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(54) **Sheet take-out apparatus**

(57) A sheets take-out apparatus (1) has a table (2) for loading a plurality of postal matter (P) upright, a back-up plate (3) for pressing postal matter in the stacking direction (T1) and supplying them to a take-out position, a lower stream side floor belt (4) installed so as to be partially exposed from the table in the neighborhood of the take-out position, an upper stream side floor belt (7),

a take-out roller (11), and two auxiliary rollers (16a, 16b). A difference in the projection position between the auxiliary rollers pressed by the postal matter supplied to the take-out position is detected and the inclination of the postal matter is detected. On the basis of the detection results, the moving speeds of the floor belts (4, 7) are controlled so as to correct the posture of the postal matter upright.

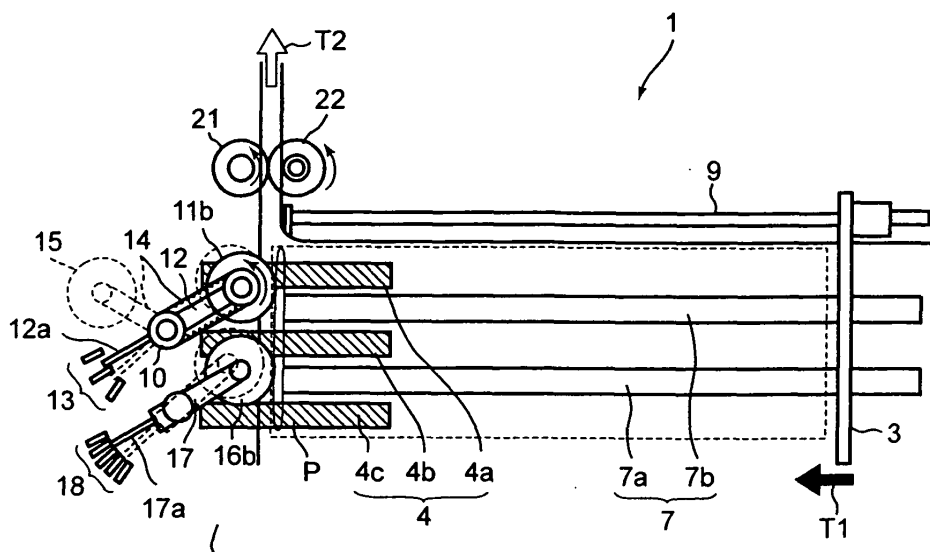


FIG. 1

Description**BACKGROUND OF THE INVENTION**

1. Field of the invention

[0001] The present invention relates to a sheets take-out apparatus for taking out a plurality of paper-like materials particularly such as postal matter one by one.

2. Description of the Related Art

[0002] Conventionally, as a sheets take-out apparatus, as described in Japanese Patent Application Publication No. 2002-68490, an apparatus for taking out a plurality of postal matter one by one in an upright state. This take-out apparatus has two sets of floor belts that make contact with the lower end sides of a plurality of postal matter dropped side by side and are extended in the lining direction of the postal matter. The postal matter is transferred by the two sets of floor belts, is moved to the take-out position, and is taken out by a take-out roller arranged at the take-out position.

[0003] The take-out apparatus, when taking out postal matter, controls the speed of the floor belts to form a gap between the postal matter, inserts a lever into the gap, moves it in the lining direction, thereby supplies the postal matter at the front end in the lining direction to a take-out means.

[0004] However, in the aforementioned conventional take-out apparatus, the driving mechanism for the lever to be inserted between postal matter is complicated and a problem arises that the cost is increased. Further, when the lever causes malfunctions, postal matter may be damaged.

SUMMARY OF THE INVENTION

[0005] An object of the present invention is to provide a sheets take-out apparatus for surely correcting the posture of paper-like materials by a simple constitution and stably taking out paper-like materials.

[0006] According to the present invention, there is provided a sheets take-out apparatus comprising a table configured to make contact with lower end sides of a plurality of sheets and loading them in an upright state; a backup plate configured to press and convey the plurality of sheets loaded on the table in a direction of faces of the sheets, thereby supply the sheets to a take-out position; a first floor belt installed so as to be exposed from the table to move the exposed part toward the take-out position in a conveying direction of the sheets, thereby move the lower end sides of the sheets toward the take-out position, a second floor belt installed in a neighborhood of the take-out position from the first floor belt so as to be exposed from the table to move the exposed part toward the take-out position in the conveying direction of the sheets, thereby move the lower end sides of the sheets toward the take-out position; take-out means for taking out the sheets supplied to the take-out position in a direction almost perpendicular to the conveying direction of the sheets; detection means for detecting a posture of the sheets supplied to the take-out position; and control means, on the basis of detection results by the detection means, for controlling a moving speed of at least one of the first and second floor belts and correcting the posture of the sheets supplied to the take-out position.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] Fig. 1 is a plan view showing the schematic structure of the sheets take-out apparatus relating to an embodiment of the present invention,

[0008] Fig. 2 is a front view of the sheets take-out apparatus shown in Fig. 1,

[0009] Fig. 3 is a block diagram showing the control system for controlling the operation of the sheets take-out apparatus shown in Fig. 1,

[0010] Fig. 4 is a partially enlarged diagram for explaining the operation for correcting forward falling of postal matter,

[0011] Fig. 5 is a partially enlarged diagram for explaining the operation for correcting backward falling of postal matter,

[0012] Fig. 6 is a plan view showing the schematic structure of the sheets take-out apparatus relating to another embodiment of the present invention, and

[0013] Fig. 7 is a block diagram showing the control system for controlling the operation of the sheets take-out apparatus shown in Fig. 6.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0014] Hereinafter, the embodiments of the present invention will be explained with reference to the accompanying

drawings.

[0015] Fig. 1 shows a plan view of sheets take-out apparatus 1 (hereinafter, just referred to as take-out apparatus 1) relating to the embodiments of the present invention viewed from above. Fig. 2 shows a front view of take-out apparatus 1. Take-out apparatus 1, for example, takes out a plurality of postal matter P (paper-like materials) dropped in a batch one by one and sends them to a processing portion at the later stage. Further, on apparatus 1, a plurality of postal matter P is dropped in a batch extending over a maximum length of about 2 m.

[0016] Take-out apparatus 1 has flat table 2 for loading a plurality of postal matter P dropped in a batch in a state that they are lined in the face direction with the lower end sides thereof in contact. At the right end of table 2 shown in the drawing, backup plate 3 is installed. Backup plate 3 is uprightly installed almost in the vertical direction almost perpendicular to table 2.

[0017] Backup plate 3 presses postal matter P in the lining direction thereof, that is, in the face direction (in the direction of arrow T1 shown in Fig. 1) and conveys all postal matter P in the direction of arrow T1. As a result, postal matter P at the front end in the conveying direction is supplied to the take-out position at the left end of table 2 shown in the drawing.

[0018] In the neighborhood of the take-out position, lower-stream side floor belt 4 (a second floor belt) is installed. Lower-stream side floor belt 4 has three endless belts 4a, 4b, and 4c lined away from each other in the direction (the direction of arrow T2 shown in Fig. 1) almost perpendicular to the conveying direction (the direction of arrow T1) of postal matter P. Belts 4a, 4b, and 4c are wound and stretched round a plurality of pulleys 5 and a part thereof is exposed toward the lower end sides of postal matter P from table 2. And, lower stream side floor belt 4 having three belts 4a, 4b, and 4c is moved by motor 6 and the parts of three belts 4a, 4b, and 4c exposed upward from table 2 make contact with the lower end sides of postal matter P to move postal matter P toward the take-out position.

[0019] Further, between three belts 4a, 4b, and 4c of lower-stream side floor belt 4, two endless belts 7a and 7b are installed as upstream side floor belt 7 (first floor belt). Upstream side floor belt 7 is wound and stretched round a plurality of pulleys 5 and a part thereof is positioned so as to be exposed upward from table 2. Upstream side floor belt 7 is driven by motor 8 and the exposed part moves toward the take-out position in the stacking direction.

[0020] Upstream side floor belt 7 is projected upward from lower-stream side floor belt 4 and postal matter P moved by upstream side floor belt 7 is transferred and conveyed to lower-stream side floor belt 4.

[0021] The exposed part of lower stream side floor belt 4 can move only several pieces of postal matter P in the neighborhood of the take-out position among postal matter P loaded on table 2, while the exposed part of upper stream side floor belt 7 makes contact with the lower end sides of the postal matter excluding several pieces of postal matter P in the neighborhood of the take-out position among all postal matter P loaded on table 2. Namely, postal matter P in the neighborhood of backup plate 3 is moved by upstream side floor belt 7, is transferred to lower-stream side floor belt 4, and is supplied to the take-out position.

[0022] Backup plate 3 is attached slidably to shaft 9 extending in the conveying direction of postal matter P and the neighborhood of the lower end portion thereof is connected to upstream side floor belt 7. And, backup plate 3, as upstream side floor belt 7 moves, moves in the conveying direction of postal matter P along shaft 9. Namely, backup plate 3 moves toward the take-out position at the same speed as that of upstream side floor belt 7 by motor 8.

[0023] At the take-out position of postal matter P, take-out roller 11 functioning as a take-out means of the present invention is installed. Take-out roller 11 has a lower take-out roller 11a (a first take-out roller) rotating in contact with the neighborhood of the lower end sides of postal matter P supplied to the take-out position and an upper take-out roller 11b (a second take-out roller), separately and independently installed above lower take-out roller 11a, rotating in contact with the neighborhood of the upper end of postal matter P. Rollers 11a and 11b are arranged in a posture that the rotation shafts thereof extend almost in the vertical direction and the outer peripheral surfaces thereof rotate in contact with the surface of postal matter P. And, take-out roller 11, that is, lower take-out roller 11a and upper take-out roller 11b are rotated in a predetermined direction, thus postal matter P supplied to the take-out position is taken out in the direction perpendicular to the conveying direction and almost in the horizontal direction (the direction of arrow T2 shown in Fig. 1) (hereinafter, this direction is referred to as the take-out direction), that is, in the upward direction in Fig. 1.

[0024] The rotation shaft of upper take-out roller 11b is rotatably attached to the front end of swing arm 12 (the fourth support member). The base end of swing arm 12 is installed rotatably round the rotation shaft attached to a frame (not drawn) of take-out apparatus 1 and is pressed clockwise in Fig. 1 by a spring not drawn. Namely, swing arm 12 functions so as to press upper take-out roller 11b attached to the front end thereof to postal matter P supplied to the take-out position at a fixed pressure.

[0025] At the base end of swing arm 12, projection 12a is installed and projection 12a is detected by sensor 13 (a detection means). Sensor 13 detects projection 12a at a plurality of positions. Namely, by detection of projection 12a by sensor 13, the swing angle of swing arm 12 is detected up to $\pm 20^\circ$ at an interval of 5° . By doing this, the projection amount of upper take-out roller 11b attached to the front end of swing arm 12 in the conveying direction can be detected. In other words, upper take-out roller 11b is pressed by postal matter P supplied to the take-out position, and when

swing arm 12 swings against the pressing force, the angle of swing arm 12 is detected via sensor 13, and the projection position of upper take-out roller 11b in the conveying direction is detected.

[0026] Further, upper take-out roller 11b, via a plurality of pulleys 10 and timing belts 14, is connected to motor 15 (a second drive portion) and when motor 15 is rotated in a predetermined direction, rotates in the take-out direction of postal matter P.

[0027] On the other hand, lower take-out roller 11a, similarly to upper take-out roller 11b mentioned above, is attached rotatably to the front end of swing arm 12 (a third support member) and is arranged so as to press the surface of postal matter P at a fixed pressure. When the swing angle of swing arm 12 is detected by sensor 13 (the detection means), the projection amount of lower take-out roller 11a is detected. Further, lower take-out roller 11a is rotated in the take-out direction of postal matter P by motor 15 (the first drive portion).

[0028] At the separated position on the upstream side of take-out roller 11 in the take-out direction of postal matter P supplied to the take-out position, auxiliary roller 16 having the same structure as that of take-out roller 11 is installed. Auxiliary roller 16 has a lower auxiliary roller 16a (a first auxiliary roller) follow-rotating in contact with the neighborhood of the lower end sides of postal matter P supplied to the take-out position and upper auxiliary roller 16b (a second auxiliary roller) separately and independently installed above lower auxiliary roller 16a follow-rotating in contact with the neighborhood of the upper end of postal matter P. Rollers 16a and 16b are arranged in a posture that the rotation shafts thereof extend almost in the vertical direction and the outer peripheral surfaces thereof make contact with the surface of postal matter P and rotate according to postal matter P to be taken out.

[0029] The rotation shaft of upper auxiliary roller 16b is rotatably attached to the front end of swing arm 17 (a second support member). The base end of swing arm 17 is installed rotatably round the rotation shaft attached to a frame (not drawn) of take-out apparatus 1 and is pressed clockwise in Fig. 1 by a spring not drawn. Namely, swing arm 17 functions so as to press upper auxiliary roller 16b attached to the front end thereof to postal matter P supplied to the take-out position at a fixed pressure.

[0030] At the base end of swing arm 17, projection 17a is installed and projection 17a is detected by sensor 18 (a detection means). Sensor 18 detects projection 12a at a plurality of positions. Namely, by detection of projection 17a by sensor 18, the swing angle of swing arm 17 is detected up to $\pm 20^\circ$ at an interval of 5° . By doing this, the projection amount of upper auxiliary roller 16b attached to the front end of swing arm 17 in the conveying direction can be detected. In other words, upper auxiliary roller 16b is pressed by postal matter P supplied to the take-out position, and when swing arm 17 swings against the pressing force, the angle of swing arm 17 is detected via sensor 18, and the projection position of upper auxiliary roller 16b in the conveying direction is detected.

[0031] On the other hand, lower auxiliary roller 16a, similarly to upper auxiliary roller 16b mentioned above, is attached rotatably to the front end of swing arm 17 (the first support member) and is arranged so as to press the surface of postal matter P at a fixed pressure. The swing angle of swing arm 17 is detected by sensor 18 (the detection means) and the projection amount of lower auxiliary roller 16a is detected.

[0032] On the lower-stream side of postal matter P supplied to the take-out position in the take-out direction, feed roller 21 and reverse roller 22 are installed. Feed roller 21 is installed in the rolling and touching position with the surface of postal matter P to be taken out on the rolling and touching side of take-out roller 11, holds and rotates postal matter P between reverse roller 22 and itself, thereby feeds postal matter P. Reverse roller 22 gives torque to postal matter P in the opposite direction of the take-out direction thereof and functions so as to separate second postal matter P and subsequent postal matter taken out by postal matter P fed by feed roller 21.

[0033] Fig. 3 shows a block diagram of the control system for controlling the operation of take-out apparatus 1 aforementioned.

[0034] To controller 20 functioning as a control means for controlling the operation of take-out apparatus 1, sensor 13a for detecting the projection position of lower take-out roller 11a, sensor 13b for detecting the projection position of upper take-out roller 11b, sensor 18a for detecting the projection position of lower auxiliary roller 16a, and sensor 18b for detecting the projection position of upper auxiliary roller 16b are connected.

[0035] Further, to controller 20, motor 8 for moving upper stream side floor belt 7 and backup plate 3, motor 6 for moving lower stream side floor belt 4, motor 15a for rotating lower take-out roller 11a, motor 15b for rotating upper take-out roller 11b, and motor 23 for rotating feed roller 21 are connected.

[0036] Hereinafter, the operation of take-out apparatus 1 having the aforementioned structure and particularly the operation for correcting the posture of postal matter P supplied to the take-out position will be explained by referring to Figs. 4 and 5. Fig. 4 shows a state partially enlarged that the upper end sides of postal matter P supplied to the take-out position which are separated from table 2 are inclined in the direction separating from backup plate 3 and Fig. 5 shows a state that the upper end sides of postal matter P supplied to the take-out position are inclined toward backup plate 3.

[0037] As shown in Fig. 4, when the upper end sides of postal matter P are inclined toward the left in the drawing, upper auxiliary roller 16b is pressed by postal matter P more greatly than lower auxiliary roller 16a, so that difference L is generated in the projection amount between two rollers 16a and 16b. Controller 20 detects difference L as falling

of postal matter P via sensors 18a and 18b and corrects the posture of postal matter P so as to eliminate difference L.

[0038] Namely, in this case, controller 20, to make moving speed V1 of lower-stream side floor belt 4 higher than moving speed V2 of upstream side floor belt 7, controls motors 6 and 8. Then, the lower end sides of postal matter P on lower stream side floor belt 4 are moved toward the take-out position at a comparatively high speed, while the upper end sides of postal matter P are moved at a comparatively low speed depending on moving speed V2 of upper stream side floor belt 7 and the falling of postal matter P is corrected. After correction, moving speed V1 of lower-stream side floor belt 4 and moving speed V2 of upstream side floor belt 7 are controlled to the same speed and the apparatus is returned to the normal supply operation.

[0039] Further, as shown in Fig. 5, when the upper end sides of postal matter P are inclined toward the right in the drawing, postal matter P presses lower auxiliary roller 16a more greatly than upper auxiliary roller 16b, so that difference L is generated in the projection amount between two rollers 16a and 16b. Controller 20 detects difference L as falling of postal matter P via sensors 18a and 18b and corrects the posture of postal matter P so as to eliminate difference L.

[0040] Namely, in this case, controller 20, to make moving speed V1 of lower-stream side floor belt 4 lower than moving speed V2 of upstream side floor belt 7, controls motors 6 and 8. Then, the lower end sides of postal matter P on lower stream side floor belt 4 are moved toward the take-out position at a comparatively low speed, while the upper end sides of postal matter P are moved at a comparatively high speed depending on moving speed V2 of upper stream side floor belt 7 and the falling of postal matter P is corrected. After correction, moving speed V1 of lower-stream side floor belt 4 and moving speed V2 of upstream side floor belt 7 are controlled to the same speed and the apparatus is returned to the normal supply operation. Further, in this case, there is the possibility that the moving speed of lower-stream side floor belt 4 may be decreased, so that a state that after correction, postal matter P at the front end in the conveying direction is not supplied to the take-out position may be considered. In this case, feed roller 21 is stopped temporarily, and the take-out of postal matter P is stopped once, and at the point of time when postal matter P at the front end in the conveying direction is supplied to the take-out position, the take-out is restarted.

[0041] When the falling of postal matter P is corrected as mentioned above, the surface of postal matter P evenly makes contact with two take-out rollers 11a and 11b and two auxiliary rollers 16a and 16b and stable take-out is enabled. Inversely, when postal matter P is inclined as shown in Figs. 4 and 5, if it is intended to take out postal matter P, postal matter P may be skewed or damaged and when the inclination angle is larger than the allowable value, it is impossible to take out postal matter P. Namely, by adopting the aforementioned control of the present invention, by a simple apparatus constitution, the posture of postal matter P supplied to the take-out position can be corrected easily and surely and postal matter P can be taken out stably.

[0042] Further, as mentioned above, a difference in the projection position between two auxiliary rollers 16a and 16b which roll and make contact with postal matter P to be taken out and follow-rotate is detected, and falling of postal matter P is detected, thus the falling state of postal matter P can be detected more precisely. Namely, according to the constitution of this embodiment, using two take-out rollers 11a and 11b, the falling of postal matter P can be detected similarly. However, vibration generated when take-out rollers 11a and 11b are rotated can be a noise component, so that precise detection may not be performed. Therefore, detection of falling of postal matter P using two auxiliary rollers 16a and 16b to which no driving force is transferred is effective.

[0043] Fig. 6 shows a plan view of take-out apparatus 30 relating to another embodiment of the present invention. Further, Fig. 7 shows a block diagram of the control system for controlling the operation of take-out apparatus 30. Take-out apparatus 30 has almost the same structure as that of take-out apparatus 1 mentioned above except that upstream side floor belt 7 has one belt, and lower-stream side floor belt 4 has two belts 4a and 4b, and two motors 6a and 6b for driving independently two lower-stream side floor belts 4a and 4b are installed.

[0044] Namely, in take-out apparatus 30, controller 20 detects the respective projection positions of two take-out rollers 11a and 11b and two auxiliary rollers 16a and 16b via sensors 13a, 13b, 18a, and 18b, on the basis of the detection results, detects three-dimensionally the posture of postal matter P supplied to the take-out position, and controls the moving speeds of upper stream side floor belt 7 and two lower stream side floor belts 4a and 4b so as to make the posture of postal matter P upright. At this time, the posture of postal matter P can be detected not only as the aforementioned falling but also as inclination and torsion in the take-out direction.

[0045] For example, when the end portion of postal matter P to be taken out on the lower stream side (the rear side of the apparatus) in the take-out direction is inclined more toward backup plate 3 than the end portion of the upper stream side (the front side), the moving speed of floor belt 4a on the lower stream side in the take-out direction is made higher than the moving speed of floor belt 4b on the upper stream side in the take-out direction. Inversely, when the end portion of postal matter P on the upper stream side in the take-out direction is inclined more toward backup plate 3 than the end portion on the lower stream side, the moving speed of floor belt 4b on the upper stream side in the take-out direction is made higher than the moving speed of floor belt 4a on the lower stream side in the take-out direction.

[0046] Therefore, even if postal matter P to be taken out is in any posture, it can be corrected uprightly and postal matter P can be taken out stably. Further, such control can be applied to take-out apparatus 1 having three lower stream side floor belts 4a, 4b, and 4c aforementioned and in this case, it is desirable to control central belt 4b to a fixed

speed and adopt the aforementioned control to belts 4a and 4c on both sides.

[0047] Further, the present invention is not limited straight to the aforementioned embodiment and at the execution stage, within a range that is not deviated from the object of the present invention, the components may be modified and concretized. Further, by appropriate combinations of a plurality of components disclosed in the aforementioned embodiment, various inventions can be formed. For example, from all the components indicated in the aforementioned embodiment, some components may be deleted. Furthermore, components extending over different embodiments may be combined properly.

[0048] For example, in the aforementioned embodiment, using two take-out rollers 11a and 11b and two auxiliary rollers 16a and 16b, with the surface of postal matter P at the take-out position, the rollers make contact at four locations and the projection position of each roller at each position is detected. However, it is possible to use one take-out roller and detect the projection position of the roller at three locations and also in this case, the posture of postal matter P can be detected three-dimensionally.

[0049] Further, in the aforementioned embodiment, a case that the moving speed of upper stream side floor belt 7 and the moving speed of lower stream side floor belt 4 are controlled, thus the posture of postal matter P is corrected is explained. However, the present invention is not limited to it and for example, it is possible to independently project or move back four rollers 11a, 11b, 16a, and 16b from postal matter P, thereby correct the posture of postal matter P.

[0050] Hereinafter, some concrete control operation examples by take-out apparatus 1 explained by referring to Figs. 1 and 2 will be explained.

[Operation example 1]

[0051] When the tolerance of the take-out position in the conveying direction where postal matter P can be stably taken out is assumed as buffer B, the moving speeds of floor belts 4 and 7 can be expressed as a function of buffer B, the projection position of each of rollers 11a, 11b, 16a, and 16b respectively detected via sensors 13a, 13b, 18a, and 18b mentioned above, and processing speed K [sheets/h] of take-out apparatus 1. Further, assuming the projection position of each of take-out rollers 11a and 11b detected via sensors 13a and 13b as P₁, the projection position of each of auxiliary rollers 16a and 16b detected via sensors 18a and 18b as P₂, and the tilt angle of postal matter P supplied to the take-out position as L, the moving speed functions of floor belts 4 and 7 are expressed by the following formulas (1) to (3).

$$V_1 = f(L, V_2) \quad (1)$$

$$V_2 = f(B, K) \quad (2)$$

$$B = f(P_1, P_2, L) \quad (3)$$

[0052] When controlling V₁ and V₂ on the basis of the formulas (1) to (3) and grouping possible cases, a control table such as Table 1 is obtained. The combinations given in Table 1 are expressed by the names when the states of P₁, P₂, and L are coded as shown below using a default speed of V. Further, a special speed independent of the formulas (1) to (3) is assumed as V_x.

P₁

- 1: Limited position (normal take-out limited position) where roller 11 is pushed in by postal matter
- 2: Reference position (ideal position))
- 3: Projection limited position of roller 11 (feed startable position)

P₂

- 1: Limited position (normal take-out limited position) where roller 16 is pushed in by postal matter
- 2: Others

L

- a: State shown in Fig. 4 (forward falling)

b: Upright

c: State shown in Fig.5 (backward falling)

[Table 1]

Combination (P ₁ -P ₂ -L)	V ₁ , V ₂	Feed continued?	Remarks
1-1-a	V ₁ =V _X , V ₂ =0	N	To 1-1-b
1-1-b	V ₁ =V ₂ =0	Y	
1-1-c	V ₁ =V ₂ =0→ V ₁ =-V _X , V ₂ =-V _X	N	Retry after reversion
1-2-a	V ₁ =V _X , V ₂ =0	N	To 1-2-b
1-2-b	V ₁ =V ₂ =0	Y	
1-2-c	V ₁ =V ₂ =0→ V ₁ =-V _X , V ₂ =-V _X	N	Retry after reversion
2-1-a	V ₁ =V _X , V ₂ =0	N	To 2-1-b
2-1-b	V ₁ =V ₂ =0	Y	
2-1-c	V ₁ =V ₂ =0→ V ₁ =-V _X , V ₂ =-V _X	N	Retry after reversion
2-2-a	V ₁ =f(L), V ₂ =V(V ₁ >V ₂)	Y	
2-2-b	V ₁ =V ₂ =V or V ₁ =V ₂ =0	Y	Pre-state kept
2-2-c	V ₁ =f(L), V ₂ =V(V ₁ <V ₂)	N	To 2-2-b
3-1-a	V ₁ =V _X , V ₂ =0	N	To 3-1-b
3-1-b	V ₁ =V ₂ =0	Y	
3-1-c	V ₁ =V ₂ =0→ V ₁ =-V _X , V ₂ =-V _X	N	Retry after reversion
3-2-a	V ₁ =f(L), V ₂ =V(V ₁ >V ₂)	Y	
3-2-b	V ₁ =V ₂ =V	Y	
3-2-c	V ₁ =f(L), V ₂ =V(V ₁ <V ₂)	N	To 3-2-b

[0053] As shown in Table 1, according to the supposed state of postal matter P, the control of V₁ and V₂ is switched, thus continuous stable feed can be performed. Particularly, when the posture of postal matter P cannot be corrected only by changing the moving speeds of V₁ and V₂, the lower-stream side floor belt 4 is moved once in the reverse direction, and then the retry operation is repeated, thus take-out apparatus 1 can be prevented from complete stop.

[0054] When the aforementioned control based on Table 1 is adopted and in take-out apparatus 1, the take-out operation is performed at a processing speed of 40,000 sheets/hour (a mean length of 200 mm is supposed) and at a conveying speed of 3.6 m/s of postal matter P with a width of 0.15 to 6 mm and a length of 135 to 255 mm, the following results are obtained. Here, to improve the processing capacity of take-out apparatus 1, a fixed gap method with the take-out gap of postal matter P fixed is adopted. Namely, a strict processing speed varies with the length of postal matter P to be handled. Further, [page 14] the mean length 200 mm is supposed, so that the gap is set to about 124 mm. Furthermore, buffer B (the movable range of take-out roller 11 and auxiliary roller 16) is assumed as 6 mm and the tilt angle of postal matter P, assuming within ±5° as a normal posture, is detected up to ±20° every 5°. Furthermore, when the default speed V (≡ V₂) is set to 66.7 mm/s, and V₁ is linearly changed for the detection angle within a range from 73.3 to 60.0 mm/s (±10%), and V_X is set to 10 mm/s, even if postal matter P is intentionally pushed down up to ±20°, abnormal take-out due to a skew of 2° or more can be controlled to 0.2% or less and the speed reduction due to the temporary stop of take-out can be controlled to 3% or less.

[Operation example 2]

[0055] Here, it is premised to guide a user by handling precautions and serviceman's explanation so as to preset postal matter P in a forward falling state (the state shown in Fig. 4) in take-out apparatus 1 and control not to set postal matter P in a backward falling state (the state shown in Fig. 5) and in an upright state. Further, on the assumption of such control, moving speed V_1 of lower-stream side floor belt 4 is not made lower than moving speed V_2 of upstream side floor belt 7. Namely, postal matter P is all set in a forward falling state, so that a case of an occurrence of backward falling may not be considered. On the other hand, as explained in operation example 1, when correcting the posture of backward falling, there is the possibility that according to the state of postal matter P, the take-out operation by take-out roller 11 may be stopped temporarily. However, in operation example 2, it is not required, so that the reduction in the processing speed due to the temporary stop can be prevented.

[0056] Further, the control range of V_1 is limited, so that the control combination of V_1 and V_2 is simplified. A control table of possible cases in operation example 2 is shown in Table 2. The numerals used in Table 2 are the same as those in Table 1.

[Table 2]

Combination ($P_1 \cdot P_2 \cdot L$)	V_1, V_2	Feed continued?	Remarks
1-1-a	$V_1 = V_X, V_2 = 0$	N	To 1-1-b
1-1-b	$V_1 = V_2 = 0$	Y	
1-2-a	$V_1 = V_X, V_2 = 0$	N	To 1-2-b
1-2-b	$V_1 = V_2 = 0$	Y	
2-1-a	$V_1 = V_X, V_2 = 0$	N	To 2-1-b
2-1-b	$V_1 = V_2 = 0$	Y	
2-2-a	$V_1 = f(L),$ $V_2 = V(V_1 > V_2)$	Y	To 2-2-b
2-2-b	$V_1 = V_2 = V$ or $V_1 = V_2 = 0$	Y	Pre-state kept
3-1-a	$V_1 = V_X, V_2 = 0$	N	To 3-1-b
3-1-b	$V_1 = V_2 = 0$	Y	
3-2-a	$V_1 = f(L),$ $V_2 = V(V_1 > V_2)$	Y	
3-2-b	$V_1 = V_2 = V$	Y	

[0057] The forward falling angle of postal matter P to be set is set to about 10° and on the basis of Table 2, similarly to operation example 1, when the take-out operation is performed at a processing speed of 40,000 sheets/hour (a mean length of 200 mm is supposed) and at a conveying speed of 3.6 m/s of postal matter P with a width of 0.15 to 6 mm and a length of 135 to 255 mm, abnormal take-out due to a skew of 2° or more can be controlled to 0.1% or less and the speed reduction due to the temporary stop of take-out can be controlled to 0.2% or less.

[Operation example 3]

[0058] Here, the projection positions of two take-out rollers 11a and 11b are detected by sensors 13a and 13b and the falling state of postal matter P is detected by take-out roller 11. Therefore, the posture of postal matter P is detected at four locations of two take-out rollers 11a and 11b and two auxiliary rollers 16a and 16b in total as a projection position of each roller and all the postures of postal matter P can be detected accurately.

[0059] In this case, the control operation by take-out apparatus 1 can be explained basically by adding detection angle L_p by take-out roller 11 to the relational expression in operation example 1 mentioned above. The functions at this time are expressed by the following formulas (4) to (6).

$$V_1 = f(L, L_p, V_2) \quad (4)$$

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$$V_2 = f(B, K) \quad (5)$$

$$B = f(P_1, P_2, L, L_p) \quad (6)$$

[0060] Further, a control table at this time can be obtained by adding L_p to the table of operation example 1 mentioned above. The control table in operation example 3 is shown in Tables 3a and 3b. Further, numeral L_p in Table 3 indicates the same meaning as that of L .

[Table 3]

Combination (P_1 - P_2 - L - L_p)	V_1, V_2	Feed continued?	Remarks
1-1-a-a	$V_1=V_X, V_2=0$	N	To 1-1-b-b
1-1-a-b	$V_1=V_X, V_2=0$	N	To 1-1-b-b
1-1-a-c	$V_1=V_2=0 \rightarrow$ $V_1=V_X, V_2=-V_X$	N	Retry after reversion
1-1-b-a	$V_1=V_X, V_2=0$	N	To 1-1-b-b
1-1-b-b	$V_1=V_2=0$	Y	
1-1-b-c	$V_1=V_2=0 \rightarrow$ $V_1=-V_X, V_2=-V_X$	N	Retry after reversion
1-1-c-a	$V_1=V_2=0 \rightarrow$ $V_1=-V_X, V_2=-V_X$	N	Retry after reversion
1-1-c-b	$V_1=V_2=0 \rightarrow$ $V_1=-V_X, V_2=-V_X$	N	Retry after reversion
1-1-c-c	$V_1=V_2=0 \rightarrow$ $V_1=-V_X, V_2=-V_X$	N	Retry after reversion
1-2-a-a	$V_1=V_X, V_2=0$	N	To 1-2-b-b
1-2-a-b	$V_1=V_X, V_2=0$	N	To 1-2-b-b
1-2-a-c	$V_1=V_2=0 \rightarrow$ $V_1=-V_X, V_2=-V_X$	N	Retry after reversion
1-2-b-a	$V_1=V_X, V_2=0$	N	To 1-2-b-b
1-2-b-b	$V_1=V_2=0$	Y	
1-2-b-c	$V_1=V_2=0 \rightarrow$ $V_1=-V_X, V_2=-V_X$	N	Retry after Reversion
1-2-c-a	$V_1=V_2=0 \rightarrow$ $V_1=-V_X, V_2=-V_X$	N	Retry after Reversion
1-2-c-b	$V_1=V_2=0 \rightarrow$ $V_1=-V_X, V_2=-V_X$	N	Retry after Reversion
1-2-c-c 1-2-c-c	$V_1=V_2=0 \rightarrow$ $V_1=-V_X, V_2=-V_X$	N	Retry after Reversion
2-1-a-a	$V_1=V_X, V_2=0$	N	To 2-1-b-b
2-1-a-b	$V_1=V_X, V_2=0$	N	To 2-1-b-b
2-1-a-c	$V_1=V_X, V_2=0$	N	To 2-1-b-b
2-1-b-a	$V_1=V_2=0$	Y	
2-1-b-b	$V_1=V_2=0$	Y	

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[Table 3] (continued)

Combination (P ₁ -P ₂ -L-L _p)	V ₁ , V ₂	Feed continued?	Remarks
2-1-b-c	V ₁ =V ₂ =0	Y	
2-1-c-a	V ₁ =V ₂ =0→ V ₁ =-V _X , V ₂ =-V _X	N	Retry after Reversion
2-1-c-b	V ₁ =V ₂ =0→ V ₁ =-V _X , V ₂ =-V _X	N	Retry after Reversion
2-1-c-c	V ₁ =V ₂ =0→ V ₁ =-V _X , V ₂ =-V _X	N	Retry after Reversion
2-2-a-a	V ₁ =f(L, L _p), V ₂ =V(V ₁ >V ₂)	Y	
2-2-a-b	V ₁ =f(L, L _p), V ₂ =V(V ₁ >V ₂)	Y	
2-2-a-c	V ₁ =V ₂ =0→ V ₁ =-V _X , V ₂ =-V _X	N	Retry after Reversion
2-2-b-a	V ₁ =f(L, L _p), V ₂ =V(V ₁ >V ₂)	Y	
2-2-b-b	V ₁ =V ₂ =V or V ₁ =V ₂ =0	Y	Pre-state kept
2-2-b-c	V ₁ =f(L, L _p), V ₂ =V(V ₁ <V ₂)	N	To 2-2-b-b
2-2-c-a	V ₁ =V ₂ =0→ V ₁ =-V _X , V ₂ =-V _X	N	Retry after Reversion
2-2-c-b	V ₁ =f(L, L _p), V ₂ =V(V ₁ <V ₂)	Y	To 2-2-b-b
2-2-c-c	V ₁ =f(L, L _p), V ₂ =V(V ₁ <V ₂)	Y	To 2-2-b-b
3-1-a-a	V ₁ =V _X , V ₂ =0	N	To 3-1-b-b
3-1-a-b	V ₁ =V _X , V ₂ =0	N	To 3-1-b-b
3-1-a-c	V ₁ =V _X , V ₂ =0	N	To 3-1-b-b
3-1-b-a	V ₁ =V _X , V ₂ =0	N	To 3-1-b-b
3-1-b-b	V ₁ =V ₂ =0	Y	
3-1-b-c	V ₁ =V _X , V ₂ =0	N	To 3-1-b-b
3-1-c-a	V ₁ =V ₂ =0→ V ₁ =-V _X , V ₂ =-V _X	N	Retry after Reversion
3-1-c-b	V ₁ =V ₂ =0→ V ₁ =-V _X , V ₂ =-V _X	N	Retry after Reversion
3-1-c-c	V ₁ =V ₂ =0→ V ₁ =-V _X , V ₂ =-V _X	N	Retry after Reversion
3-2-a-a	V ₁ =f(L, L _p), V ₂ =V(V ₁ >V ₂)	Y	
3-2-a-b	V ₁ =f(L, L _p), V ₂ =V(V ₁ >V ₂)	Y	
3-2-a-c	V ₁ =V ₂ =0→ V ₁ =-V _X , V ₂ =-V _X	N	Retry after Reversion

[Table 3] (continued)

Combination (P_1 - P_2 - L - L_p)	V_1, V_2	Feed continued?	Remarks
3-2-b-a	$V_1=f(L, L_p),$ $V_2=V(V_1>V_2)$	Y	
3-2-b-b	$V_1=V_2=V$	Y	
2-2-b-c	$V_1=f(L, L_p),$ $V_2=V(V_1<V_2)$	N	To 3-2-b-b
3-2-c-a	$V_1=V_2=0 \rightarrow$ $V_1=-V_X, V_2=-V_X$	N	Retry after Reversion
3-2-c-b	$V_1=f(L, L_p),$ $V_2=V(V_1<V_2)$	N	To 3-2-b-b
3-2-c-c	$V_1=f(L, L_p),$ $V_2=V(V_1<V_2)$	N N	To 3-2-b-b

[0061] Similarly to operation example 2 mentioned above, when the take-out operation is performed at a processing speed of 40,000 sheets/hour (a mean length of 200 mm is supposed) and at a conveying speed of 3.6 m/s of postal matter P with a width of 0.15 to 6 mm and a length of 135 to 255 mm, even if postal matter P is intentionally pushed down up to $\pm 20^\circ$, abnormal take-out due to a skew of 2° or more can be controlled to 0.1% or less and the speed reduction due to the temporary stop of take-out can be controlled to 3% or less. Here, the tilt angle of postal matter P by take-out roller 11, similarly to the detection by auxiliary roller 16, assuming within $\pm 5^\circ$ as a normal posture, is detected up to $\pm 20^\circ$ every 5° . L and L_p are always compared, and a larger detection value is adopted, and it is made linearly change to the detection angle. The other values are the same as those of operation example 1.

[Operation example 4]

[0062] Also in this case, similarly to operation example 2 mentioned above, postal matter P is guided beforehand so as to enter a forward falling state and is controlled not to be set in a backward falling state and an upright state. Under such control, in operation example 4, similarly to operation example 2, moving speed V_1 of lower-stream side floor belt 4 is set not lower than moving speed V_2 of upstream side floor belt 7. Namely, postal matter P1 is all set in the forward falling state, so that a case of an occurrence of backward falling may not be considered. In this case, in operation example 4, take-out roller 11 also detects the tilt angle of postal matter P, so that compared with operation example 2, the posture of postal matter P can be detected more accurately, thus a take-out operation of postal matter P can be performed stably. When correcting the backward falling, the take-out operation by take-out roller 11 must be stopped temporarily. However, operation example 4 does not require it, thus the reason that the reduction in the processing speed can be prevented is the same as that of operation example 2.

[0063] Furthermore, as compared with operation example 3, the variable range of moving speed V_1 of lower-stream side floor belt 4 is limited, so that the control combination of V_1 and V_2 is simplified. A control table in operation example 4 is shown in Table 4. Further, numeral L_p in Table 4 indicates the same means as that of L.

[Table 4]

Combination (P_1 - P_2 - L - L_p)	V_1, V_2	Feed continued?	Remarks
1-1-a-a	$V_1=V_X, V_2=0$	N	To 1-1-b-b
1-1-a-b	$V_1=V_X, V_2=0$	N	To 1-1-b-b
1-1-b-a	$V_1=V_X, V_2=0$	N	To 1-1-b-b
1-1-b-b	$V_1=V_2=0$	Y	
1-2-a-a	$V_1=V_X, V_2=0$	N	To 1-2-b-b
1-2-a-b	$V_1=V_X, V_2=0$	N	To 1-2-b-b
1-2-b-a	$V_1=V_X, V_2=0$	N	To 1-2-b-b

[Table 4] (continued)

Combination (P ₁ -P ₂ -L-P _p)	V ₁ , V ₂	Feed continued?	Remarks
1-2-b-b	V ₁ =V ₂ =0	Y	
2-1-a-a	V ₁ =V _X , V ₂ =0	N	To 2-1-b-b
2-1-a-b	V ₁ =V _X , V ₂ =0	N	To 2-1-b-b
2-1-b-a	V ₁ =V ₂ =0	Y	
2-1-b-b	V ₁ =V ₂ =0	Y	
2-2-a-a	V ₁ =f(L, L _p), V ₂ =V(V ₁ >V ₂)	Y	
2-2-a-b	V ₁ =f(L, L _p), V ₂ =V(V ₁ >V ₂)	Y	
2-2-b-a	V ₁ =f(L, L _p), V ₂ =V(V ₁ >V ₂)	Y	
2-2-b-b	V ₁ =V ₂ =V or V ₁ =V ₂ =0	Y	Pre-state kept
3-1-a-a	V ₁ =V _X , V ₂ =0	N	To 3-1-b-b
3-1-a-b	V ₁ =V _X , V ₂ =0	N	To 3-1-b-b
3-1-b-a	V ₁ =V _X , V ₂ =0	N	To 3-1-b-b
3-1-b-b	V ₁ =V ₂ =0	Y	
3-2-a-a	V ₁ =f(L, L _p), V ₂ =V(V ₁ >V ₂)	Y	
3-2-a-b	V ₁ =f(L, L _p), V ₂ =V(V ₁ >V ₂)	Y	
3-2-b-a	V ₁ =f(L, L _p), V ₂ =V(V ₁ >V ₂)	Y	
3-2-b-b	V ₁ =V ₂ =V	Y	

[0064] Similarly to operation example 2, the forward falling angle of postal matter P to be set is set to about 10° and when the take-out operation is performed at a processing speed of 40,000 sheets/hour (a mean length of 200 mm is supposed) and at a conveying speed of 3.6 m/s of postal matter P with a width of 0.15 to 6 mm and a length of 135 to 255 mm, abnormal take-out due to a skew of 2° or more can be controlled to 0.05% or less and the speed reduction due to the temporary stop of take-out can be controlled to 0.2% or less. Further, L and L_p are always compared and the decision method adopting a larger detection value is the same as that of operation example 3.

[0065] In operation examples 1 to 4 mentioned above, a case that the projection positions of take-out roller 11 and auxiliary roller 16 are detected by sensors 13 and 18 is explained. However, the present invention is not limited to it and a potentiometer or a rotary encoder can be used.

[0066] As explained above in detail, in the take-out apparatus of the present invention, the projection positions of two take-out rollers 11a and 11b and two auxiliary rollers 16a and 16b are detected by the sensors, thus on the basis of the detection results, the posture of postal matter P including the falling, inclination, and distortion can be detected three-dimensionally, and the moving speeds of lower stream side floor belt 4 and upper stream side floor belt 7 are variably controlled, so that by correcting the posture of fallen sheets so as to raise it, the sheets can be supplied.

[0067] Therefore, the skew which is a conventional problem can be corrected, and the failure of interruption of the continuous supply operation of postal matter P can be suppressed to a minimum, and a highly efficient apparatus can be realized by a simpler constitution than the conventional.

[0068] Although the above-mentioned embodiment of the present invention explained postal matters as sheets, the present invention is not limited to this but may be applied to banknotes, negotiable securities, etc. as sheets.

[0069] The sheets take-out apparatus of the present invention has the aforementioned constitution and operation, so that by a simple constitution, the posture of sheets can be corrected surely and sheets can be taken out stably.

[0070] 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 sheets take-out apparatus comprising:

a table (2) configured to make contact with lower end sides of a plurality of sheets (P) and loading them in an upright state;
 a backup plate (3) configured to press and convey the plurality of sheets loaded on the table in a direction of faces of the sheets, thereby supply the sheets to a take-out position;
 a first floor belt (7) installed so as to be exposed from the table to move the exposed part toward the take-out position in a conveying direction (T1) of the sheets, thereby move the lower end sides of the sheets toward the take-out position;
 a second floor belt (4) installed in a neighborhood of the take-out position from the first floor belt so as to be exposed from the table to move the exposed part toward the take-out position in the conveying direction of the sheets, thereby move the lower end sides of the sheets toward the take-out position;
 take-out means (11) for taking out the sheets supplied to the take-out position in a direction (T2) almost perpendicular to the conveying direction (T1) of the sheets;
 detection means (13; 18) for detecting a posture of the sheets supplied to the take-out position; and
 control means (20), on the basis of detection results by the detection means, for controlling a moving speed of at least one of the first and second floor belts and correcting the posture of the sheets supplied to the take-out position.

2. The sheets take-out apparatus according to Claim 1 further comprising:

a first auxiliary roller (16a), arranged behind in the take-out direction of the sheets by the take-out means, configured to follow-rotate in contact with a neighborhood of the lower end sides of the sheets taken out by the take-out means;
 a first support member (17) configured to support movably the first auxiliary roller in the conveying direction of the sheets so as to allow the first auxiliary roller to rotate and touch the sheets at a fixed pressure;
 a second auxiliary roller (16b) configured to follow-rotate in contact with the sheets at a position separated upward from the first auxiliary roller; and
 a second support member (17) configured to support movably the second auxiliary roller in the conveying direction of the sheets so as to allow the second auxiliary roller to rotate and touch the sheets at a fixed pressure,

wherein the detection means (18) detects displacements of the first and second support members, thereby detects the posture of the sheets.

3. The sheets take-out apparatus according to Claim 2, wherein the take-out means (11) includes:

a first take-out roller (11a) configured to rotate and touch in a neighborhood of the lower end sides of the sheets supplied to the take-out position;
 a third support member (12) configured to support movably the first take-out roller in the conveying direction of the sheets so as to allow the first take-out roller to rotate and touch the sheets at a fixed pressure;
 a first drive portion (15) configured to rotate the first take-out roller in the take-out direction of the sheets;
 a second take-out roller (11b) configured to rotate and touch the sheets at a position separated upward from the first take-out roller;
 a fourth support member (12) configured to support movably the second take-out roller in the conveying direction of the sheets so as to allow the second take-out roller to rotate and touch the sheets at a fixed pressure; and
 a second drive portion (15) configured to rotate the second take-out roller in the take-out direction of the sheets,

wherein the detection means (13, 18) detects displacements of the first to fourth support members, thereby detects the posture of the sheets.

- 5 4. The sheets take-out apparatus according to one of Claims 1 to 3, wherein the control means (20), when the detection means (13, 18) detects that upper end sides of the sheets (P) are inclined in a direction separating from the backup plate (3), controls a moving speed of the second floor belt (4) so as to be higher than a moving speed of the first floor belt (7) and when the detection means detects that the upper end sides of the sheets are inclined toward the backup plate, controls the moving speed of the second floor belt so as to be lower than the moving speed of the first floor belt.

- 10 5. The sheets take-out apparatus according to one of Claims 1 to 4, wherein:

the second floor belt (4) has a plurality of independent movable belts (4 a-c) lined in the take-out direction of the sheets and

15 the control means (20), on the basis of the detection results by the detection means, controls independently moving speeds of the plurality of belts.

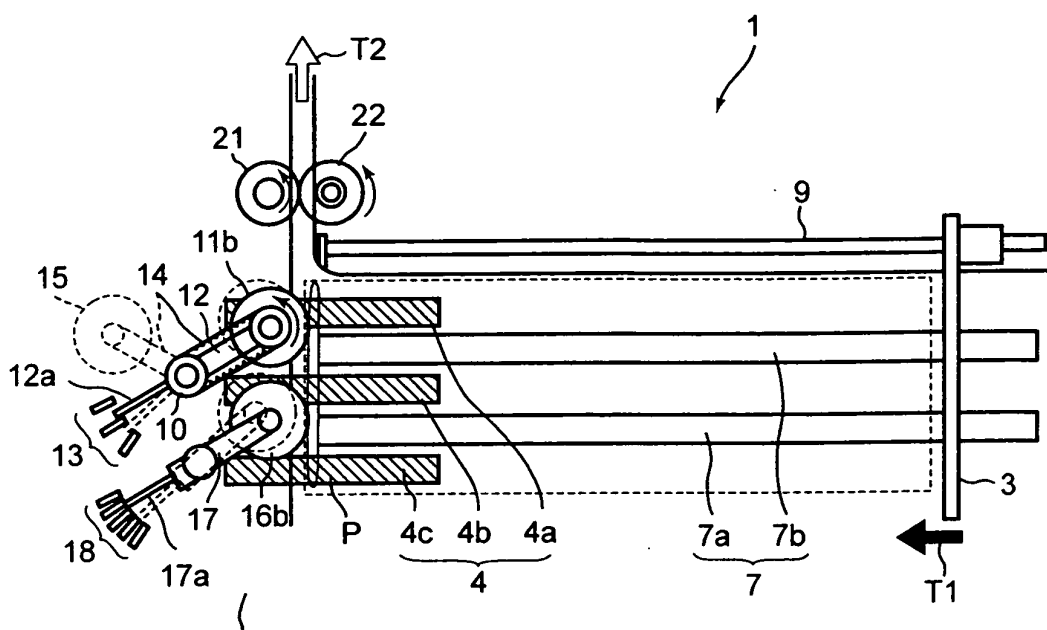


FIG. 1

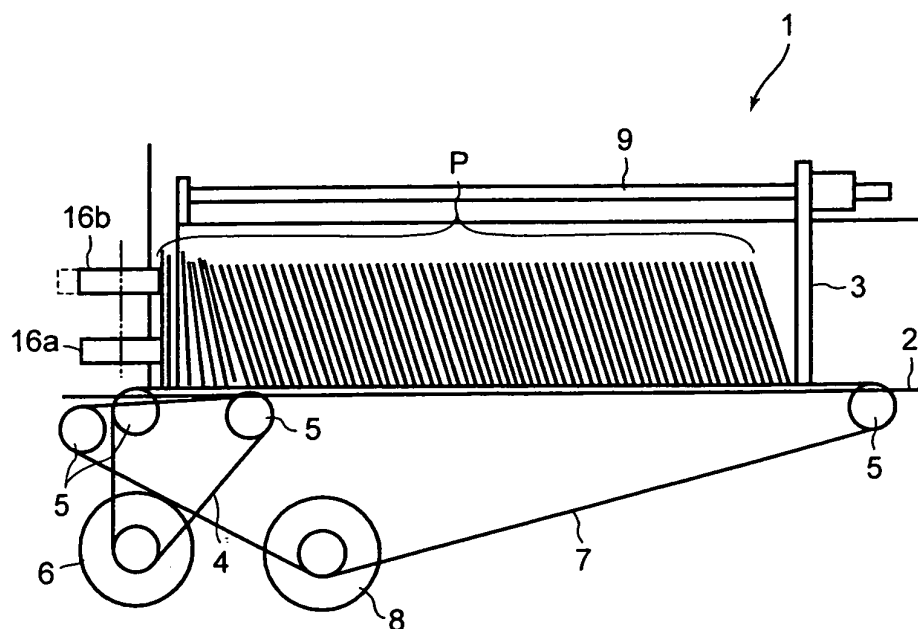


FIG. 2

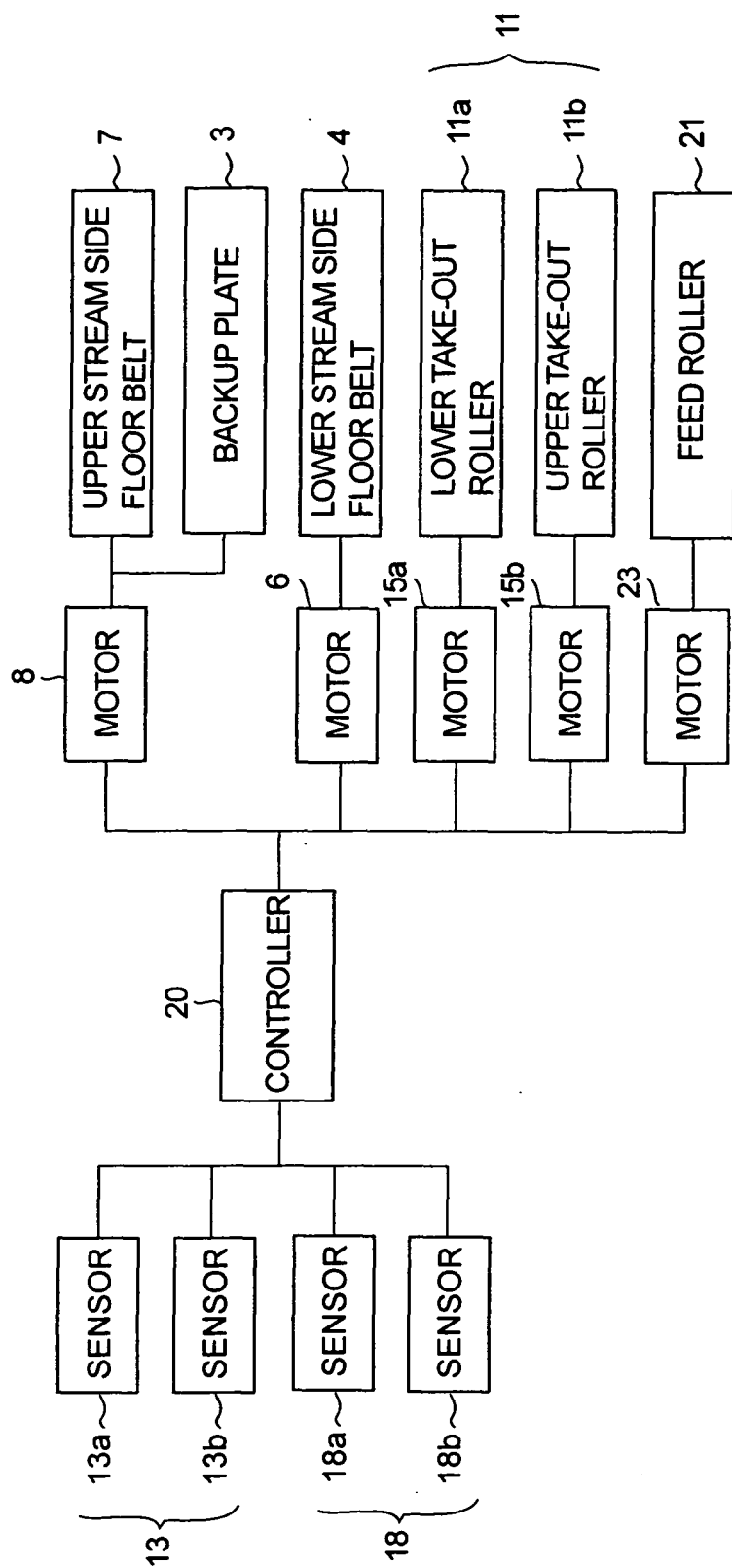


FIG. 3

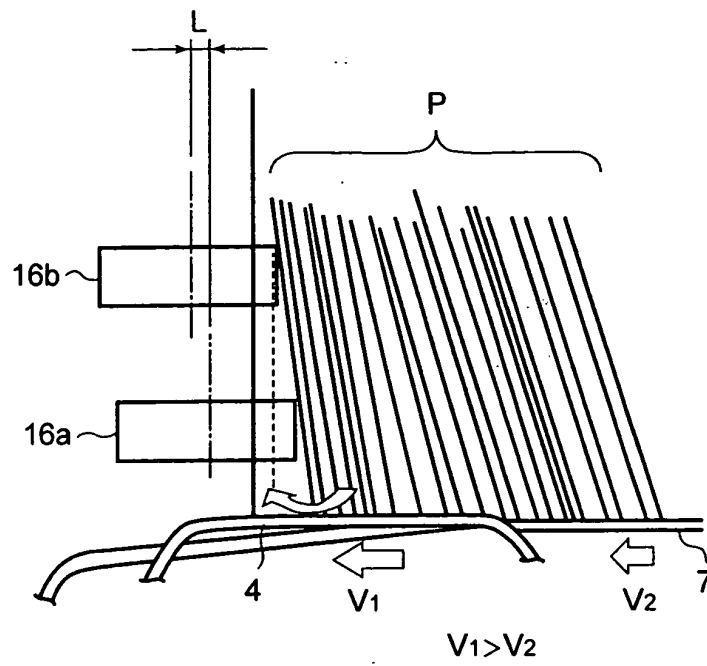


FIG. 4

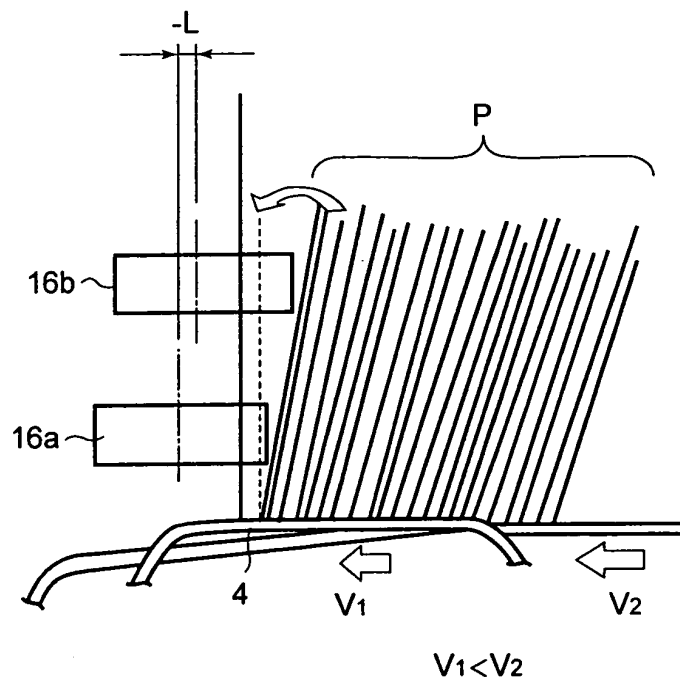


FIG. 5

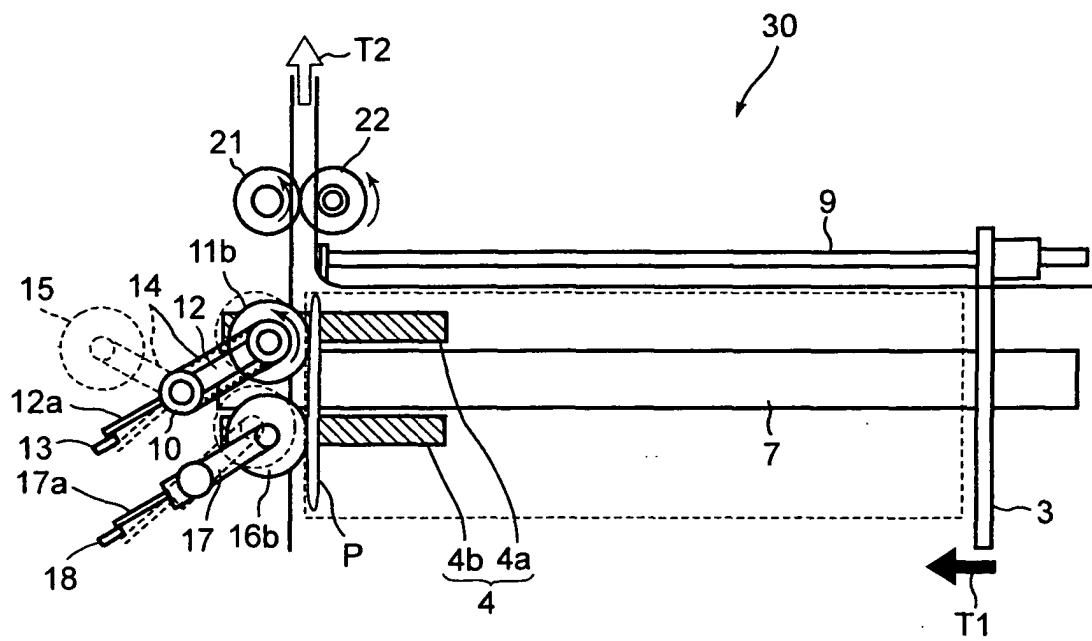


FIG. 6

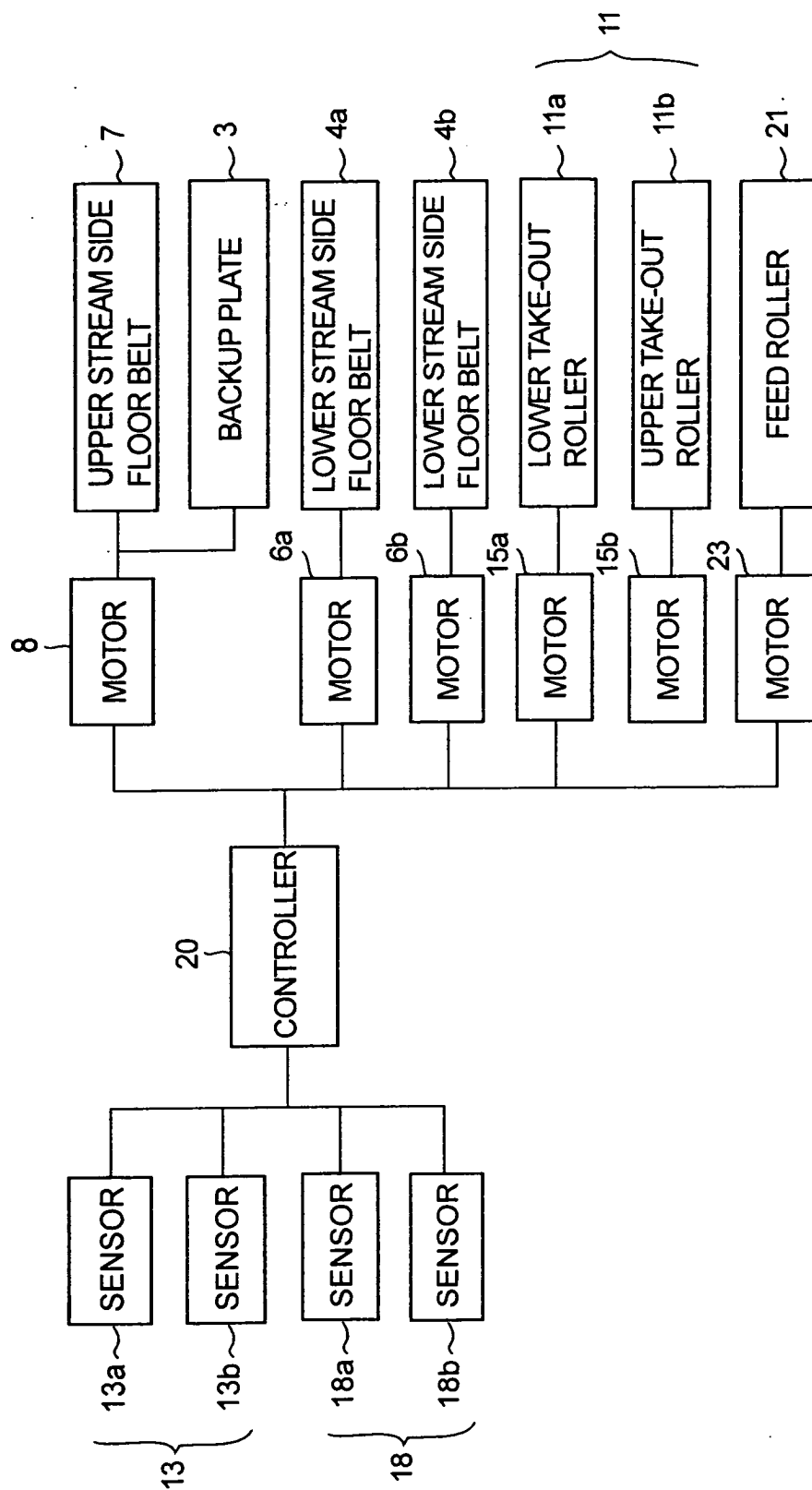


FIG. 7



European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 04 02 5088

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Place of search Munich		Date of completion of the search 28 February 2005	Examiner Pollet, D
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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28-02-2005

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