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(54) **Sheet separation method, sheet separation mechanism and sheet feeder**

Blattseparierungsverfahren, Blattseparierungsmechanismus und Blattzuführvorrichtung

Procédé de séparation de feuilles, mécanisme de séparation de feuilles et dispositif d'alimentation de feuilles

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(73) Proprietor: **NEC Corporation**
Minato-ku
Tokyo 108-8001 (JP)

(72) Inventor: **Oki, Takashi**
Tokyo 108-8001 (JP)

(74) Representative: **Vossius & Partner**
Siebertstrasse 4
81675 München (DE)

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Description

[0001] The present invention relates to a sheet separation method which separates a sheet one by one from a bundle of sheets and a sheet separation mechanism and moreover, relates to a sheet feeder having such sheet separation mechanism.

[0002] A sheet separation mechanism which separates a sheet one by one from a bundle of sheets is known. These sheets are for example, postal matters such as postcards, letters and envelopes. Such sheet separation mechanism feeds a separated sheet to a processing step or a processing apparatus in a succeeding stage (i.e. next stage). For example, a sheet feeder shown in Fig. 18 includes a mounting table 101, a feeding conveyor 102 and a sheet separation mechanism 103.

[0003] The mounting table 101 is a table on which a bundle 10 of sheets 11 is placed in an upright position. The feeding conveyor 102 conveys the bundle 10 of sheets 11 placed on the mounting table 101 toward a next stage. The sheet separation mechanism 103 separates the sheet 11 one by one from the bundle 10 that has been conveyed to an end part of the feeding conveyor 102 and feeds the separated sheet 11 to a processing apparatus in the stage.

[0004] In such sheet feeder, a posture of the bundle 10 of sheets 11 placed on the mounting table 101 is maintained in an upright position by a compartment 104 provided for the feeding conveyor 102. The bundle 10 is conveyed toward the sheet separation mechanism 103 by the compartment 104 and a bottom belt 105 (i.e. in a direction of an arrow D11 in Fig.18) while keeping the upright posture. When the bundle 10 reaches the sheet separation mechanism 103, the sheets 11 are suctioned in order, from a top sheet, by a vacuum suction chamber 107 via a suction belt 106 having a plurality of through-holes therein. The suctioned sheet 11 is fed one by one in a predetermined conveying direction (in a direction of an arrow D12 in Fig. 18) according to a revolution of the suction belt 106.

[0005] However, in the sheet separation mechanism 103 employing such suction belt, if the bundle 10 includes the sheets 11 which are attached firmly to each other, it is quite likely that the sheets 11 cannot be separated one by one. In such case, a bundle including two or more sheets 11 is fed to a processing apparatus in a next stage. For example, when the sheets 11 whose surface is vinyl-coated are stacked, the sheets 11 are firmly adhered to each other. In the above mentioned related art, since sheets cannot be properly separated through a suction/conveying operation of the suction belt 106, a plurality of sheets are simultaneously fed to a next stage.

[0006] Accordingly, as a further related art, for example, another sheet separation mechanism is disclosed in JP-A-63 (1988) -1.06245 (the U.S. counterpart application thereof is US-A-4,815,723). The sheet separation mechanism includes a suction/pulling unit (i.e. capture unit), a separation unit (i.e. detachment unit) and a conveying unit. The suction/pulling unit sucks and pulls an edge part of a sheet apart from a bundle of sheets using a movable suction head (i.e. sucker). The separation unit separates a sheet whose edge part has been palled apart from the bundle. The conveying unit conveys the sheet separated from the bundle toward a processing unit in a next stage. Since such sheet separation mechanism suctions an edge part of a sheet to pull the sheet apart from the bundle, the sheet, separation mechanism has a good performance for separating for a sheet compared with a sheet separation mechanism employing a suction belt.

[0007] EP-A-0 368 166 discloses an automatic strip and sheet loader system. The system is used for successively feeding the topmost sheet of plural stacked sheets on command. The system comprises magazine means for supporting plural stacked sheets, pickup head means mounted on said magazine means for lifting one end of said topmost sheet, separator means mounted on said magazine means to complete the separation of said topmost sheet from the remaining stacked sheets, drive roll means contacting said raised forward end of said topmost sheet and control system means for sequentially effecting their operation in response to demand and start control signals in accord with predetermined instructions and conditions.

[0008] However, a suction head of a sheet separation mechanism of such related art only moves linearly in a vertical direction to a surface of a sheet. Therefore, even when such suction head is used, a sheet is not separated from a bundle of sheets if edge parts of the sheets are strongly attached to each other.

[0009] The present invention was made to solve such technical problem. An object of the present invention is to provide a sheet separation method, a sheet separation mechanism, and a sheet feeder in which a sheet can be certainly separated one by one even when stacked sheets are firmly contacted each other. This object is achieved with the features of the claims.

[0010] Exemplary features and advantages of the present invention will become apparent from the following detailed description when taken with the accompanying drawings in which:

Fig. 1 is a plan view of a sheet feeder according to an exemplary embodiment of the present invention.

Fig. 2 is a front view of the sheet feeder according to the exemplary embodiment of the present invention.

Fig. 3 is a plan view showing a sheet conveying mechanism in a conveying state with maintaining an upright position in the exemplary embodiment of the present invention.

Fig. 4 is a front view showing the sheet conveying mechanism in a conveying state with maintaining an upright position in the exemplary embodiment of the present invention.

Fig. 5 is a plan view showing the sheet conveying mechanism in a conveying state with a posture con-

trol in the exemplary embodiment of the present invention.

Fig. 6 is a front view showing the sheet conveying mechanism in a conveying state with a posture control in the exemplary embodiment of the present invention.

Fig. 7A is a plan view showing a sheet separation mechanism (at the beginning of a suction/pulling step) in the exemplary embodiment of the present invention.

Fig. 7B is a cross sectional view showing a schematic cross section taken along the line VIIB - VIIB viewing from an arrow direction in Fig. 7A.

Fig. 8A is a plan view showing the sheet separation mechanism (at the beginning of a separation step) in the exemplary embodiment of the present invention.

Fig. 8B is a cross sectional view showing a schematic cross section taken along the line VIIIB - VIIIB viewing from an arrow direction in Fig. 8A.

Fig. 9A is a plan view showing the sheet separation mechanism (during the separation step) in the exemplary embodiment of the present invention.

Fig. 9B is a. cross sectional view showing a schematic cross section taken along the line IXB - IXB viewing from an arrow direction in Fig. 9A.

Fig. 10A is a plan view showing the sheet separation mechanism (at the beginning of a conveying step) in the exemplary embodiment of the present invention.

Fig. 10B is a cross sectional view showing a schematic cross section taken along the line XB - XB viewing from an arrow direction in Fig. 10A.

Fig. 11 is a plan view showing the sheet separation mechanism (during an original position returning step) in the exemplary embodiment of the present invention.

Fig. 12 is a plan view showing an example of a suction head operation mechanism in the exemplary embodiment of the present invention.

Fig. 13 is a figure viewing from an arrow direction at a position of the line XIII - XIII in Fig. 12.

Fig. 14 is a cross sectional view showing a schematic cross section taken along the line XIV - XIV viewing from an arrow direction in Fig. 13.

Fig. 15 is a partial side view showing the suction head operation mechanism in the exemplary embodiment of the present invention.

Fig. 16 is a partial front view showing the suction head operation mechanism in normal state in the exemplary embodiment of the present invention.

Fig. 17 is a partial front view showing the suction head operation mechanism in twist movement state in the exemplary embodiment of the present invention.

Fig. 18 is a front view showing a related art of a sheet feeder.

(a sheet feeder)

[0011] Fig. 1 is a plan view of a sheet feeder in an exemplary embodiment according to the present invention. Fig. 2 is a front view of the sheet feeder in the exemplary embodiment according to the present invention.

[0012] As shown in Fig.1 and Fig. 2, a sheet feeder in the exemplary embodiment according to the present invention includes a sheet conveying mechanism 20 and a sheet separation mechanism 30. The sheet conveying mechanism 20 conveys a bundle 10 of sheets 11, placed in an upright position, toward the sheet separation mechanism 30 (in a direction of an arrow D1 in Fig. 1). The sheet separation mechanism 30 separates a sheet 11 one by one from the bundle 10 that is conveyed to an end part of the sheet conveying mechanism 20 and feeds the separated sheet 11 to a processing step or a processing apparatus (not shown) in a next stage (in a sheet feeding direction of an arrow D2 in Fig.1).

(a sheet conveying mechanism)

[0013] First, the sheet conveying mechanism 20 will be described with reference to Fig. 3 to Fig. 6. Fig. 3 is a plan view showing the sheet conveying mechanism 20 for conveying a bundle 10 of sheets 11 in an upright position in the exemplary embodiment of the present invention. Fig. 4 is a front view showing the sheet conveying mechanism 20 for conveying the bundle 10 in an upright position in the exemplary embodiment. Fig. 5 is a plan view showing the sheet conveying mechanism 20 in a conveying state with a posture control in the exemplary embodiment. Fig. 6 is a front view showing the sheet conveying mechanism 20 in a conveying state with a posture control in the exemplary embodiment.

[0014] As shown in Fig. 3 to Fig. 6, the sheet conveying mechanism 20 includes a mounting table 21, an end plate 22, an upright position maintaining/conveying unit 23 and a posture controlling/conveying unit 24. The mounting table 21 is a table on which the bundle 10 of sheets 11 is placed in an upright position. The end plate 22 moves in a direction of an arrow D1 and applies a pressure to the bundle 10 of sheets 11 to convey it, while keeping a posture of the bundle 10.

[0015] The upright position maintaining/conveying unit 23 conveys the bundle 10 in the direction of the arrow D1 while keeping the bundle 10 in an upright position. The upright position maintaining/conveying unit 23 includes conveying belts 25 having teeth engaged with a bottom end of the sheet 11. Two conveying belts 25 are arranged side by side along the mounting table 21, and the belts 25 are driven at almost the same speed as that of the end plate 22. By the driving operation, the bundle 10 of sheets 11 is conveyed to the posture controlling/conveying unit 24 while maintaining an upright position.

[0016] The posture controlling/conveying unit 24 controls a posture of the bundle 10 which is conveyed to an end part of the upright position maintaining/conveying

unit 23 while conveying the bundle 10 toward the sheet separation mechanism 30. The posture controlling/conveying unit 24 includes two conveying belts 26 having teeth engaged with a bottom end of the sheet 11 and angle detection sensors 27 which detect a posture of the bundle 10 of the sheets 11- The conveying belts 26 are arranged side by side so that the bundle 10 of the sheet 11 can be smoothly caught from the conveying belts 25. The angle detection sensors 27 are arranged at both sides of a conveying path of the posture controlling/conveying unit 24 to detect an angle of the sheets 11. For example, in case that a target angle in a posture control of the sheets 11 is 30 degrees, three angle detection sensors 27 are arranged on a straight line at an angle of 30 degrees with respect to a conveying direction (i.e. arrow direction D1) of the sheets 11 in Fig. 4. An angle detection of the sheets 11 is performed based on a detection timing of the angle detection sensors 27.

[0017] In the sheet conveying mechanism 20 mentioned above, the bundle 10 of sheets 11 is placed on the conveying belts 25 of the mounting table 21 in an upright position as shown in Fig. 3 and Fig. 4. Then, the end plate 22 and the conveying belts 25 convey the bundle 10 of sheets 11 toward a next stage (direction D1) while maintaining an upright position.

[0018] Next, a conveyance of the bundle 10 of sheets 11 is taken over from the conveying belts 25 to the conveying belts 26 as shown in Fig. 5 and Fig. 6. Because the conveying belts 26 drive at a higher speed than the conveying belts 25 and the end plate 22, the bundle 10 is further conveyed while changing an angle of an upright position. At the time, the angle of the bundle 10 is detected by the angle detection sensors 27 and a driving speed of the conveying belt 25 (or 26) is controlled by feedback-control. By performing such control , the angle of the bundle 10 can be adjusted to an arbitrary value. For example, in the exemplary embodiment, a driving speed of the conveying belt 25 (or 26) is feedback-controlled so that the target angle of the bundle 10 at an end part of the conveying belt 26 becomes 30 degrees.

(a sheet separation mechanism)

[0019] Next, the sheet separation mechanism 30 will be described with reference to Fig. 7A to Fig. 11 . Fig. 7A is a plan view showing the sheet separation mechanism 30 at the beginning of a suction/pulling step in the exemplary embodiment. Fig. 7B is a cross sectional view showing a schematic cross section taken along the line VIIB - VIIB viewing from an arrow direction in Fig. 7A. Fig. 8A is a plan view showing the sheet separation mechanism 30 at the beginning of a separation step in the exemplary embodiment. Fig. 8B is a cross sectional view showing a schematic cross section taken along the line VIIIB - VIIIB viewing from an arrow direction in Fig. 8A. Fig. 9A is a plan view showing the sheet separation mechanism 30 during the separation step in the exemplary embodiment. Fig. 9B is a cross sectional view showing a schematic cross section taken along the line IXB - IXB viewing from an arrow direction in Fig. 9A. Fig. 10A is a plan view showing the sheet separation mechanism 30 at the beginning of a conveying step in the exemplary embodiment. Fig. 10B is a cross sectional view showing a schematic cross section taken along the line XB - XB viewing from an arrow direction in Fig. 10A. Fig. 11 is a plan view showing the sheet separation mechanism during an original position returning step in the exemplary embodiment.

[0020] As shown in those drawings, the sheet separation mechanism 30 includes a suction/pulling unit 31, a separation unit 32 and a conveying unit 33. The suction/pulling unit 31 suctions an edge part of the sheet 11 to pull the edge part apart from the bundle 10. The separation unit 32 completely separates the sheet 11 whose edge part is pulled from the bundle 10. The conveying unit 33 conveys the sheet 11 separated from the bundle 10 to a processing step or a processing apparatus (not shown) in a next stage.

[0021] The suction/pulling unit 31 includes a suction head 34, an arm 35 and a suction head operation mechanism 40 (not shown in Fig. 7A to Fig. 11). The suction head 34 is connected to a vacuum source (not shown) to suction an edge part of the sheet 11. The arm 35 moves the suction head 34 in a predetermined direction. The suction head operation mechanism 40 drives the suction head 34 via the arm 35 to perform a necessary operation. The suction head operation mechanism 40 is described in detail below. The arm 35 not only move the suction head 34 in a vertical direction to a surface of the bundle 10 but also move the suction head 34 along a curved line to tilt the suction head 34 with respect to the surface of the bundle 10 as if to turn over the suctioned edge part of the sheet to be separated. Because of such movements of the suction head 34, an only suctioned edge part of the sheet 11 is bent, curled or curved. That is, the suctioned edge part of the sheet is pulled apart from the bundle 10 to generate a gap between the (first positioned) sheet 11 and the bundle 10 (i.e., the remaining sheets). For example, the arm 35 moves the suction head 34 in a direction of an arrow D4 shown in Fig. 7B. Such operation can be enabled by the suction head operation mechanism 40 explained in detail, below.

[0022] The separation unit 32 includes a separation roller 36. The separation roller 36 is inserted into a gap between the sheet 11 that is partially separated by the suction/pulling unit 31 and a remaining part of the bundle 10 by revolution of the separation roller 36. Accordingly, the only one sheet 11 is completely separated from the bundle 10.

[0023] In the exemplary embodiment, three separation rollers 36a to 36c are arranged so as to protrude radially from a rotatable pulley 37. The separation rollers 36a to 36c are arranged side by side at a predetermined interval in a rotation direction of the pulley 37 (direction of an arrow D3 in the drawings). The separation rollers 36a to 36c revolve around the pulley 37 and may also rotate

about each rotation axis. When the separation rollers 36a to 36c are inserted in turn into a gap between the sheet 11 that is partially pulled by the suction head 34 and the bundle 10, the sheet 11 can be completely separated from the bundle 10. Further, a plate-like conveyance guide 38 for preventing sagging (i.e. drooping) of the separated sheet 11 is provided for the separation roller 36c that is the last separation roller.

[0024] The conveying unit 33 includes a conveying roller 39. As mentioned below, the conveying roller 39 rotates on its axis while the sheet 11 is located between the conveying roller 39 and the separation, roller 36c. Thereby, a rotation force of the conveying roller 39 is transmitted to the sheet 11 separated from the bundle 10 and the separated sheet 11 is conveyed toward a processing step or a processing apparatus in a next stage.

[0025] Further, the sheet separation mechanism 30 described above can be applied to a bundle of sheets with various angle postures including a horizontal posture and a vertical posture by adjusting an angle of a revolution plane of the separation rollers 36a to 36c and a movement mode or direction of the suction head 34. According to an angle detection of the sheet 11 in the sheet conveying mechanism 20, an angle of a revolution plane of the separation rollers 36a to 36c and a movement mode or direction of the suction head 34 may be adjusted automatically. Because of such adjustments, separating performance of the sheet separation mechanism 30 is further improved.

(a sheet separation method)

[0026] Next, a sheet separation method will be described with reference to Fig. 7A to Fig. 11. In the sheet separation mechanism 30, first, as shown in Fig. 7A and Fig. 7B, an edge part of a top sheet of the sheet 11 of the bundle 10 is suctioned by the suction head 34. After that, the suction head 34 moves the suctioned edge part of the sheet 11 so as to bend the edge part in a direction shown as arrow D4 in Fig.7B, while lifting the edge part up in a vertical direction to a surface of the bundle 10. Further, a movement in which the suction head 34 moves along a curved line indicated as the arrow D4 in Fig. 7B is called as "twist movement" here. By the twist movement of the suction head 34, as shown in Fig. 8A and Fig. 8B, an edge part of the sheet 11 is pulled apart from the bundle 10 (a suction/pulling step).

[0027] Next, as shown in Fig. 8A to Fig. 9B, the pulley 37 rotates in a direction illustrated as an arrow D3. As a result, the separation rollers 36a to 36c are inserted in turn into a gap between the sheet 11 that is partially pulled and the bundle 10 and accordingly, the sheet 11 is gradually separated from the bundle 10. When the separation roller 36c that is the last separation roller reaches a location opposed to the conveying roller 39 as shown in Fig. 10A, a rotation of the pulley 37 stops (a separation step).

[0028] Next, as shown in Fig. 10B, suction by the suction head 34 stops to release the separated sheet 11, and also the conveying roller 39 rotates on its axis (rotation in a direction of an arrow D5). As a result, the separated sheet 11 which is sandwiched between the conveying roller 39 and the separation roller 36c is conveyed toward a next stage (in a direction of an arrow D2). At the time, sagging of the separated sheet 11 is prevented by the conveyance guide 38 (a conveying step) .

[0029] When a conveyance of the separated sheet 11 is completed, the pulley 37 rotates again as shown in Fig. 11, and the separation rollers 36a to 36c are returned to an original position (Fig. 7A) (an original position returning step).

(a suction head operation mechanism)

[0030] Next, a suction head operation mechanism 40 which is an actual operation mechanism of the suction head 34 will be described with reference to Fig. 12 to Fig. 17. Fig. 12 is a plan view showing an example of the suction head operation mechanism 40 in the exemplary embodiment. Fig. 13 is a figure viewing from an arrow direction at a position of the line XIII - XIII in Fig. 12. Fig. 4 is a cross sectional view showing a schematic cross section taken along the line XIV - XIV viewing from an arrow direction in Fig. 13. Fig. 15 is a partial side view showing the suction head operation mechanism 40 in the exemplary embodiment. Fig. 16 is a partial front view showing the suction head operation mechanism 40 in normal state in the exemplary embodiment. Fig. 17 is a partial front view showing the suction head operation mechanism 40 in twist movement state in the exemplary embodiment.

[0031] The suction head operation mechanism 40 shown in above drawings includes a twist movement unit which controls the suction head 34 to perform the above-mentioned twist movement and an up-and-down movement unit which controls the suction head 34 to perform an up-and-down movement.

[0032] The twist movement unit includes a swinging link 41, a spindle 42, a slider 43 and an air cylinder 44. One end of the swinging link 41 supports the suction head 34 via the arm 35. The other end of the swinging link 41 is connected to the air cylinder 44. The slider 43 swingably supports the swinging link 41 via the spindle 42 parallel to the arm 35. The air cylinder 44 is provided between the slider 43 and the swinging link 41. As shown in Fig. 16 and Fig. 17, when the air cylinder 44 performs expanding movement, force of the expanding movement transmits to the other end of the swinging link 41. Then, the swinging link 41 swings about the spindle 42 that serves as a supporting point (in a direction of an arrow D7 in Fig. 16), and the twist movement of the suction head 34 is performed.

[0033] The up-and-down movement unit includes a guide rail 45, a base 46, a servo motor 47, a pulley 48 and a connection rod 49. The guide rail 45 is provided

on the base 46 to guide an up-and-down slide operation of the slider 43. The base 46 supports up-and-down slidably the slider 43 via the guide rail 45.

[0034] The servo motor 47 is provided below the base 46. The pulley 48 is connected to a drive shaft of the servo motor 47 and is rotated within a predetermined angle range according to a rotation of the drive shaft. The connection rod 49 connects the pulley 48 and one end of the slider 43. When the servo motor 47 drives, driving force thereof is transmitted to the slider 43 via the pulley 48 and the connection rod 49 (in a direction of an arrow D6 in Fig. 13). As a result, the slider 43 slides up-and-down along the guide rail 45 and the suction head 34 provided at an end of the arm 35 moves up-and-down.

[0035] In the sheet separation mechanism and the sheet separation method of the exemplary embodiment as mentioned above, the suction/pulling unit 31 includes the suction head 34 which suctions an edge part of the sheet 11 and the edge part of the sheet 11 is partly separated from the bundle 10 by the twist movement of the suction head 34. As a result, even when sheets 11 in the bundle 10 strongly adhere to each other, the sheet 7.1 can be certainly separated one by one and stably fed to a next step.

[0036] The separation unit 32 includes the plurality of separation rollers 36a to 36c which revolve around the pulley 37. The separation rollers 36a to 36c are inserted in turn into a gap between the sheet 11 that is partly pulled by the suction/pulling unit 31 and the bundle 10. Accordingly, the only one sheet 11 is separated from the bundle 10. Thus, the separation unit 32 of the exemplary embodiment can separate the sheet 11 that is partly pulled by the suction/pulling unit 31 from the bundle 10 quickly and certainly.

[0037] The conveying unit 33 includes the conveying roller 39. The sheet 11 is sandwiched between the separation roller 36c and the conveying roller 39. The rotation force of the conveying roller 39 conveys and feeds the sheet 11 separated from the bundle 10 toward a next stage (i.e. a processing apparatus in a next step) . Thus, in the exemplary embodiment, the separated sheet 11 can be certainly conveyed and also a structure of the conveying unit 33 can be simplified by utilizing the separation roller 36c for a part of the conveying unit 33.

[0038] The exemplary embodiment described above can be applied to a sheet feeder having a sheet separation mechanism. In particular, a sheet separation mechanism of the exemplary embodiment is suitable for a supply feeder of a large scale mail sorting apparatus, but also it can be applied to a supply feeder which separates and supplies a mail such as an ordinary postcard and a letter or a supply feeder which separates and supplies other sheets.

[0039] As mentioned above, by employing the present invention, an edge part of a sheet is suctioned by a suction head and the edge part of the sheet is partly separated from a bundle of the sheets by the twist movement of the suction head. Therefore, the sheet can be certainly separated one by one from the bundle in which the sheets strongly adhere to each other and the separated sheet is stably fed to a next step.

[0040] The previous description of exemplary embodiments is provided to enable a person skilled in the art to make and use the present invention. Moreover, various modifications to these exemplary embodiments will be readily apparent to those skilled in the art, and the generic principles and specific examples defined herein may be applied to other exemplary embodiments without the use of inventive faculty. Therefore, the present invention is not intended to be limited to the exemplary embodiments described herein but is to be accorded the widest scope as defined in the claims.

Claims

1. A sheet separation method for separating a sheet (11) one by one from a bundle (10) of the sheets (11) and feeding the separated sheet (11) to a next processing step, comprising:

   suctioning an edge part of the sheet (11) and pulling the suctioned edge part from the bundle (10) by a twist movement;
   separating the sheet (11) from the bundle (10), the edge part of the sheet (11) being suctioned and pulled; and
   conveying the sheet (11) separated from the bundle (10) in a predetermined direction,
   characterized in that
   the separating includes inserting at least one separation roller (36) which moves along a surface of the bundle (10) into a gap between the suctioned edge part of the sheet (11) and the bundle (10),
   wherein a plate-like guide (38) provided to the separation roller (36c) prevents the sheet (11) separated from sagging.

2. The sheet separation method according to claim 1, wherein the pulling includes:

   an up-and-down movement in which a suction head (34) that suctions the edge part moves in a vertical direction to a surface of the bundle (10): and
   a twist movement in which the suction head (34) moves along a curved direction to the surface of the bundle (10).

3. The sheet separation method according to claim 1 or 2, wherein the conveying includes rotating a conveying roller (39) which sandwiches the separated sheet (11) with the separation roller (36).

4. A sheet separation mechanism (30) for separating

a sheet (11) one by one from a bundle (10) of the sheets (11) and feeding the separated sheet (11) to a next processing step, comprising:

a suction/pulling unit (31) including a suction head (34) for suctioning an edge part of the sheet (11) and pulling the suctioned edge part, of the sheet (11) apart from the bundle (10) by a twist movement of the suction head (34);
a separation unit (32) for separating the sheet (11) from the bundle (10), the edge part of the sheet (11) being suctioned and pulled by the suction head (34); and
a conveying unit (33) for conveying the sheet (11) separated from the bundle (10) in a predetermined direction,
characterized in that
the separation unit (32) includes at least one separation roller (36) which moves along a surface of the bundle (10), and
the sheet (11) is separated from the bundle (10) by inserting the separation roller (36) into a gap between the edge part of the sheet (11) suctioned and pulled by the suction/pulling unit (31) and the bundle (10),
wherein the separation roller (36c) includes a plate-like guide (38) for preventing the sheet (11) separated from the bundle (10) by the suction/pulling unit (32) from sagging.

5. The sheet separation mechanism 30 according to claim 4, wherein the suction/pulling unit (31) comprises:

an up-and-down movement unit which moves the suction head (34) to perform an up-and-down movement in a vertical direction to a surface of the bundle (10) and
a twist movement unit which moves the suction head (34) to perform a twist movement along a curved direction to the surface of the bundle (10).

6. The sheet separation mechanism (30) according to claim 4 or 5, wherein the conveying unit (33) includes a conveying roller (39) which sandwiches the separated sheet (11) with the separation roller (36), and the sheet (11) separated from the bundle (10) is conveyed in a predetermined direction by a rotation of the conveying roller (39) on its axis.

7. A sheet feeder comprising a sheet conveying mechanism (20) which conveys a bundle (10) of sheets (11) and a sheet separation mechanism (30) according to claim 4, 5 or 6 which separates the sheet (11) one by one from the bundle (10) that is conveyed to an end part of the sheet conveying mechanism (20).

8. The sheet feeder according to claim 7, wherein the sheet conveying mechanism (20) comprises:

an upright position maintaining/conveying unit (23) which conveys the bundle (10) placed on a mounting table (21) toward the sheet separation mechanism (30) while maintaining an upright position of the bundle (10); and
a posture controlling/conveying unit (24) which controls a posture of the bundle (10) before reaching the sheet separation mechanism (30) while conveying the bundle (10) toward the sheet separation mechanism (30).

Patentansprüche

1. Blatttrennverfahren zum Trennen von Blättern (11) nacheinander einzeln von einem Stapel (10) der Blätter (11) und zum Weiterleiten der getrennten Blätter (11) zu einem nächsten Prozessschritt, welches folgende Schritte aufweist:

Ansaugen eines Randteils des Blatts (11) und Ziehen des angesaugten Randteils von dem Stapel (10) durch eine Drehbewegung,
Trennen des Blatts (11) von dem Stapel (10), wobei der Randteil des Blatts (11) angesogen und gezogen wird, und
Befördern des von dem Stapel (10) getrennten Blatts (11) in einer vorbestimmten Richtung,
dadurch gekennzeichnet, dass
das Trennen das Einfügen mindestens einer Trennrolle (36) aufweist, die sich entlang einer Fläche des Stapels (10) in einen Zwischenraum zwischen dem angesaugten Randteil des Blatts (11) und dem Stapel (10) bewegt, wobei eine plattenartige Führung (38), die an der Trennrolle (36c) bereitgestellt ist, verhindert, dass sich das getrennte Blatt (11) durchbiegt.

2. Blatttrennverfahren nach Anspruch 1, wobei das Ziehen aufweist:

eine Auf-und-ab-Bewegung, bei der sich ein Saugkopf (34), der den Randteil ansaugt, in vertikaler Richtung zu einer Fläche des Stapels (10) bewegt, und
eine Drehbewegung, bei der sich der Saugkopf (34) entlang einer Krümmungsrichtung zu der Fläche des Stapels (10) bewegt.

3. Blatttrennverfahren nach Anspruch 1 oder 2, wobei das Befördern das Drehen einer Förderrolle (39) aufweist, welche das getrennte Blatt (11) mit der Trennrolle (36) sandwichförmig einschließt.

4. Blatttrennvorrichtung (30) zum Trennen von Blättern

(11) nacheinander einzeln von einem Stapel (10) der Blätter (11) und zum Weiterleiten der getrennten Blätter (11) zu einem nächsten Prozessschritt, welcher aufweist:

eine Saug/Zug-Einheit (31) mit einem Saugkopf (34) zum Ansaugen eines Randteils des Blatts (11) und zum Ziehen des angesaugten Randteils des Blatts (11) von dem Stapel (10) fort durch eine Drehbewegung des Saugkopfs (34),
eine Trenneinheit (32) zum Trennen des Blatts (11) von dem Stapel (10), wobei der Randteil des Blatts (11) durch den Saugkopf (34) angesaugt und gezogen wird, und
eine Beförderungseinheit (33) zum Befördern des von dem Stapel (10) getrennten Blatts (11) in einer vorbestimmten Richtung,
dadurch gekennzeichnet, dass
die Trenneinheit (32) mindestens eine Trennrolle (36) aufweist, die sich entlang einer Fläche des Stapels (10) bewegt, und
das Blatt (11) von dem Stapel (10) getrennt wird, indem die Trennrolle (36) in einen Zwischenraum zwischen dem von der Saug/Zug-Einheit (31) angesaugten und gezogenen Randteil des Blatts (11) und dem Stapel (10) eingeführt wird, wobei die Trennrolle (36c) eine plattenartige Führung (38) aufweist, um zu verhindern, dass sich das durch die Saug/Zug-Einheit (31) von dem Stapel (10) getrennte Blatt (11) durchbiegt.

5. Blatttrennvorrichtung (30) nach Anspruch 4, wobei die Saug/Zug-Einheit (31) aufweist:

eine Auf-und-ab-Bewegungseinheit, welche den Saugkopf (34) bewegt, so dass er eine Auf-und-ab-Bewegung in vertikaler Richtung zu einer Fläche des Stapels (10) ausführt, und
eine Drehbewegungseinheit, welche den Saugkopf (34) bewegt, so dass er eine Drehbewegung entlang einer Krümmungsrichtung zur Fläche des Stapels (10) ausführt.

6. Blatttrennvorrichtung (30) nach Anspruch 4 oder 5, wobei die Beförderungseinheit (33) eine Förderrolle (39) aufweist, welche das getrennte Blatt (11) mit der Trennrolle (36) sandwichförmig einschließt, und das von dem Stapel (10) getrennte Blatt (11) durch eine Drehung der Förderrolle (39) um ihre Achse in einer vorbestimmten Richtung befördert wird.

7. Blattvorschubvorrichtung mit: einem Blattbeförderungsmechanismus (20), welcher einen Stapel (10) von Blättern (11) befördert, und einer Blatttrennvorrichtung (30) nach Anspruch 4, 5 oder 6, die die Blätter (11) nacheinander einzeln von dem Stapel (10), der zu einem Endteil des Blattbeförderungsmechanismus (20) befördert wird, trennt.

8. Blattvorschubvorrichtung nach Anspruch 7, wobei der Blattbeförderungsmechanismus (20) aufweist:

eine Einheit (23) zum Aufrechterhalten der aufrechten Position und zum Befördern, welche den auf einen Anbringungstisch (21) gelegten Stapel (10) zur Blatttrennvorrichtung (30) befördert, während die aufrechte Position des Stapels (10) aufrechterhalten wird, und
eine Einheit (24) zum Steuern der Ausrichtung und zum Befördern, welche die Ausrichtung des Stapels (10) steuert, bevor er die Blatttrennvorrichtung (30) erreicht, während der Stapel (10) zur Blatttrennvorrichtung (30) befördert wird.

Revendications

1. Procédé de séparation de feuilles pour séparer individuellement une feuille (11) d'un paquet (10) des feuilles (11) et acheminer la feuille séparée (11) à une étape de traitement suivante, comprenant les étapes consistant à :

aspirer une partie de bord de la feuille (11) et tirer la partie de bord aspirée du paquet (10) par un mouvement de torsion ;
séparer la feuille (11) du paquet (10), la partie de bord de la feuille (11) étant aspirée et tirée ; et
transporter la feuille (11) séparée du paquet (10) dans une direction prédéterminée,

caractérisé en ce que
la séparation comprend l'insertion d'au moins un rouleau de séparation (36) qui se déplace le long d'une surface du paquet (10) dans un intervalle formé entre la partie de bord aspirée de la feuille (11) et le paquet (10), dans lequel
un guide en plaque (38) fourni au rouleau de séparation (36c) empêche la feuille (11) séparée de s'affaisser.

2. Procédé de séparation de feuilles selon la revendication 1, dans lequel la traction comprend :

un mouvement vers le haut et le bas, dans lequel une tête d'aspiration (34) qui aspire la partie de bord se déplace dans une direction verticale vers une surface du paquet (10) ; et
un mouvement de torsion, dans lequel la tête d'aspiration (34) se déplace le long d'une direction incurvée vers la surface du paquet (10).

3. Procédé de séparation de feuilles selon la revendication 1 ou 2, dans lequel le transport comprend la rotation d'un rouleau de transport (39) qui prend en sandwich la feuille séparée (11) avec le rouleau de séparation (36).

4. Mécanisme de séparation de feuilles (30) pour séparer individuellement une feuille (11) d'un paquet (10) des feuilles (11) et acheminer la feuille séparée (11) à une étape de traitement suivante, comprenant :

une unité d'aspiration/traction (31) comprenant une tête d'aspiration (34) pour aspirer une partie de bord de la feuille (11) et tirer la partie de bord de la feuille aspirée (11) hors du paquet (10) par un mouvement de torsion de la tête d'aspiration (34) ;
une unité de séparation (32) pour séparer la feuille (11) du paquet (10), la partie de bord de la feuille (11) étant aspirée et tirée par la tête d'aspiration (34) ; et
une unité de transport (33) pour transporter la feuille (11) séparée du paquet (10) dans une direction prédéterminée,

caractérisé en ce que
l'unité de séparation (32) comprend au moins un rouleau de séparation (36) qui se déplace le long d'une surface du paquet (10) et
la feuille (11) est séparée du paquet (10) en insérant le rouleau de séparation (36) dans un intervalle formé entre la partie de bord de la feuille (11) aspirée et tirée par l'unité d'aspiration/traction (31) et le paquet (10),
dans lequel le rouleau de séparation (36c) comprend un guide en plaque (38) pour empêcher la feuille (11) séparée du paquet (10) par l'unité d'aspiration/traction (31) de s'affaisser.

5. Mécanisme de séparation de feuilles (30) selon la revendication 4, dans lequel l'unité d'aspiration/traction (31) comprend :

une unité de mouvement vers le haut et le bas qui déplace la tête d'aspiration (34) pour effectuer un mouvement vers le haut et le bas dans une direction verticale vers une surface du paquet (10) ; et
une unité de mouvement de torsion qui déplace la tête d'aspiration (34) afin d'effectuer un mouvement de torsion le long d'une direction incurvée vers la surface du paquet (10).

6. Mécanisme de séparation de feuilles (30) selon la revendication 4 ou 5, dans lequel l'unité de transport (33) comprend un rouleau de transport (39) qui prend en sandwich la feuille séparée (11) avec le rouleau de séparation (36) et la feuille (11) séparée du paquet (10) est transportée dans une direction prédéterminée par rotation du rouleau de transport (39) sur son axe.

7. Chargeur de feuilles comprenant un mécanisme de transport de feuilles (20) qui transporte un paquet (10) de feuilles (11) et un mécanisme de séparation de feuilles (30) selon la revendication 4, 5 ou 6 qui sépare individuellement la feuille (11) du paquet (10), qui est transporté vers une partie d'extrémité du mécanisme de transport de feuille (20).

8. Chargeur de feuilles selon la revendication 7, dans lequel le mécanisme de transport de feuilles (20) comprend :

une unité de maintien/transport en position droite (23) qui transporte le paquet (10) placé sur une table de montage (21) vers le mécanisme de séparation de feuilles (30) tout en maintenant une position droite du paquet (10) ; et
une unité de commande/transport (24) qui commande une posture du paquet (10) avant d'atteindre le mécanisme de séparation de feuilles (30) tout en transportant le paquet (10) vers le mécanisme de séparation de feuilles (30).

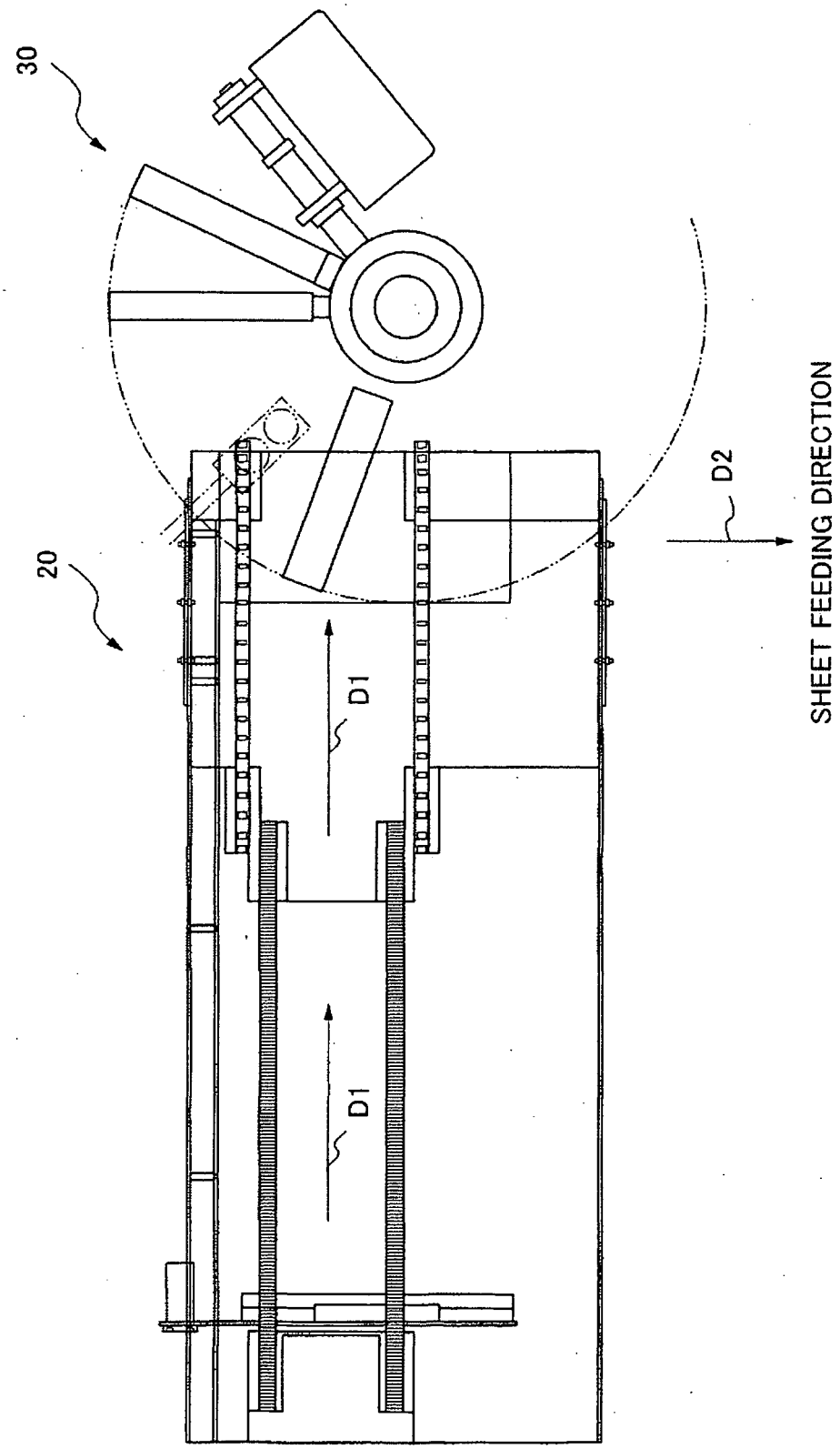


Fig.1

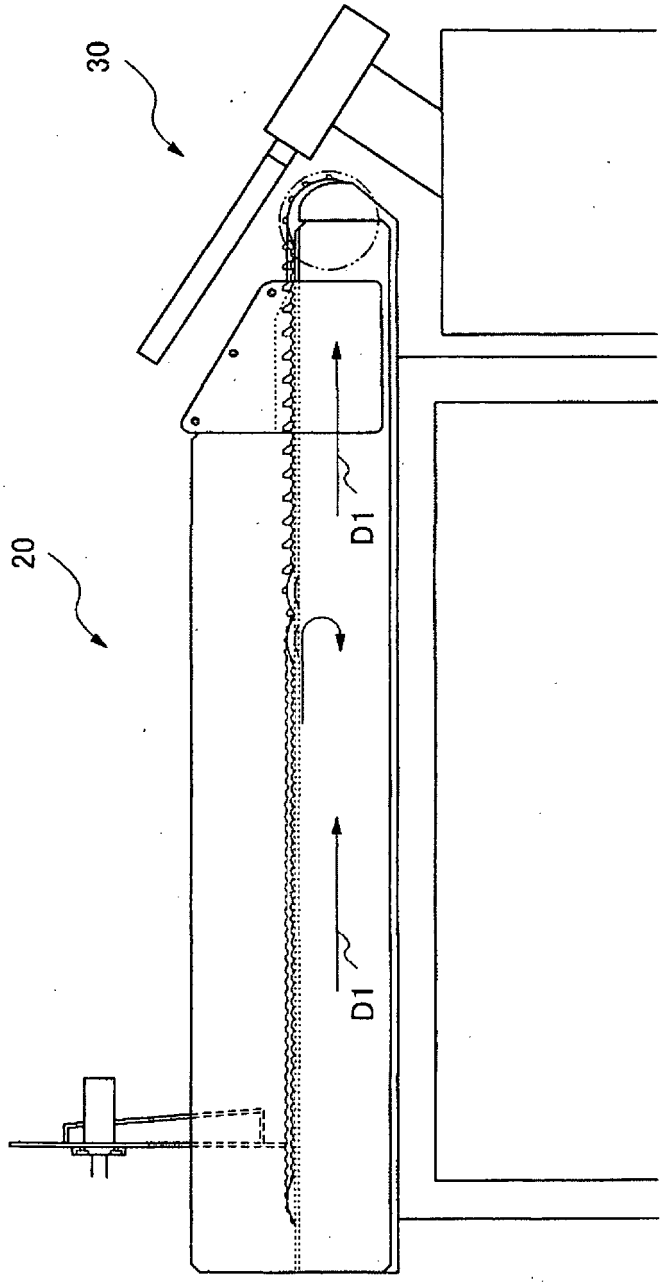


Fig.2

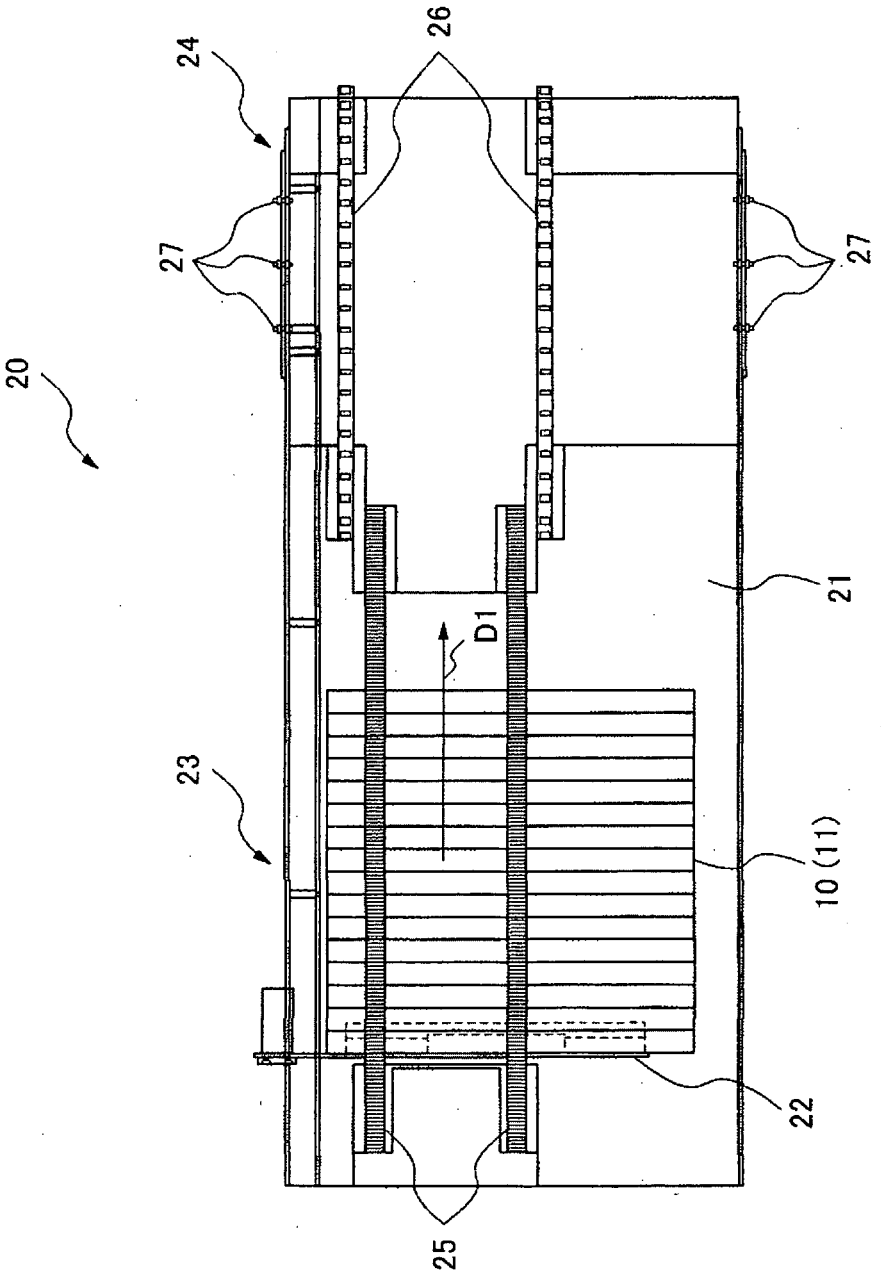


Fig.3

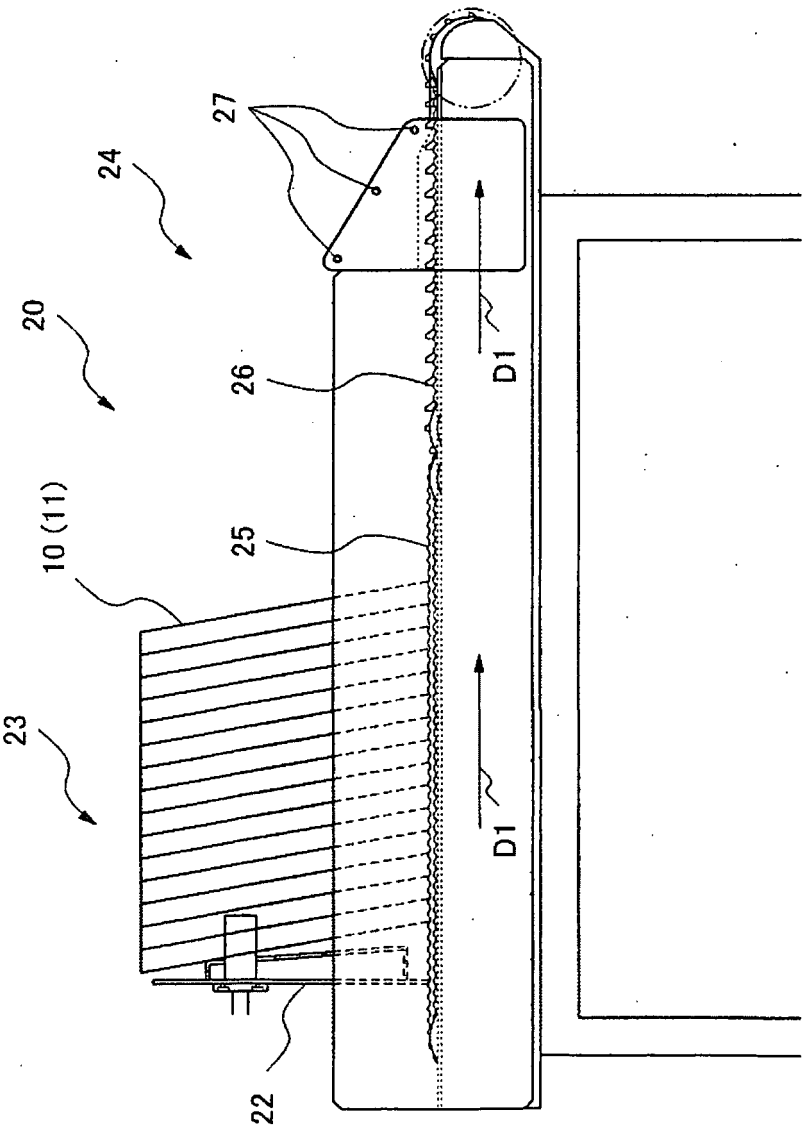


Fig.4

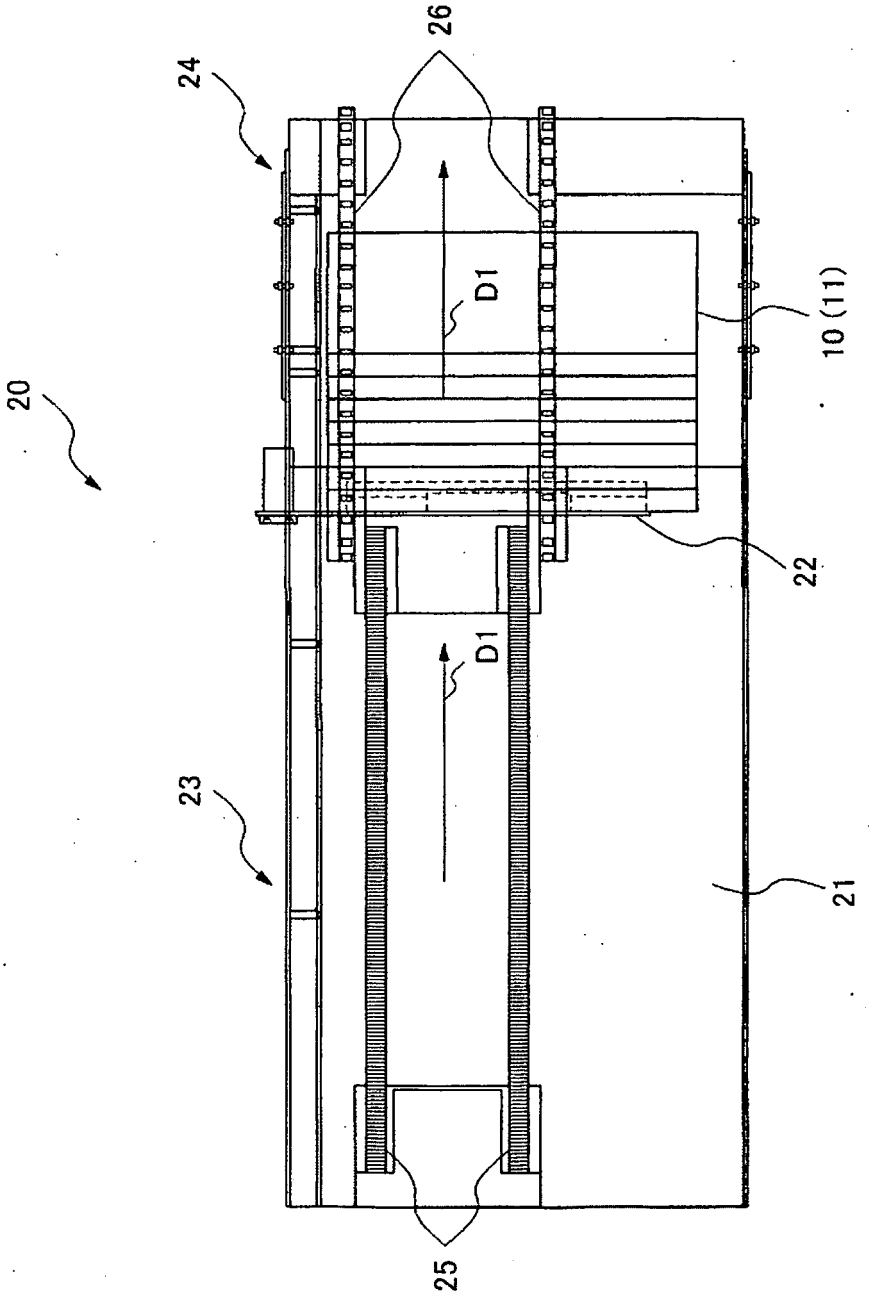


Fig.5

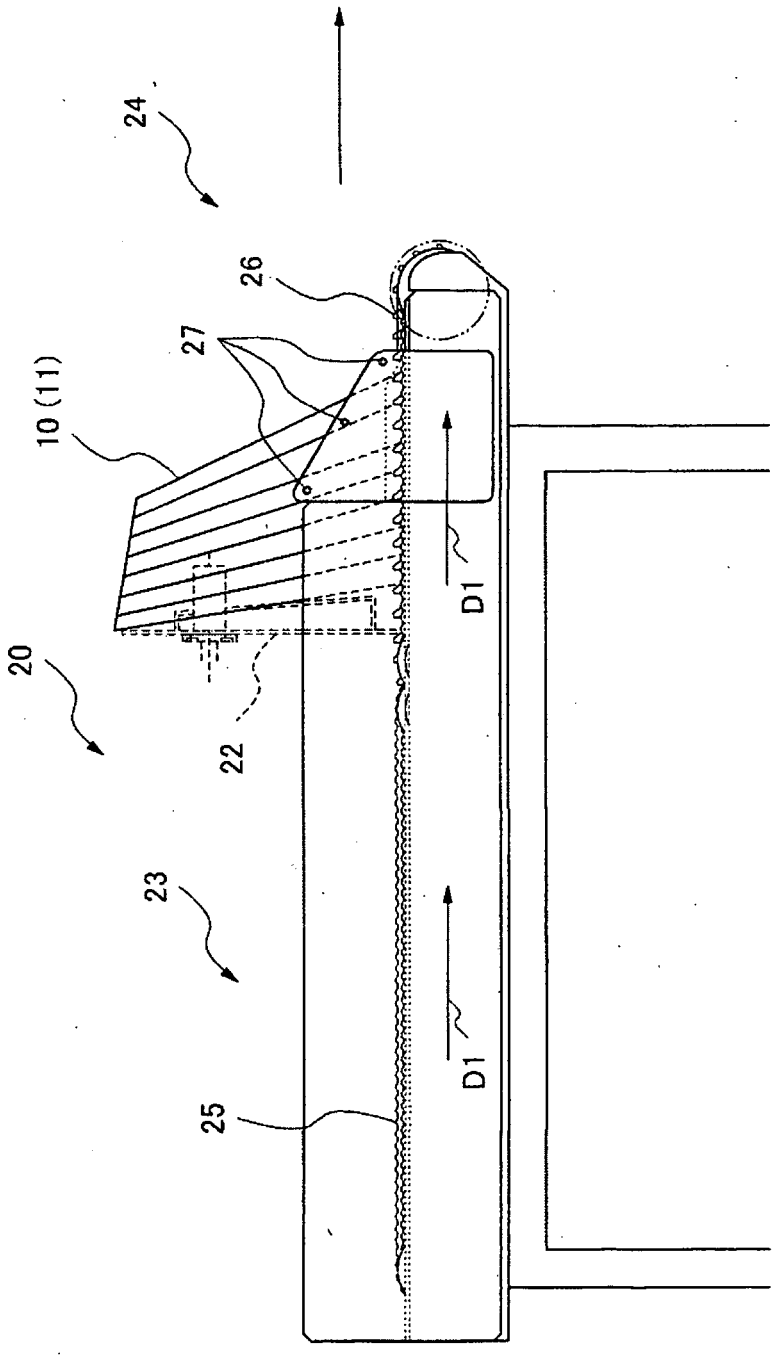


Fig.6

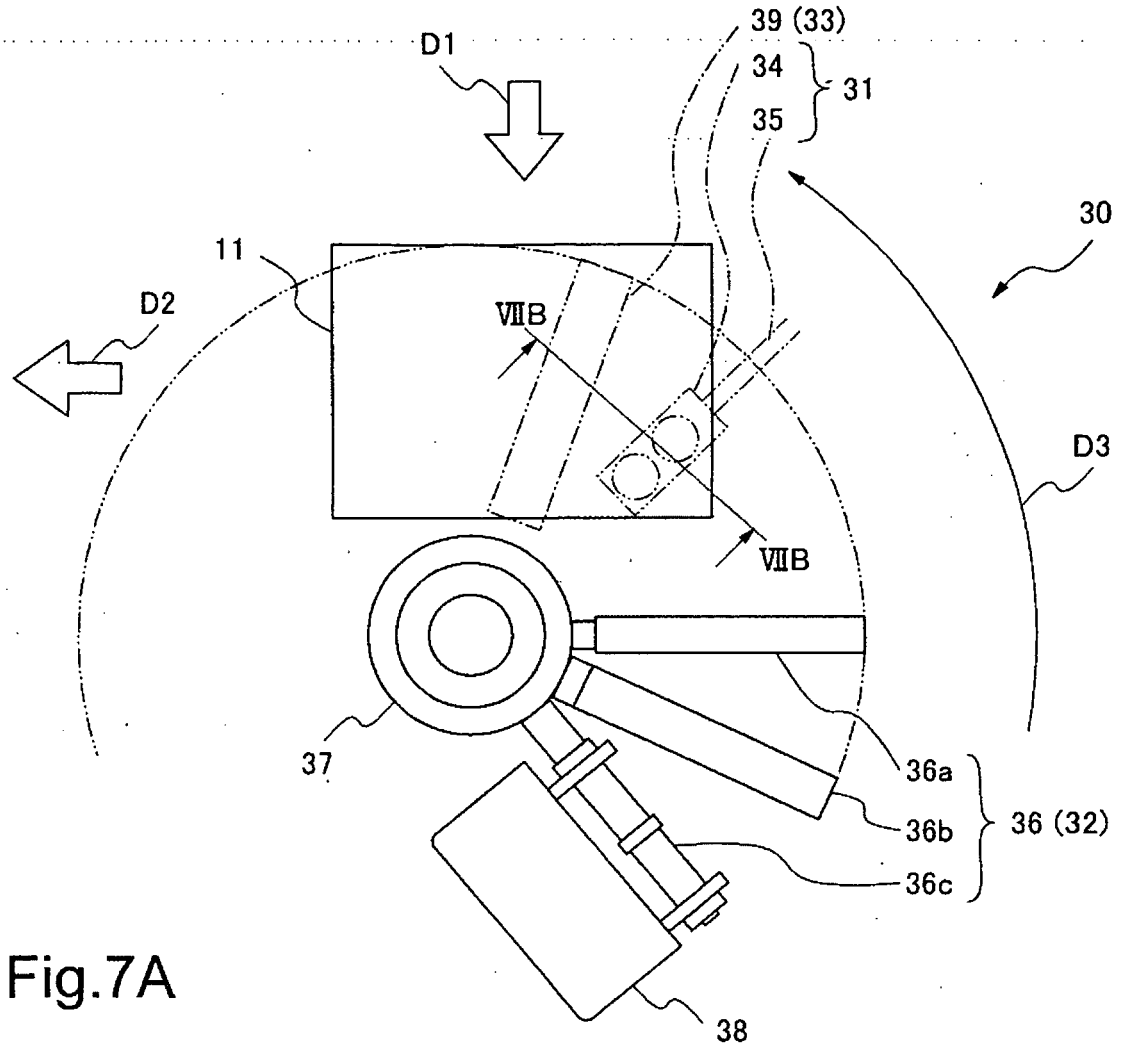

39 (33)
34
31
35
D1
30
11
D2
VIIB
D3
VIIB
37
36a
36b
36 (32)
36c
38

Fig.7A

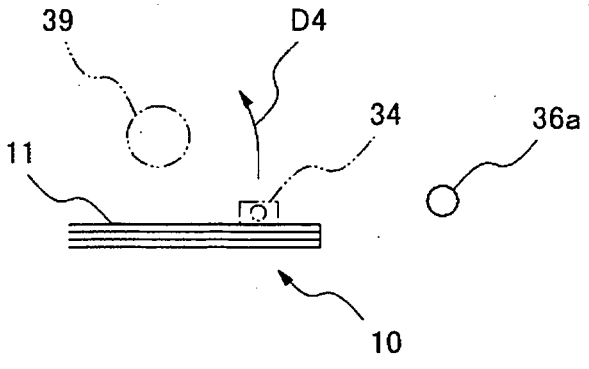

39
D4
34
36a
11
10

Fig.7B

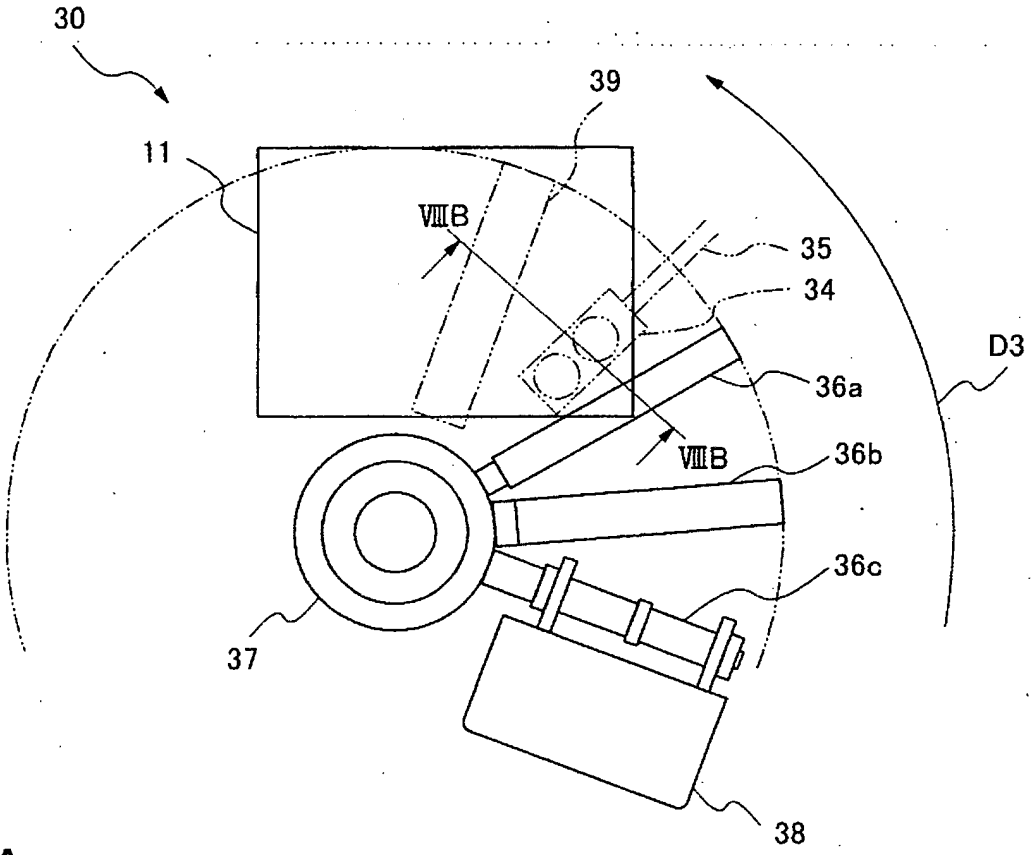


Fig.8A

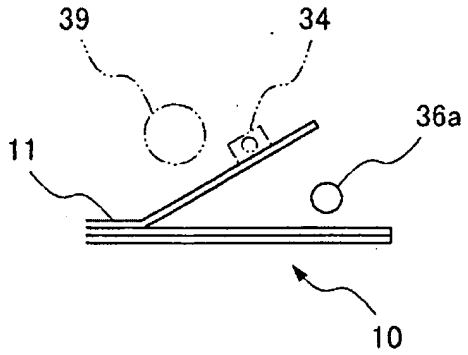


Fig.8B

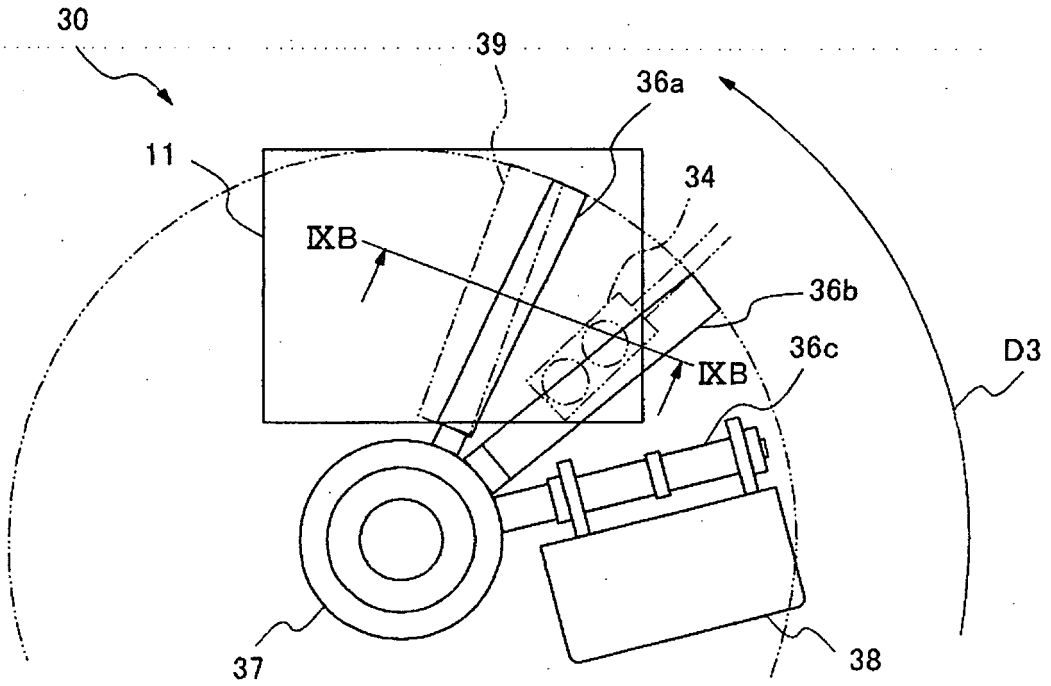


Fig.9A

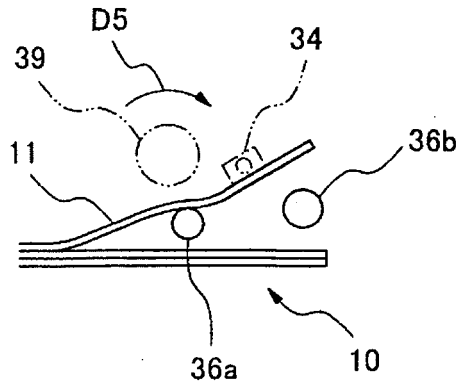


Fig.9B

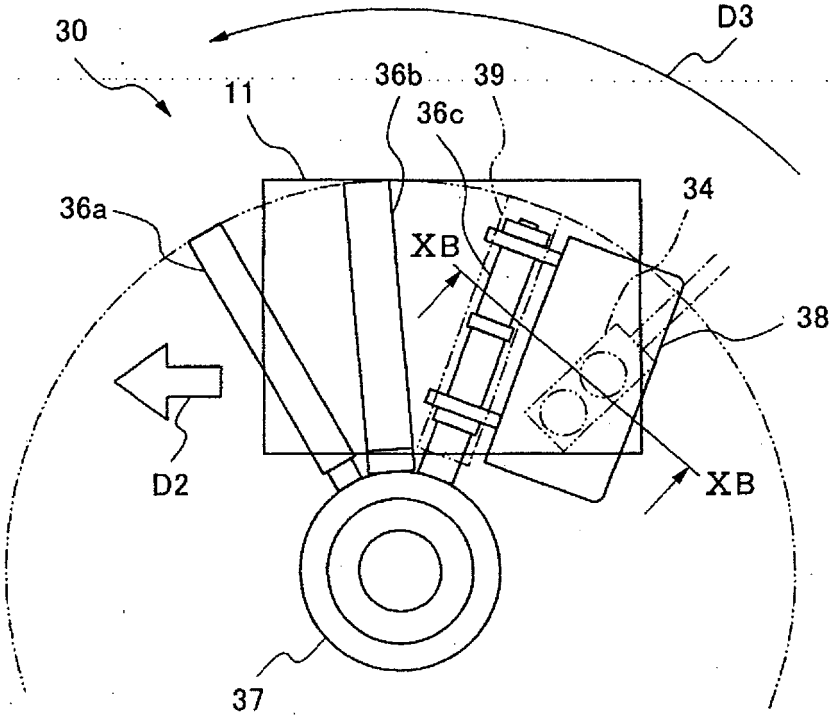


Fig.10A

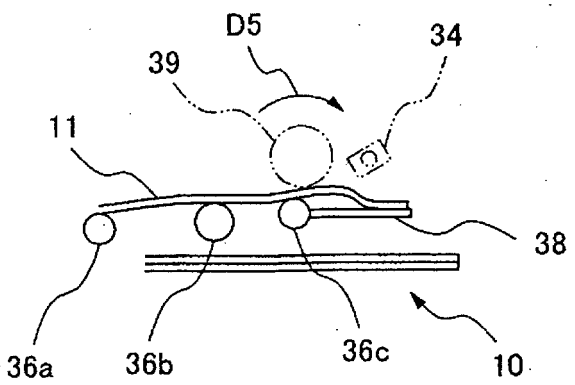


Fig.10B

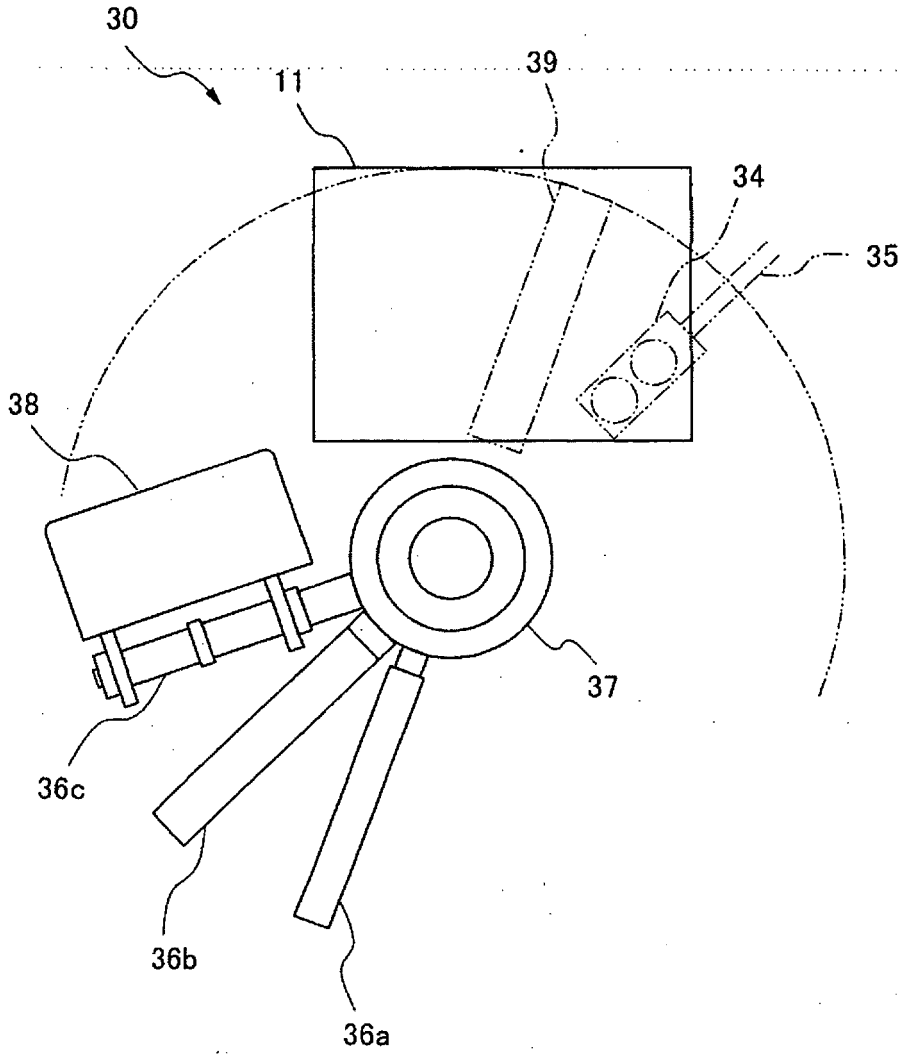


Fig.11

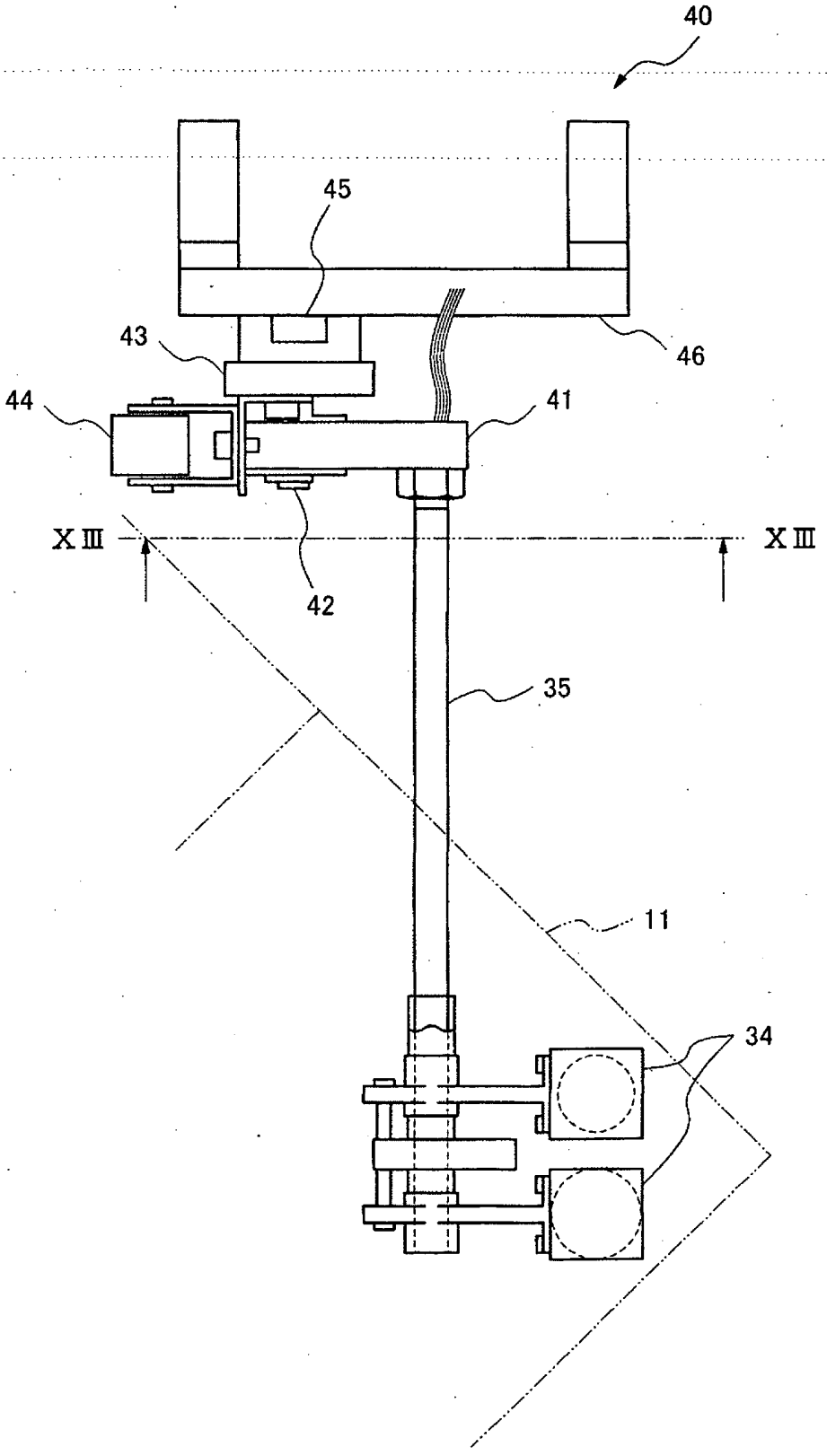


Fig.12

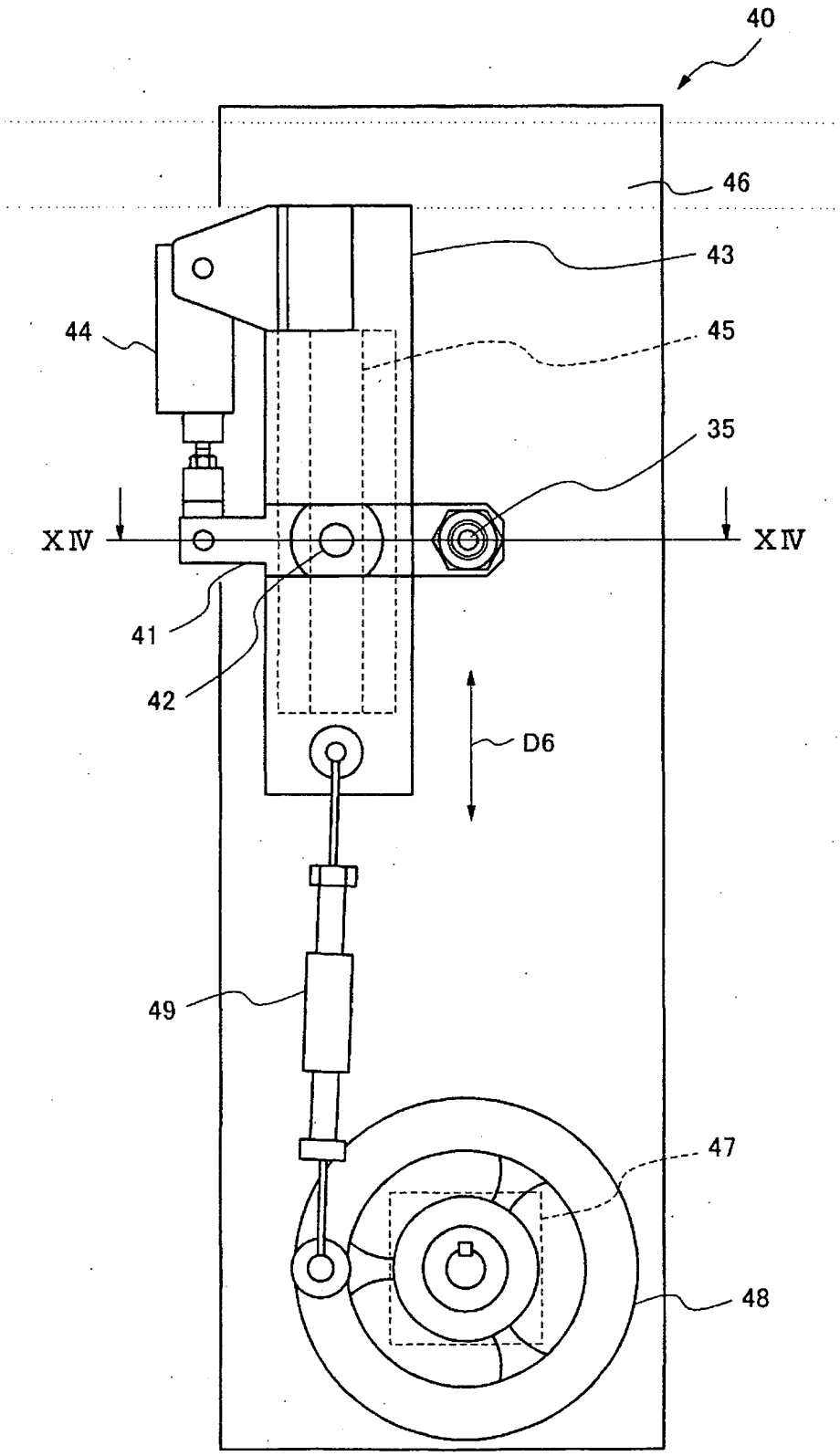


Fig.13

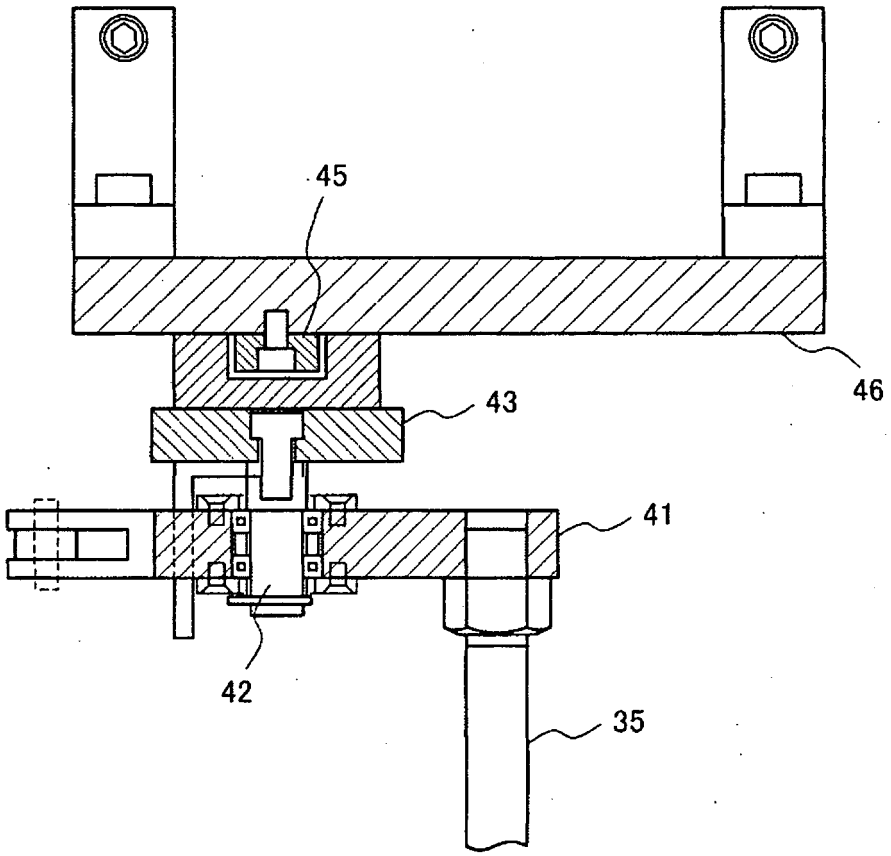


Fig.14

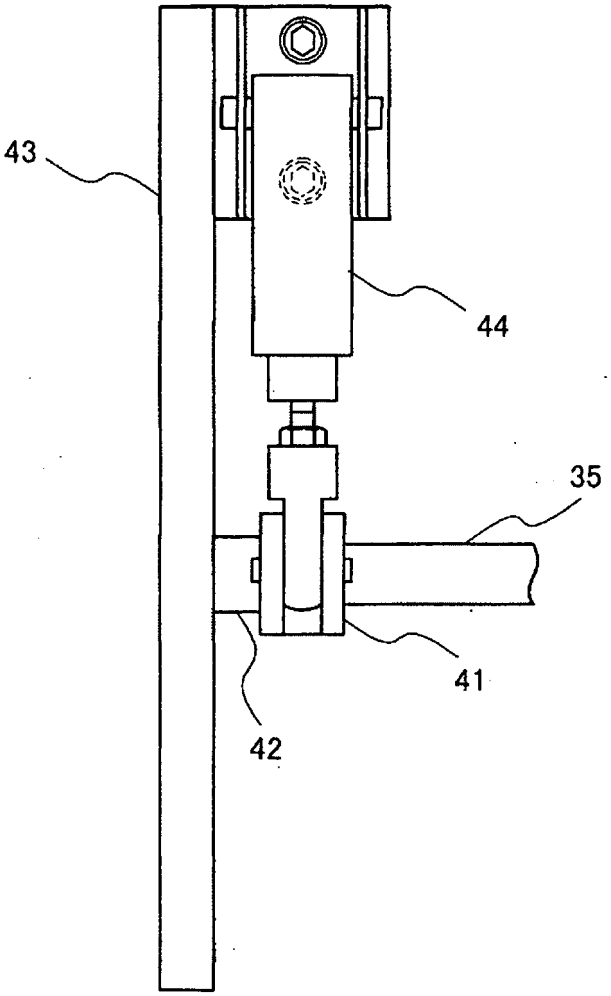


Fig.15

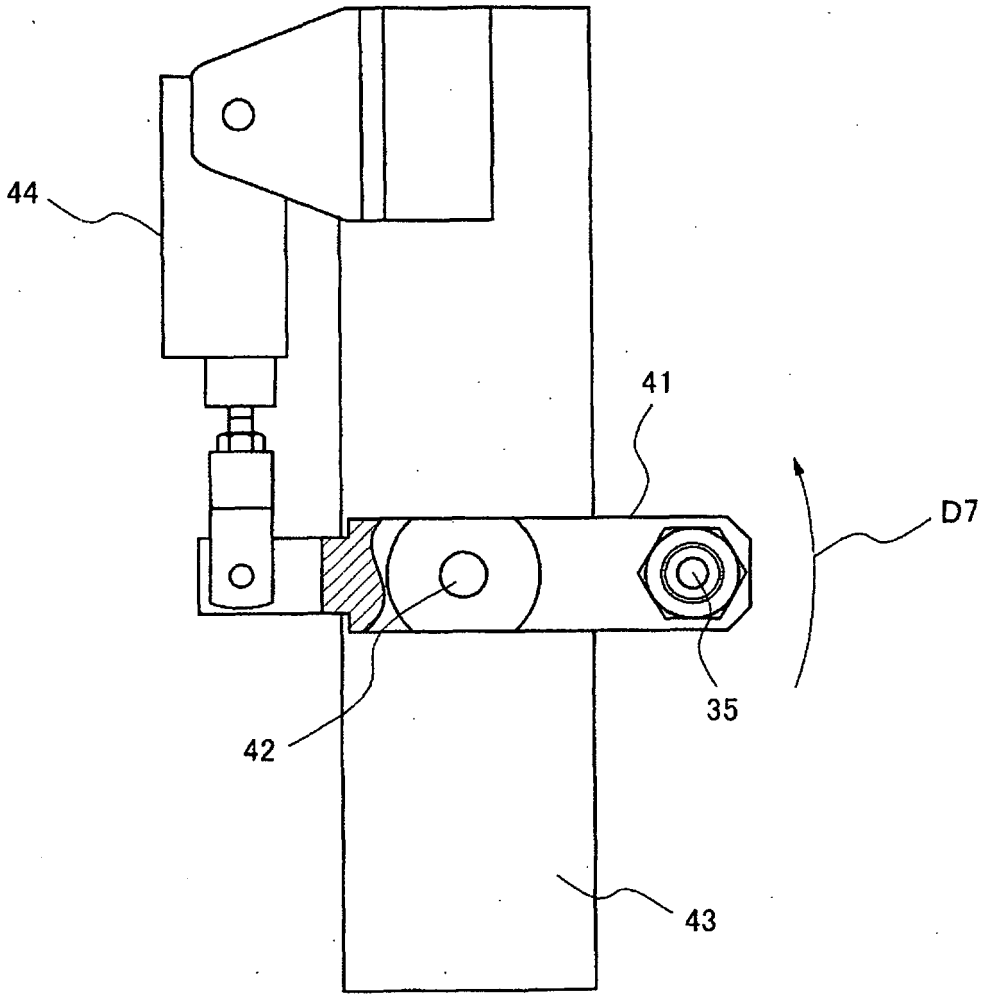


Fig.16

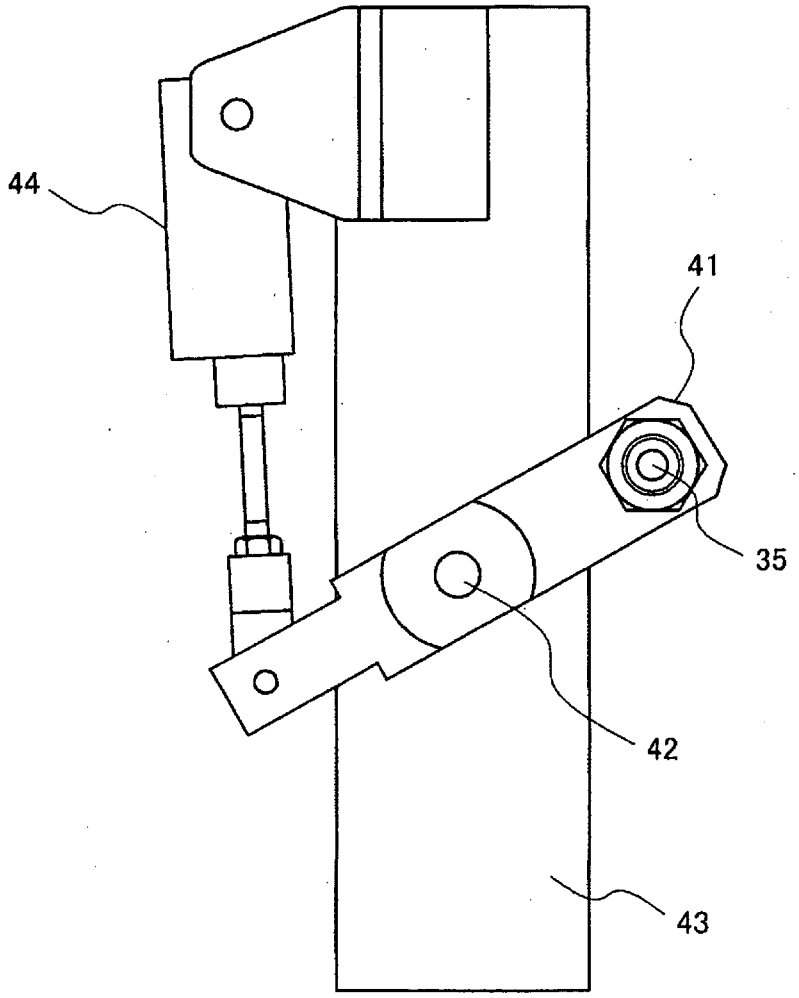


Fig.17

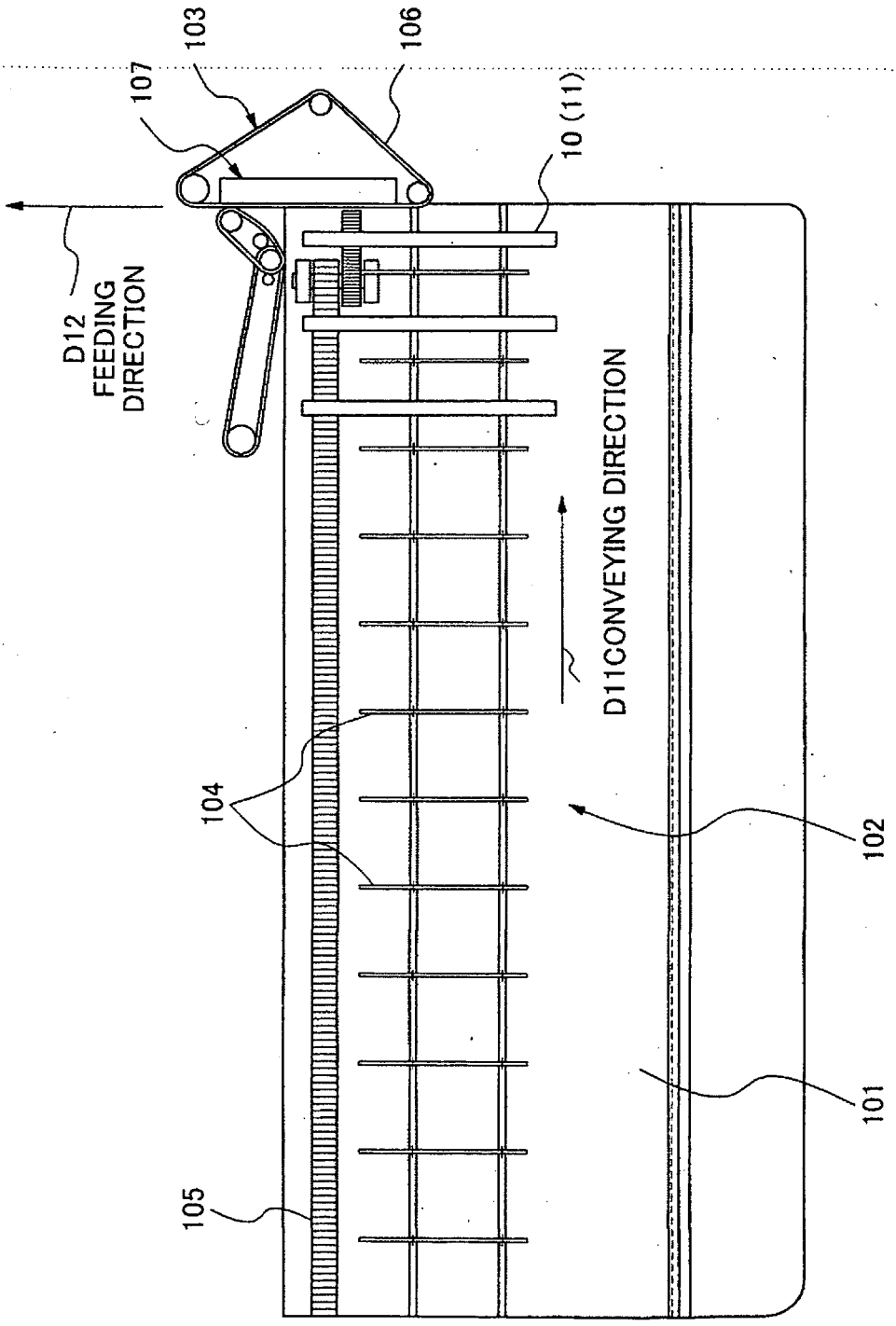


Fig.18
(RELATED ART)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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- US 4815723 A **[0006]**
- EP 0368166 A **[0007]**