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(54) Paper sheet takeout device

(57) A paper sheet takeout device (1) has a mounting base (2) on which a plurality of pieces of mail (P) are mounted in a vertical posture, floor belts (4a, 4b and 7) partially exposed from the mounting base (2), a backup plate (3), a takeout roller (11) and an auxiliary roller (18). A diameter of a pulley (5a) around which a floor belt (4a) on a downstream side in a takeout direction (T2) of the mail (P) wound is set to be larger than that of a pulley (5b) around which a floor belt (4b) is wound, and the floor belts are driven by the same floor motor 6 to thereby set a feed by the floor belt (4a) to be larger than that of the floor belt (4b).

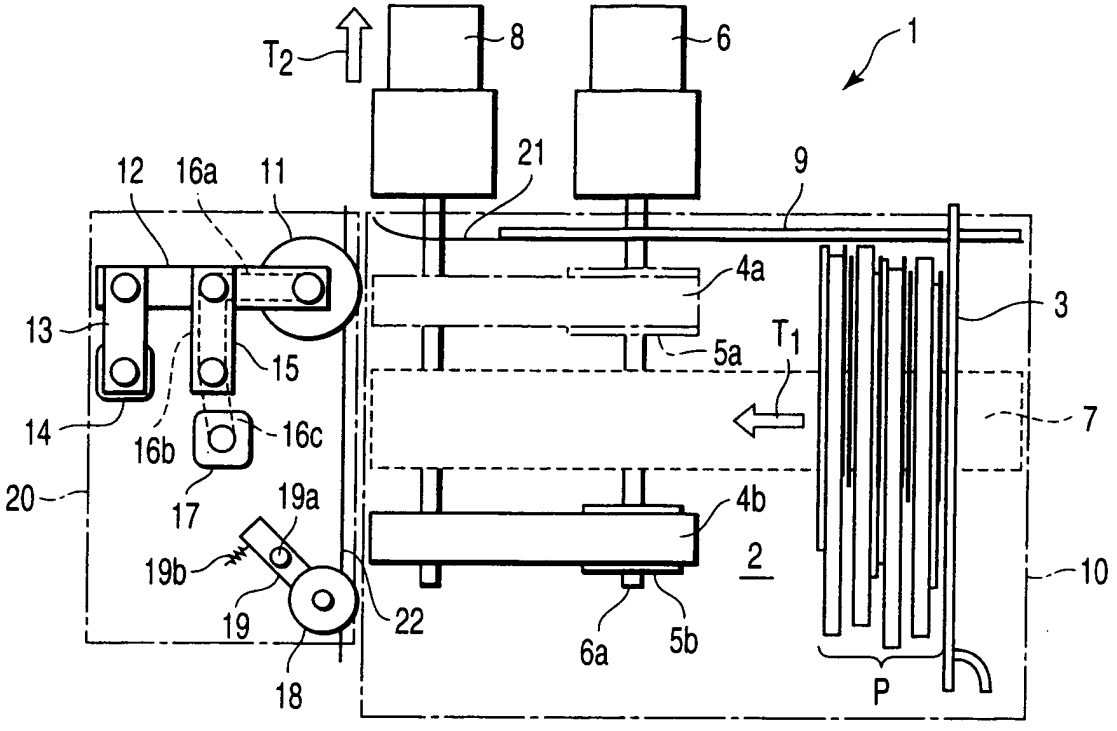

FIG. 1

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Description

[0001] The present invention relates to a paper sheet takeout device which takes a plurality of sheets of paper such as mail sheet by sheet.

[0002] Heretofore, as a paper sheet takeout device, a takeout device is known which takes a plurality of pieces of mail piece by piece in a vertical posture (see, e.g., Jpn. Pat. Appln. KOKAI Publication No. 2005-145671). This takeout device has a mounting base on which lower edges of a plurality of sheets of paper abut in a state in which the paper sheets are accumulated to mount the paper sheets thereon in a vertical posture; a backup plate which urges the paper sheets in an accumulated direction of the paper sheets to feed the paper sheets to a takeout position; two downstream-side floor belts which are partially exposed from the mounting base in a position close to the takeout position to extend in a feed direction (accumulated direction); an upstream-side floor belt which is partially exposed from the mounting base in a position apart from the takeout position to extend along the feed direction; a takeout roller brought into rotatable contact with the paper sheets fed to the takeout position in an end portion of the accumulated direction to rotate and thereby take out the paper sheets in order from the end portion in a direction substantially crossing the feed direction at right angles, that is, an arrangement direction of each floor belt; and an auxiliary roller disposed on an upstream side of the takeout roller along this takeout direction and brought into rotatable contact with the paper sheets taken out of the takeout position to be driven to rotate.

[0003] In the takeout device having the above structure, in a case where the end portion of the paper sheet in the takeout position on the downstream side along the takeout direction tilts from the end portion on the upstream side toward the backup plate, a movement speed of the downstream-side floor belt on the downstream side in the takeout direction is set to be higher than that of the downstream-side floor belt on the upstream side in the takeout direction. Accordingly, a posture of the paper sheet is corrected to be straight along the takeout direction. Conversely, in a case where the end portion of the paper sheet in the takeout position on the upstream side along the takeout direction tilts from the end portion on the downstream side toward the backup plate, the movement speed of the downstream-side floor belt on the upstream side in the takeout direction is set to be higher than that of the downstream-side floor belt on the downstream side in the takeout direction. Accordingly, the posture of the paper sheet is corrected to be straight along the takeout direction.

[0004] However, when the posture of the paper sheet is corrected to be straight along the takeout direction as described above, the paper sheet is taken out in a state in which the paper sheet is strongly pressed onto the auxiliary roller, and a load is applied in a direction reverse to the takeout direction of the paper sheet from the auxiliary roller. Therefore, a send-out force exerted by the takeout roller is offset as much as the load, and there occur problems that efficiency of transmission of the send-out force deteriorates, and a send-out operation becomes unstable.

[0005] An object of this invention is to provide a paper sheet takeout device which can reduce a load resistance in a direction reverse to a takeout direction and which can stably take out paper sheets.

[0006] To achieve the above object, in an aspect of this invention, there is provided a paper sheet takeout device comprising: a mounting base on which lower edges of a plurality of paper sheets abut in a state in which the paper sheets are accumulated to mount the paper sheets thereon in a vertical posture; a backup plate which urges the plurality of paper sheets mounted on this mounting base in an accumulated direction of the paper sheets to feed the paper sheets in an end portion of the accumulated direction to a takeout position; first and second floor belts which are exposed from the mounting base to extend along the accumulated direction, respectively, exposed portions of the first and second floor belts being moved along the accumulated direction toward the takeout position to thereby move the lower edges of the paper sheets toward the takeout position, the first and second floor belts being arranged apart from each other in a takeout direction substantially crossing the accumulated direction at right angles; a takeout roller brought into contact with the paper sheets fed to the takeout position to rotate, thereby taking out the paper sheets in the takeout direction; and an auxiliary roller disposed apart from this takeout roller on an upstream side in the takeout direction to face the takeout position, the auxiliary roller being configured to support the paper sheets fed to the takeout position, wherein a feed of the paper sheets to the takeout roller is set to be relatively larger than that of the paper sheets to the auxiliary roller.

[0007] Moreover, in another aspect of this invention, there is provided a paper sheet takeout device comprising: a mounting base on which lower edges of a plurality of paper sheets abut to mount the paper sheets thereon in a vertical posture in a state which the paper sheets are accumulated; a backup plate which urges the plurality of paper sheets mounted on this mounting base in an accumulated direction of the paper sheets to feed the paper sheets in an end portion of the accumulated direction to a takeout position; first and second floor belts which are exposed from the mounting base to extend along the accumulated direction, respectively, exposed portions of the first and second floor belts being moved along the accumulated direction toward the takeout position to thereby move the lower edges of the paper sheets toward the takeout position, the first and second floor belts being arranged apart from each other in a takeout direction substantially crossing the accumulated direction at right angles; a takeout roller brought into contact with the paper sheets fed to the takeout position to rotate, thereby taking out the paper sheets in the takeout direction; and

an auxiliary roller disposed apart from this takeout roller on an upstream side in the takeout direction to face the takeout position, the auxiliary roller being configured to support the paper sheets fed to the takeout position, wherein a press of the paper sheets to the takeout roller is set to be relatively larger than that of the paper sheets to the auxiliary roller.

[0008] Furthermore, in still another aspect of this invention, there is provided a paper sheet takeout device comprising: a mounting base on which lower edges of a plurality of paper sheets abut in a state in which the paper sheets are accumulated to mount the paper sheets thereon in a vertical posture; a backup plate which urges the plurality of paper sheets mounted on this mounting base in an accumulated direction of the paper sheets to feed the paper sheets in an end portion of the accumulated direction to a takeout position; a first floor belt which is exposed from the mounting base to extend along the accumulated direction, an exposed portion of the first floor belt being moved along the accumulated direction toward the takeout position to thereby move the lower edges of the paper sheets toward the takeout position; a second floor belt which is disposed apart from the first floor belt on an upstream side in a takeout direction substantially crossing the accumulated direction at right angles and substantially parallel to the first floor belt, an exposed portion of the second floor belt from the mounting base being moved toward the takeout position to thereby move the lower edges of the paper sheets toward the takeout position; first and second motors which drive these first and second floor belts independently of each other so that a movement speed of the first floor belt on a downstream side in the takeout direction is higher than that of the second floor belt on the upstream side in the takeout direction; a takeout roller brought into contact with the paper sheets fed to the takeout position to rotate, thereby taking out the paper sheets in the takeout direction; and an auxiliary roller disposed apart from this takeout roller on the upstream side in the takeout direction to face the takeout position, the auxiliary roller being configured to support the paper sheets fed to the takeout position.

[0009] The invention can be more fully understood from the following detailed description when taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a plan view showing a schematic structure of a takeout device in a first embodiment of this invention;
FIG. 2 is a front view of the takeout device of FIG. 1;
FIG. 3A is a side view showing such a positional relation that each roller of the takeout device of FIG. 1 comes into contact with mail;
FIG. 3B is a plan view of FIG. 3A;
FIG. 4 is an operation explanatory view showing an operation of the takeout device of FIG. 1;
FIG. 5 is an operation explanatory view showing an operation of the takeout device of FIG. 1;
FIG. 6 is a plan view showing a schematic structure of a takeout device in a second embodiment of this invention;
FIG. 7 is a front view of the takeout device of FIG. 6;
FIG. 8 is an operation explanatory view showing an operation of the takeout device of FIG. 6;
FIG. 9 is an operation explanatory view showing an operation of the takeout device of FIG. 6;
FIG. 10 is a plan view showing a schematic structure of a takeout device in a third embodiment of this invention;
FIG. 11 is a front view of the takeout device of FIG. 10;
FIG. 12 is an operation explanatory view showing an operation of the takeout device of FIG. 10;
FIG. 13 is an operation explanatory view showing an operation of the takeout device of FIG. 10;
FIG. 14 is a plan view showing a schematic structure of a takeout device in a fourth embodiment of this invention;
FIG. 15 is a front view of the takeout device of FIG. 6;
FIG. 16 is an operation explanatory view showing an operation of the takeout device of FIG. 14;
FIG. 17 is an operation explanatory view showing an operation of the takeout device of FIG. 14;
FIG. 18 is a plan view showing a schematic structure of a takeout device in a fifth embodiment of this invention;
FIG. 19 is a front view of the takeout device of FIG. 18;
FIG. 20 is an operation explanatory view showing an operation of the takeout device of FIG. 18;
FIG. 21 is an operation explanatory view showing an operation of the takeout device of FIG. 18;
FIG. 22 is a plan view showing a schematic structure of a takeout device in a sixth embodiment of this invention;
FIG. 23 is a front view of the takeout device of FIG. 22;
FIG. 24 is an operation explanatory view showing an operation of the takeout device of FIG. 22;
FIG. 25 is an operation explanatory view showing an operation of the takeout device of FIG. 22;
FIG. 26 is a plan view showing a schematic structure of a takeout device in a seventh embodiment of this invention;
FIG. 27 is a front view of the takeout device of FIG. 26;
FIG. 28 is an flowchart showing an operation of the takeout device of FIG. 26;
FIG. 29 is an operation explanatory view showing an operation of the takeout device of FIG. 26;
FIG. 30 is an operation explanatory view showing an operation of the takeout device of FIG. 26;
FIG. 31 is an operation explanatory view showing an operation of the takeout device of FIG. 26; and
FIG. 32 is an operation explanatory view showing an operation of the takeout device of FIG. 26.

[0010] Embodiments of this invention will be described hereinafter in detail with reference to the drawings.

[0011] FIG. 1 shows a plan view of a paper sheet takeout device 1 (hereinafter referred to simply as the takeout device 1) in a first embodiment of this invention as viewed from above, and FIG. 2 shows a front view of this takeout device 1. This takeout device 1 takes out, for example, a plurality of pieces of mail P (paper sheets) projected in a batch piece by piece to feed them to a rear-stage processing section.

[0012] As shown in FIG. 1, the takeout device 1 has: a feed unit 10 which supplies the mail P to a takeout position; and a send-out unit 20 which sends out the mail P fed to the takeout position piece by piece.

[0013] The feed unit 10 has a flat mounting base 2 on which lower edges of the plurality of pieces of mail P projected in a batch in an accumulated state are abut to mount them thereon in a vertical posture. In a shown right end of the mounting base 2 (i.e., an end portion apart from the takeout position), a backup plate 3 is disposed. The backup plate 3 is disposed in a substantially vertical direction substantially crossing the mounting base 2 at right angles.

[0014] The backup plate 3 presses the mail P in an arrangement direction of the mail, that is, in an accumulated direction (an arrow T1 direction in FIG. 1), and supplies all of the mail P in the arrow T1 direction. As a result, the mail P existing in a distant end of a feed direction is fed to the takeout position in a shown left end of the mounting base 2.

[0015] In the vicinity of the takeout position, two endless downstream-side floor belts 4a, 4b (first and second floor belts). The downstream-side floor belts 4a, 4b are arranged apart from each other in a direction (arrow T2 direction in FIG. 1) substantially crossing a feed direction (arrow T1 direction) of the mail P, and substantially parallel to each other, and the belts are extended along the feed direction T1 of the mail P, respectively.

[0016] As shown in FIG. 2, the downstream-side floor belts 4a, 4b are wound around a plurality of pulleys 5 with tension, and a part of the floor belts is exposed from the mounting base 2 toward the lower edge of the mail P. Moreover, the downstream-side floor belts 4a, 4b are endlessly run by a single floor motor 6, and function so that portions of the belts exposed upwards from the mounting base 2 come into contact with the lower edge of the mail P to move the mail P toward the takeout position.

[0017] In the present embodiment, two pulleys 5a, 5b having different diameters are coaxially attached to a driving shaft 6a of the motor 6, the downstream-side floor belt 4a (first floor belt) disposed on a downstream side along the takeout direction (arrow T2 direction) of the mail P is wound around the pulley 5a (first pulley) having a comparatively large diameter, and the downstream-side floor belt 4b (second floor belt) disposed on an upstream side along the arrow T2 direction is wound around the pulley 5b (second pulley) having a comparatively small diameter.

[0018] That is, the diameters of the pulleys 5a, 5b which transmit a driving force of the floor motor 6 are varied to vary running speeds of two downstream-side floor belts 4a, 4b. Accordingly, a feed force of the mail P by the downstream-side floor belt 4a on the downstream side in the takeout direction T2 is set to be larger than that of the mail P by the downstream-side floor belt 4b on the upstream side in the takeout direction T2. The feed force mentioned herein is a force to feed the mail P in the accumulated direction, that is, the force to feed the mail P toward the takeout position, and indicates a force (press use) to press the mail P in a distant end of the feed direction onto a takeout roller 11 and an auxiliary roller 18 described later.

[0019] Moreover, one endless upstream-side floor belt 7 is disposed between two downstream-side floor belts 4a, 4b. The upstream-side floor belt 7 is wound around the plurality of pulleys 5 with tension, and positioned so that a part of the belt is exposed upwards from the mounting base 2. This upstream-side floor belt 7 is driven by a motor 8, and an exposed portion moves along the accumulated direction toward the takeout position.

[0020] The downstream-side floor belts 4a, 4b protrude upwards from the upstream-side floor belt 7 in the vicinity of the takeout position, and the mail P moved by the upstream-side floor belt 7 is transferred to the downstream-side floor belts 4a, 4b and moved. That is, the exposed portions of the downstream-side floor belts 4a, 4b can move only several pieces of mail P close to the takeout position among the pieces of mail P mounted on the mounting base 2. On the other hand, the exposed portion of the upstream-side floor belt 7 comes into the lower edge of the mail except several pieces of mail P close to the takeout position among all of the pieces of mail P mounted on the mounting base 2. In other words, the mail P close to the backup plate 3 is moved by the upstream-side floor belt 7, transferred to the downstream-side floor belt 4 and fed to the takeout position.

[0021] It is to be noted that the backup plate 3 is slidably attached to a shaft 9 extended along the feed direction T1 of the mail P, and the vicinity of a lower end portion of the backup plate is connected to the upstream-side floor belt 7. Moreover, the backup plate 3 moves in the feed direction T1 of the mail P along the shaft 9 by the movement of the upstream-side floor belt 7. That is, the backup plate 3 is moved toward the takeout position by the motor 8 at a speed equal to that of the upstream-side floor belt 7.

[0022] The send-out unit 20 is disposed adjacent to the takeout position of the mail P. The send-out unit 20 has the takeout roller 11 which comes into contact with the mail P fed to the takeout position by the above feed unit 10 to rotate in the takeout direction T2. As shown in FIGS. 2 and 3A, the takeout roller 11 has: a lower takeout roller 11a which comes into a portion close to the lower edge of the mail P fed to the takeout position to rotate; and an upper takeout roller 11b which is independently

rotatably disposed above and apart from this lower takeout roller 11a. As shown in FIG. 3A, the upper takeout roller 11b is disposed above and apart from the lower takeout roller 11a to such an extent that the upper takeout roller can come into contact with the smallest piece of mail Pmin to be handled by the takeout device 1.

[0023] The takeout rollers 11a, 11b (hereinafter referred to generically as the takeout roller 11 in some cases) are arranged in such postures that rotation shafts of the rollers extend in a substantially vertical direction crossing the directions T1, T2 at right angles, respectively, and outer peripheral surfaces of the rollers come into contact with the surface of the mail P to rotate. The takeout roller 11 is disposed in a slanted position on the downstream side in the takeout direction T2 of the mail P so that the mail P having all sizes can be taken out. Moreover, when the takeout roller 11 is rotated in a counterclockwise direction in FIG. 1, the mail P fed to the takeout position is taken out in a substantially horizontal direction (arrow T2 direction in FIG. 1) (hereinafter referred to as the takeout direction) crossing the accumulated direction at right angles, that is, in an upward direction in FIG. 1.

[0024] The rotation shafts of the takeout rollers 11a, 11b are rotatably attached to a distant end of a first arm 12. A rotation distant end of a second arm 13 is rotatably attached to a proximal end of the first arm 12, and a torque control servo motor 14 is attached to a proximal end of the second arm 13. To substantially the center of the first arm, a rotation distant end of a third arm 15 is rotatably attached. Consequently, the takeout roller 11 is movable in the feed direction of the mail P, that is, substantially parallel to the accumulated direction by such a parallel link mechanism, and the roller is pressed onto the mail P fed to the takeout position with the pressure based on control of the servo motor 14.

[0025] Moreover, the rotation shafts of the takeout rollers 11a, 11b are connected to a motor 17 via three timing belts 16a, 16b and 16c, and the motor 17 is rotated in a predetermined direction to rotate the takeout roller 11 in the takeout direction of the mail P.

[0026] Furthermore, the auxiliary roller 18 is disposed in a position apart from the takeout roller on the upstream side of the takeout roller 11 along the takeout direction T2 of the mail P fed to the takeout position. The auxiliary roller 18 has three roller portions 18a, 18b and 18c arranged apart from one another along a rotation shaft of the auxiliary roller 18. The roller portions 18a, 18b and 18c are independently rotatable with respect to the rotation shaft extended in the substantially vertical direction, and an outer peripheral surface of the auxiliary roller comes into contact with the surface of the mail P to rotate following the mail P taken out. As shown in, for example, FIG. 3B, to send out the mail P having a comparatively large size, this auxiliary roller 18 functions to support the mail P on the upstream side along the takeout direction from a position where the takeout roller 11 has come into the mail P.

[0027] The rotation shaft of the auxiliary roller 18 is rotatably attached to a swinging distant end of a swinging arm 19. The swinging arm 19 rotates around a rotation shaft 19a disposed substantially in the center of the swinging arm. A proximal end portion of the swinging arm 19 is connected to a spring 19b which urges the swinging arm 19 around the rotation shaft 19a of the arm in the counterclockwise direction in the drawing. That is, the swinging arm 19 presses, with a certain pressure, the auxiliary roller 18b attached to the distant end of the swinging arm onto the mail P fed to the takeout position.

[0028] Furthermore, on a downstream side in the takeout direction T2 of the mail P fed to the takeout position, a feed roller and a reverse roller (not shown) are arranged here. The feed roller is disposed in such a position as to come into rotatable contact with the surface of the mail P to be taken out on a side on which the takeout roller 11 comes into rotatable contact with the mail. When the feed roller rotates with the mail P held between the feed roller and the reverse roller, the mail P is fed in the arrow T2 direction. The reverse roller applies a separation torque to the mail P in a direction the reverse of the takeout direction of the mail, and functions to separate second and subsequent pieces of mail P following the piece of mail P taken out by the feed roller.

[0029] It is to be noted that a guide plate 21 is disposed on a rear side of the above feed unit 10, that is, in a position adjacent to the mounting base 2 on the downstream side (upper side in FIG. 1) of the mounting base along the takeout direction T2 of the mail P. This guide plate 21 guides the distant end of the mail P in the takeout direction T2, the mail being fed to the takeout position by the backup plate 3, the upstream-side floor belt 7 and the downstream-side floor belts 4a, 4b. In the vicinity of the takeout position of the mail P, this guide plate 21 is slightly curved toward the downstream side in the takeout direction T2.

[0030] Moreover, the above send-out unit 20 has a guide plate 22 disposed to face the feed unit 10 along the mail P fed to the takeout position by the feed unit. This guide plate 22 has a plurality of openings (not shown) to expose the takeout roller 11 and the auxiliary roller 18 toward the feed unit 10. As shown in FIG. 2, in the vicinity of the uppermost positioned roller portion 18c of the auxiliary roller 18, this guide plate 22 is slightly bent in a direction apart from the feed unit 10. Accordingly, even in a case where the mail P mounted on the mounting base 2 in a vertical posture falls on the side of the send-out unit 20, a portion of the mail P close to an upper end thereof does not come into contact with the guide plate 22.

[0031] Here, there will be described a function and an effect of the takeout device 1 in the above first embodiment with reference to FIGS. 4 and 5.

[0032] In the above takeout device 1, the diameter of the pulley 5a around which the downstream-side floor belt 4a (hereinafter referred to simply as the floor belt 4a) is wound is set to be larger than that of the pulley 5b

around which the downstream-side floor belt 4b (hereinafter referred to simply as the floor belt 4b). Among two downstream-side floor belts 4a, 4b of the feed unit 10, the floor belt 4a is disposed on the downstream side in the takeout direction T2 of the mail P, and the floor belt 4b is disposed on the upstream side in the takeout direction T2. Moreover, since the two pulleys 5a, 5b are attached to the driving shaft 6a of the single motor 6, a difference is made between the running speeds of two floor belts 4a, 4b. Specifically, the running speed (movement speed) of the floor belt 4a is set to be higher than that of the floor belt 4b. As a result, the feed force of the mail P by the floor belt 4a becomes larger than that by the floor belt 4b, and the pressure between the takeout roller 11 and the mail P becomes larger than that between the auxiliary roller 18 and the mail P.

[0033] For example, assuming that the running speed of the upstream-side floor belt 7 is V1, the running speed of the floor belt 4a is V2, and the running speed of the floor belt 4b is V3, as described above, the floor belt 4a is driven at the running speed which is higher than that of the other floor belts 7, 4b (V1 = V3 < V2). Therefore, the mail P substantially extending parallel to the takeout direction T2 as shown in FIG. 4 is changed to such a position that the distant end of the mail in the takeout direction is pressed onto the takeout roller 11 as shown in FIG. 5.

[0034] Moreover, although not shown herein, according to the present embodiment, even in a case where the mail P is projected in a state in which the mail tilts in a reverse direction (posture with which a rear end of the mail P in the takeout direction abuts on the auxiliary roller 18), while a send-out operation is continued, the posture of the mail P gradually changes as shown in FIG. 5 (so that the proximal end of the mail P in the takeout direction is pressed onto the takeout roller 11).

[0035] On the other hand, in the above conventional device, the posture of the mail fed to the takeout position is controlled to be substantially parallel to the takeout direction. Therefore, the pressure of the mail with respect to the takeout roller becomes substantially equal to that of the mail with respect to the auxiliary roller, and a load resistance of the auxiliary roller following the mail taken out largely functions with respect to the mail. Additionally, as in the conventional device, when the posture of the mail is controlled to be substantially parallel to the takeout direction, the mail easily comes into contact with the guide plate and the like. When the mail comes into contact with another member, the load resistance is generated. If the load resistance acts on the mail in the direction reverse to the takeout direction in this manner, the send-out operation of the mail becomes unstable.

[0036] However, as in the takeout device 1 of the present embodiment, when the posture of the mail P fed to the takeout position is controlled into the above posture, the mail P can be detached from the auxiliary roller 18 (or pressed to the auxiliary roller 18 with a weak force), the load resistances from the auxiliary roller 18 and the guide plate 22 can be reduced, a send-out force of the takeout roller 11 can efficiently be applied to the mail P, and the mail P can stably be taken out.

[0037] It is to be noted that in the present embodiment, the relation is obtained in which the running speed V1 of the upstream-side floor belt 7 is set to be equal to the running speed V3 of the floor belt 4b, and the running speed V2 of the floor belt 4a is set to be higher than the running speed (V1 = V3 < V2), but a relation (V3 < V2) may be satisfied in which at least the running speed V2 of the floor belt 4a is set to be higher than the running speed V3 of the floor belt 4b, and the running speed V1 of the upstream-side floor belt 7 is not related.

[0038] Next, there will be described a paper sheet takeout device 23 (hereinafter referred to simply as the takeout device 23) in a second embodiment of this invention with reference to FIGS. 6 to 9. It is to be noted that here constituting elements which function in the same manner as in those of the above takeout device 1 are denoted with the same reference numerals, and detailed description thereof is omitted.

[0039] As shown in FIG. 6, the takeout device 23 has two downstream-side floor belts 24, 25 driven at an equal running speed by a single motor 6. In the above first embodiment, the diameters of the pulleys 5a, 5b are varied to vary the running speed of the downstream-side floor belts 4a, 4b, but in the present embodiment, diameters of two pulleys 5 attached to a rotation shaft 6a of a motor 6 are equal, and two downstream-side floor belts 24, 25 run at an equal speed.

[0040] Instead, in the present embodiment, a frictional coefficient of the surface of the downstream-side floor belt 24 (first floor belt) (hereinafter referred to simply as the floor belt 24) on a downstream side in a takeout direction of mail P is set to be relatively larger than that of the surface of the downstream-side floor belt 25 (second floor belt) (hereinafter referred to simply as the floor belt 25) on an upstream side in the takeout direction of the mail P. Accordingly, a frictional force (first frictional force) of the floor belt 24 which acts on a lower edge of the mail P is set to be larger than that (second frictional force) of the floor belt 25 which acts on the lower edge of the mail P. Therefore, a feed to feed the mail P by the floor belt 24 becomes relatively larger than that to feed the mail P by the floor belt 25.

[0041] For example, assuming that a gravity of the mail P which acts on the floor belts 24, 25 is W, the frictional coefficient of the surface of the floor belt 24 is $\mu 1$, the feed exerted by the floor belt 24 is F1, the frictional coefficient of the surface of the floor belt 25 is $\mu 2$, and the feed exerted by the floor belt 25 is F2, $\mu 1 > \mu 2$. Therefore, $F1 (= \mu 1 \bullet W) > F2 (= \mu 2 \bullet W)$.

[0042] In a case where the frictional coefficients of the floor belts 24, 25 are varied in this manner, even when a running speed of the floor belt 24 is equal to that of the floor belt 25, the feed F1 of the floor belt 24 can be set to be relatively larger than the feed F2 of the floor belt 25. As a result, a press between a takeout roller 11 and

the mail P can be set to be relatively larger than that between an auxiliary roller 18 and the mail P.

[0043] That is, even in a case where the mail P is fed to a takeout position in a posture substantially parallel to a takeout direction T2 as shown in FIG. 8, after as shown in FIG. 9, the mail P in a distant end of a feed direction T1 is fed to the takeout position, a portion of the mail P in the takeout position close to a distant end of the takeout direction T2 can comparatively strongly be pressed onto the takeout roller 11, and the posture of the mail P can be changed as shown.

[0044] Moreover, although not shown, the posture of the mail P does not change as shown in FIG. 9 in some case, but the feed exerted by the floor belt 24 which acts on the portion of the mail P close to the distant end of the takeout direction is relatively stronger than that exerted by the floor belt 25 which acts on a portion of the mail P close to a rear end of the takeout direction. Therefore, a load resistance from the auxiliary roller 18 which acts on the mail P and a load resistance from a guide plate 22 can be reduced, a send-out force of the takeout roller 11 can be applied to the mail P with a good efficiency, and a send-out operation can be stabilized.

[0045] Next, there will be described a paper sheet takeout device 31 (hereinafter referred to simply as the takeout device 31) in a third embodiment of this invention with reference to FIGS. 10 to 13. It is to be noted that here constituting elements which function in the same manner as in those of the above takeout device 23 of the second embodiment are denoted with the same reference numerals, and detailed description thereof is omitted.

[0046] As shown in FIGS. 10 and 11, in the takeout device 31, instead of varying the frictional coefficients of the surfaces of the floor belts 24, 25 as in the above second embodiment, a plurality of pawl-like protrusions 33 (profiles) are arranged on the surface of a downstream-side floor belt 32 (first floor belt) (hereinafter referred to simply as the floor belt 32) on a downstream side in a takeout direction. These protrusions 33 act on a lower edge of mail P mounted on a mounting base 2, and the lower edge of each piece of mail P is fitted between the protrusions 33 and moved in a accumulated direction T1. That is, even in the present embodiment, a feed of the mail P by the floor belt 32 becomes relatively larger than that of the mail P by a floor belt 25 which does not have any protrusion.

[0047] Therefore, as shown in, for example, FIG. 12, even in a case where the mail P is fed to a takeout position in a posture substantially parallel to a takeout direction T2, after as shown in FIG. 13, the mail P in a distant end of the feed direction T1 is fed to the takeout position, a portion of the mail P in the takeout position close to a distant end of the takeout direction T2 can comparatively strongly be pressed onto a takeout roller 11, and the posture of the mail P can be changed as shown.

[0048] Therefore, even in the present embodiment, in the same manner as in the above second embodiment, a press between the mail P and the takeout roller 11 can be set to be relatively larger than that between the mail P and an auxiliary roller 18. A load resistance from the auxiliary roller 18 which acts on the mail P and a load resistance from a guide plate 22 can be reduced, a send-out force of the takeout roller 11 can be applied to the mail P with a good efficiency, and a send-out operation can be stabilized.

[0049] Next, there will be described a paper sheet takeout device 41 (hereinafter referred to simply as the takeout device 41) in a fourth embodiment of this invention with reference to FIGS. 14 to 17. It is to be noted that here constituting elements which function in the same manner as in those of the above takeout device 23 of the second embodiment are denoted with the same reference numerals, and detailed description thereof is omitted.

[0050] As shown in FIGS. 14 and 15, in the takeout device 41, instead of varying the frictional coefficients of the surfaces of two downstream-side floor belts 24, 25 as in the above second embodiment, a width along T2 of a downstream-side floor belt 42 (first floor belt) (hereinafter referred to simply as the floor belt 42) on a downstream side in a takeout direction is set to be relatively larger than that of a downstream-side floor belt 25 (second floor belt) (hereinafter referred to simply as the floor belt 25) on an upstream side in the takeout direction.

[0051] In this manner, the width of the floor belt 42 can be set to be relatively larger than that of the floor belt 25 to thereby set a length of the floor belt 42 which comes into contact with a lower edge of mail P to be comparatively large, and a frictional force exerted on the lower edge of the mail P can comparatively be enlarged. Therefore, even in the present embodiment, a feed of the mail P by the floor belt 42 becomes relatively larger than that of the mail P by the floor belt 25.

[0052] Therefore, as shown in, for example, FIG. 16, even in a case where the mail P is fed to a takeout position in a posture substantially parallel to the takeout direction T2, after as shown in FIG. 17, the mail P in a distant end of a feed direction T1 is fed to the takeout position, a portion of the mail P in the takeout position close to a distant end of the takeout direction T2 can comparatively strongly be pressed onto a takeout roller 11, and the posture of the mail P can be changed as shown.

[0053] In consequence, even in the present embodiment, in the same manner as in the above second and third embodiments, a press between the mail P and the takeout roller 11 can be set to be relatively larger than that between the mail P and an auxiliary roller 18. A load resistance from the auxiliary roller 18 which acts on the mail P and a load resistance from a guide plate 22 can be reduced, a send-out force of the takeout roller 11 can be applied to the mail P with a good efficiency, and a send-out operation can be stabilized.

[0054] Next, there will be described a paper sheet takeout device 51 (hereinafter referred to simply as the takeout device 51) in a fifth embodiment of this invention

with reference to FIGS. 18 to 21. It is to be noted that here constituting elements which function in the same manner as in those of the above takeout device 23 of the second embodiment are denoted with the same reference numerals, and detailed description thereof is omitted.

[0055] As shown in FIGS. 18 and 19, in the takeout device 51, instead of varying the frictional coefficients of the surfaces of two floor belts 24, 25 as in the above second embodiment, a frictional coefficient of the surface of a downstream-side floor belt 52 (first floor belt) (hereinafter referred to simply as the floor belt 52) on a downstream side in a takeout direction and a width of the floor belt are set to be equal to those of a downstream-side floor belt 25 (second floor belt) (hereinafter referred to simply as the floor belt 25) on an upstream side in the takeout direction. In addition, an elongated-strip-like frictional member 53 is disposed adjacent to the floor belt 25.

[0056] The frictional member 53 functions to exert a certain frictional force on a lower edge of mail P mounted on a mounting base 2 in a vertical posture, and is extended along a feed direction T1 of the mail P. Especially, this frictional member 53 is positioned and disposed in such a position as to face an auxiliary roller 18 which is a main cause for a load resistance exerted in a direction reverse to a takeout position of the mail P, and the member is disposed slightly apart from a guide plate 22. That is, this frictional member 53 is disposed to thereby exert the frictional force in the direction the reverse of the feed direction T1 with respect to the lower edge of the mail P fed toward a takeout position, and the member functions to weaken a feed exerted by a floor belt 25 adjacent to the member.

[0057] On the other hand, if the frictional member 53 is extended to the takeout position, in a case where the mail P fed to the takeout position is taken out from the takeout position in an arrow T2 direction, a frictional force in a direction reverse to the takeout direction is generated on an upstream side in the takeout direction of the mail P, and a disadvantage against the scope of the present invention is caused. Therefore, in the present embodiment, the frictional member 53 is disposed in a position apart from the guide plate 22 to prevent the mail P to be taken out from the takeout position from being interfered with by the frictional member 53, and an undesirable load resistance is prevented from being applied to the mail P to be taken out in an arrow T2 direction.

[0058] When a feed by the floor belt 25 is weakened as described above, a feed exerted by the floor belt 25 (frictional member 53) on an upstream side of the takeout direction can be set to be smaller than that exerted by the floor belt 52 on the downstream side in the takeout direction of the mail P in the takeout position. In the same manner as in the above embodiments, pressure between the mail P and a takeout roller 11 can be set to be relatively larger than that between the mail P and the auxiliary roller 18, a load resistance from the auxiliary roller 18 which acts on the mail P and a load resistance from the guide plate 22 can be reduced, a send-out force of the takeout roller 11 can be applied to the mail P with a good efficiency, and a send-out operation can be stabilized.

[0059] Therefore, even in a case where as shown in, for example, FIG. 20, the mail P is fed to the takeout position in a posture substantially parallel to the takeout direction T2, as the mail P is fed to the takeout position, as shown in FIG. 21, the posture of the mail P can be changed, and a portion of the mail P in the takeout position close to a distant end of the takeout direction T2 can comparatively strongly be pressed onto the takeout roller 11. In consequence, the load resistance from the auxiliary roller 18 which acts on the mail P and the load resistance from the guide plate 22 can be reduced, the send-out force of the takeout roller 11 can be applied to the mail P with good efficiency, and the send-out operation can be stabilized.

[0060] Next, there will be described a paper sheet takeout device 61 (hereinafter referred to simply as the takeout device 61) in a sixth embodiment of this invention with reference to FIGS. 22 to 25. It is to be noted that here constituting elements which function in the same manner as in those of the above takeout device 1 of the first embodiment are denoted with the same reference numerals, and detailed description thereof is omitted.

[0061] As shown in FIGS. 22 and 23, the takeout device 61 of the present embodiment has: a floor motor 62 (first motor) which drives a downstream-side floor belt 4a (first floor belt) (hereinafter referred to simply as the floor belt 4a) on a downstream side in a takeout direction; and a floor motor 63 (second motor) which drives a downstream-side floor belt 4b (second floor belt) (hereinafter referred to simply as the floor belt 4b) on an upstream side in a takeout direction.

[0062] That is, this takeout device 61 has two floor motors 62, 63 for independently running two downstream-side floor belts 4a, 4b. That is, in the above first embodiment, the single motor 6 is used, and the diameters of the pulleys 5a, 5b are varied to thereby vary running speeds of the downstream-side floor belts 4a, 4b, but in the present embodiment, two floor motors 62, 63 are independently driven to thereby vary the running speed of the floor belts 4a, 4b.

[0063] For example, assuming that the running speed of an upstream-side floor belt 7 is V1, the running speed of the floor belt 4a is V2 and the running speed of the floor belt 4b is V3, as described above, the floor belt 4a is driven at a running speed higher than that of the other floor belts 7, 4b (V1 = V3 < V2). Therefore, the mail P substantially parallel to the takeout direction T2 as shown in FIG. 24 is changed to a posture with which a distant end of the mail in the takeout direction is pressed onto a takeout roller 11.

[0064] Moreover, although not shown here, according to the present embodiment, even in a case where the mail P is projected in a tilted state in a reverse direction (posture with which a rear end of the mail P in the takeout direction abuts on an auxiliary roller 18), as a send-out

operation is continued, the posture of the mail P gradually changes as shown in FIG. 25 (so that the distant end of the mail P in the takeout direction is pressed onto the takeout roller 11).

[0065] As described above, even in the present embodiment, an effect similar to that of the above first embodiment can be produced. That is, the running speeds of the floor belts 4a, 4b can be varied to thereby detach the mail P from the auxiliary roller 18 (or the mail can be pressed with a small force), load resistances from the auxiliary roller 18 and a guide plate 22 can be reduced, a send-out force by the takeout roller 11 can be applied to the mail P with good efficiency, and the mail P can stably be taken out.

[0066] It is to be noted that in the present embodiment, a relation is obtained in which the running speed V1 of the upstream-side floor belt 7 is set to be equal to the running speed V3 of the floor belt 4b, and the running speed V2 of the floor belt 4a is set to be higher than the running speed (V1 = V3 < V2), but a relation (V3 < V2) may be satisfied in which at least the running speed V2 of the floor belt 4a is set to be higher than the running speed V3 of the floor belt 4b, and the running speed V1 of the upstream-side floor belt 7 is not related.

[0067] Next, there will be described a paper sheet takeout device 71 (hereinafter referred to simply as the takeout device 71) in a seventh embodiment of this invention with reference to FIGS. 26 and 27. It is to be noted that here constituting elements which function in the same manner as in those of the above takeout device 61 of the sixth embodiment are denoted with the same reference numerals, and detailed description thereof is omitted.

[0068] As shown in FIGS. 26 and 27, the takeout device 71 has: a first detecting section 72 which detects that a takeout roller 11 protruded from a guide plate 22 toward a takeout position is pushed as much as a value exceeding a certain threshold value in an arrow T1 direction; and a second detecting section 73 which detects that an auxiliary roller 18 protruded from the guide plate 22 toward the takeout position is pushed as much as a value exceeding a certain threshold value in the arrow T1 direction. The takeout device 71 also has a controller 74 which drives and controls two floor motors 62, 63. The takeout device 71 of the present embodiment has a constitution similar to that of the above takeout device 61 except that these two detecting sections 72, 73 and the controller 74 are disposed.

[0069] The first detecting section 72 is disposed to detect that there is mail P in the vicinity of the guide plate 22 in the vicinity of the takeout roller 11. In the present embodiment, a protruded position of the takeout roller 11 is detected by the encoder 72 built in a servo motor 14 for pressing the takeout roller 11 toward the mail P. That is, in the present embodiment, the servo motor 14 also serves as the first detecting section 72.

[0070] The second detecting section 73 is disposed to detect that there is the mail P in the vicinity of the guide plate 22 in the vicinity of the auxiliary roller 18. In the present embodiment, the photointerrupter 73 detects that a swinging arm 19 to which a rotation shaft of the auxiliary roller 18 is rotatably attached has been rotated in a specific rotation position. Accordingly, it is detected that the auxiliary roller 18 is pushed above the certain threshold value.

[0071] It is to be noted that here, as the first detecting section 72, the encoder is used, but a photointerrupter may be used, and there is also a method in which a proximity sensor or the like is used.

[0072] In the following description, the first and second detecting sections 72, 73 turn on, when the takeout roller 11 and the auxiliary roller 18 are pushed in by the mail P above the specific threshold value. The sections turn off, when the mail P is detached from the guide plate 22.

[0073] There will be described hereinafter an operation of the above takeout device 71 with reference to a flow chart of FIG. 28 and operation explanatory views of FIGS. 29 to 32. It is to be noted that here it is assumed that a running speed of an upstream-side floor belt 7 is V1, a running speed of an upstream-side floor belt 4a is V2 an a running speed of a downstream-side floor belt 4b is V3.

[0074] When a plurality of pieces of mail P as treatment objects are projected into the takeout device 71 to start a feed operation (FIG. 28 step 1), the controller 74 drives the downstream-side floor belt 4a on a downstream side in a takeout direction at a running speed (usual speed: V1 = V3 < V2) higher than that of the upstream-side floor belt 7 and the downstream-side floor belt 4b.

[0075] Thereafter, the controller 74 monitors a state of the mail P fed to a takeout position via the first detecting section 72 and the second detecting section 73 (step 2), and one of states shown in FIGS. 29 to 32 is judged (step 3). Moreover, based on this judgment result, the floor motor 62 (first motor) and the floor motor 63 (second motor) are driven and controlled, and driving of the floor belt 4a and the floor belt 4b is controlled (step 4).

[0076] Thereafter, until there is not any more mail P as a feed object on a mounting base 2 (step 5; YES), processing of the steps 2 to 4 is repeated (steps 2 to 4), thereby ending the feed operation. It is to be noted that although not shown in the flow chart of FIG. 28, here the upstream-side floor belt 7 repeats the driving and stopping in the same manner as in the floor belt 4a.

[0077] To be more specific, in a case where the mail P is detached from the takeout roller 11 and the auxiliary roller 18 as shown in FIG. 29, that is, the first detecting section 72 and the second detecting section 73 turn off, respectively, the floor belt 4a is operated at a running speed higher than that of the floor belt 4b (V2 > V3). Therefore, when the floor belts 4a, 4b continue to be driven as they are, as shown in FIG. 30, a posture is changed so that a portion of the mail P close to a distant end of the takeout direction is pressed onto the takeout roller 11.

[0078] Moreover, in a case where it is judged by the judgment of the above step 3 that the mail P has the posture shown in FIG. 30, that is, the only first detecting

section 72 turns on, the posture of the mail P is appropriate, and therefore the floor belts 4a and 4b are stopped.

[0079] Furthermore, in a case where it is judged in the step 3 that the mail P has the posture shown in FIG. 31, that is, the only second detecting section 73 turns on, the floor belt 4a (and the upstream-side floor belt 7) is driven to press the distant end of the mail P in the takeout direction onto the takeout roller 11. Simultaneously, to reduce a load resistance applied from the auxiliary roller 18 to the mail P, the floor belt 4b facing the auxiliary roller 18 is reversed. According to this operation, the mail P changes from the posture shown in FIG. 31 to that shown in FIG. 30.

[0080] In addition, in a case where it is judged in the step 3 that the mail P has a posture shown in FIG. 32, that is, both of the first and second detecting sections 72, 73 turn on, the portion of the mail P close to the distant end of the takeout direction is already pressed onto the takeout roller 11. Therefore, the floor belt 4a (and the upstream-side floor belt 7) stops. Simultaneously, to reduce the load resistance applied from the auxiliary roller 18 to the mail P, the floor belt 4b is reversed. According to this operation, the mail P changes from the posture shown in FIG. 32 to that shown in FIG. 30.

[0081] As described above, according to the present embodiment, regardless of the posture of the mail P projected into the takeout device 71, the load resistances applied from the auxiliary roller 18 and the guide plate 22 to the mail P can be reduced, and a send-out force of the takeout roller 11 can be applied to the mail P with a good efficiency.

[0082] It is to be noted that in the present embodiment, the driving of each of the floor motors 8, 62 and 63 is controlled so that the running speed V1 of the upstream-side floor belt 7 is set to be equal to the running speed V3 of the floor belt 4b, and the running speed V2 of the floor belt 4a is set to be higher than the above running speed (V1 = V3 < V2). However, at least the running speed of the floor belt 4a on the downstream side in the takeout direction of the mail P may be set to be higher than that of the floor belt 4b on the upstream side (V3 < V2), and the running speed V1 of the upstream-side floor belt 7 is not related. In the present embodiment, the operation (timing of the driving or the stopping) of the upstream-side floor belt 7 is adapted to that of the floor belt 4a, but the operation timing of the upstream-side floor belt 7 may be adapted to that of the floor belt 4b.

[0083] It is explicitly stated that all features disclosed in the description and/or the claims are intended to be disclosed separately and independently from each other for the purpose of original disclosure as well as for the purpose of restricting the claimed invention independent of the composition of the features in the embodiments and/or the claims. It is explicitly stated that all value ranges or indications of groups of entities disclose every possible intermediate value or intermediate entity for the purpose of original disclosure as well as for the purpose of restricting the claimed invention, in particular as limits of value ranges.

Claims

1. A paper sheet takeout device comprising:

a mounting base (2) on which lower edges of a plurality of paper sheets (P) abut in a state in which the paper sheets are accumulated to mount the paper sheets thereon in a vertical posture;
a backup plate (3) which urges the plurality of paper sheets mounted on this mounting base in an accumulated direction (T1) of the paper sheets to feed the paper sheets in an end portion of the accumulated direction to a takeout position;
first and second floor belts (4a, 4b) which are exposed from the mounting base to extend along the accumulated direction, respectively, exposed portions of the first and second floor belts being moved along the accumulated direction toward the takeout position to thereby move the lower edges of the paper sheets toward the takeout position, the first and second floor belts being arranged apart from each other in a takeout direction (T2) substantially crossing the accumulated direction at right angles;
a takeout roller (11) brought into contact with the paper sheets fed to the takeout position to rotate, thereby taking out the paper sheets in the takeout direction; and
an auxiliary roller (18) disposed apart from this takeout roller on an upstream side in the takeout direction to face the takeout position, the auxiliary roller being configured to support the paper sheets fed to the takeout position,

characterized in that a feed force of the paper sheets to the takeout roller is set to be relatively larger than that of the paper sheets to the auxiliary roller.

2. The paper sheet takeout device according to claim 1, **characterized in that** a movement speed of the first floor belt (4a) on a downstream side in the takeout direction is set to be higher than that of the second floor belt (4b) on the upstream side.

3. The paper sheet takeout device according to claim 2, **characterized by** further comprising:

a single motor (6) which drives the first and second floor belts (4a, 4b);
a second pulley (5b) which is attached to a rotation shaft (6a) of this motor and around which the second floor belt is wound; and

a first pulley (5a) which is attached to the rotation shaft of the motor and around which the first floor belt is wound and a diameter of which is larger than that of the second pulley.

4. The paper sheet takeout device according to claim 1, **characterized in that** a first frictional force exerted by the first floor belt (24) on a downstream side in the takeout direction on the lower edges of the paper sheets is set to be larger than a second frictional force exerted by the second floor belt (25) on the upstream side on the lower edges of the paper sheets.

5. The paper sheet takeout device according to claim 4, **characterized in that** a frictional coefficient of the surface of the first floor belt (24) is set to be relatively larger than that of the surface of the second floor belt (25).

6. The paper sheet takeout device according to claim 4, **characterized in that** a width of the first floor belt (42) is set to be relatively larger than that of the second floor belt (25).

7. The paper sheet takeout device according to claim 1, **characterized in that** the surface of the first floor belt (32) on a downstream side in the takeout direction is provided with a plurality of protrusions (33) which act on the lower edges of the paper sheets.

8. The paper sheet takeout device according to claim 1, **characterized in that** adjacent to the second floor belt (25) on the upstream side in the takeout direction, a frictional member (53) which exerts a frictional force on the lower edges of the paper sheets is extended in the accumulated direction.

9. The paper sheet takeout device according to claim 8, **characterized in that** the frictional member (53) is disposed in such a position as to face the auxiliary roller (18).

10. The paper sheet takeout device according to claim 9, **characterized in that** the frictional member (53) is disposed in a position which does not interfere with the lower edges of the paper sheets taken out from the takeout position in the takeout direction (T2).

11. A paper sheet takeout device comprising:

a mounting base (2) on which lower edges of a plurality of paper sheets (P) abut in a state in which the paper sheets are accumulated to mount the paper sheets thereon in a vertical posture;
a backup plate (3) which urges the plurality of paper sheets mounted on this mounting base in an accumulated direction (T1) of the paper sheets to feed the paper sheets in an end portion of the accumulated direction to a takeout position;
first and second floor belts (4a, 4b) which are exposed from the mounting base to extend along the accumulated direction, respectively, exposed portions of the first and second floor belts being moved along the accumulated direction toward the takeout position to thereby move the lower edges of the paper sheets toward the takeout position, the first and second floor belts being arranged apart from each other in a takeout direction (T2) substantially crossing the accumulated direction at right angles;
a takeout roller (11) brought into contact with the paper sheets fed to the takeout position to rotate, thereby taking out the paper sheets in the takeout direction; and
an auxiliary roller (18) disposed apart from this takeout roller on an upstream side in the takeout direction to face the takeout position, the auxiliary roller being configured to support the paper sheets fed to the takeout position,

characterized in that pressure of the paper sheets on the takeout roller is set to be relatively larger than that of the paper sheets on the auxiliary roller.

12. The paper sheet takeout device according to claim 11, **characterized in that** a movement speed of the first floor belt (4a) on a downstream side in the takeout direction is set to be higher than that of the second floor belt (4b) on the upstream side.

13. The paper sheet takeout device according to claim 12, **characterized by** further comprising:

a single motor (6) which drives the first and second floor belts (4a, 4b);
a second pulley (5b) which is attached to a rotation shaft (6a) of this motor and around which the second floor belt is wound; and
a first pulley (5a) which is attached to the rotation shaft of the motor and around which the first floor belt is wound and a diameter of which is larger than that of the second pulley.

14. The paper sheet takeout device according to claim 11, **characterized in that** a first frictional force exerted by the first floor belt (24) on a downstream side in the takeout direction on the lower edges of the paper sheets is set to be larger than a second frictional force exerted by the second floor belt (25) on the upstream side on the lower edges of the paper sheets.

15. The paper sheet takeout device according to claim

14, **characterized in that** a frictional coefficient of the surface of the first floor belt (24) is set to be relatively larger than that of the surface of the second floor belt (25).

16. The paper sheet takeout device according to claim 14, **characterized in that** a width of the first floor belt (42) is set to be relatively larger than that of the second floor belt (25).

17. The paper sheet takeout device according to claim 11, **characterized in that** the surface of the first floor belt (32) on a downstream side in the takeout direction is provided with a plurality of protrusions (33) which act on the lower edges of the paper sheets.

18. The paper sheet takeout device according to claim 11, **characterized in that** adjacent to the second floor belt (25) on the upstream side in the takeout direction, a frictional member (53) which exerts a frictional force on the lower edges of the paper sheets is extended in the accumulated direction.

19. The paper sheet takeout device according to claim 18, **characterized in that** the frictional member (53) is disposed in such a position as to face the auxiliary roller (18).

20. The paper sheet takeout device according to claim 19, **characterized in that** the frictional member (53) is disposed in a position which does not interfere with the lower edges of the paper sheets taken out from the takeout position in the takeout direction (T2).

21. A paper sheet takeout device **characterized by** comprising:

a mounting base (2) on which lower edges of a plurality of paper sheets (P) abut in a state in which the paper sheets are accumulated to mount the paper sheets thereon in a vertical posture;
a backup plate (3) which urges the plurality of paper sheets mounted on this mounting base in an accumulated direction (T1) of the paper sheets to feed the paper sheets in an end portion of the accumulated direction to a takeout position;
a first floor belt (4a) which is exposed from the mounting base to extend along the accumulated direction, an exposed portion of the first floor belt being moved along the accumulated direction toward the takeout position to thereby move the lower edges of the paper sheets toward the takeout position;
a second floor belt (4b) which is disposed apart from the first floor belt on an upstream side in a takeout direction (T2) substantially crossing the accumulated direction at right angles and substantially parallel to the first floor belt, an exposed portion of the second floor belt from the mounting base being moved toward the takeout position to thereby move the lower edges of the paper sheets toward the takeout position;
a takeout roller (11) brought into contact with the paper sheets fed to the takeout position to rotate, thereby taking out the paper sheets in the takeout direction;
an auxiliary roller (18) disposed apart from this takeout roller on the upstream side in the takeout direction to face the takeout position, the auxiliary roller being configured to support the paper sheets fed to the takeout position; and
first and second motors (62, 63) which drive these first and second floor belts independently of each other so that a movement speed of the first floor belt is higher than that of the second floor belt.

22. The paper sheet takeout device according to claim 21, **characterized by** further comprising:

a first detecting section (72) which detects that the takeout roller (11) is pushed in above a threshold value;
a second detecting section (73) which detects that the auxiliary roller is pushed in above a threshold value; and
a controller (74) which drives and controls the first and second motors based on detection results of the first and second detecting sections.

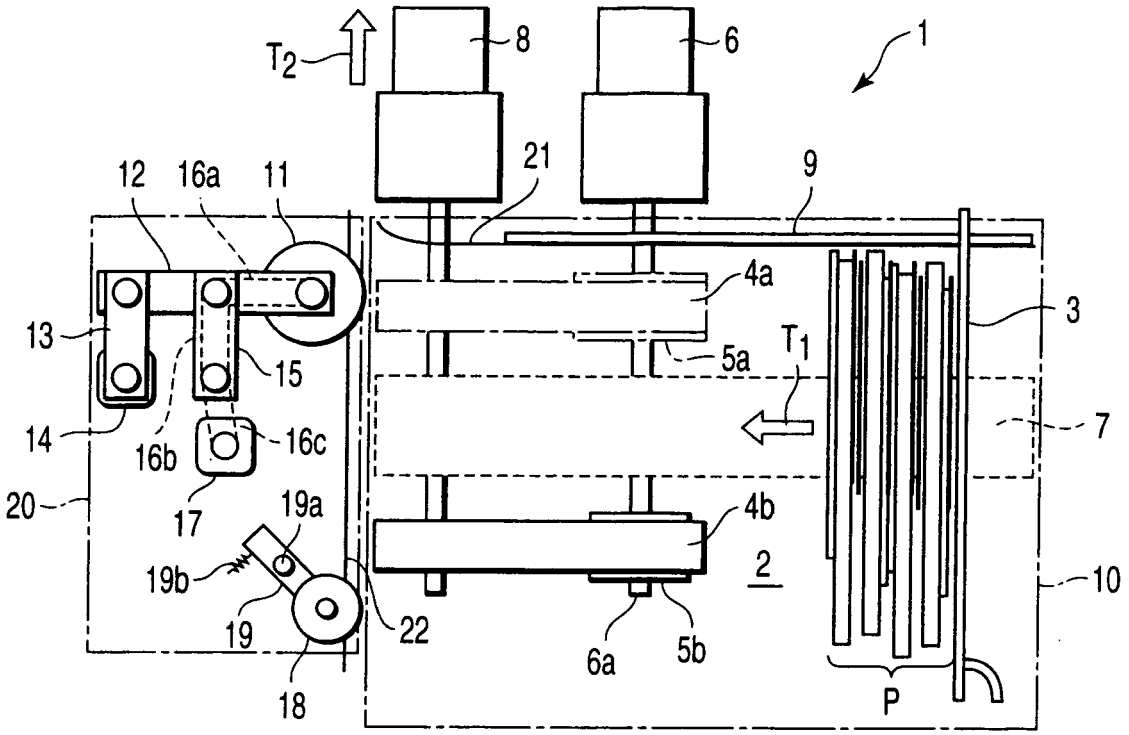
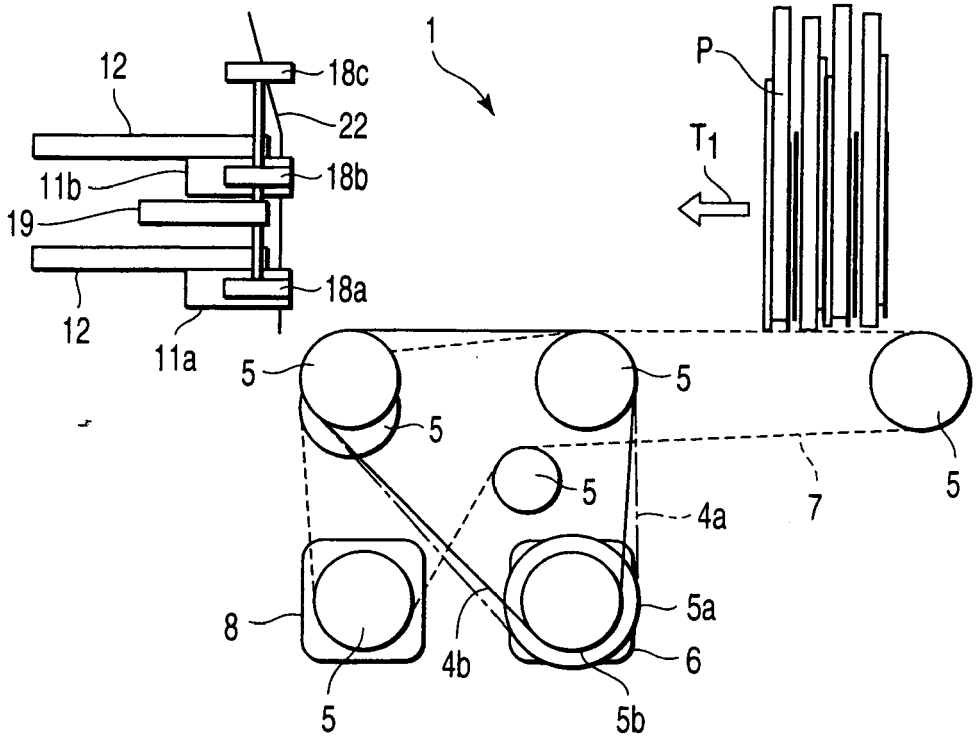

T2
8
6
1
12
16a
11
21
9
4a
3
13
15
5a
T1
14
16b
16c
7
20
17
19a
4b
19b
2
10
19
22
6a
5b
18
P

FIG. 1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12
18c
22
11b
18b
19
18a
12
11a
P
T1
5
5
5
5
5
7
4a
8
5a
4b
6
5
5b

FIG. 2

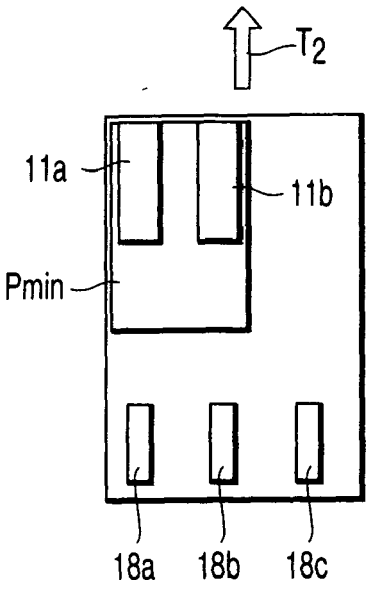

FIG. 3A

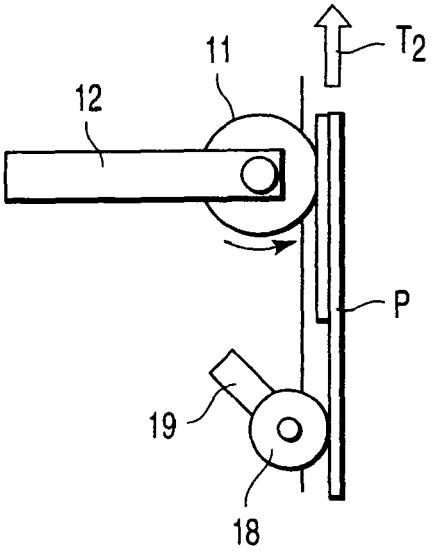

FIG. 3B

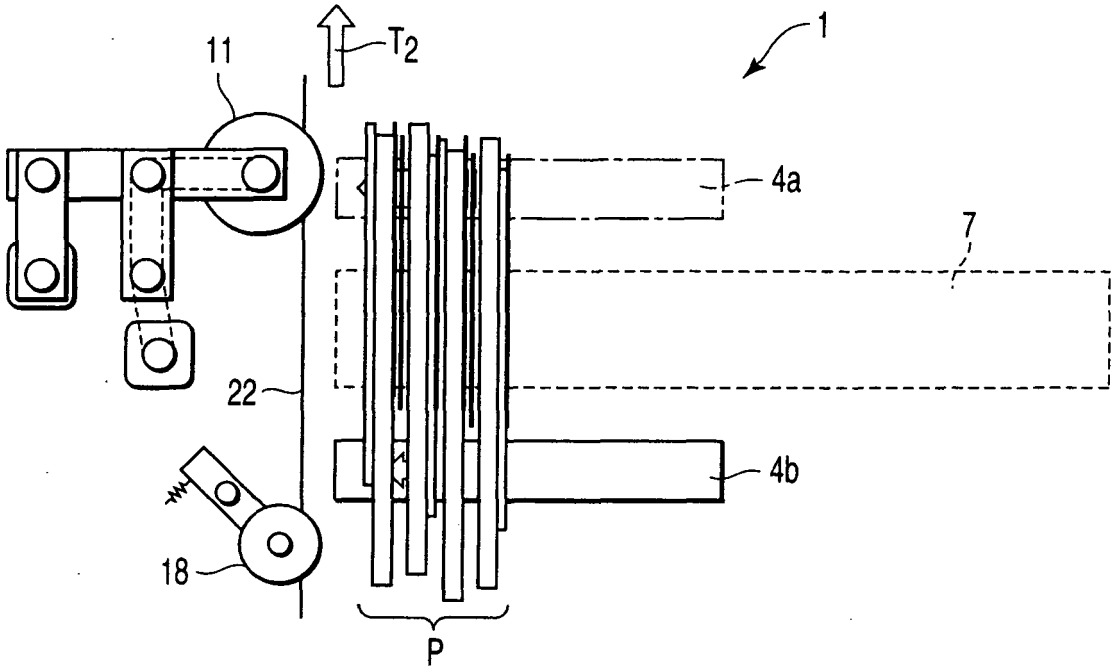

FIG. 4

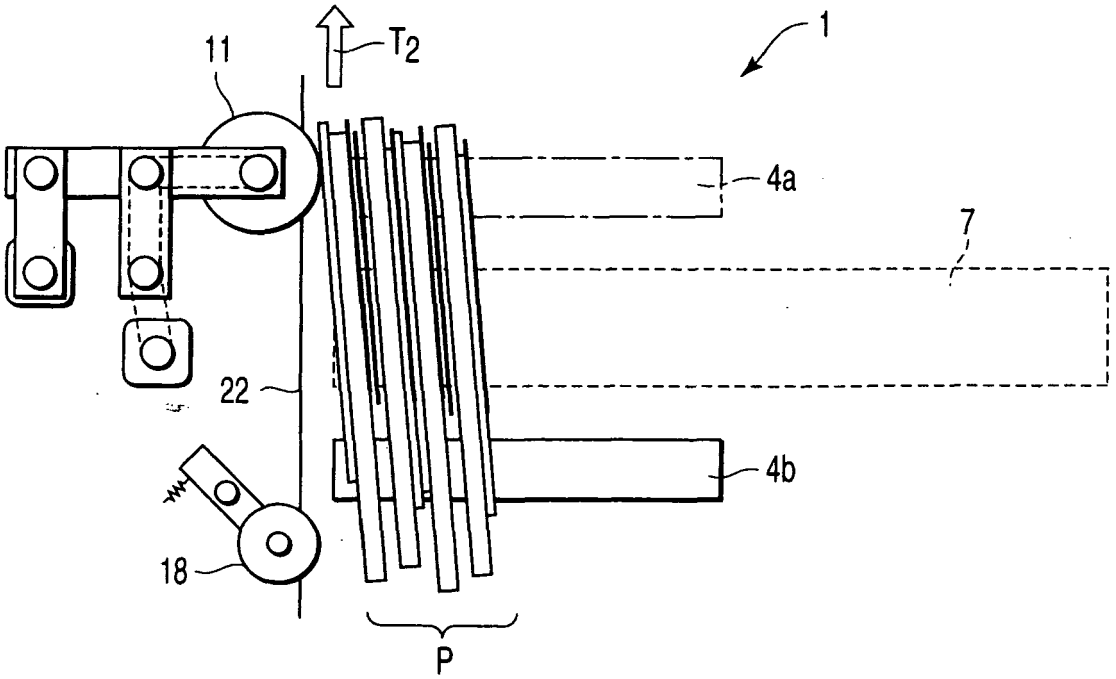

FIG. 5

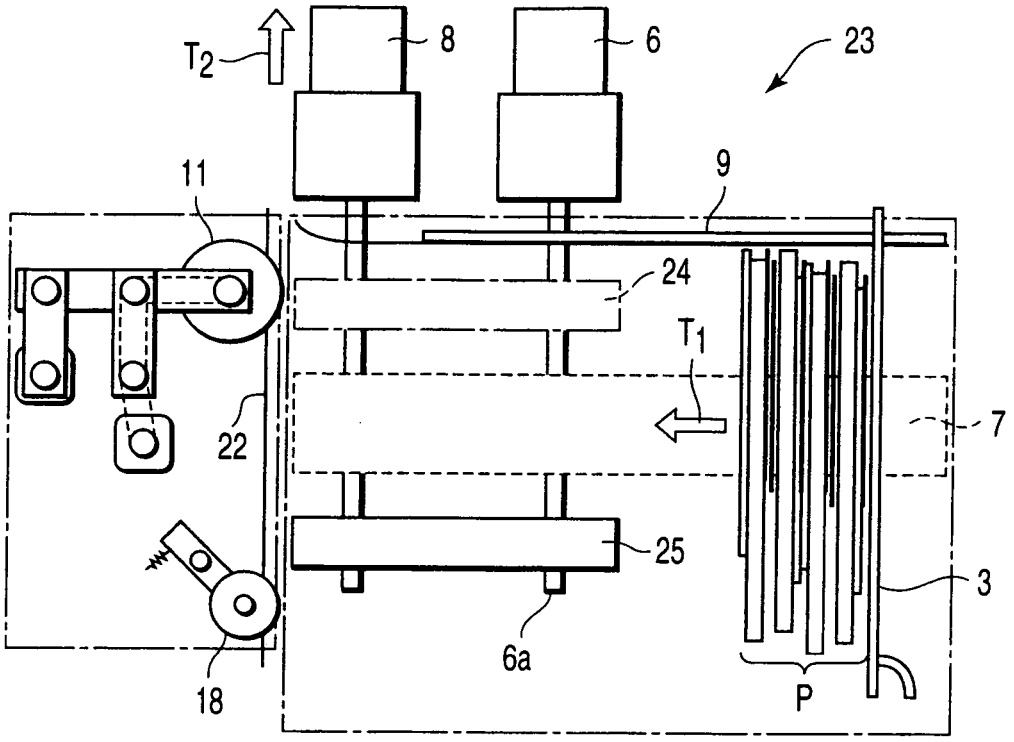
T2
8
6
23
11
9
24
T1
7
22
25
3
6a
18
P

FIG. 6

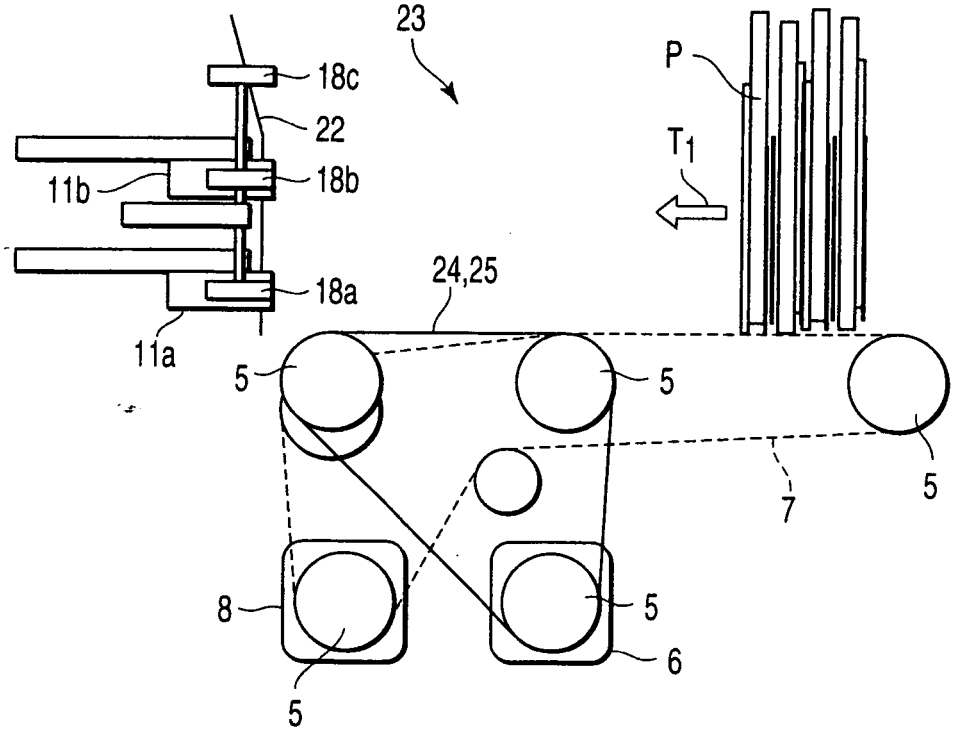
23
18c
22
11b
18b
18a
11a
24,25
P
T1
5
5
5
7
8
5
6
5

FIG. 7

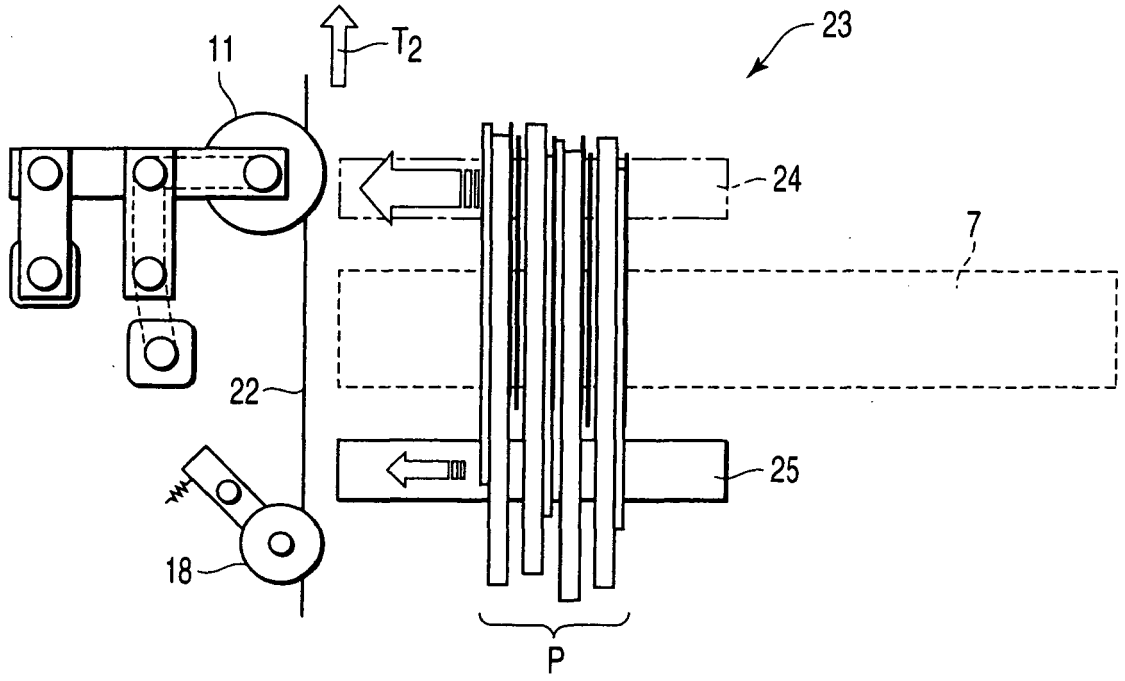

FIG. 8

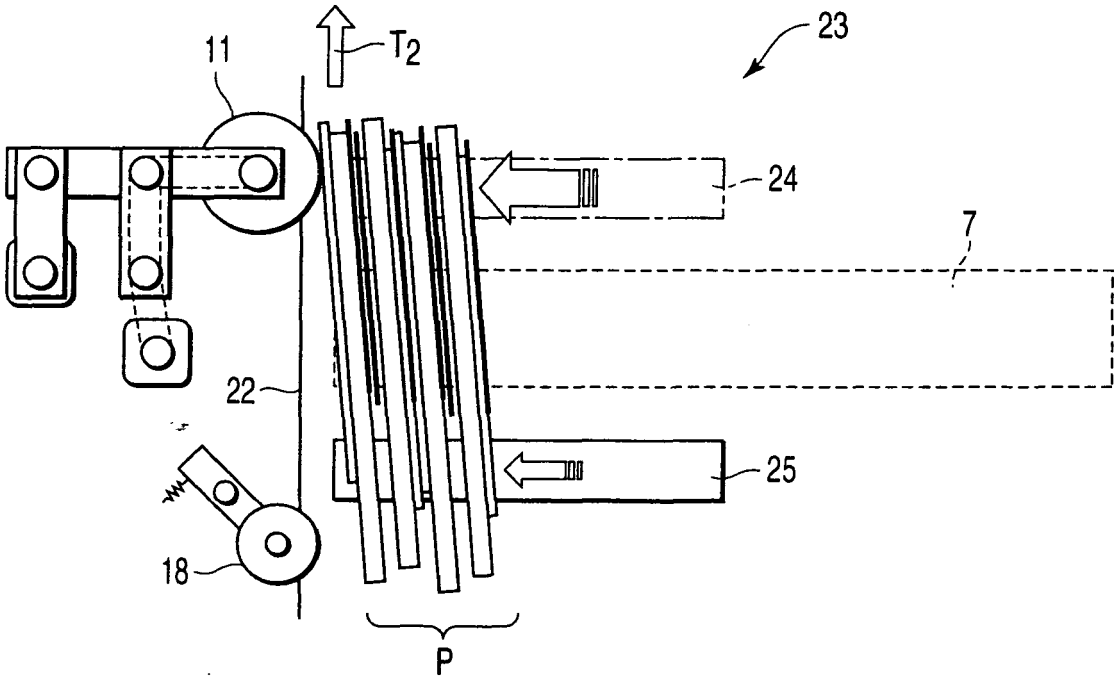

FIG. 9

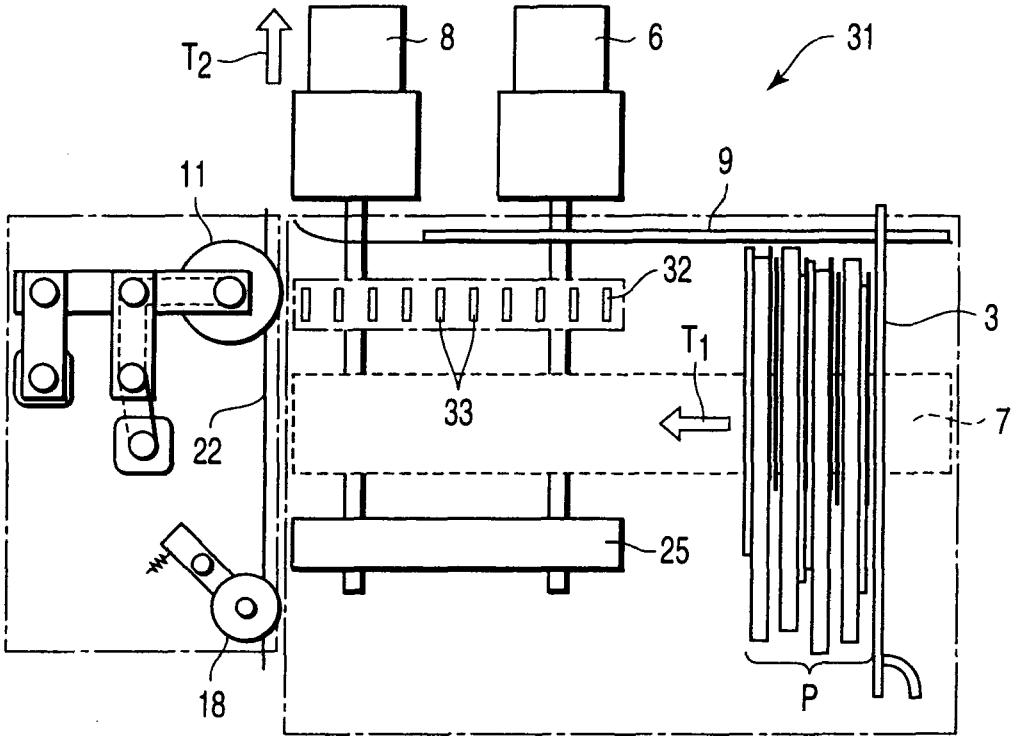
T2
8
6
31
11
9
32
3
T1
33
7
22
25
18
P

FIG. 10

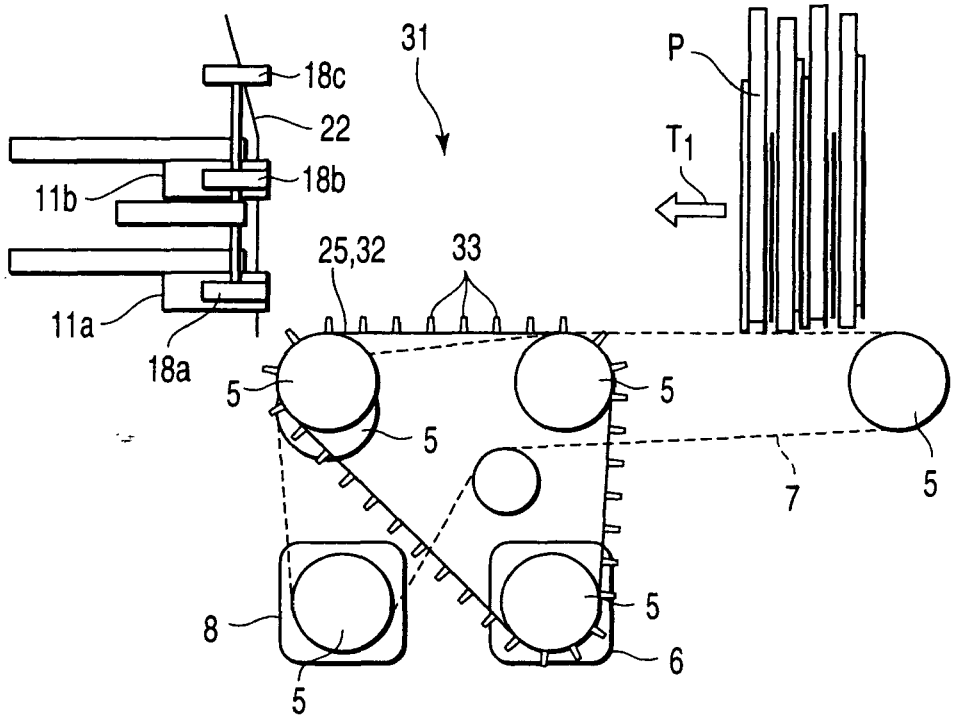
31
18c
22
18b
11b
11a
18a
25,32
33
P
T1
5
5
5
5
7
5
8
5
6
5

FIG. 11

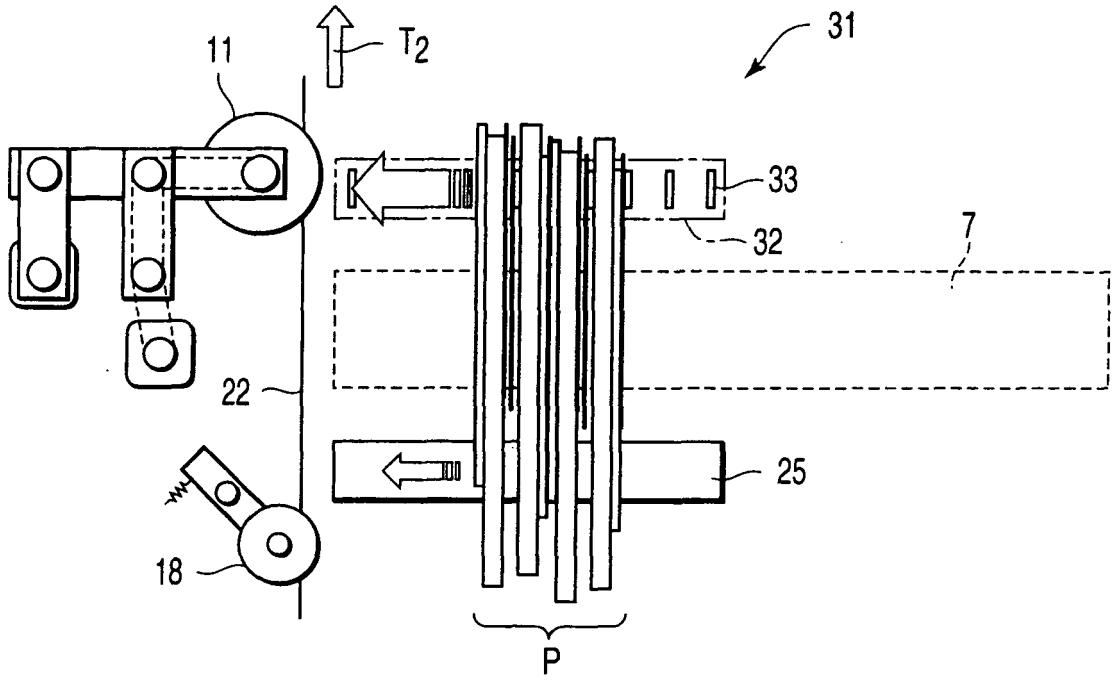

FIG. 12

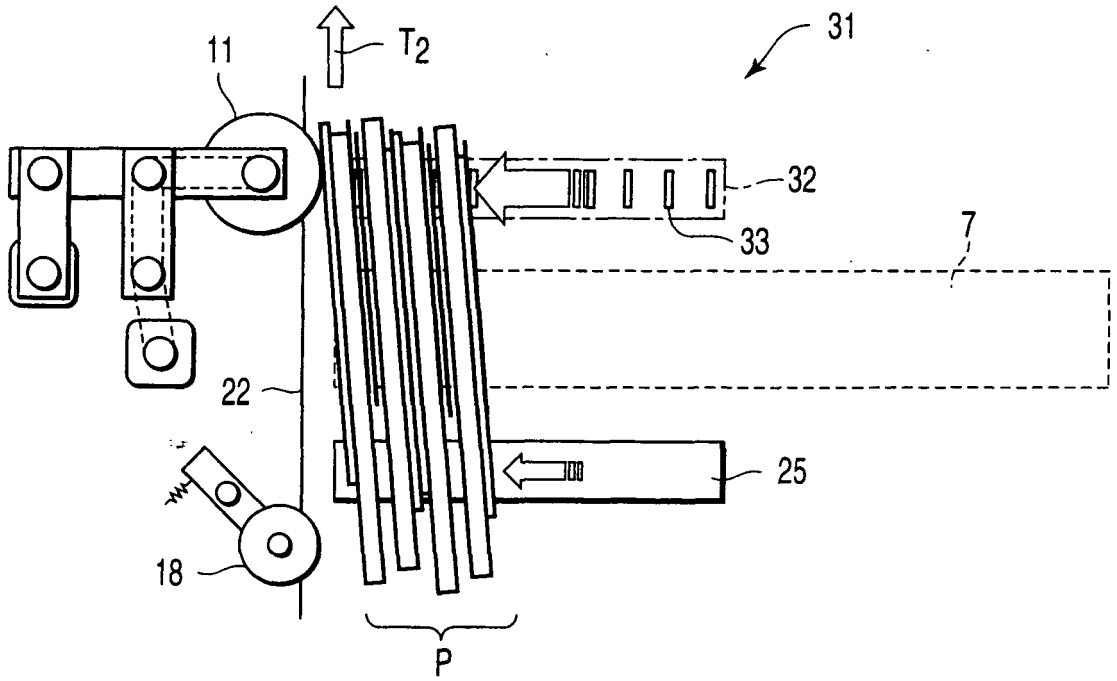

FIG. 13

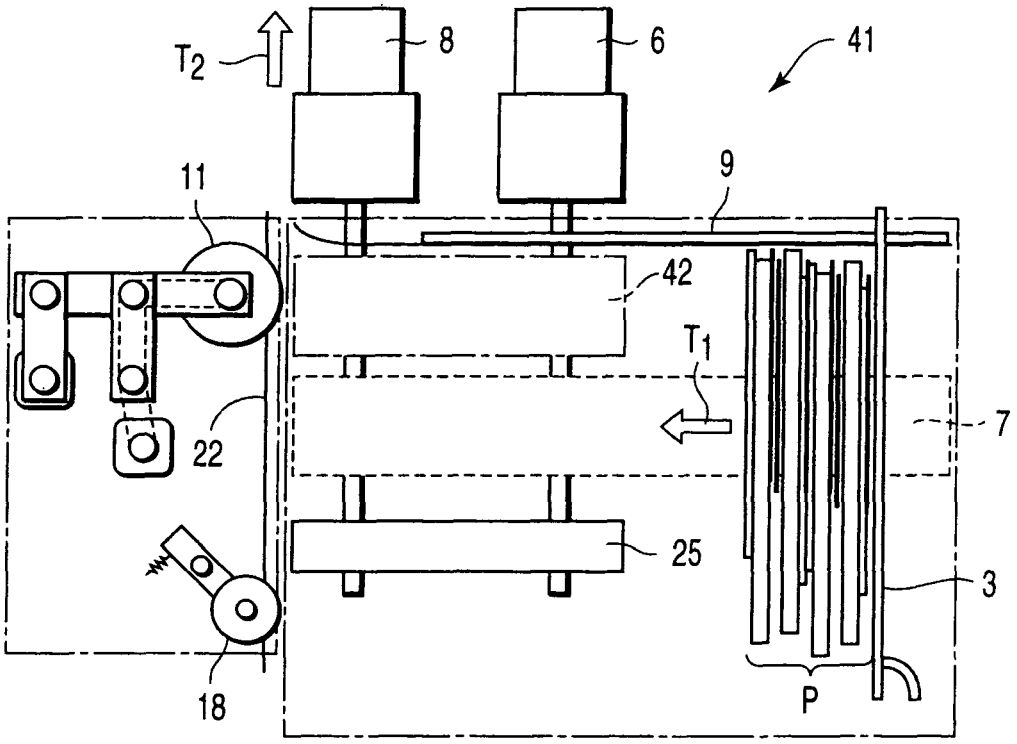
T2
8
6
41
11
9
42
T1
7
22
25
3
18
P

FIG. 14

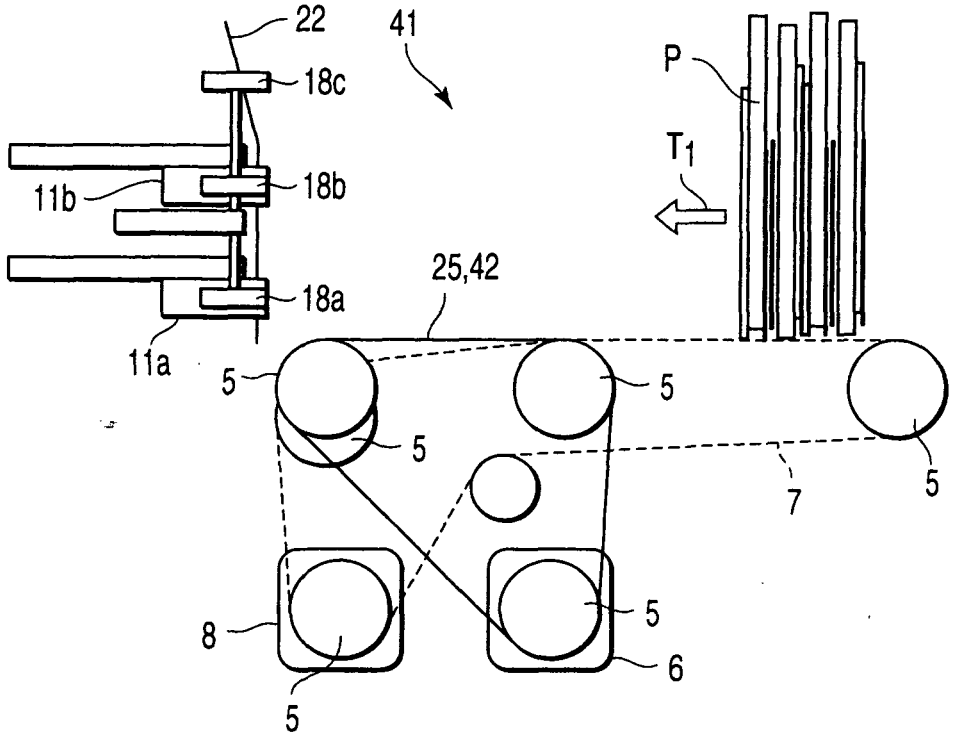
22
41
P
18c
T1
11b
18b
25,42
18a
11a
5
5
5
7
5
8
5
6
5

FIG. 15

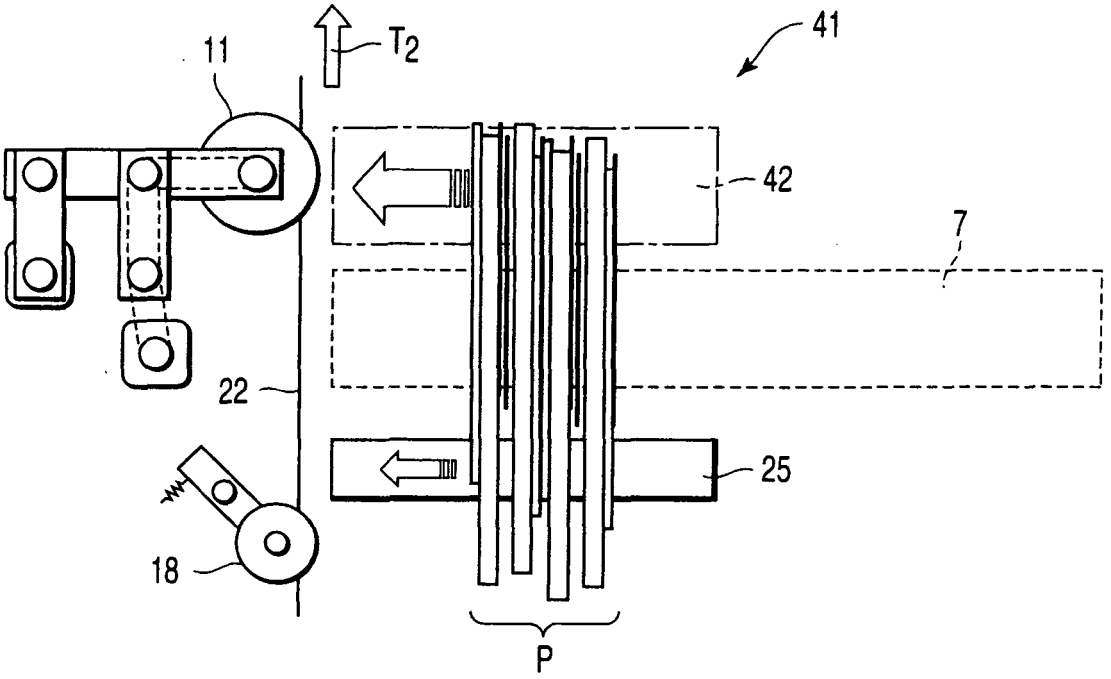

FIG. 16

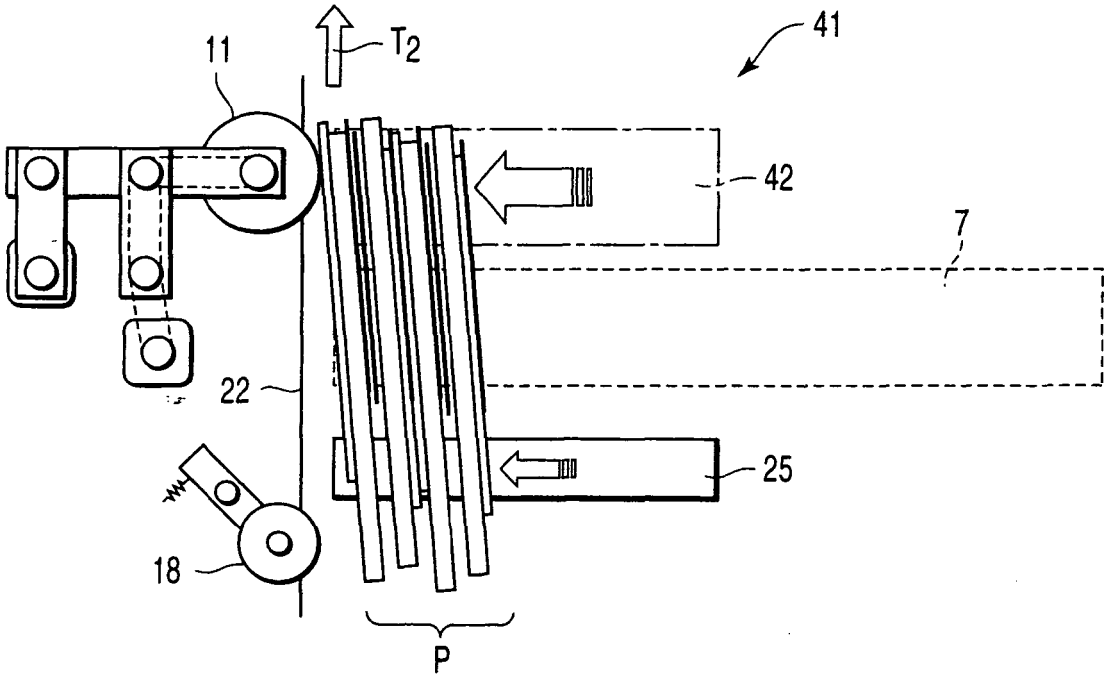

FIG. 17

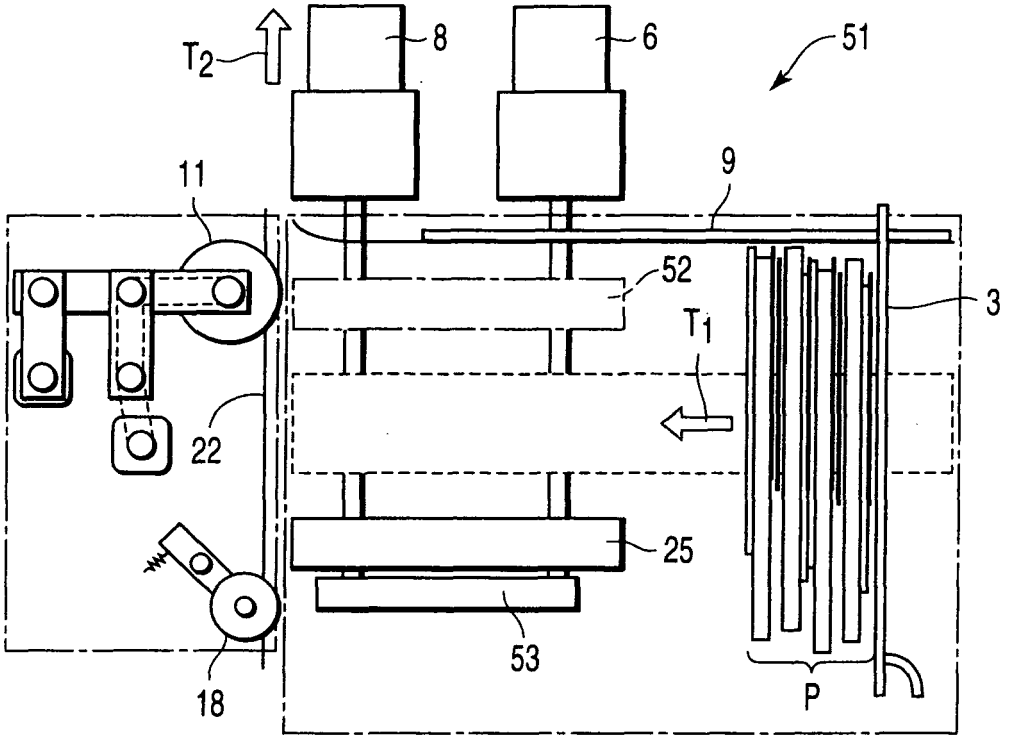
T2
8
6
51
11
9
52
3
T1
22
25
53
18
P

FIG. 18

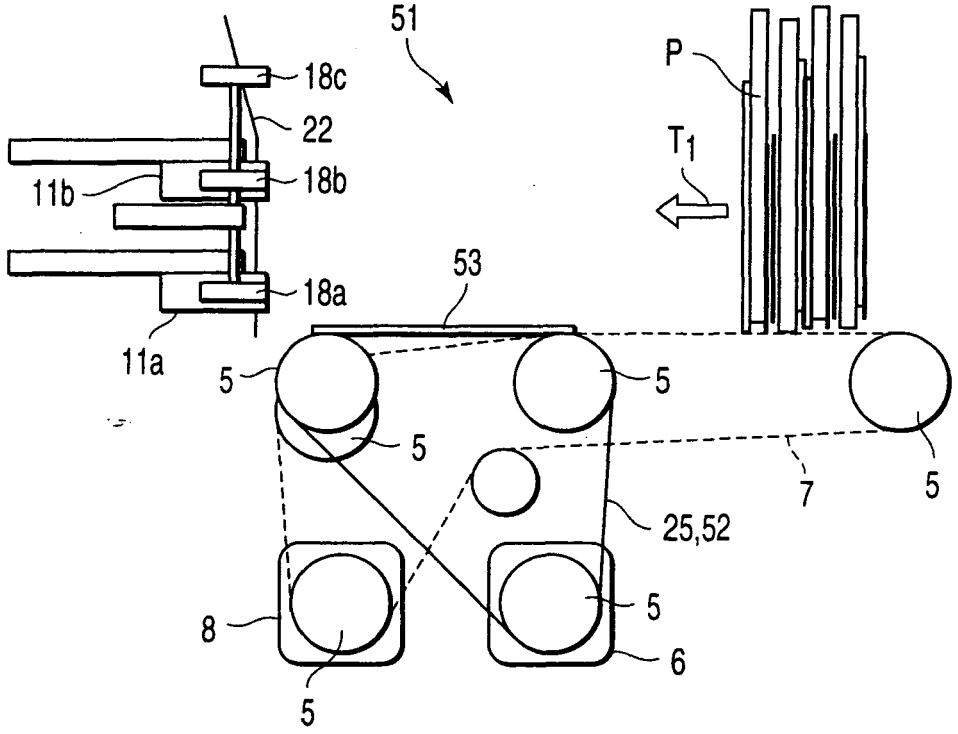
51
18c
22
11b
18b
18a
11a
53
P
T1
5
5
5
5
7
25,52
8
5
6
5

FIG. 19

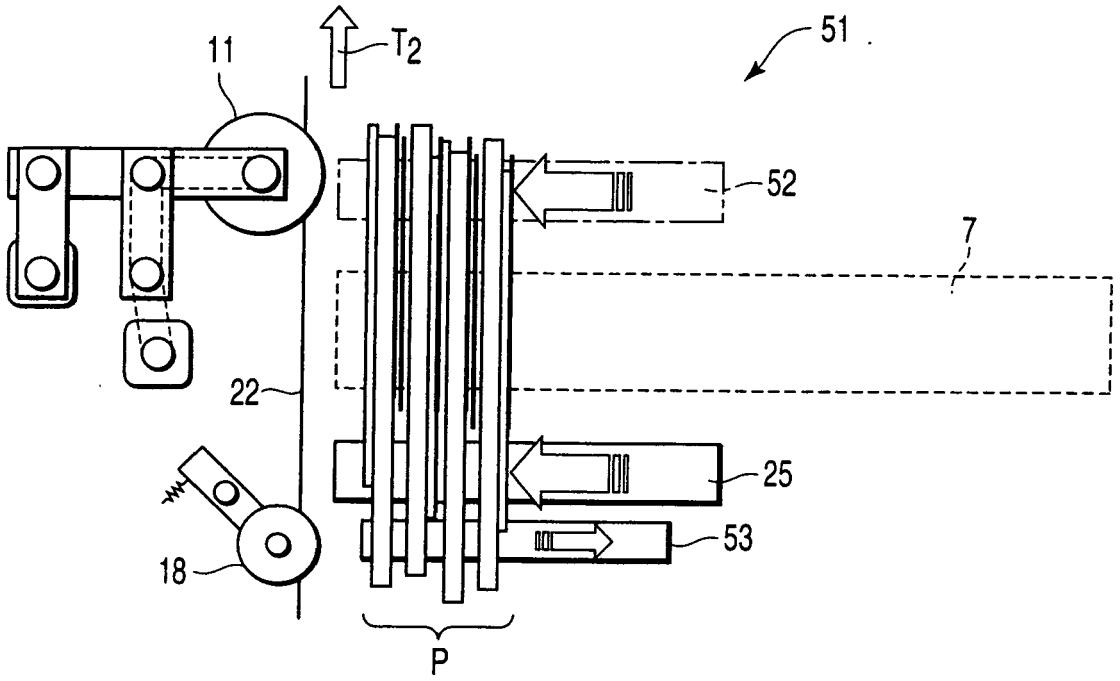

FIG. 20

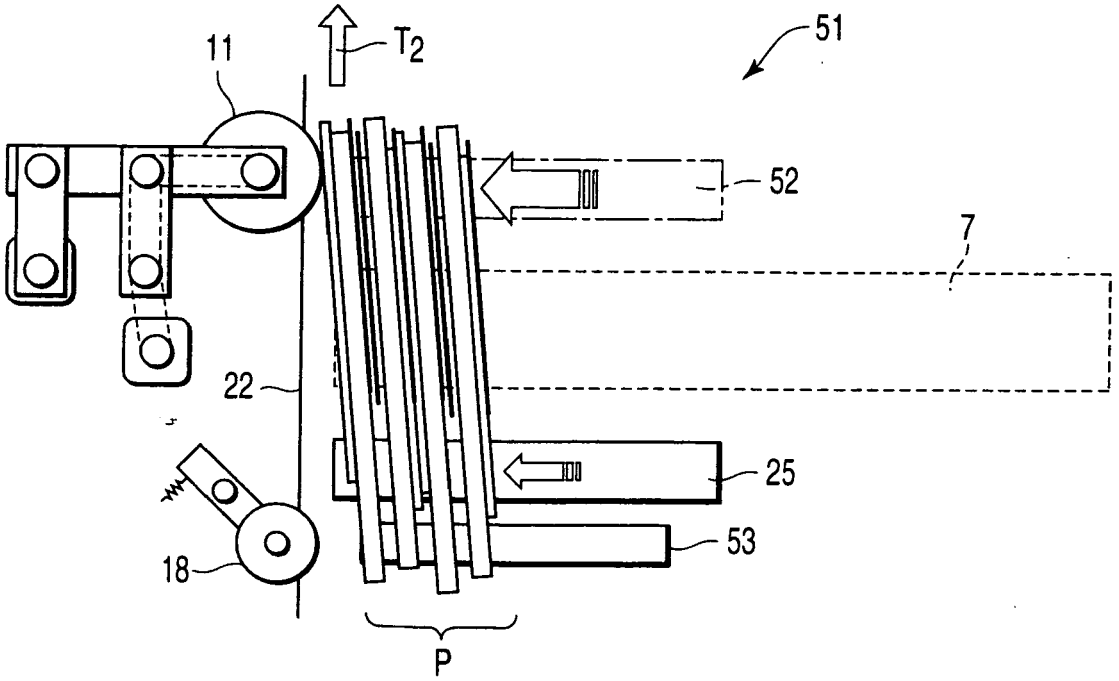

FIG. 21

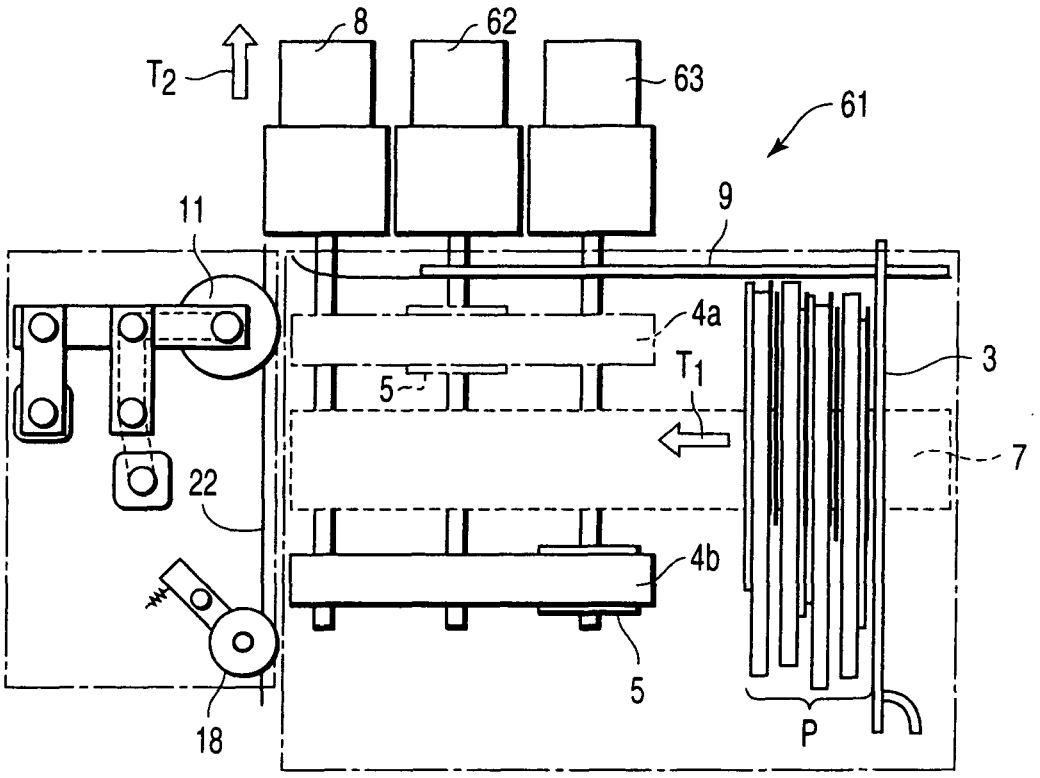
T2
8
62
63
61
11
9
4a
T1
3
5
7
22
4b
5
18
P

FIG. 22

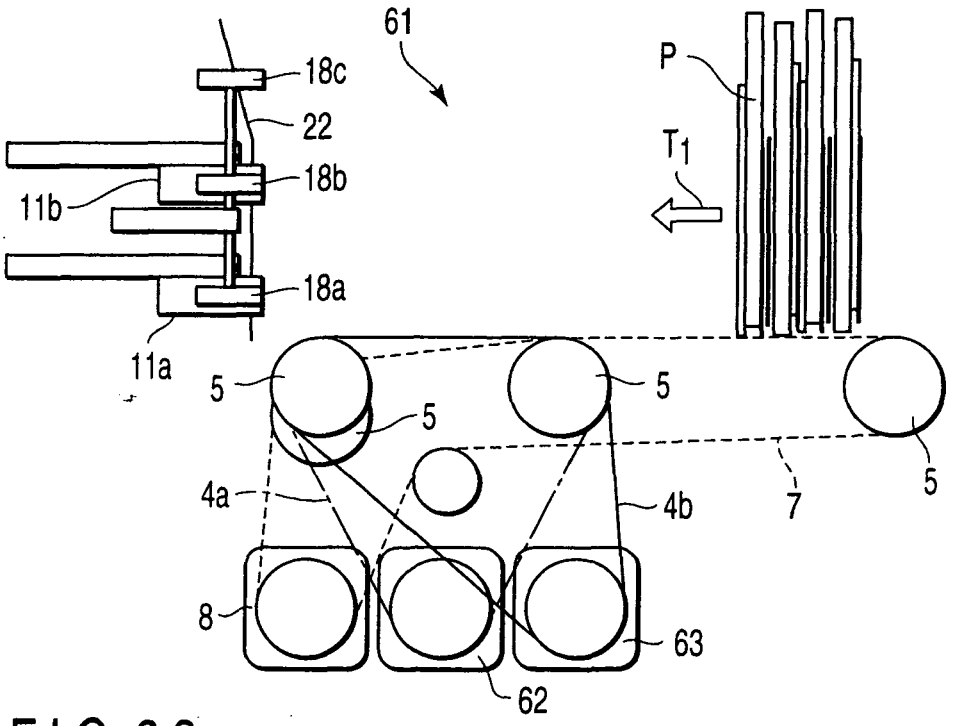
61
18c
22
18b
11b
18a
11a
P
T1
5
5
5
5
4a
4b
7
8
63
62

FIG. 23

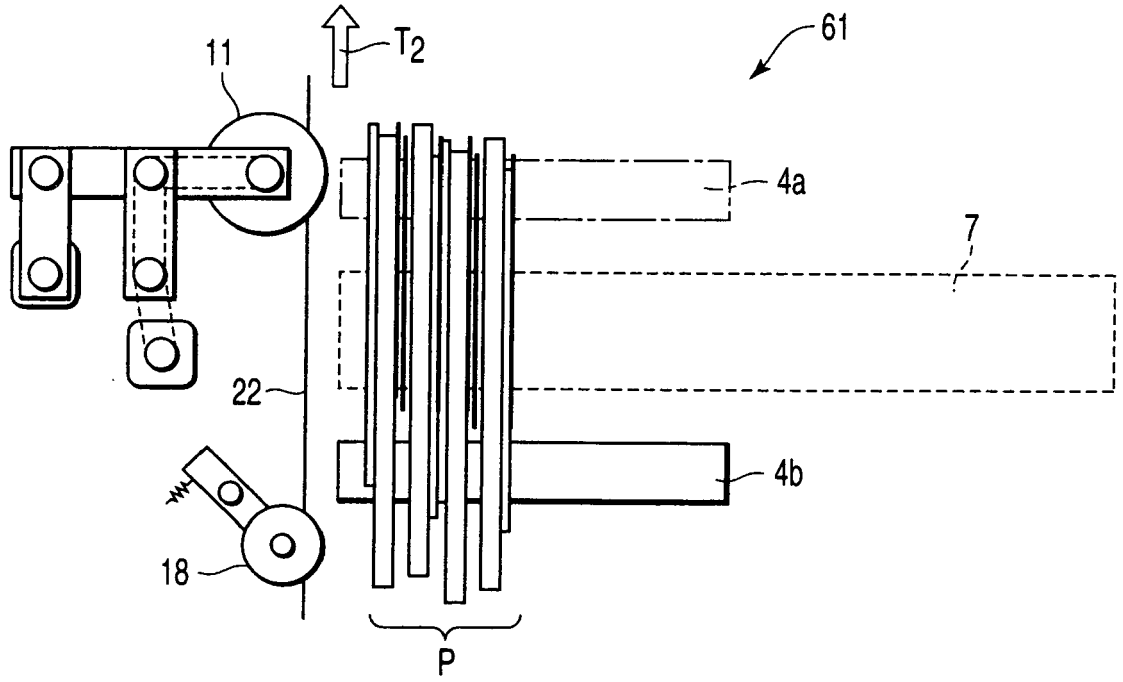

FIG. 24

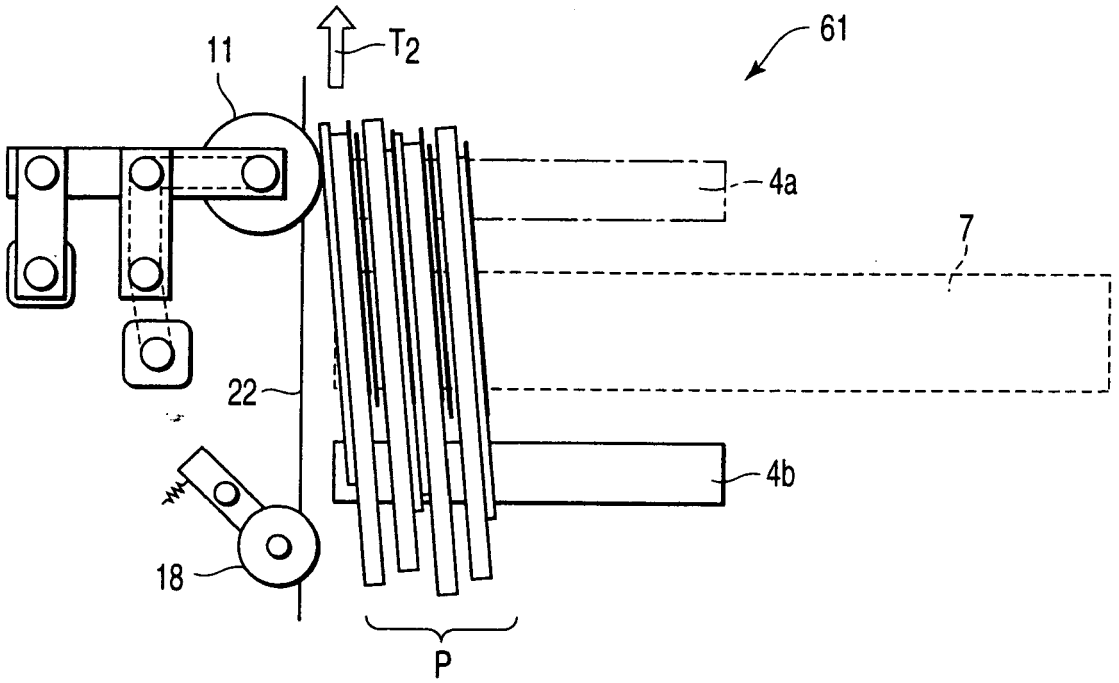

FIG. 25

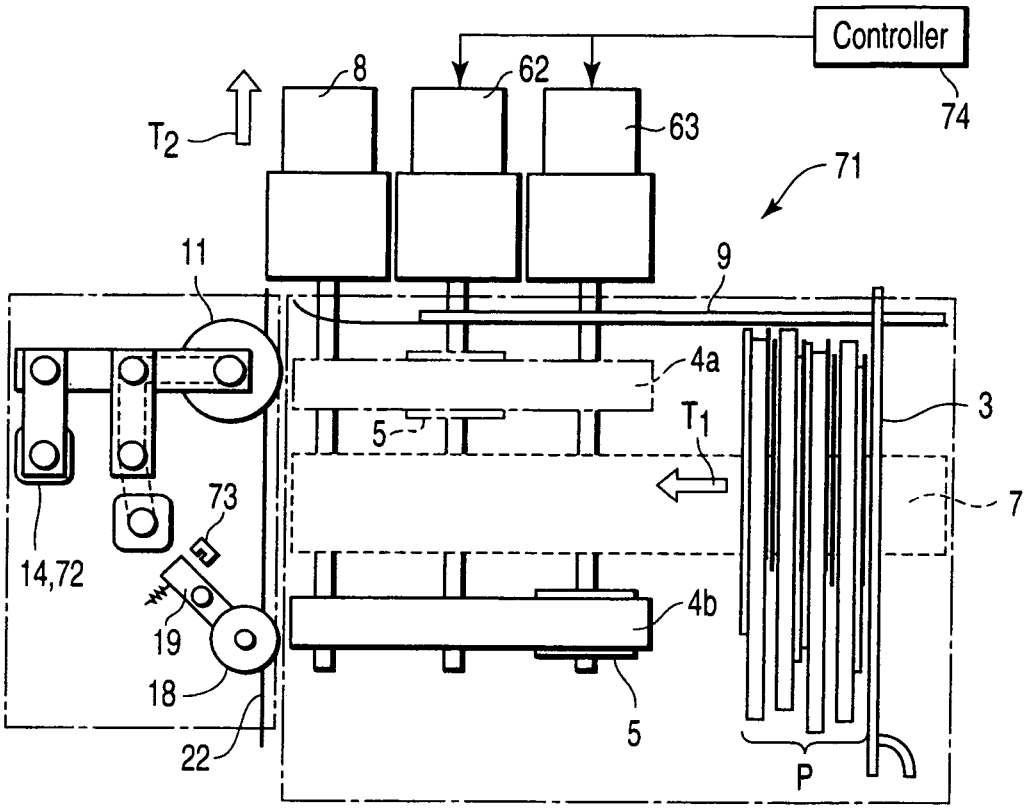
Controller
74
8
62
63
T_2
71
11
9
4a
5
T_1
3
7
73
14,72
19
18
22
4b
5
P

FIG. 26

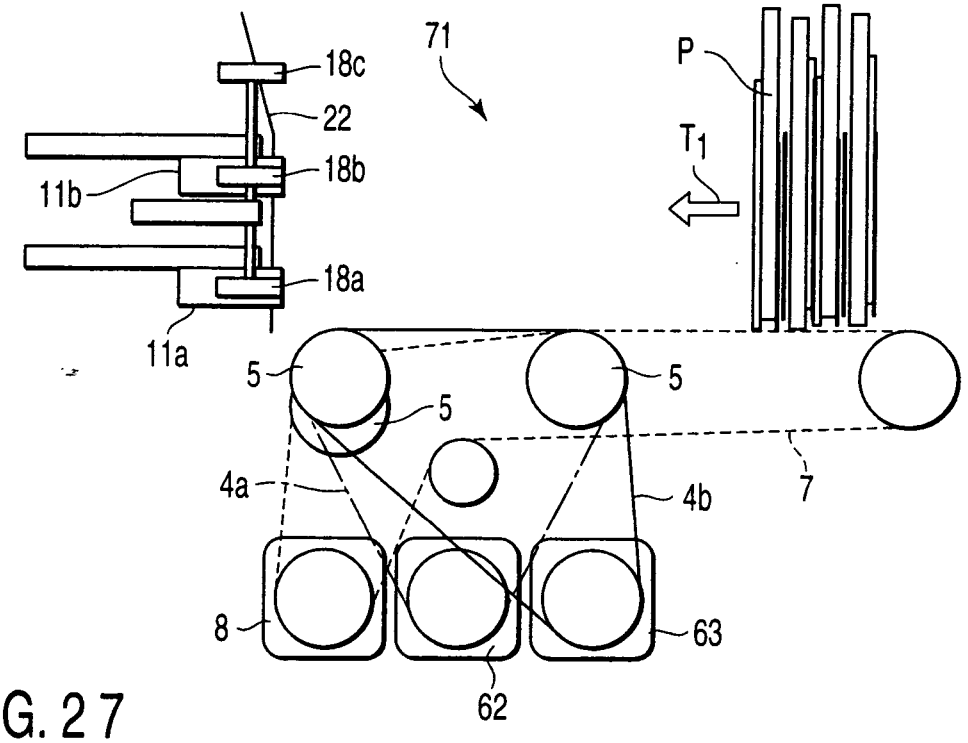
71
18c
22
18b
11b
18a
11a
P
T_1
5
5
5
4a
4b
7
8
63
62

FIG. 27

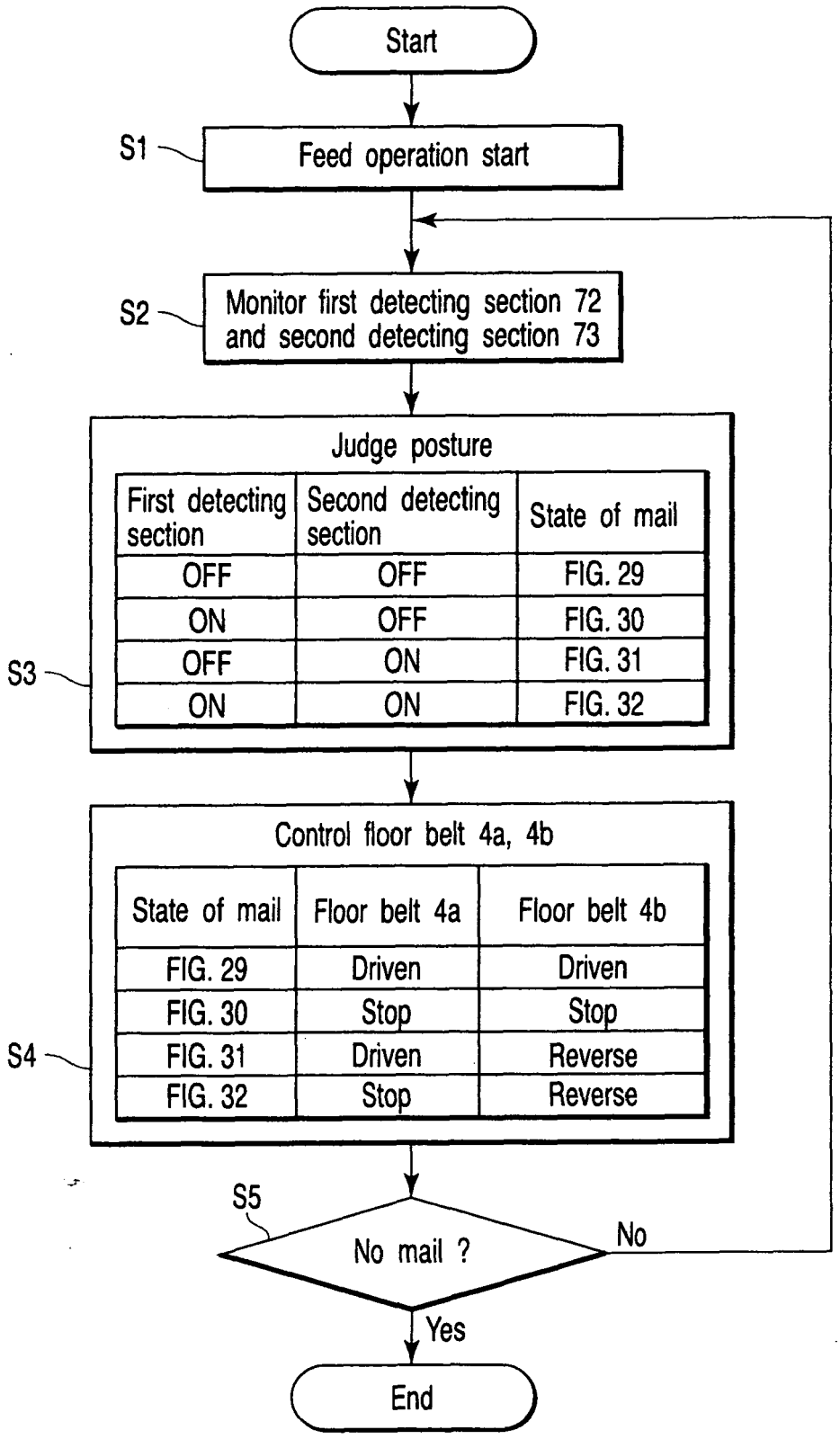
Start
S1
Feed operation start
S2
Monitor first detecting section 72 and second detecting section 73
Judge posture
S3
First detecting section | Second detecting section | State of mail
OFF | OFF | FIG. 29
ON | OFF | FIG. 30
OFF | ON | FIG. 31
ON | ON | FIG. 32
Control floor belt 4a, 4b
S4
State of mail | Floor belt 4a | Floor belt 4b
FIG. 29 | Driven | Driven
FIG. 30 | Stop | Stop
FIG. 31 | Driven | Reverse
FIG. 32 | Stop | Reverse
S5
No mail ?
No
Yes
End

FIG. 28

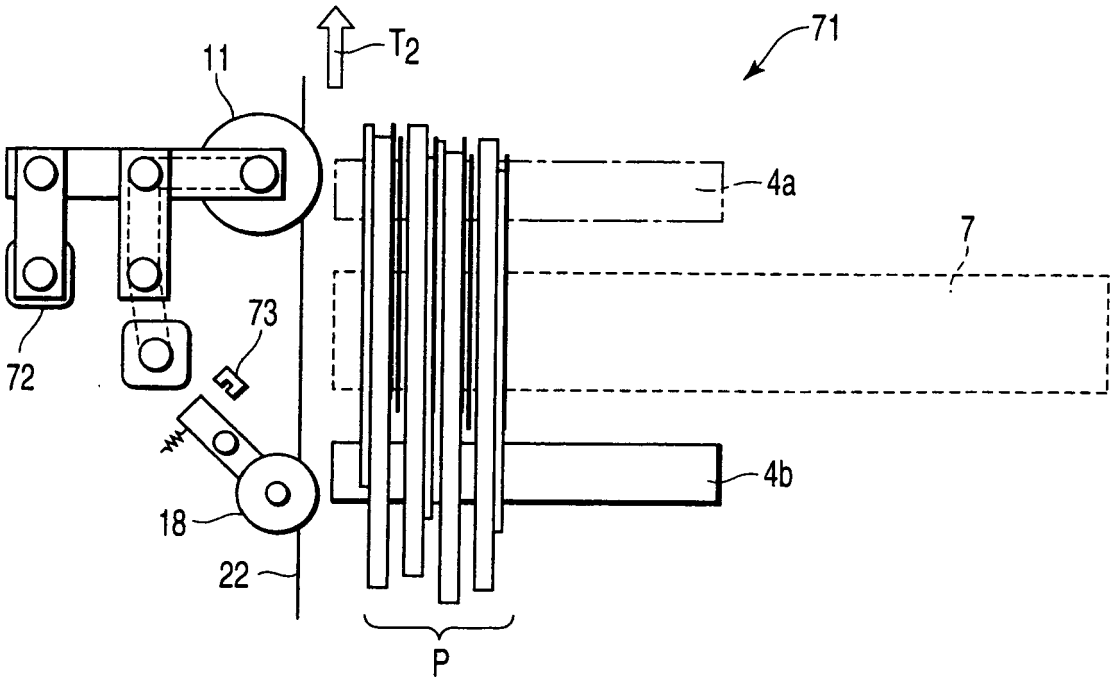

FIG. 29

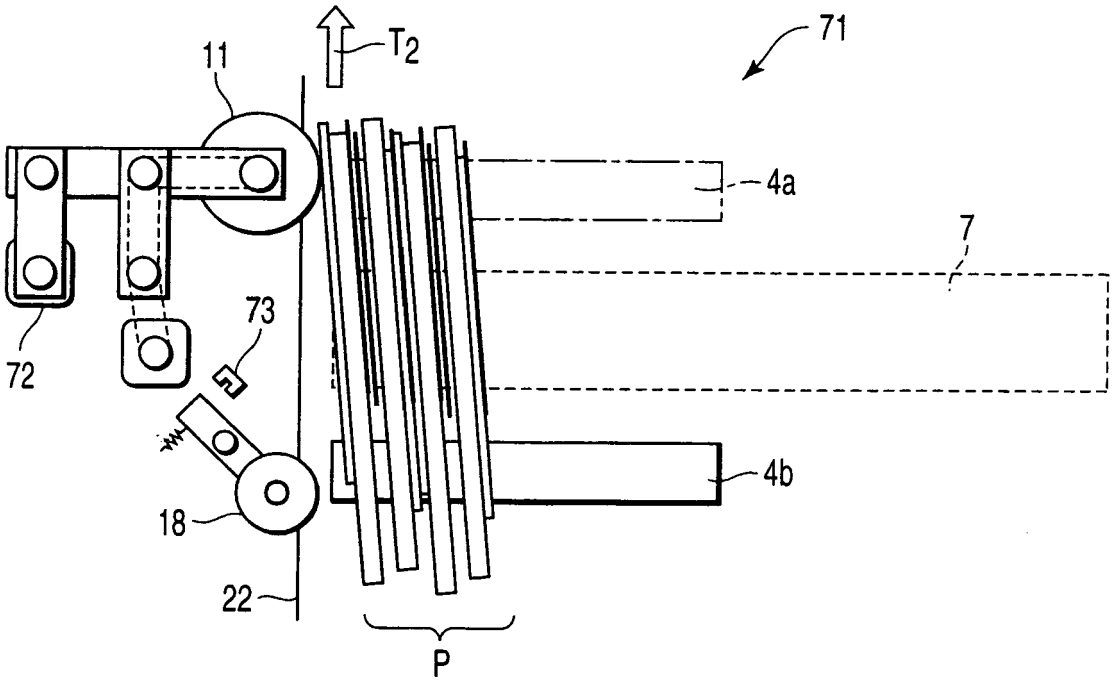

FIG. 30

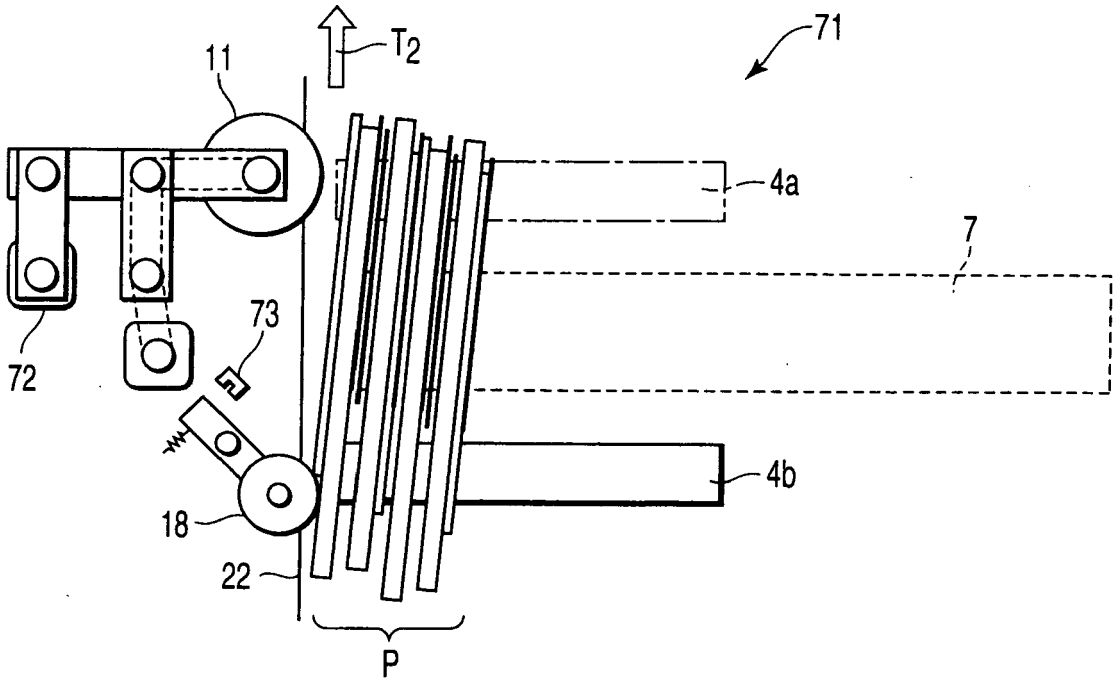

FIG. 31

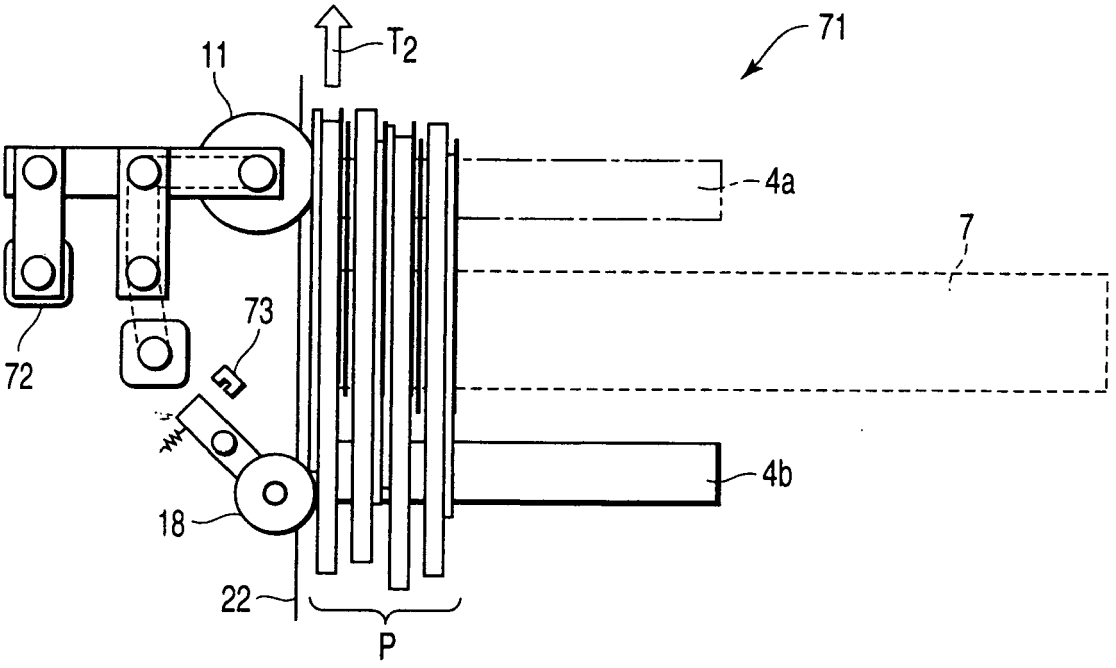

FIG. 32

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2005145671 A **[0002]**