73.

[0040] At a base end side (an opposite side of the arc surface 72a) of the main body portion 72, a base plate 74 for fixing the main body portion 72 to the sheet takeout and separation device 10 is provided. In addition, on the arc surface 72a of the main body portion 72, and a side surface 72b where the arc surface 72a is formed, a support plate 75 is formed so as to cover the arc surface 72a and the side surface 72b.

[0041] The base plate 74 and the support plate 75 are respectively fixed to the main body portion 72 using bonding agent or the like. In addition, a base end side of the support plate 75 is fixed to the base plate 74 via a fixing plate 76 and bolts 77.

[0042] The support plate 75 has a role to prevent that

the main body portion 72 is torn off from the base plate 74 due to the shock when a sheet enters, and a role for supporting that the main body portion 72 returns to the original shape after the main body portion 72 has been deformed. In addition, stainless-steel is preferable for the material of the support plate 75. Stainless-steel is used, and thereby elasticity and rust prevention of the support plate 75 can be ensured. In addition, a wall thickness of the support plate 75 is set to about 0.1 mm, for example, so that the support plate 75 does not affect the deformation of the main body portion 72 as far as possible.

[0043] Further, a protection cover 78 is provided on the surface of the support plate 75, at a position corresponding to the arc surface 72a of the main body portion 72. The protection cover 78 prevents the deterioration, abrasion of the main body portion 72 and the support plate 75 due to the shock when a sheet enters.

[0044] The protection cover 78 is formed of a metal plate such as a stainless-steel plate, for example. A wall thickness of the protection cover 78 is set to about 1 mm, for example. With the configuration like this, the protection cover 78 can follow the deformation of the main body portion 72. In addition, in the support plate 75 and the protection cover 78, suction holes 79 are respectively formed at the positions corresponding to the suction holes 73 of the main body portion 72. By this means, a negative pressure is given to the suction holes 79 of the protection cover 78 via the suction holes 73 of the main body portion 72.

[0045] Here, a surface roughening treatment M for increasing a friction coefficient of the surface of the protection cover 78 is performed on the protection cover 78, at a periphery of the suction holes 79. For example, as the surface roughening treatment M, diamond coating, sand blast, spraying and so on can be cited. For example, when it is assumed that a friction coefficient μ' of a place where the surface roughening treatment M is not performed is 0.1, the surface roughening treatment M is performed so that a friction coefficient μ of a place where the surface roughening treatment M is performed becomes about 0.3 - 0.5.

[0046] Here, to perform the surface roughening treatment M to the periphery of the suction holes 79 means to perform the surface roughening treatment M to the surface within a range separated by each $d/2$ along the sending direction B from the rims of the suction holes 739, when it is assumed that a diameter of the suction hole 79 is d , as shown in Fig. 7, for example. In addition, as shown in Fig. 8, the surface roughening treatment M may be performed on the surface within a range of a diameter of about $2d$, with respect to the diameter d of the suction hole 79, coaxially with the suction holes 79.

[0047] Returning to Fig. 2 and Fig. 3, the gap correction section 7, along with a plurality of various conveying belts and rollers (not shown), compose a part of a conveying mechanism 80 to convey a sheet. The gap correction section 7 is arranged at the downstream side of the separation portion 33 in the sending direction B. The gap

correction section 7 is provided with a sponge roller 81 and a drive roller 82 which are arranged opposite to each other so as to sandwich the main conveying path 4 therebetween. The sponge roller 81 is a soft roller having elasticity, and deforms in accordance with the change in a thickness of a sheet to be conveyed through the main conveying path 4.

[0048] The drive roller 82 is rotationally driven by a drive motor (Not shown. an AC servo motor or the like, for example), and changes a conveying speed of a sheet by the acceleration and deceleration of the rotation. By this means, when an interval (gap) between a sheet which has been sandwiched by the sponge roller 81 and the drive roller 82, and a preceding sheet in the conveying direction is smaller than a specified value, the gap correction section 7 decelerates the conveying speed of the sheet, to broaden the interval. On the other hand, when an interval between a sheet which has been sandwiched by the sponge roller 81 and the drive roller 82, and a preceding sheet in the conveying direction is larger than a specified value, the gap correction section 7 accelerates the conveying speed of the sheet, to shorten the interval.

[0049] Next, an operation of the separation portion 33 will be described, based on Fig. 2, Fig. 6, Fig. 9 and Fig. 10.

[0050] Fig. 9 is an explanation diagram showing a behavior of the double-sheet takeout preventing block when a sheet passes through the separation portion. Fig. 10A, Fig. 10B and Fig. 10C are explanation diagrams of an action of the separation portion, and each shows a behavior of a sheet passing through the separation portion.

[0051] To begin with, as shown in Fig. 2, a front sheet (a sheet located closest to the sub takeout portion 31 side), out of a plurality of sheets stacked along the feeding direction A, is sucked and taken out by the sub takeout portion 31, and the taken-out sheets are sent out to the main takeout portion 32 one by one. A sheet which has been sent out to the main takeout portion 32 passes through the gap S (refer to Fig. 6) between the double-sheet takeout preventing block 71 of the separation portion 33 and the takeout belt 43 of the main takeout portion 32, and is sent out to the gap correction section 7.

[0052] Here, when a thickness of a sheet is equivalent to, or thinner than the gap S between the double-sheet takeout preventing block 71 and the takeout belt 43, the sheet passes through the gap S, without change.

[0053] On the other hand, when a thickness of a sheet is thicker than the gap S between the double-sheet takeout preventing block 71 and the takeout belt 43, as shown in Fig. 9, an end portion of the sheet at the sending direction B side comes in contact with the protection cover 78 of the double-sheet takeout preventing block 71. Further, the sheet presses the double-sheet takeout preventing block 71. Then, the double-sheet takeout preventing block 71 is compressed and deformed so that it is slightly bent backward toward the downstream side in the sending direction B. And the sheet passes through

the gap S while pressing the double-sheet takeout preventing block 71 away.

[0054] Here, when it is assumed that a radius of curvature of the arc surface 72a formed on the main body portion 72 of the double-sheet takeout preventing block 71 is R, a wall thickness of the protection cover 78 is t, a maximum thickness of a sheet is Hmax, and the gap between the double-sheet takeout preventing block 71 and the takeout belt 43 is S, as shown in Fig. 6, Fig. 9, the radius of curvature R is set so as to satisfy

$$R \geq (H_{\max} - S) \times 2 - t \dots (1).$$

[0055] When the expression (1) is satisfied, it is possible to set a position of a contact point P (refer to Fig. 9) where the protection cover 78 and the sheet contact, so that an angle θ which a line connecting the contact point P and the center of the arc surface 72a and a line connecting the suction hole 93 of the protection cover 78 and the center of the arc surface 72a make becomes not more than 60 degrees. In other words, the contact point P that contacts the sheet can be set within a range of R/2 from the tip of the takeout belt 43 side of the main body portion 72. For this reason, when the main body portion 72 is pressed by the sheet, it is possible to set a direction of the force acting on the main body portion 72 by this pressing force, to a direction to which the main body portion 72 is surely compressed.

[0056] In addition, it is preferable to set a size of the main body portion 72 in the length direction (a vertical direction in Fig. 6) to not less than about 5 times the maximum deformation amount (Hmax - S) of the main body portion 72. When set in this manner, the compression deformation distortion of the main body portion 72 can be decreased as much as possible, and thereby it is possible to enhance the durability against fatigue destruction, when the main body portion 72 is repeatedly deformed.

[0057] In addition, since the surface roughening treatment M is performed on the protection cover 78 only at the periphery of the suction holes 79 (refer to Fig. 5), when the double-sheet takeout preventing block 71 is compressed and deformed so that it is slightly bent backward toward the downstream side in the sending direction B, the place where the surface roughening treatment M is performed faces toward the downstream side in the sending direction B. For this reason, when a thick sheet comes in contact with the protection cover 78, the sheet comes to make contact with the place of the protection cover 78 where the surface roughening treatment is not performed, and thereby the friction between the protection cover 78 and the sheet does not increase. Accordingly, the sheet can smoothly pass through between the double-sheet takeout preventing block 71 and the takeout belt 43.

[0058] Next, a case in which two sheets are sent out

from the main takeout portion 32 in an overlapping manner will be described.

[0059] When two sheets conveyed by the main takeout portion 32 try to pass through the gap S between the double-sheet takeout preventing block 71 and the takeout belt 43 in an overlapping state, as shown in Fig. 10A, a sheet at the double-sheet takeout preventing block 71 side, out of the sheets in an overlapping state, is sucked by the suction holes 79 of the double-sheet takeout preventing block 71, and stops on the spot, as shown in Fig. 10B. Since, a large friction force does not act on between the sheets in an overlapping state, the sheet at the takeout belt 43 side is sent out to the gap correction section 7 without change.

[0060] Here, the surface roughening treatment M is performed on the protection cover 78 of the double-sheet takeout preventing block 71, at the periphery of the suction holes 79 (refer to Fig. 5). For this reason, a friction force between the periphery of the suction holes 79 and the sheet sucked by the suction holes 79 becomes large. Accordingly, it is possible to surely stop one of the sheets in an overlapping state, by the double-sheet takeout preventing block 71, while weakening the suction force (negative pressure) of the double-sheet takeout preventing block 71.

[0061] In addition, the plurality of suction holes 79 provided in the protection cover 78 are arranged along a direction orthogonal to the sending direction B with equal intervals (refer to Fig. 5). For this reason, it is possible to prevent that the sheet sucked by the double-sheet takeout preventing block 71 might be rotated (skew) around one point.

[0062] Subsequently, when the sheet at the takeout belt 43 side completely passes through the double-sheet takeout preventing block 71, as shown in Fig. 10C, the sheet which has been stopped by the double-sheet takeout preventing block 71 is sucked to the takeout belt 43 side. And this sheet is sent out to the gap correction section 7 without change.

[0063] Here, a suction force of the valve device 42 of the main takeout portion 32 against a sheet is set sufficiently larger than a suction force of the separation portion 33 against a sheet. For this reason, when the sheet at the takeout belt 43 side has completely passed through the double-sheet takeout preventing block 71, the sheet which has been stopped by the double-sheet takeout preventing block 71 is surely sucked to the takeout belt 43 side.

[0064] In addition, when at least one sheet out of overlapping two sheets is sufficiently thick, the sheet at the double-sheet takeout preventing block 71 side comes to stop in front thereof, without reaching the suction holes 79 of the protection cover 78. That is, a force by which the sheet at the double-sheet takeout preventing block 71 side tries to press the double-sheet takeout preventing block 71 away acts on as a resistance force, and thereby the sheet stops, and during this time, the sheet at the takeout belt 43 side is sent out to the gap correction sec-

tion 7. For the reason, sheets still in an overlapping state can be surely separated by the separation portion 33, regardless of the thicknesses of the sheets.

[0065] In addition, as described above, a prescribed speed of the suction belt 31b in the sub takeout portion 31 is set slower than a speed of the takeout belt 43 in the main takeout portion 32. For this reason, an interval not less than a prescribed interval is provided between a sheet (first sheet) which has firstly been sent out from the feeding section 2, and a sheet (second sheet) which has been sent out next, and thereby the overlapping of the first sheet and the second sheet can be resolved. Accordingly, it is possible to prevent that the sheet which has been stopped by the double-sheet takeout preventing block 71 might overlap again with a sheet located in a more upstream side than this sheet in the sending direction B.

[0066] In this manner, in the double-sheet takeout preventing block 71 of the present embodiment, the surface roughening treatment M is performed on the protection cover 78 provided on the main body portion 72. For this reason, when sheets still in an overlapping state are conveyed by the takeout belt 43, it is possible to surely stop a sheet at the double-sheet takeout preventing block 71 side, using a friction force of a place where the surface roughening treatment M is performed. Accordingly, it is possible to prevent that a plurality of sheets is sent out in an overlapping manner, and the occurrence of conveying trouble can be prevented. In addition to this, it is possible to strengthen a stopping power of a sheet without increasing the suction force of the separation portion 33, and it can be prevented that a plurality of sheets is sent out in a overlapping manner, and thereby the sheet takeout and separation device 10 (a negative pressure generator and so on provided in the separation portion 33) can be miniaturized.

[0067] In addition, the main body portion 72 is formed of elastic material which elastically deforms in accordance with the thickness of a sheet, and further the surface roughening treatment M is performed on the protection cover 78 at the periphery of the suction holes 79. For this reason, overlapping sheets can be efficiently stopped by the suction holes 79, and in addition, it is possible to prevent that a thick sheet or the like might be damaged by a place where the surface roughening treatment M is performed.

[0068] Further, the protection cover 78 of the double-sheet takeout preventing block 71 is of a metal plate (stainless-steel plate, for example). For this reason, it is possible to set a friction coefficient of a place where the surface roughening treatment M is not performed low, while keeping the stiffness of the protection cover 78 itself. Accordingly, when sheets do not overlap and the sheets are conveyed one by one, the sheets can smoothly pass through on the double-sheet takeout preventing block 71.

[0069] In addition, a plurality of the suction holes 79 of the protection cover 78 is formed with equal intervals

along a direction orthogonal to the sending direction B. For this reason, the suction holes 79 can prevent that a sheet sucked by the double-sheet takeout preventing block 71 is rotated (skew) around one point. That is, when a sheet is stopped at one point, there is a possibility that the sheet might be skewed around that point. But a sheet is stopped at at least two or more points, and thereby it can be prevented that a sheet might be skewed.

[0070] Further, the double-sheet takeout preventing block 71 is arranged opposite to the takeout belt 43 through the gap S, at the downstream side of the sending direction B in the takeout belt 43. For this reason, when sheets still in an overlapping state are conveyed by the takeout belt 43, while one sheet out of these sheets is stopped by the double-sheet takeout preventing block 71, the other sheet can surely be sent out to the gap correction section 7 by the takeout belt 43.

[0071] In addition, on the main body portion 72 of the double-sheet takeout preventing block 71, the arc surface 72a is formed at the takeout belt 43 side (tip side), and also at the entering side of a sheet (upstream side in the sending direction B). For this reason, the double-sheet takeout preventing block 71 can smoothly receive a sheet.

[0072] Further, the radius of curvature R of the arc surface 72a is set so as to satisfy the expression (1). For this reason, when the main body portion 72 is pressed by a sheet, it is possible to set a direction of the force acting on the main body portion 72 by this pressing force, to a direction to which the main body portion 72 is surely compressed.

[0073] In the above-described embodiment, the case has been described that the surface roughening treatment M is performed only to the periphery of the suction holes 79 in the protection cover 78 of the double-sheet takeout preventing block 71. But without being limited to this, the surface roughening treatment M may be performed to the whole surface of the protection cover 78. In addition, the surface roughening treatment M may be performed to only about a half of the whole surface of the protection cover 78 including the periphery of the suction holes 79. In this case, it is necessary to set a friction coefficient by the surface roughening treatment M, so that the surface roughening treatment M does not damage a sheet.

[0074] In addition, in the above-described embodiment, the case has been described in which the surface roughening treatment M is performed to the protection cover 78, by diamond coating, sand blast, spraying, and so on, for example. But the surface roughening treatment M is not limited to this, a tape, a rubber sheet, or the like for enhancing the friction resistance may be pasted on the surface of the protection cover 78. In this case, it is desirable to perform a replacing operation of a tape or a rubber sheet, in accordance with the using frequency of the sheet processing apparatus 1.

[0075] In addition, in the above-described embodiment, the case in which the protection cover 78 is formed

of a stainless-steel plate, for example, has been described. But the protection cover 78 is not limited to this, the material of the protection cover 78 may be material, if a friction coefficient at the surface of the material is low. For example, the material may be engineering plastics of which abrasion resistance was examined.

[0076] According to the sheet takeout and separation device and the sheet processing apparatus as described above, since the surface roughening treatment M is performed on the protection cover 78 of the double-sheet takeout preventing block 71, it is possible to surely prevent that a plurality of sheets are sent out in an overlapping manner, and the occurrence of conveying trouble can be prevented. In addition, since it is possible to prevent that a plurality of sheets are sent out in an overlapping manner, while weakening the suction force of the separation portion 33 as much as possible, the sheet takeout and separation device 10 (a negative pressure generator and so on provided in the separation portion 33) can be miniaturized.

[0077] While certain embodiments have been described, these embodiments have been presented by way of example only, and are not intended to limit the scope of the inventions.

Claims

1. A sheet takeout and separation device, comprising:

a takeout section to take out a sheet;
a sending section to send out the sheet taken out by the takeout section; and
a separation portion which is provided so as to come in contact with the sheets taken out in an overlapping state by the takeout section, and separates the relevant sheets one by one;
wherein the separation portion includes:

a separation portion main body which elastically deforms in accordance with a thickness of the sheet, and
a cover which is provided on the separation portion main body so as to come in contact with the sheet,
wherein a roughening treatment has been applied on a surface of the cover.

2. The sheet takeout and separation device according to Claim 1, further comprising a suction hole for sucking the sheet provided in a contact surface of the separation portion to contact with the sheet, and the surface roughening treatment is performed on the cover so as to surround at least a periphery of the suction hole.

3. The sheet takeout and separation device according to Claim 1 or 2, further comprising a plurality of suc-

tion holes aligned perpendicular to a conveying direction of the sheet for sucking the sheet provided in a contact surface of the separation portion to contact with the sheet, and the surface roughening treatment is performed on the cover so as to surround at least a periphery of the suction holes.

4. The sheet takeout and separation device according to any one of Claim 1 to Claim 3, wherein the separation portion faces the sending section via a gap, at a downstream side in a sheet sending direction in the sending section.

5. The sheet takeout and separation device according to any of Claims 1 to 4, wherein the separation portion main body is in the form of an arc surface at an entering side of the sheet.

6. The sheet takeout and separation device according to Claim 5, wherein when it is assumed that a radius of curvature of the arc surface is R, a wall thickness of the cover is t, a maximum thickness of the sheet is Hmax, and the gap is S,
the radius of curvature R is set so as to satisfy

$$R \geq (H_{\max} - S) \times 2 - t.$$

7. The sheet takeout and separation device according to any of Claims 1 to 6, wherein the separation portion further has a support plate fitted on the separation portion main body at the entering side of the sheet, and the cover is fitted on the support plate.

8. The sheet takeout and separation device according to any of Claims 1 to 7, wherein the sending section has a suction hole for sucking the sheet, and a suction force of the suction hole of the sending section is larger than a suction force of the suction hole of the separation portion.

9. The sheet takeout and separation device according to any of Claims 1 to 8, wherein the sending section has a belt formed with the suction hole of the sending section.

10. The sheet takeout and separation device according to any of Claims 1 to 9, wherein the separation portion is provided so as to come in contact with the sheet located at an opposite side of the sending section, out of the sheets taken out in an overlapping state by the takeout section.

11. A sheet processing apparatus, comprising:

the sheet takeout and separation device according to any one of Claim 1 to Claim 10; and

a sorting processing section to perform sorting processing of the sheet sent out by the sending section.

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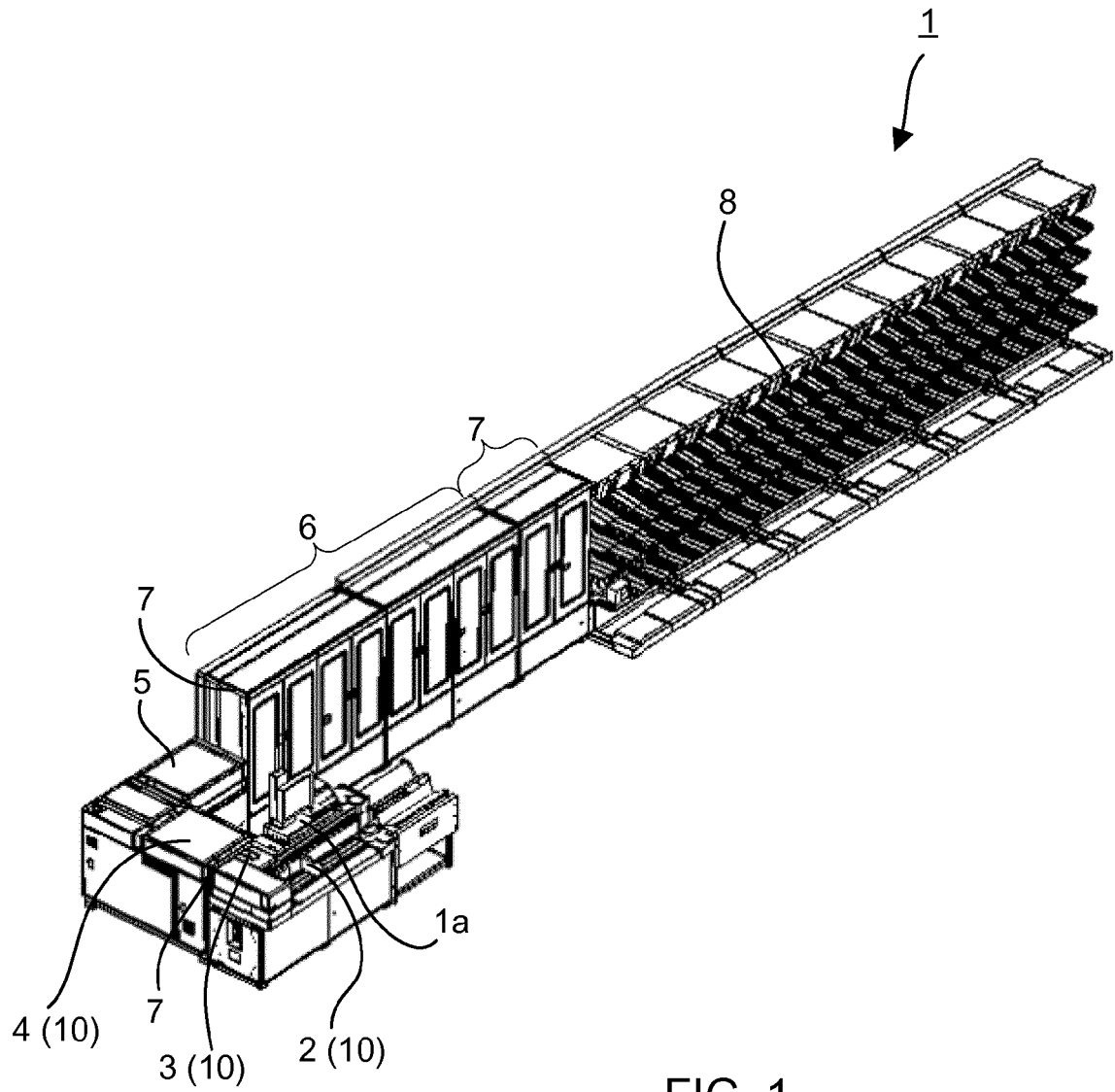


FIG. 1

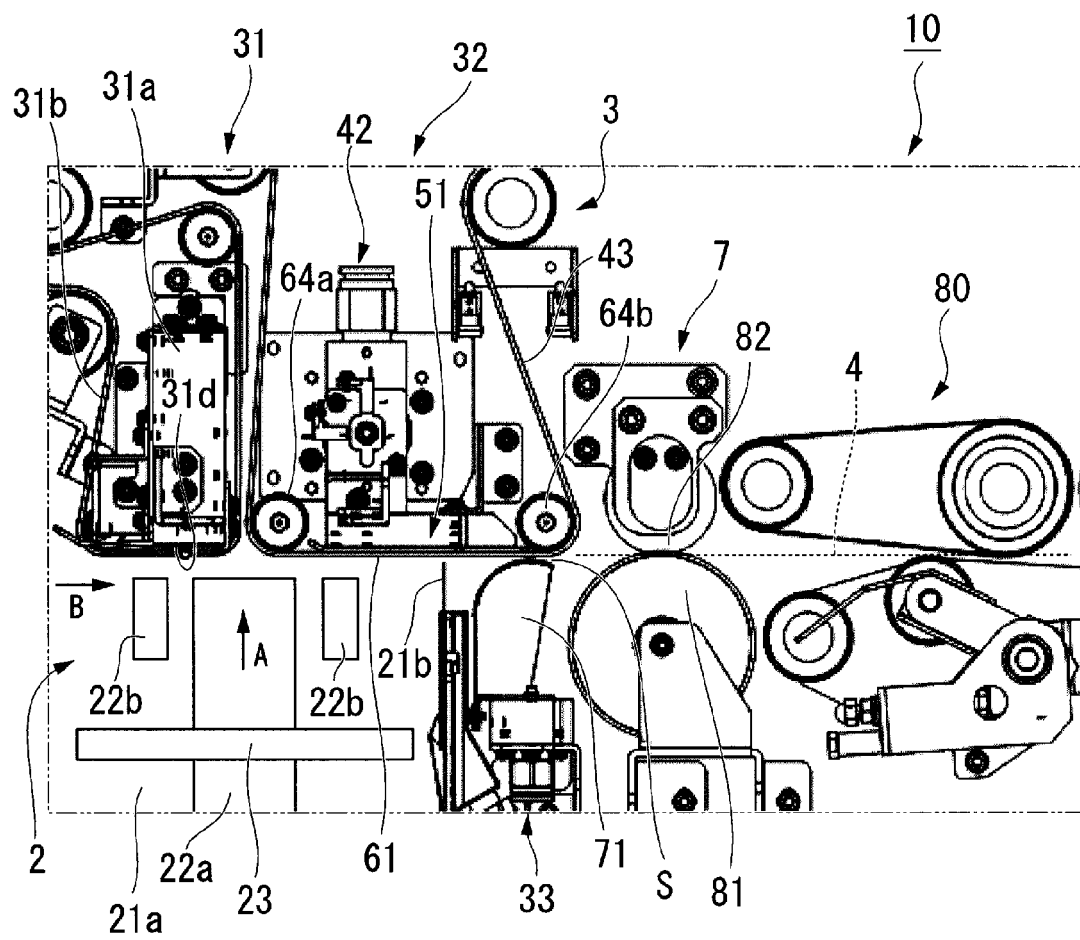


FIG. 2

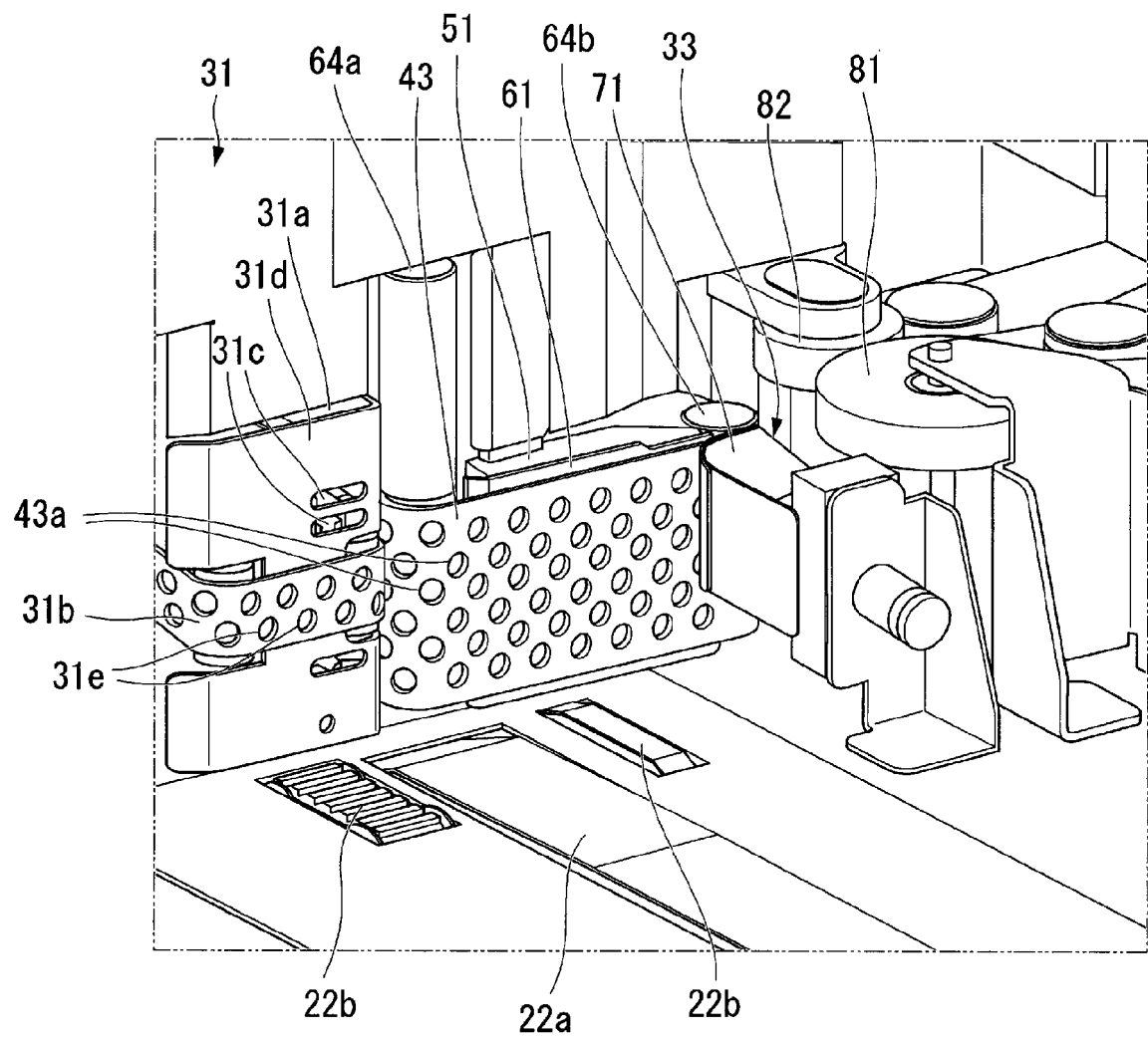


FIG. 3

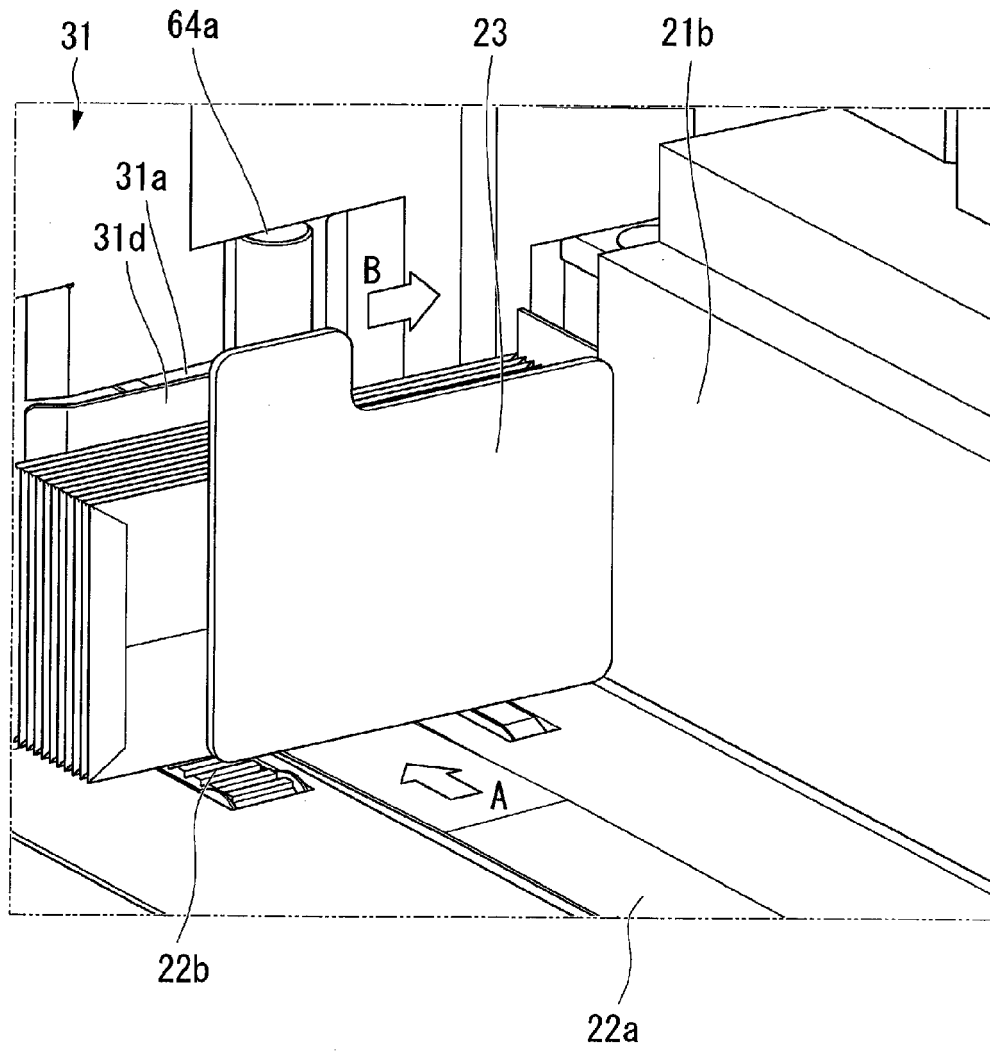


FIG. 4

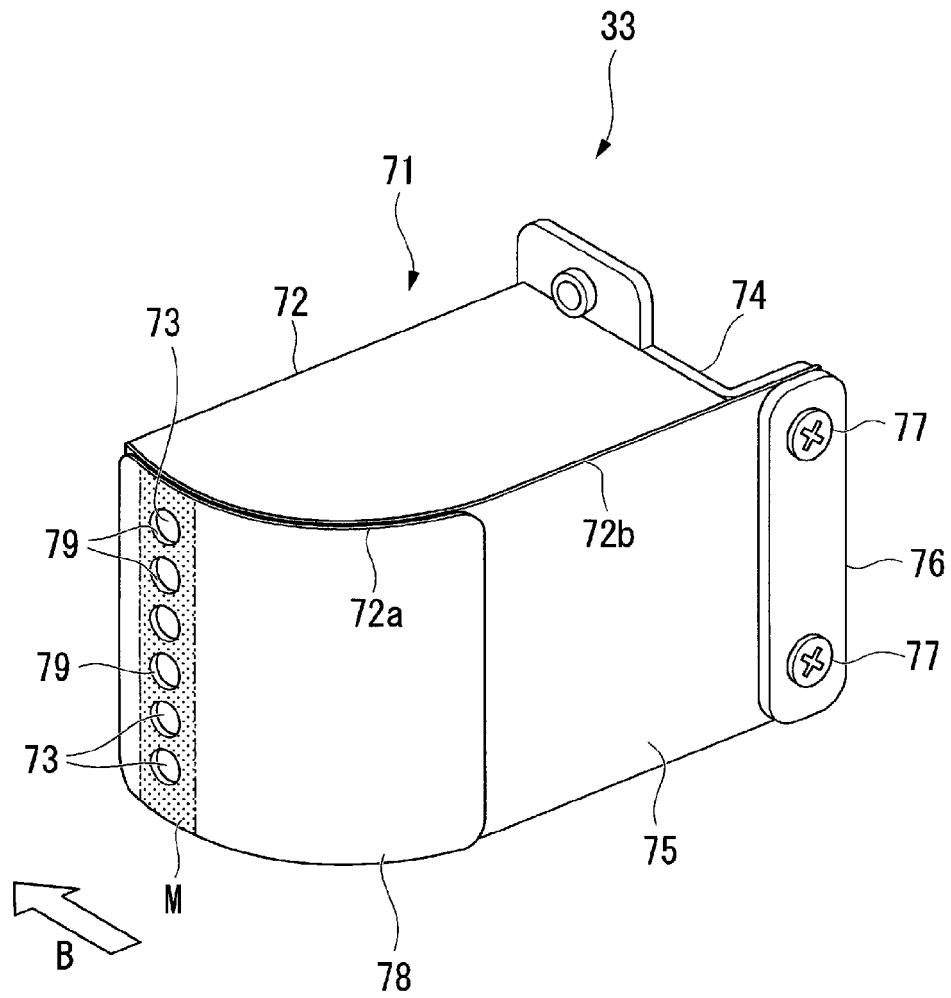


FIG. 5

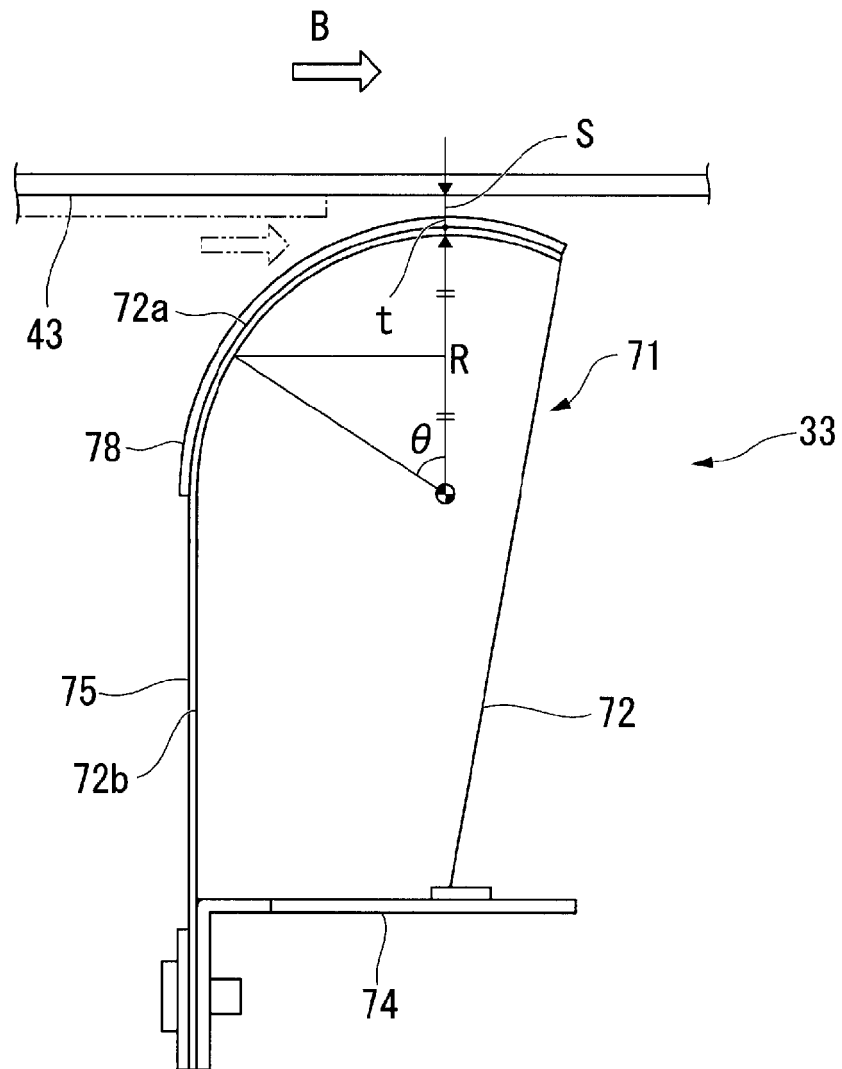
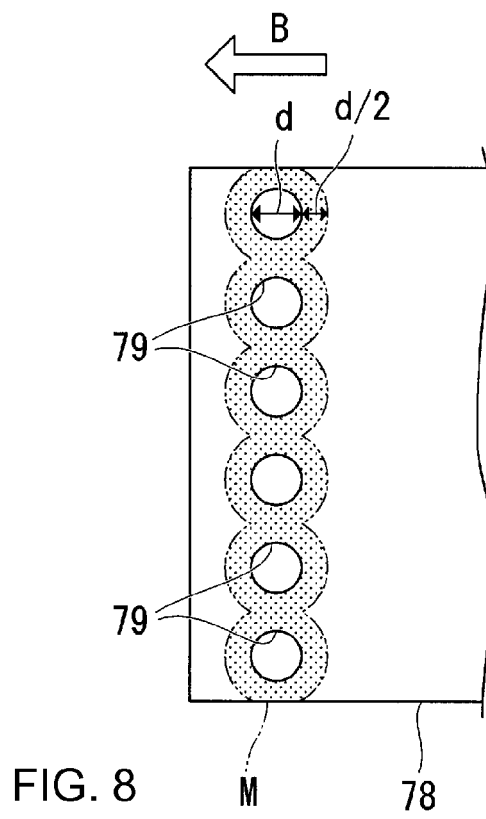
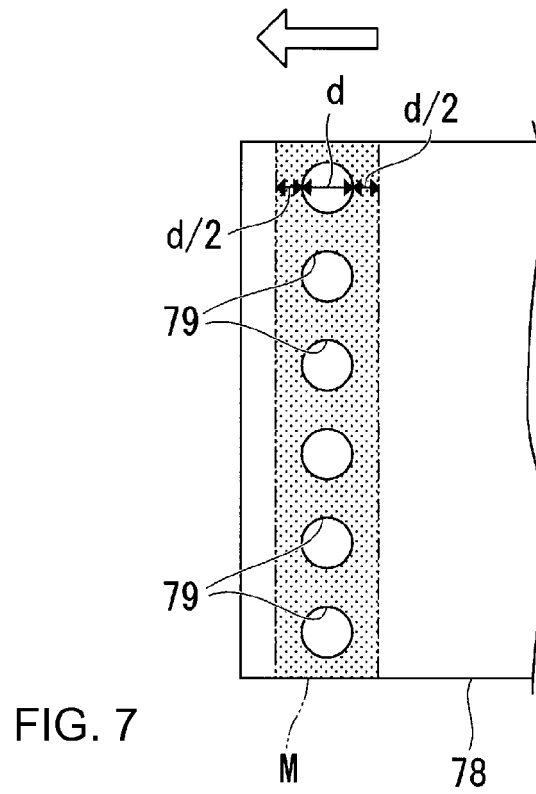


FIG. 6



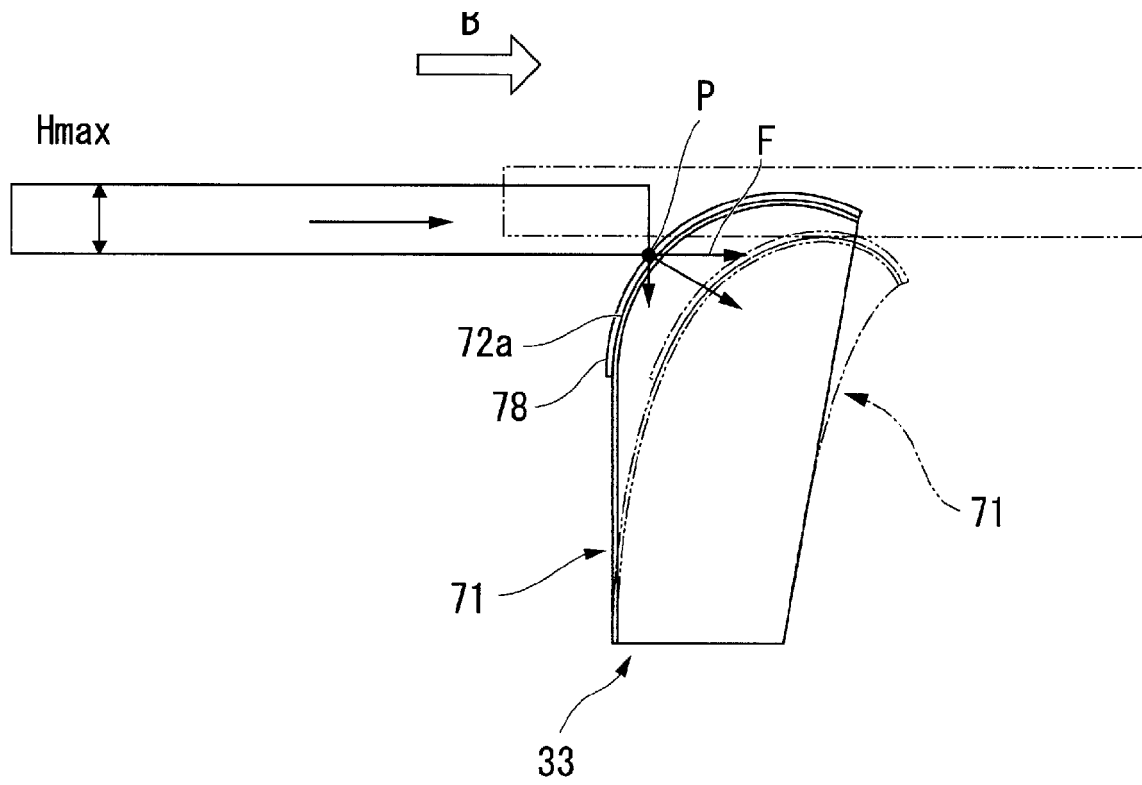
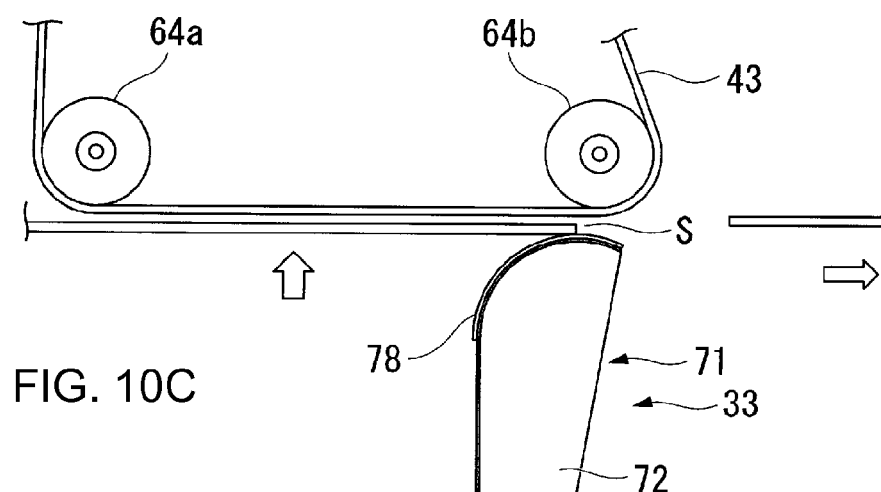
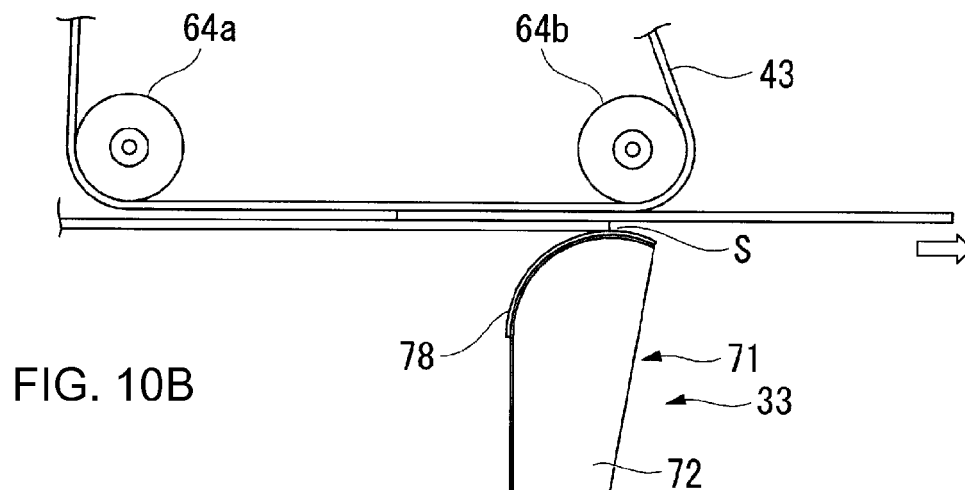
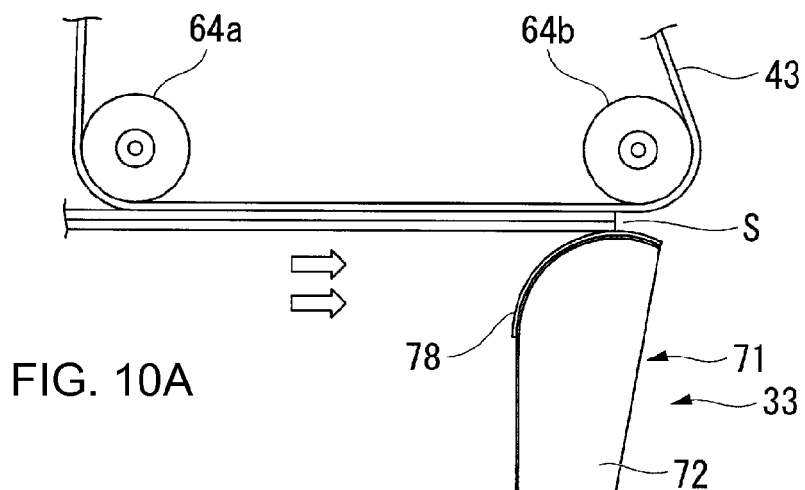


FIG. 9





EUROPEAN SEARCH REPORT

Application Number
EP 15 18 0940

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 5 725 209 A (TAKAHASHI MASAHIRO [JP] ET AL) 10 March 1998 (1998-03-10)	1,4,5,10	INV. B65H3/12 B65H3/52
Y	* the whole document *	2,3,6-9,11	
Y	EP 2 639 190 A2 (TOSHIBA KK [JP]) 18 September 2013 (2013-09-18) * the whole document *	2,3,6-9,11	
A	WO 2009/118927 A1 (TOSHIBA KK [JP]; NARUOKA YOSHIHIKO [JP]; ASARI YUKIO [JP]; MITSUYA YUS) 1 October 2009 (2009-10-01) * the whole document *	1	
A	US 5 888 047 A (AUERBACH DAVID R [US] ET AL) 30 March 1999 (1999-03-30) * the whole document *	1	
			TECHNICAL FIELDS SEARCHED (IPC)
			B65H
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
The Hague		10 December 2015	Athanasiadis, A
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 15 18 0940

5

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

10-12-2015

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5725209 A	10-03-1998	JP 3258832 B2	18-02-2002
		JP H0899734 A	16-04-1996
		US 5725209 A	10-03-1998
EP 2639190 A2	18-09-2013	EP 2639190 A2	18-09-2013
		JP 2013216494 A	24-10-2013
		US 2013241135 A1	19-09-2013
WO 2009118927 A1	01-10-2009	JP 2009227460 A	08-10-2009
		WO 2009118927 A1	01-10-2009
US 5888047 A	30-03-1999	NONE	

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EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82