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(11) **EP 1 076 027 A2**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
14.02.2001 Bulletin 2001/07

(51) Int. Cl.⁷: **B65H 29/70, B65H 29/14**

(21) Application number: **00116240.3**

(22) Date of filing: **08.08.2000**

(84) Designated Contracting States:
**AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU
MC NL PT SE**
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **09.08.1999 JP 22531899**

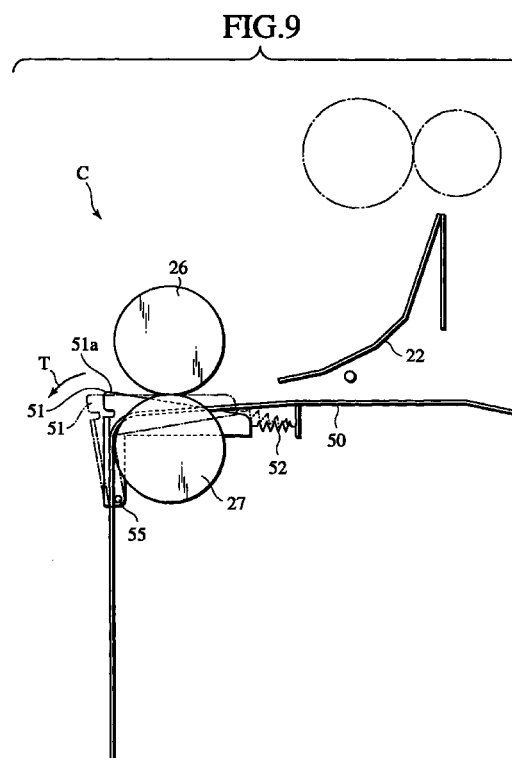
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(54) **Collating apparatus**

(57) The collating apparatus of the present invention comprises a pair of discharged paper attitude forcing trays provided at positions at both sides of a pair of discharge rollers, respectively, and each having a forcible guide surface for guiding a lower surface of a collated matter conveyed onto paper discharge guide plate, wherein the forcible guide surface of each of the discharged paper attitude forcing trays is constituted to be positioned upward of a position at which the pair of discharge rollers almost press-contact with each other and to allow a height of the forcible guide surface to be varied. According to the present invention, uneven flight distance does not occur, stable paper alignment is ensured, and paper jamming and paper wrinkle do not occur, irrespectively of degree of firmness of the collated matter.



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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a paper collating apparatus for stacking a plurality of types of paper sheets in a predetermined order and for discharging them as a collated matter. The present invention particularly relates to a discharge technique for discharging collated matters to a stacker section.

2. Description of the Related Art

[0002] Fig. 1 is an overall perspective view of a conventional collating apparatus.

[0003] As shown in Fig. 1, the conventional collating apparatus is comprised of a paper feed section 71 having a plurality of paper feed trays 70a to 70j arranged vertically and conveying many sheets 72 stacked on the respective paper feed trays 70a to 70j one by one at predetermined timing, a collating and conveying section (not shown) collating the plural sheets 72 conveyed from the respective paper feed trays 70a to 70j of the paper feed section 71 to provide collated matters 73 (shown in Figs. 2(A) and 2(B)) and conveying the collated matters 73 to a discharge section 74, the discharge section 74 discharging the collated matters 73 conveyed from the collating and conveying section to a stacker section 75, and the stacker section 75 provided with a paper discharge tray 76 for stacking the collated matters 73 discharged from the discharge section 74 and provided with a pair of side fences 77, 78 and a front fence 79 arranged on the paper discharge tray 76.

[0004] As shown in Figs. 2(A) and 2(B), the discharge section 74 has a paper discharge guide plate 80 guiding the collated matters 73 conveyed from the collating and conveying section to the stacker section 75 side and a pair of upper and lower discharge rollers 81 and 82 at positions downstream of the paper discharge guide plate 80 and at which the rollers 81 and 82 confront the stacker section 75. The paired discharge rollers 81 and 82 are arranged almost in a press-contact state and the positions of the paired discharged rollers 81 and 82 almost in a press-contact state are set to be slightly higher than the paper discharge guide plate 80.

[0005] With the above configuration, many sheets 72 sorted according to paper types (contents) are stacked on, for example, the uppermost paper feed table 70a to the lowermost paper feed table 70j, respectively. One unit of a collated matter 73 obtained by stacking sheets 72 in the vertical order of these paper feed trays 70a to 70j will be described. When a start mode is selected, respective sheets 72 from the uppermost paper feed tray 70a to the lowermost paper feed tray 70j are sequentially conveyed with predetermined timing delays. The conveyed sheets 72 are collated by

the collating and conveying section to thereby provide collated matters 73. The resultant collated matters 73 are discharged to the stacker section 75 through the discharge section 74. By executing the series of operations continuously, many collated matters of paper sheets 72 are stacked on the stacker section 75.

[0006] In the discharge section 74 in the above-stated operation process, the collated matters 73 conveyed from the collating and conveying section are guided by the paper discharge guide plate 80, introduced between the paired discharge rollers 81 and 82 and applied with a discharge force toward the stacker section 75 by the rotation force of the paired discharge rollers 81 and 82. However, no consideration is given to with what flight attitude the collated matters 73 are flown. This causes a disadvantage in that if a collated matter 73 lack firmness (if collated matter 73 consists of light sheets or small number of sheets), the flight attitude of the collated matter 73 becomes particularly unstable, thereby making flight distance uneven and making it difficult to stably align the sheets.

[0007] Furthermore, as another conventional discharge section 74, there is proposed one as shown in Figs. 3(A) and 3(B). In case of this discharge section 74, the position at which a pair of discharge rollers 81 and 82 are almost in a press-contact state is set slightly lower than a paper discharge guide plate 80 compared with the above-stated conventional case. With this configuration, the both sides of a collated matter 73 are bent upward by the paper discharge guide plate 80 relative to the center of the collated matter 73, the flight attitude of the collated matter 73 is V-shaped if viewed from the front side and the collated matter 73 takes stable flight attitude, so that no uneven flight distance occurs and stable sheet alignment is ensured.

[0008] Nevertheless, according to another conventional case stated above, the collated matter 73 is forcedly bent into a V-shape. Due to this, if the collated matter 73 is firm (the collated matter 73 consists of heavy sheets or many sheets), excessive bending force acts on the collated matter 73, thereby causing paper jamming and paper wrinkle.

SUMMARY OF THE INVENTION

[0009] The present invention has been made to overcome the above-stated disadvantages. It is, therefore, an object of the present invention to provide a collating apparatus which does not make flight distance uneven irrespectively of whether a collated matter has firmness or not, ensures stable paper alignment and does not cause paper jamming and paper wrinkle.

[0010] One of the features of the present invention is a collating apparatus provided with a paper feed section, having a plurality of paper feed trays, for conveying a plurality of sheets stacked on the plurality of paper feed trays one by one at predetermined timing; a collating and conveying section for collating the plurality of

sheets conveyed from the respective paper feed trays of the paper feed section to provide collated matters, and for conveying the collated matters to a discharge section; the discharge section, having a paper discharge guide plate provided for guiding the collated matters conveyed from the collating and conveying section to a stacker section side and having a pair of upper and lower discharge rollers provided downstream of the paper discharge guide plate almost in a press-contact state, for discharging the collated matters introduced between the pair of discharge rollers to a stacker section by rotation force of the pair of discharge rollers; and the stacker section having a paper discharge tray for stacking the collated matters discharged from the discharge section, characterized by comprising a pair of discharged paper attitude forcing trays provided at positions of both sides of the pair of discharge rollers and each having a forcible guide surface for guiding a lower surface of the collated matter conveyed onto the paper discharge guide plate, wherein the forcible guide surface of each of the discharged paper attitude forcing trays is positioned upward of a position at which the pair of discharge rollers almost press-contact with each other, and a height of the forcible guide surface is variable.

[0011] According to this collating apparatus, a pair of discharged paper attitude forcing trays each having a forcible guide surface for guiding a lower surface of the collated matter conveyed onto the paper discharge guide plate, are provided at positions of both sides of the pair of discharge rollers, and the forcible guide surface of each of the discharged paper attitude forcing trays is constituted such that the forcible guide surface is positioned upward of a position at which the pair of discharge rollers almost press-contact with each other and that a height of the forcible guide surface is variable. Accordingly, if the collated matter lacks firmness (the collated matter consists of light sheets or small number of sheets), the forcible guide surface of each of the paired discharged paper attitude forcing trays is placed at the upper position, whereby a bending force acts on the collated matter to allow the collated matter to be discharged while taking a V-shaped flight attitude. If the collated matter has firmness (the collated matter consists of heavy sheets or many sheets), the forcible guide surface of each of the paired discharged paper attitude forcing trays is placed at the lower position, whereby a bending force does not act on the collated matter so strongly and the collated matter is discharged while taking a V-shaped flight attitude with small angle or without taking the V-shaped flight attitude. Consequently, although a bending force acts on the collated matter which lacks firmness, the collated matter does not suffer paper jamming or paper wrinkle. This is because the collated matter is easily bent due to lack of firmness. Besides, since the collated matter takes a stable V-shaped flight attitude when flown, it does not suffer uneven flight distance and the stable alignment of paper is

ensured. On the other hand, a bending force does not strongly act on the collated matter having firmness. Due to this, the collated matter does not suffer paper jamming or paper wrinkle. Besides, although the collated matter does not take a V-shaped flight attitude when flown, the attitude is stable due to its firmness. In this way, the collated matter does not suffer uneven flight distance and the stable alignment of paper is ensured.

[0012] It is preferable to constitute each of the discharged paper attitude forcing trays such that the height of the forcible guide surface is movable between an upper position and a lower position and that each of the discharged paper attitude forcing trays is urged toward the upper position by the urging means and that, if the forcible guide surface is pressed, the discharged paper attitude forcing trays is moved toward the lower position against an urging force of the urging means.

[0013] According to this constitution, each of the discharged paper attitude forcing trays is constituted such that the height of the forcible guide surface is movable between an upper position and a lower position and that each of the discharged paper attitude forcing trays is urged toward the upper position by the urging means and that, if the forcible guide surface is pressed, the discharged paper attitude forcing trays is moved toward the lower position against an urging force of the urging means. Therefore, if the collated matter lacks firmness, the force of the collated matter for pressing the forcible guide surface of each of the paired discharged paper attitude forcing trays is weak, whereby the forcible guide surface is placed at the upper position to increase the angle of V-shaped flight attitude. If the collated matter has firmness, the force of the collated matter for pressing the forcible guide surface of each of the paired discharged paper attitude forcing trays is strong, whereby the forcible guide surface is placed at the lower position and the angle of the V-shaped flight attitude becomes smaller or zero. As a result, the height of the forcible guide surface of each of the paired discharged paper attitude forcing trays is automatically varied according to the degree of firmness of the collated matter. Thus, an operator does not need to vary the height of the forcible guide surface according to the degree of firmness of the collated matter.

[0014] Also, it is preferable to constitute each of the discharged paper attitude forcing trays to be rotatably supported by the paper discharge guide plate and to be urged toward the direction opposite to a collated matter discharge direction by the urging means and to be moved toward lower position by rotating toward the collated matter discharge direction.

[0015] According to this constitution, each of the discharged paper attitude forcing trays is constituted to be rotatably supported by the paper discharge guide plate and to be moved toward the lower position by being urged by the urging means in a direction opposite to a collated matter discharge direction and by rotating toward the collated matter discharge direction. Due to

this, if the collated matter has firmness, the paired discharged paper attitude forcing trays rotate in the same direction as the discharge direction of the collated matters, whereby each forcible guide surface is moved to the lower position and, therefore, smoothly moved along the collated matter, making it possible to advantageously prevent the occurrence of paper jamming and paper wrinkle.

[0016] And also, it is preferable that a pair of auxiliary discharged paper attitude forcing trays, each having a forcible guide surface positioned at least upward of the forcible guide surface of each of the discharged paper attitude forcing trays, are provided at positions outside of the pair of discharged paper attitude forcing trays, respectively.

[0017] According to this constitution, a pair of auxiliary discharged paper attitude forcing trays each having a forcible guide surface positioned at least upward of the forcible guide surface of each of the discharged paper attitude forcing trays, are provided at positions outside of the pair of discharged paper attitude forcing trays, respectively. Therefore, if the width of the collated matter is large, not only the forcible guide surface of each of the paired discharged paper attitude forcing trays but also the forcible guide surface of each of the paired auxiliary discharged paper attitude forcing trays outside of the paired discharged paper attitude forcing trays guide the lower surface at the both sides of the collated matter. Due to this, even the collated matter having large width and lacking firmness is discharged while taking a V-shaped flight attitude if viewed from the front side. Hence, the collated matter has a stable flight attitude and the stable alignment of paper is ensured without causing uneven flight distance.

[0018] Other and further objects and features of the present invention will become obvious upon understanding of the illustrative embodiments about to be described in connection with the accompanying drawings or will be indicated in the appended claims, and various advantages not referred to herein will occur to one skilled in the art upon employing of the invention in practice.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019]

Fig. 1 is an overall perspective view of a conventional collating apparatus;

Fig. 2 shows a conventional apparatus wherein Fig. 2(A) is a schematic front view of the discharge section of the conventional collating apparatus, and Fig. 2(B) is a schematic side view of the discharge section of the conventional collating apparatus;

Fig. 3 shows another conventional collating apparatus wherein Fig. 3(A) is a schematic front view of the discharge section of another conventional collating apparatus and Fig. 3(B) is a schematic side

view of the discharge section of another conventional collating apparatus;

Fig. 4 shows one embodiment of the present invention and is an overall perspective view of a collating apparatus;

Fig. 5 shows one embodiment of the present invention and is a block diagram showing a paper feed section, a discharge section and a stacker section;

Fig. 6 shows one embodiment of the present invention and is a side view showing a drive transfer system for transferring a driving force to the paper feed section, a collating and conveying section and the discharge section;

Fig. 7 shows one embodiment of the present invention and is a perspective view showing the distribution of a driving force to the respective paper feed sections;

Fig. 8 shows one embodiment of the present invention and is a schematic front view of the discharge section;

Fig. 9 shows one embodiment of the present invention and is a schematic side view of the discharge section;

Fig. 10 shows one embodiment of the present invention and is a perspective view of the discharge section and the stacker section;

Fig. 11 shows one embodiment of the present invention wherein Fig. 11(A) is a schematic side view of the discharge section showing a state in which the forced guide surface of a discharged paper attitude forcing tray is positioned at an upper position and Fig. 11(B) is a schematic side view of the discharge section showing a state in which the forced guide surface of a discharged paper attitude forcing tray is positioned at a lower position.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0020] Various embodiments of the present invention will be described with reference to the accompanying drawings. It is to be noted that the same or similar reference numerals are applied to the same or similar parts and elements throughout the drawings, and the description of the same or similar parts and elements will be omitted or simplified.

[0021] The embodiments of a collating apparatus according to the present invention will be described hereinafter with reference to the accompanying drawings.

[0022] As shown in Figs. 4 to 7, the collating apparatus consists of a paper feed section A conveying a plurality of types of sheets 1 at predetermined timing one by one for each type, a collating and conveying section B collating the plural sheets 1 conveyed from the paper feed section A and conveying them as collated matters 2 to a discharge section C, the discharge section C discharging the collated matters 2 from the collating and

conveying section B to a stacker section D, and the stacker section D stacking thereon the collated matters 2 discharged from the discharge section C.

[0023] The paper feed section A has ten paper feed trays 3a to 3j which are vertically arranged. Each of these paper feed trays 3a to 3j consists of a fixed paper feed tray section 4 and a movable paper feed tray section 6 having a conveying tip end side vertically moving with a support shaft 5 used as a fulcrum as shown in Fig 5. The movable paper feed tray section 6 is provided with a paper detection sensor S1 having a lever 7. The paper detection sensor S1 detects whether or not sheets 1 are stacked on the respective paper feed trays 3a to 3j. A paper feed roller 9 supported by a rotary shaft 8 is arranged at a position above the conveying tip end side of the movable paper feed tray section 6. If the movable paper feed tray portion 6 is positioned above, a stacked sheet at the uppermost position is press-contacted with the paper feed roller 9.

[0024] When the paper feed roller 9 is rotated, only the stacked sheet 1 at the uppermost position is conveyed with the involvement of the effect of a stripper plate which is not shown. An upper guide plate 10 and a lower guide plate 11 guiding sheets 1 to be conveyed are provided at positions downstream of the paper feed roller 9. The conveyed sheets 1 are guided by the upper and lower guide plates 10 and 11 and supplied to the collating and conveying section B.

[0025] A stack paper feed detector S2 has a light emission section 12 and a light reception section 13 arranged across the passages of the upper and lower guide plates 10 and 11, and detects whether or not the number of conveyed sheets 1 is one based on a sensor output level. The detector S2 also detects the presence/absence of empty feed or sheet jamming based on whether or not there is a sensor output within a predetermined time after the start of the rotation of the paper feed roller 9.

[0026] Further, the rotation timing of each paper feed roller 9 corresponding to each of the paper feed trays 3a to 3j is controlled by a solenoid clutch, which is not shown, to be described below, and sheets 1 are conveyed to the collating and conveying section B from each of the paper feed trays 3a to 3j at predetermined timing. The drive transfer system for the respective paper feed rollers 9 and the timing thereof will be described below.

[0027] As shown in Fig. 5, the collating and conveying section B has conveyer rollers 15 provided at the discharge sides of the upper and lower guide plates 10 and 11 corresponding to each of the paper feed trays 3a to 3j, and presser rollers 16 provided to face the conveyer rollers 15, respectively. Each of the presser rollers 16 arranged vertically are urged toward the corresponding conveyer roller 15 by a spring, which is not shown, and a conveyer belt 17 is laid on these presser rollers 16, 16, ... Each of the presser rollers 16 is press-contacted with the corresponding conveyer roller 15

through the conveyer belt 17. The drive transfer system of the conveyer rollers 15 will be described below.

[0028] Further, perpendicular guide plates 18 and 19 are provided on both sides of the conveyer belt 17 which is press-contacted with each conveyer roller 15 and each presser roller 16. A perpendicular conveying passage 20 is arranged between the perpendicular guide plates 18 and 19 at the both sides of the conveyer belt 17. One perpendicular guide plate 18 is comprised of a plate, whereas the other guide plate 19 is comprised of a plurality of plates integral with the upper and lower guide plates 10 and 11 of the paper feed section A.

[0029] When the respective conveyer rollers 15 rotate, the rotatable conveyer belt 17 is moved by the presser rollers 16 in response to the frictional force of the conveyer rollers 15 and the sheets 1 conveyed from the paper feed section A are put between the rotating conveyer rollers 15 and the moving conveyer belt 17 and conveyed downward over the perpendicular conveying passage 20. Here, if the sheet 1 at the lower paper feed tray side is conveyed to the collating and conveying section B at timing at which the sheet 1 conveyed from above passes through the conveyer rollers 15 provided below, the lower sheet 1 is stacked on the upper sheet 1 and conveyed downward. The conveying operation and stacking operation of the sheets 1 are repeated to thereby create a desired collated matter 2 and the resultant collated matter 2 is conveyed to the discharge section C provided further below.

[0030] As shown in Fig. 5, the discharge section C has a conveying passage changing guide plate 21 which is rotatably provided between a stacker position indicated by a solid line and a position for a device for treating imaged-sheets indicated by a virtual line in Fig. 5. The conveying passage changing guide plate 21 is urged toward a stacker position side by a spring which is not shown and driven by a solenoid which is not shown. The conveying passage changing guide plate 21 is located at the stacker position when the solenoid is turned off and at the imaged-sheet treatment device position when the solenoid is turned on. At the stacker position, the upper end of the conveying passage changing guide plate 21 is positioned along one perpendicular guide plate 18 of the collating and conveying section B and the collated matters 2 conveyed from the collating and conveying section B are introduced toward the stacker section D side. At the imaged-sheet treatment device position, the upper end of the conveying passage changing guide plate 21 is positioned along the other perpendicular guide plate 19 of the collating and conveying section B and the collated matters 2 conveyed from the collating and conveying section B are introduced toward the opposite side to the stacker section D.

[0031] Further, a stacker section side guide plate 22 and an imaged-sheet treatment device side guide plate 23 are provided below the conveying passage changing

guide plate 21. The collated matters 2 are conveyed selectively through the guide plates 22 and 23.

[0032] A discharge detection sensor S3 has a light emission section 24 and a light reception section 25 arranged across the stacker section side guide plate 22, and detects the discharge timing of the collated matters 2 based on a sensor output. Namely, when the collated matters 2 start passing through the sensor S3, a light from the light emission section 24 is shielded and the output of the light reception section 25 turns into L level. When the passage of collated matters 2 is finished, the light from the light emission section 24 is not shielded and the output of the light reception section 25 returns to H level. Based on this, the sensor S3 detects the discharge timing of the collated matters 2. The discharge detection sensor S3 also detects sheet jamming at the discharge section C when, for example, the sensor output is kept at high level H over a predetermined time.

[0033] Also, as shown in Fig. 5 and Figs. 8 to 10, a paper discharge guide plate 50 is provided at the lowest downstream of the stacker section D side guide plate 22 in a continuous fashion. The paper discharge guide plate 50 guides the collated matters 2 conveyed from the collating and conveying section B following the guiding of the stacker side guide plate 22, and introduces the collated matters 2 to the discharge side toward the stacker section D. A pair of discharge rollers 26 and 27, which are vertically arranged, are provided at the lowest downstream of the paper discharge guide plate 50 and at positions confronting the stacker section D. The paired discharge rollers 26 and 27 are arranged almost in a press-contact state and the press-contact position of the paired discharge rollers 26 and 27 slightly protrudes upward of the paper discharge guide plate 50. The upper discharge roller 26 is a driving roller, for which a drive transfer system will be described later. As the upper discharge roller 26 rotates, the lower discharge roller 27 rotates following the rotation of the upper discharge roller 26. The collated matters 2 conveyed from the collating and conveying section B are inserted between the paired discharge rollers 26 and 27 and discharged to the stacker section D by the rotation force of the paired discharge rollers 26 and 27.

[0034] Further, a pair of discharged paper attitude forcing tray 51, 51 protruding from the hole (not denoted by a reference symbol) of the paper discharge guide plate 50 are provided at positions at both sides of the paired discharge rollers 26, 27 or, to be specific, at the positions at which a sheet 1 of small width (e.g., A4, B5 and B4 size) is put. The upper surfaces of the respective trays 51 are constituted as forcible guide surfaces 51a guiding the lower surface of the collated matter 2. Each of the discharged paper attitude forcing trays 51 is rotatably supported by the paper discharge guide plate 50 at the downstream side of discharging the collated matter 2 with a support shaft 55 used as a fulcrum, and constituted to be movable between the upper position of the forcible guide surface 51a indicated by a solid line in

Fig. 9 and the lower position of the forcible guide surface 51a indicated by a virtual line in Fig. 9. Also, a tension spring 52 serving as urging means is interposed between the discharge upstream side of the discharged paper attitude forcing trays 51 and the paper discharge guide plate 50. The discharged paper attitude forcing trays 51 are urged toward the upper position sides by the spring force of this tension spring 52. That is to say, each of the discharged paper attitude forcing trays 51 is constituted to be urged in a direction opposite to the direction in which the collated matters 2 are discharged and moved to the lower position side by rotating in the same direction T as the collated matter 2 discharge direction.

[0035] Furthermore, a pair of auxiliary discharged paper attitude forcing trays 53, 53 are provided at positions at further outside of the paired discharged paper attitude forcing trays 51, 51 or, to be specific, at positions at which the both sides of a sheet 1 of large width (e.g., A3 size) is put. The auxiliary discharged paper attitude forcing trays 53 are fixed to the paper discharge guide plate 50 and the upper surfaces of the respective trays 53 are constituted as a forcible guide surface 53a guiding the lower surface of the collated matter 2. The forcible guide surface 53a is set to be put at a position at least above the forcible guide surface 51a of the paired discharged paper attitude forcing trays 51, 51.

[0036] Next, description will be given to the drive transfer system of the paper feed rollers 9, the conveyer rollers 15 and the upper discharge roller 26. As shown in Fig. 6, a driving pulley 31, a discharge pulley 32 and a conveying pulley 33 are fixed to the output shaft 30a of a main motor 30, the rotary shaft 26a of the discharge roller 26 and the rotary shaft 15a of the lowermost conveyer roller 15, respectively. The first driving belt 35 is laid on these pulleys 31, 32 and 33 and an auxiliary pulley 34.

[0037] Further, a relay pulley 37 supported by a rotary shaft 36 is provided between the vertically adjacent paper feed rollers 9, 9 and the conveying pulleys 33 are fixed to the rotary shafts 15a of the respective conveyer rollers 15. The second driving belt 39 is laid on these relay pulleys 37, the conveying pulleys 33 and the auxiliary pulleys 38. As shown in Fig. 7, a relay gear 40 is fixed to the rotary shaft 36 of each relay pulley 37 and paper feed gears 41 arranged at upper and lower positions are engaged with the relay gear 40, respectively. The paper feed gears 41 are coupled to the rotary shaft 8 of the paper feed roller 9 through solenoid clutches, which are not shown, respectively.

[0038] When the main motor 30 is driven, the first driving belt 35 is moved and the upper discharge roller 26 is thereby rotated in a direction indicated by an arrow a of Fig. 6. Following the movement of the first driving belt 35, the second driving belt 39 is moved to thereby rotate the respective conveyer rollers 15 in a direction indicated by an arrow b of Fig. 6 and the respective paper feed gears 41 are also rotated through the

respective relay pulleys 37. Then, only the paper feed roller 9 having the solenoid clutch turned on is rotated in a direction indicated by an arrow c of Fig. 6.

[0039] Fig. 10 is a perspective view of the neighborhood of the stacker section. As shown in Fig. 10, the stacker section D has a paper discharge tray 42 provided at the falling position of the collated matters 2 discharged from the discharge section C and a pair of side fences 43 and 44 positioned at both outer sides of the collated matters 2 discharged onto the discharge tray 42 and restricting an orthogonal direction to the discharge direction of the collated matters 2. One of the paired side fences 43 and 44 (left side fence in the drawings) is provided to be movable horizontally and the other fence (right side fence in the drawings) is fixed to the paper discharge tray 42. By moving the one side fence 43, the width between the paired side fences 43 and 44 can be varied according to the width of sheets 1 to be collated. A front fence 45 (shown in Fig. 4) is arranged on the paper discharge tray 42 to restrict the forward side of the discharge direction of the collated matters 2. The front face 45 is provided movably in an oblique direction to the discharge direction of the collated matters 2.

[0040] Moreover, a pair of paper discharge wings 47 and 48 having upper ends rotatably supported through support shafts 49, respectively, are provided in notch holes 43a and 44a of the paired side fences 43 and 44, respectively. Each of the paired paper discharge wing 47 and 48 is constituted to be freely moved between a wait position (indicated by a solid line shown in Fig. 10) at which the wing does not interfere with the collated matters 2 discharged from the discharge section C and an interference position (indicated by a virtual line shown in Fig. 10) at which the wing interferes with the collated matters 2 discharged from the discharge section C. In a sort mode, the driving mechanism controls each of the paired paper discharge wings 47 and 48 to be moved alternately between the wait position and the interference position in accordance with the timing at which the collated matters 2 are discharged from the discharge section C. In a normal mode, the driving mechanism controls each of the wings 47 and 48 to be always positioned at the wait position.

[0041] Next, the function of the above configuration will be described. For example, ten different types (different contents) of sheets are to be collated, many sheets 1 sorted according to types are stacked on the uppermost paper feed tray 3a to the lowermost paper feed tray 3j, respectively in a collation order. When a start switch, which is not shown, is turned on, the main motor 30 is driven and the paper feed rollers 9 of the uppermost paper feed tray 3a to the lowermost paper feed tray 3j are sequentially rotated under the control of the respective solenoid clutches in this order, thereby sequentially conveying the sheets 1 of the respective types (contents) to the collating and conveying section

B one by one. The sheets 1 thus conveyed are collated at the positions of the conveyer rollers 15 of the collating and conveying section B and conveyed downward. The final collating treatment is conducted at the position of the conveyer roller 15 at the lowermost position to thereby provide a desired collated matter 2. The collated matter 2 is fed to the discharge section C, progressed by the conveying passage changing guide plate 21 toward the stacker section D side and discharged to the stacker section D by the rotation of the paired discharge rollers 26 and 27. A series of these operations are continuously executed, thereby sequentially discharging collated matters 2 in units.

[0042] In the normal mode, the paired paper discharge wings 47 and 48 are held at their respective wait positions, and the collated matters 2 are stacked on the paper discharge tray 42 for each unit without horizontally offsetting one another. In the sort mode, the paired paper discharge wings 47 and 48 are alternately positioned at their respective interference positions, and the collated matters 2 are sorted right and left and stacked on the paper discharge tray 42.

[0043] In the discharge process of the discharge section C in the above-stated operation, the collated matter 2 conveyed from the collating and conveying section B is guided by the paper discharge guide plate 50, introduced between the paired paper discharge roller 26 and 27, and discharged toward the stacker section D by the rotation force of the paired paper discharge rollers 26 and 27. At the same time, the lower surface at the both sides of the collated matter 2 is guided by the forcible guide surfaces 51a of the paired discharged paper attitude forcing trays 51, 51 and then discharged.

[0044] Here, if the collated matter 2 lacks firmness (the collated matter 2 consists of light sheets or small number of sheets), the forcible guide surfaces 51a are held at their respective upper positions and the paired forcible guide surfaces 51a, 51a protrude, by D, from the position at which the paired discharge rollers 26 and 27 almost press-contact with each other as shown in Fig. 11(A) and Fig. 8 due to the fact that the force of the collated matter 2 for pressing the forcible guide surfaces 51a of the paired discharged paper attitude forcing trays 51, 51 is weak. As a result, the collated matter 2 is discharged while taking such a V-shaped flight attitude that the central portion of the collated matter 2 is at the lower position and the collated matter 2 is directed more upward closer to the both sides thereof. Further, if the collated matter 2 has firmness (the collated matter 2 consists of heavy sheets or many sheets), the paired discharged paper attitude forcing trays 51, 51 rotate in a direction of an arrow T against the spring force of the tension spring 52 to thereby place the paired forcible guide surfaces 51a, 51a at their respective lower positions, and the positions of the paired forcible guide surfaces 51a, 51a become slightly higher than or almost equal to the position at which the paired discharge rollers 26 and 27 almost press-contact with each other as

shown in Fig. 11(B) due to the fact that the force of the collated matter 2 for pressing the forcible guide surfaces 51a of the paired discharged paper attitude forcing trays 51, 51 is strong. The collated matter 2 is discharged with the V shape having a small angle or without taking any V-shaped attitude.

[0045] That is to say, although a bending force acts on the collated matter 2 which lacks firmness, the collated matter 2 does not suffer paper jamming or paper wrinkle. This is because the collated matter 2 is easily bent due to lack of firmness. Besides, since the collated matter 2 takes a stable V-shaped flight attitude when flown, it does not suffer uneven flight distance and the stable alignment of paper is ensured. On the other hand, a bending force does not strongly act on the collated matter 2 having firmness. Due to this, the collated matter 2 does not suffer paper jamming or paper wrinkle. Besides, although the collated matter 2 does not take a V-shaped flight attitude when flown, the attitude is stable due to its firmness. Thus, the collated matter 2 does not suffer uneven flight distance and the stable alignment of paper is ensured.

[0046] Moreover, in the above-stated embodiment, the heights of the forcible guide surfaces 51a of the paired discharged paper attitude forcing trays 51, 51 are automatically varied according to the degree of firmness of the collated matters 2. Thus, an operator does not need to vary the heights of the forcible guide surfaces 51a according to the degree of firmness of the collated matters 2. However, the forcible guide surfaces 51a may be constituted such that an operator can freely vary the heights of the surfaces 51a.

[0047] Further, in the above-stated embodiment, if the collated matter 2 having firmness, the paired discharged paper attitude forcing trays 51, 51 rotated in the same direction (arrow T direction shown in Fig. 9) as the discharge direction of the collated matters 2, whereby the respective forcible guide surfaces 51a are moved to their respective lower positions and, therefore, smoothly moved along the collated matters 2, making it possible to advantageously prevent the occurrence of paper jamming and paper wrinkle.

[0048] In addition, in the above-stated embodiment, if the width of the collated matter 2 is large, not only the forcible guide surfaces 51a of the paired discharged paper attitude forcing trays 51, 51 but also the forcible guide surfaces 53a of the paired auxiliary discharged paper attitude forcing trays 53, 53 outside of the trays 51, 51 guide the lower surface at the both sides of the collated matter 2. Due to this, the collated matter 2 having large width and lacking firmness is discharged while taking a V-shaped flight attitude if viewed from the front side. Thus, the collated matter 2 has a stable flight attitude and the stable alignment of paper is ensured without causing uneven flight distance.

[0049] Additionally, in the above-stated embodiment, when the discharge mode is a sort mode, the paired paper discharge wings 47 and 48 are alternately

moved from their respective wait positions to interference positions synchronously with the timing at which the collated matters 2 are discharged from the discharge section C, and the wings 47 and 48 are allowed to interfere with the collated matters 2 to thereby offset the collated matters 2. Accordingly, while the flight attitude and flight path of the collated matter 2 are important so as to allow the paired paper discharge wings 47 and 48 to appropriately interfere with the collated matter 2, the flight attitude and flight path of the collated matters 2 are stable according to the present invention for the reasons already described above. It is, therefore, possible to ensure good sorting operation irrespectively of whether or not the collated matters 2 have firmness.

[0050] In the above-stated embodiment, the paired discharged paper attitude forcing trays 51, 51 are constituted to be rotatably supported by the paper discharge guide plate 50 with the support shaft 55 used as a fulcrum and to be moved between their respective upper and lower positions. The paired discharged paper attitude forcing trays 51, 51 may be constituted to be vertically movable and to be linearly moved between their respective upper and lower positions. Also, in the above-stated embodiment, the paired auxiliary discharged paper attitude forcing trays 53, 53 are fixed to the paper discharge guide plate 50. The trays 53, 53 may be constituted to be movable as in the case of the paired discharged paper attitude forcing trays 51, 51.

OTHER EMBODIMENTS

[0051] Various modifications will become possible for those skilled in the art after receiving the teachings of the present disclosure without departing from the scope thereof.

[0052] It goes without saying that the present invention includes various other embodiments which are not disclosed herein. Accordingly, the technical scope of the present invention should be defined only by the following claims reasonably derived from the above description.

Claims

1. A collating apparatus provided with a paper feed section, having a plurality of paper feed trays, for conveying a plurality of sheets stacked on the plurality of paper feed trays one by one at predetermined timing; a collating and conveying section for collating the plurality of sheets conveyed from the respective paper feed trays of the paper feed section to provide collated matters, and for conveying the collated matters to a discharge section; the discharge section, having a paper discharge guide plate provided for guiding the collated matters conveyed from the collating and conveying section to a stacker section side and having a pair of upper and lower discharge rollers provided downstream of the

paper discharge guide plate almost in a press-contact state, for discharging the collated matters introduced between the pair of discharge rollers to a stacker section by rotation force of the pair of discharge rollers; and the stacker section having a paper discharge tray for stacking the collated matters discharged from the discharge section, the collating apparatus comprising:

a pair of discharged paper attitude forcing trays provided at positions of both sides of said pair of discharge rollers and each having a forcible guide surface for guiding a lower surface of the collated matter conveyed onto said paper discharge guide plate, wherein
said forcible guide surface of each of the discharged paper attitude forcing trays is positioned upward of a position at which said pair of discharge rollers almost press-contact with each other, and a height of said forcible guide surface is variable.

2. The collating apparatus of claim 1, wherein

each of said discharged paper attitude forcing trays is constituted such that the height of said forcible guide surface is movable between an upper position and a lower position and that each of said discharged paper attitude forcing trays is urged toward the upper position by the urging means and that, if said forcible guide surface is pressed, said discharged paper attitude forcing trays is moved toward the lower position against an urging force of said urging means.

3. The collating apparatus of claim 2, wherein

each of said discharged paper attitude forcing trays is constituted to be rotatably supported by said paper discharge guide plate and to be urged toward the direction opposite to a collated matter discharge direction by said urging means and to be moved toward lower position by rotating toward the collated matter discharge direction.

4. The collating apparatus of claim 1, comprising:

a pair of auxiliary discharged paper attitude forcing trays provided at positions outside of said pair of discharged paper attitude forcing trays, respectively, and each having a forcible guide surface positioned at least upward of said forcible guide surface of each of said discharged paper attitude forcing trays.

FIG.1

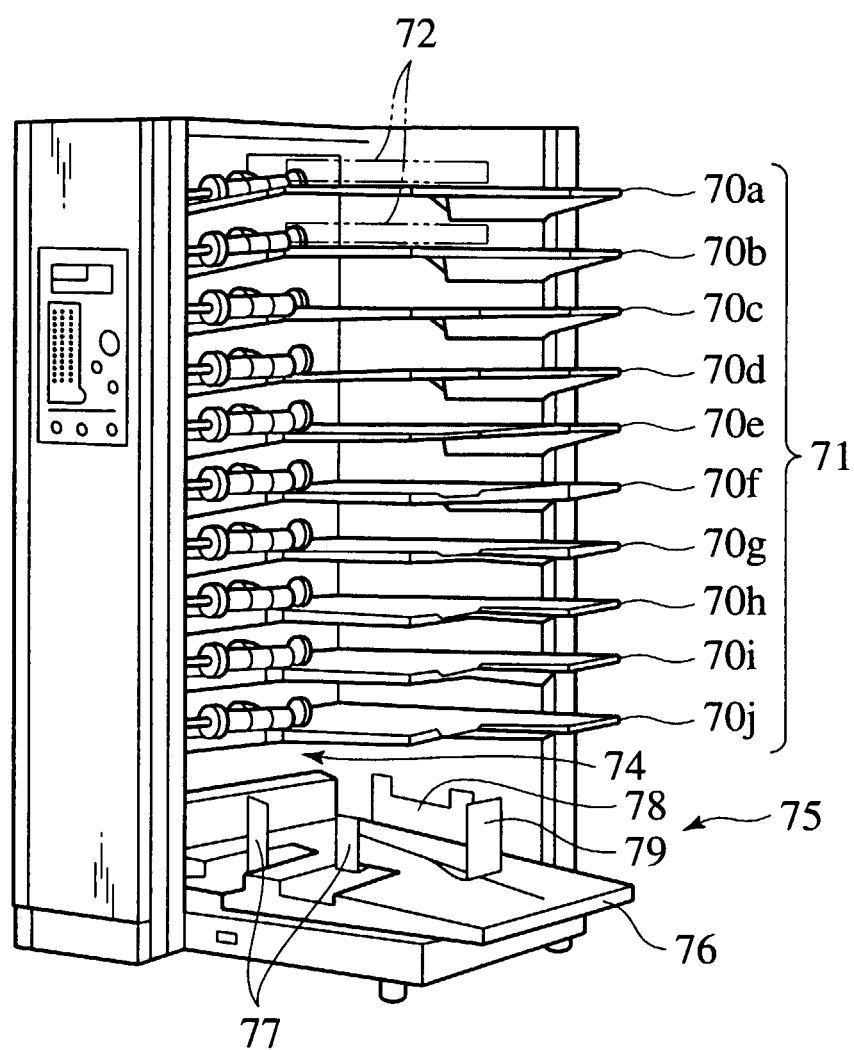


FIG.2A

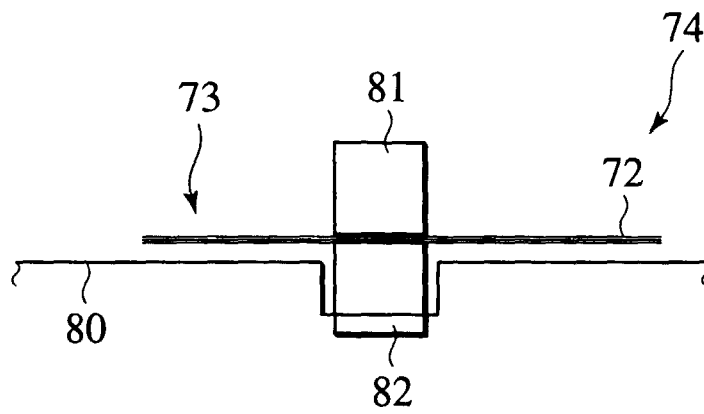


FIG.2B

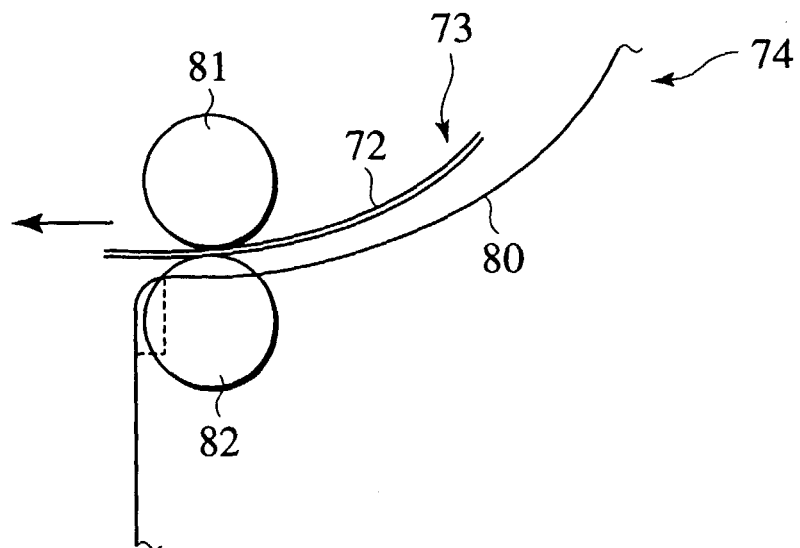


FIG.3A

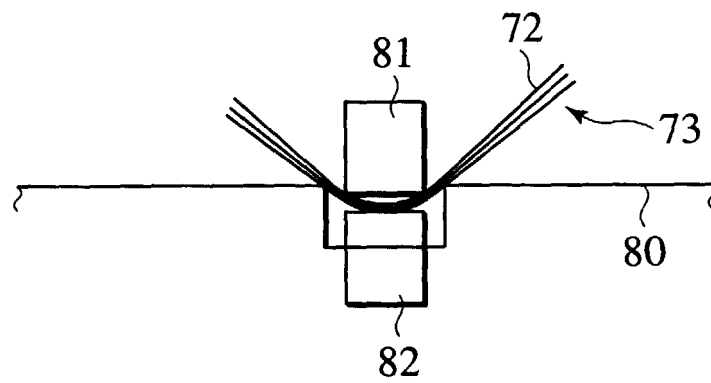


FIG.3B

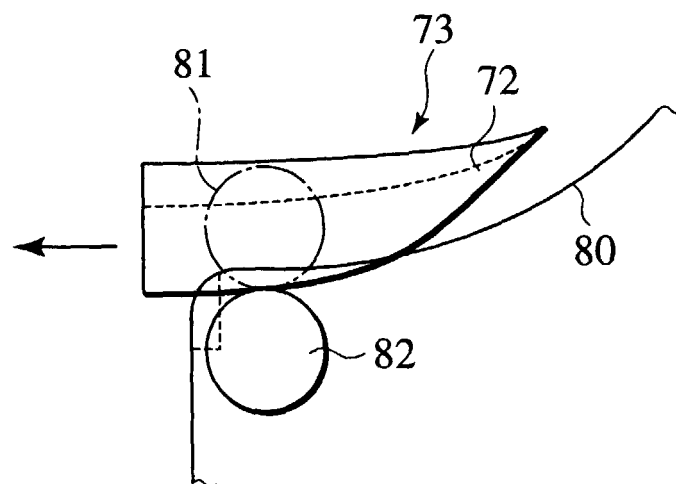


FIG.4

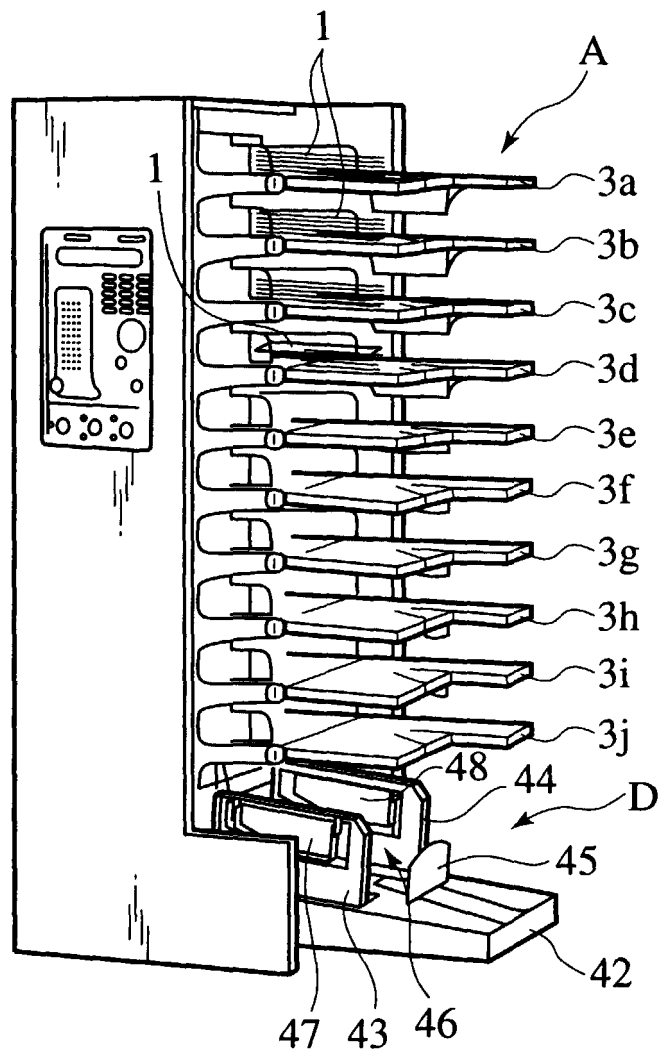


FIG.5

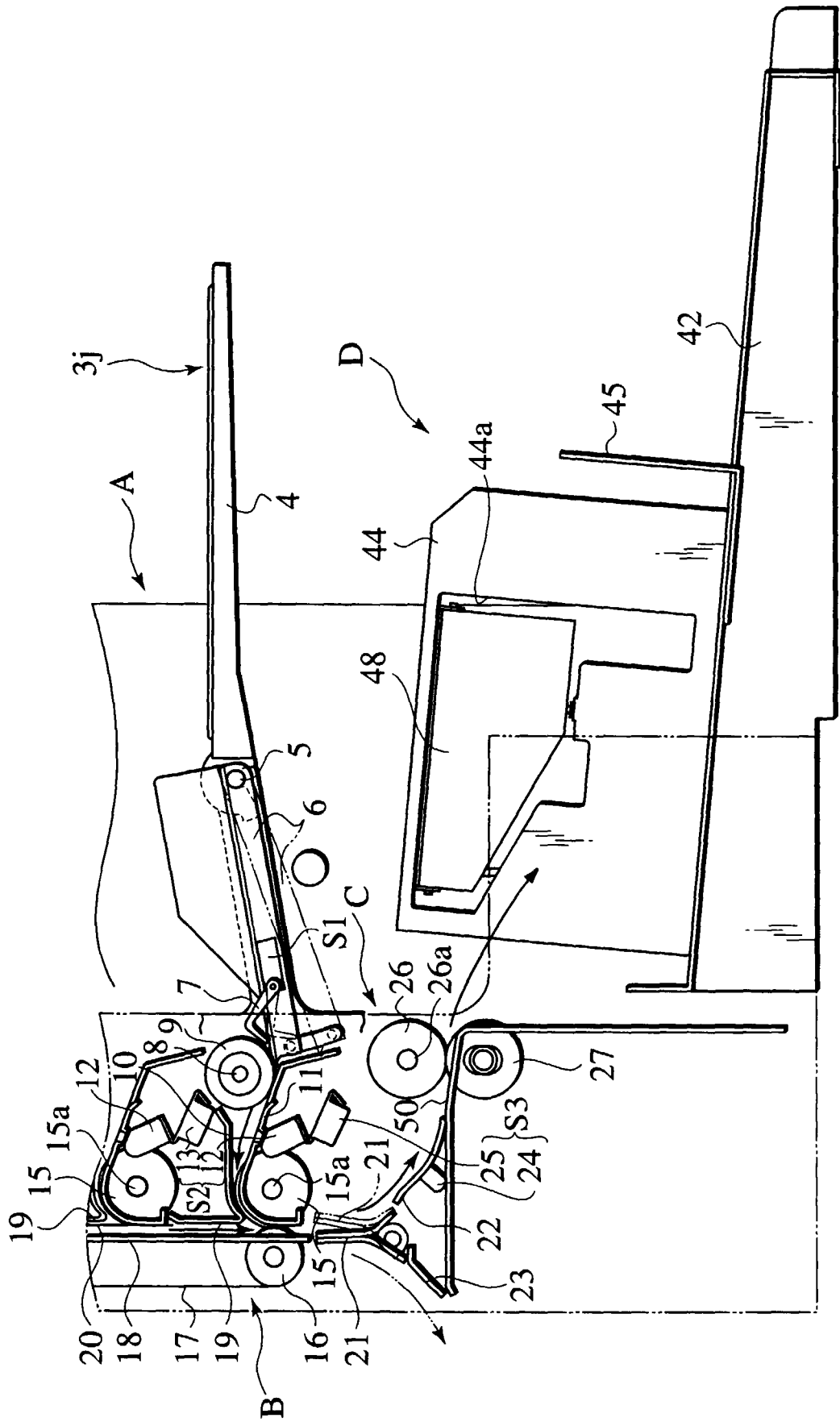


FIG.6

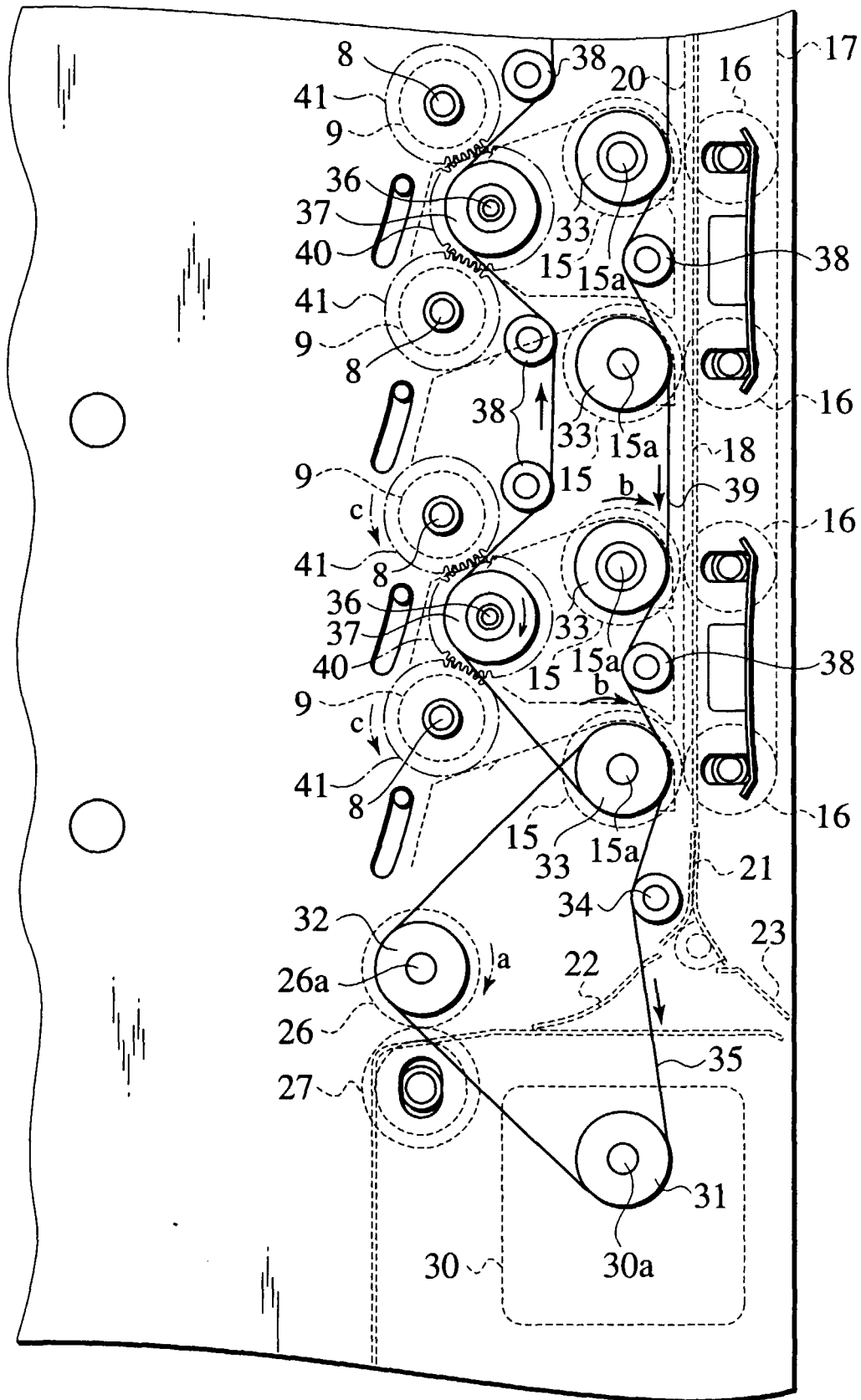


FIG.7

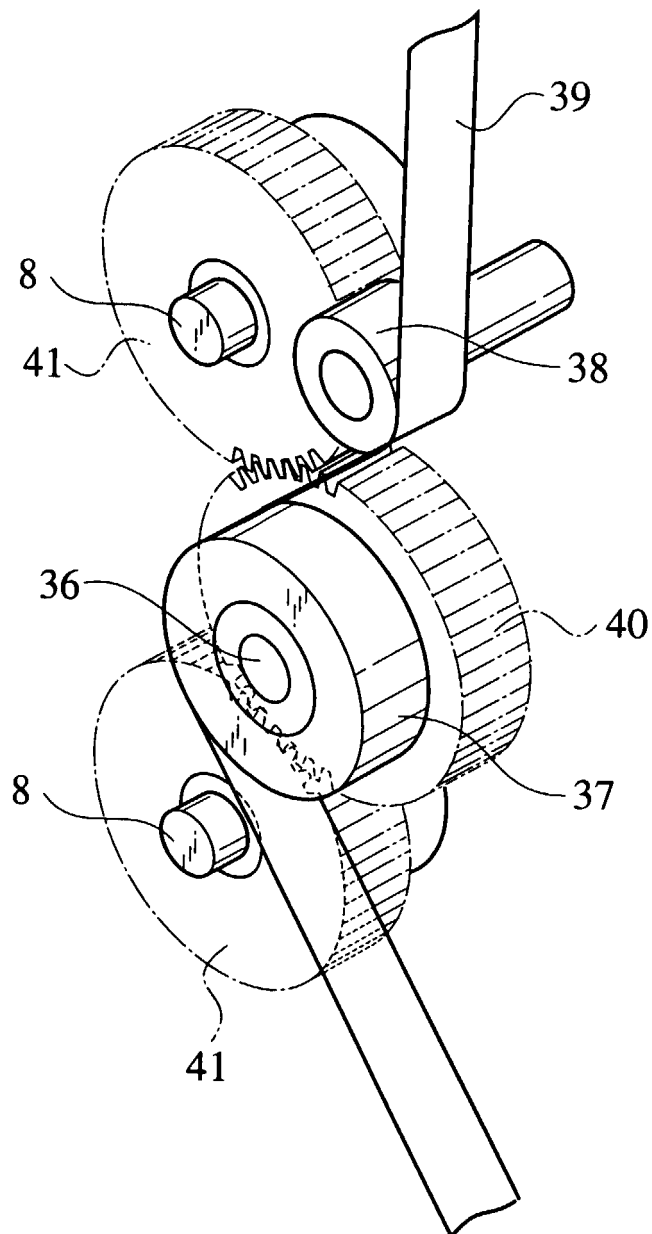


FIG.8

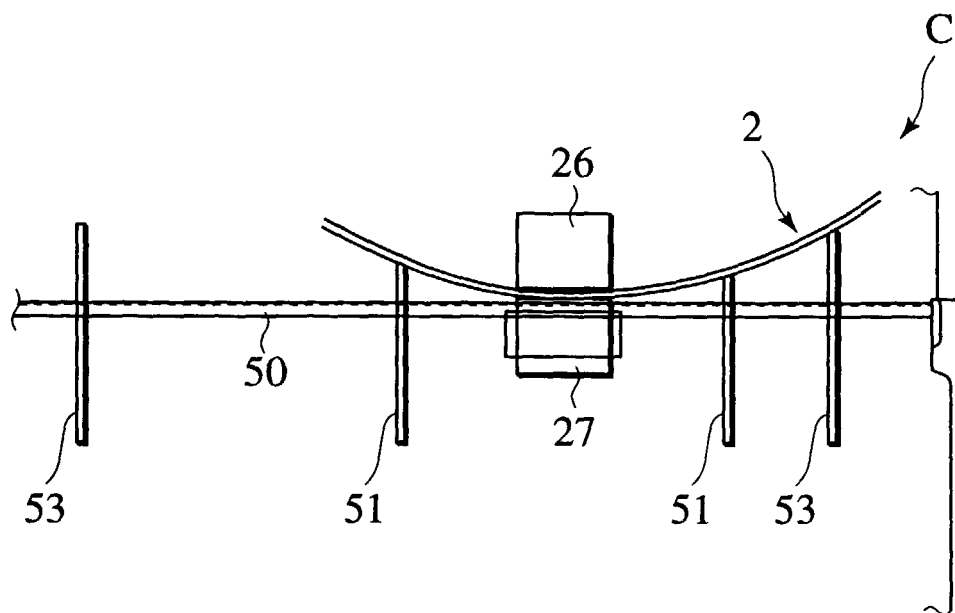


FIG.9

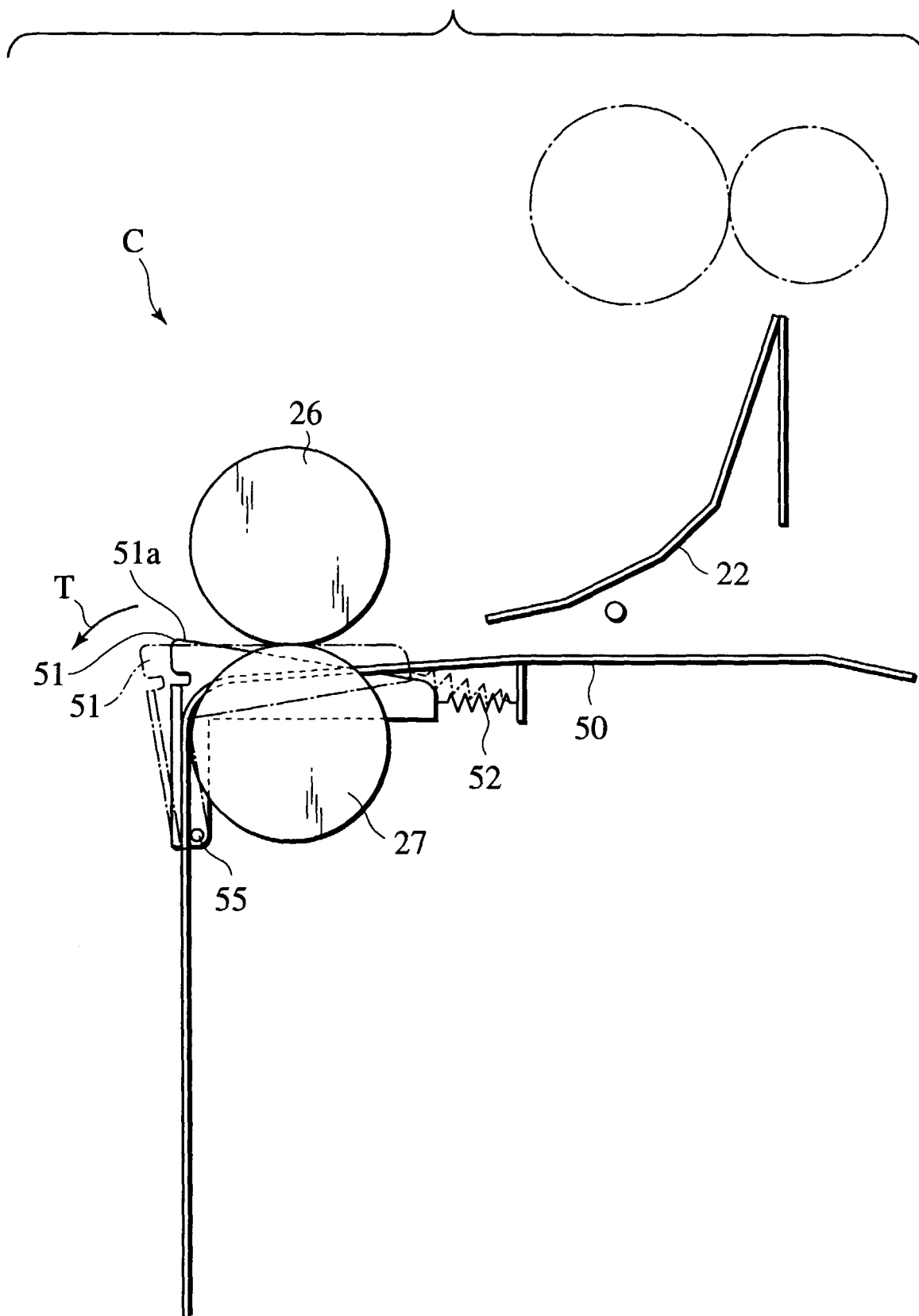


FIG.10

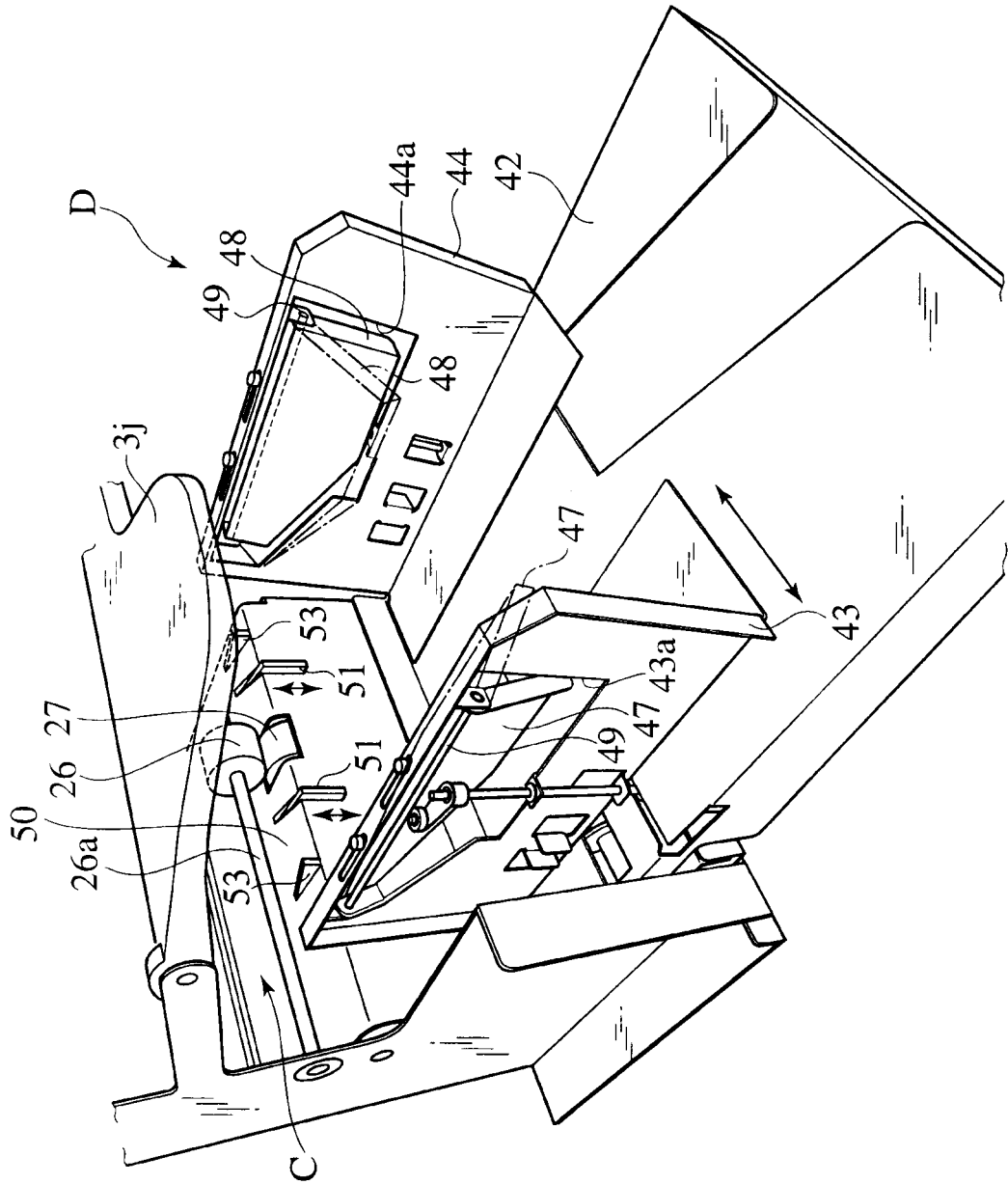


FIG.11A

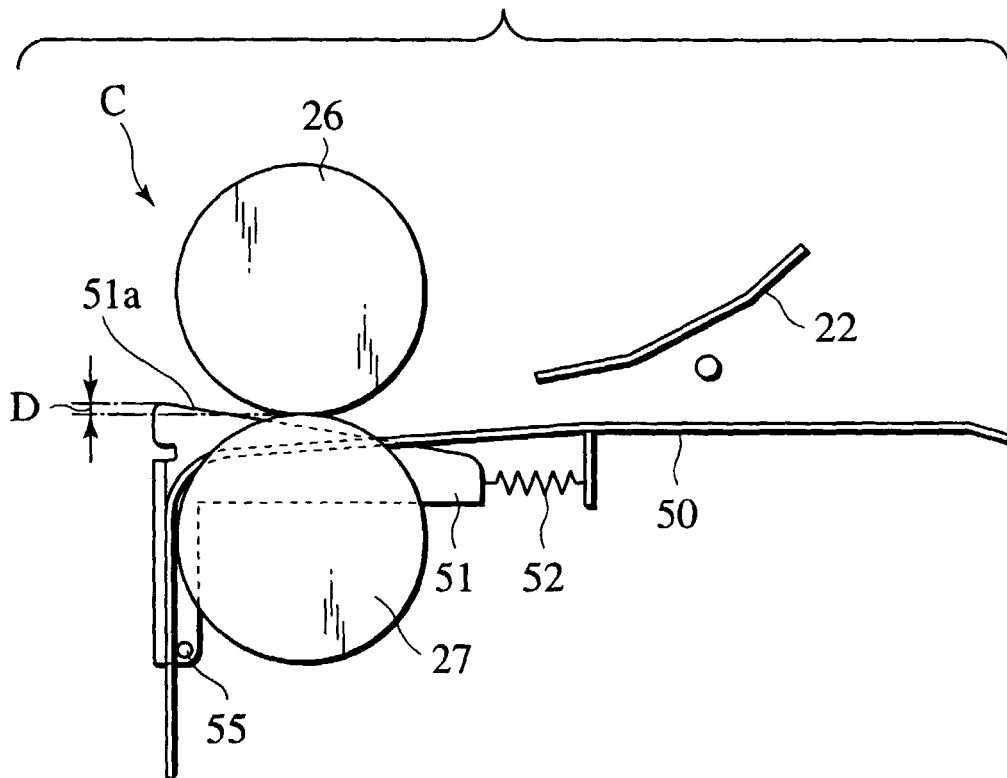


FIG. 11B

