



(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
08.06.2016 Bulletin 2016/23

(51) Int Cl.:
B65H 45/16 (2006.01)

(21) Application number: **13894132.3**

(86) International application number:
PCT/JP2013/076502

(22) Date of filing: **30.09.2013**

(87) International publication number:
WO 2015/045142 (02.04.2015 Gazette 2015/13)

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

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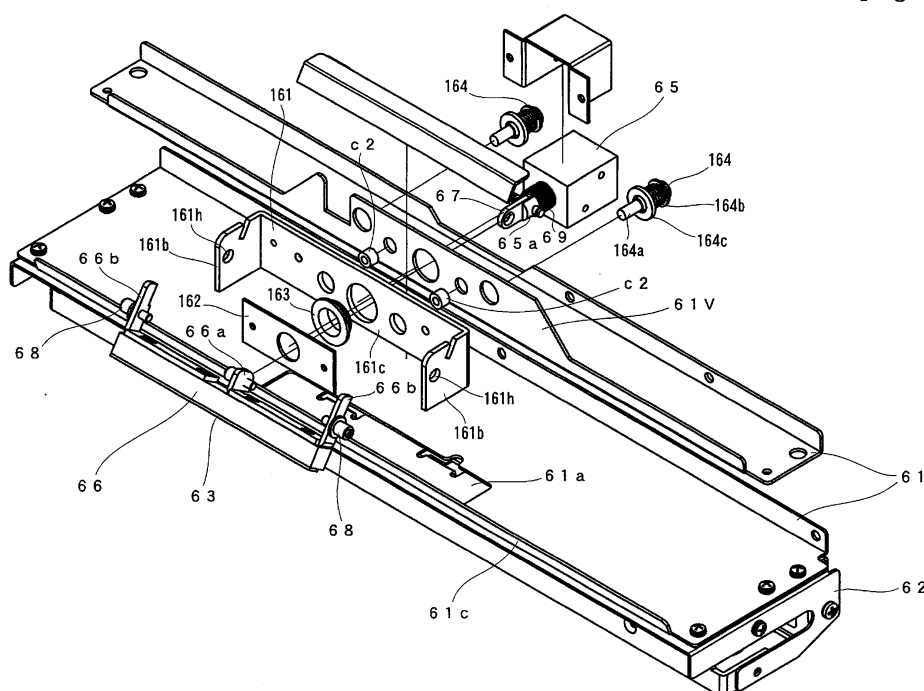
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(54) **SHEET FOLDING DEVICE**

(57) Provided is a sheet folding device comprising a deceleration means which halts a sheet by pressing. A pressure member such as rubber is disposed upon the leading end of a rod-shaped member which is rotatably retained. A sheet is decelerated by the pressure member

being applied obliquely to the sheet. The entire surface of the rubber does not make close contact with paper, and thus, a wrinkle is not formed in the paper. It is possible to ensure a stable folding location.

[Fig. 24]



Description

Technical Field

[0001] The present invention relates to a sheet folding device including a sheet deceleration means for temporarily stopping or decelerating a sheet such as printed paper along a transportation route.

Background Art

[0002] Conventionally, a sheet folding device including a sheet transportation means for drawing out sheets of paper stacked on a sheet loading unit one at a time so as to transport them, a sheet stopper for preventing the sheets transported by the sheet transportation means from traveling, and a sheet folding means for pinching and folding a bent portion of the sheet that has been prevented from traveling by the sheet stopper and partially bent as a result, is well known (Patent Document 1).

Prior Art Documents

Patent Documents

[0003]

[Patent Document 1] JP Hei 05-238637A
 [Patent Document 2] JP Sho 60-23253A
 [Patent Document 3] JP Sho 63-41377A
 [Patent Document 4] US Patent 3797820A

SUMMARY OF THE INVENTION

Problem To Be Solved By the Invention

[0004] Patent Document 2 discloses that a stopping member including rubber is attached rotatably along a predetermined axis, and the stopping member is then pressed against a piece of paper using a solenoid so as to stop it. However, since the entire rubber surface adheres to the paper through this method, the paper moves along with the stopping member or the paper becomes wrinkled. This cannot secure a stable folding location.

[0005] Patent Document 3 and Patent Document 4 disclose that a clamp is pressed against a sheet perpendicularly from above so as to stop it. However, the sheet may be damaged through this method as it is strongly pressed.

[0006] The present invention aims to resolve the above problems and provide a device for precisely folding a sheet of paper or the like at a predetermined location while reducing damage to the sheet.

Means of Solving the Problem

[0007] The present invention is a sheet folding device including sheet transportation means 11, 12, 13 and 14

for transporting a sheet S along a predetermined route, sheet deceleration means 6a and 6b for decelerating at least a part of the sheet while being transported by the sheet transportation means, folding means 11 and 13 and 11 and 14 for folding a part of the sheet that is bent as the result of deceleration by the sheet deceleration means, and a control unit for controlling the sheet deceleration means.

[0008] The sheet deceleration means includes a guide member 62 for receiving the sheet while being transported by the sheet transportation means; a stopping member that includes a plate-like pressing member 63 having a predetermined thickness and a pressing member attachment 66 having the pressing member on an end surface facing the sheet and is rotatably held at a predetermined fulcrum 63, wherein an edge ED1 of the pressing member presses the sheet traveling along the guide member against the guide member; and a stopping member driving part 65 for rotating the stopping member around the fulcrum.

[0009] The stopping member is positioned at a waiting location where the pressing member does not touch the sheet or at a pressing location where the edge of the pressing member touches the sheet but the entire surface of the pressing member does not touch the sheet, the stopping member moves from the waiting location to the pressing location by rotating in the same direction as the traveling direction of the sheet, and returns from the pressing location to the waiting location by rotating in the opposite direction to the traveling direction of the sheet, and the stopping member driving part rotates the stopping member from the waiting location to the pressing location in compliance with an instruction from the control unit, and the stopping member is held so as to rotate along a parallel axis to the travelling direction of the sheet, and the stopping member rotates due to a reaction to the sheet being pressed against the guide member by an edge of the stopping member.

BRIEF DESCRIPTION OF DRAWINGS

[0010]

FIG. 1 is a perspective view of a sheet folding device according to an embodiment of the present invention;

FIG. 2 is a drawing illustrating a state where an auxiliary guide member of the sheet folding device according to the embodiment of the present invention is pulled out;

FIG. 3 is a perspective view of the auxiliary guide member according to the embodiment of the present invention;

FIG. 4 is an operational schematic diagram of the auxiliary guide member according to the embodiment of the present invention;

FIG. 5 is an operational schematic diagram of the auxiliary guide member according to the embodi-

ment of the present invention;

FIG. 6 is a schematic diagram of the internal structure of the sheet folding device according to the embodiment of the present invention;

FIG. 7 is a side view illustrating a partially severed sheet deceleration means according to the embodiment of the present invention;

FIG. 8 is a top view of the sheet deceleration means according to the embodiment of the present invention;

FIG. 9 is a partial expanded sectional view of the sheet deceleration means according to the embodiment of the present invention;

FIG. 10 is a side view illustrating the periphery of a stopping member of the sheet deceleration means, according to the embodiment of the present invention, and a waiting location;

FIG. 11 is an operational schematic diagram of the stopping member of the sheet deceleration means according to the embodiment of the present invention;

FIG. 12 is an operational schematic diagram (comparative example) of the stopping member according to the embodiment of the present invention;

FIG. 13 is a block diagram of a control system for the device according to the embodiment of the present invention;

FIG. 14 is a block diagram of a control system for the sheet deceleration means according to the embodiment of the present invention;

FIG. 15 is a schematic diagram (timing chart) of the sheet deceleration means according to the embodiment of the present invention;

FIG. 16 is a schematic diagram of a correction table according to the embodiment of the present invention;

FIG. 17 is a schematic diagram of a driving time setting table according to the embodiment of the present invention;

FIG. 18 is a flow chart of sensor selection process according to the embodiment of the present invention;

FIG. 19 is an operational schematic diagram of the device according to the embodiment of the present invention; and

FIG. 20 is a schematic diagram explaining folding methods for a sheet using the device according to the embodiment of the present invention.

FIG. 21 is a planar view of the sheet deceleration means according to a modification.

FIG. 22 is a front view of the sheet deceleration means according to a modification.

FIG. 23 is a right side view of the sheet deceleration means according to a modification.

FIG. 24 is an exploded perspective view of the sheet deceleration means according to a modification.

FIG. 25 is an operational schematic diagram of the sheet deceleration means according to a modifica-

tion.

FIG. 26 is a view showing the operation of the sheet deceleration means according to a modification (table of observation results).

FIG. 27 is a view of the sheet skew.

BEST MODE FOR CARRYING OUT THE INVENTION

[0011] FIG. 1 is a perspective view of a sheet folding device according to an embodiment of the present invention. A sheet folding device 1 includes a sheet stocker 2, which slants downward toward the inside of the device 1, a paper ejection tray 80, which is located therebelow, and an operation panel PAN for specifying a folding method for a sheet (paper). The paper ejection tray 80 is a sheet exit E.

[0012] As shown in FIG. 2, the back of the sheet folding device 1 is detachable. This back is made up of an auxiliary guide member 90, which has a curved inner surface that receives a sheet protruding from sheet deceleration means 6a and 6b described later.

[0013] The interior of the auxiliary guide member 90 is as illustrated in FIG. 3. A plurality of (nine) plates is provided in the sheet traveling direction. The shape of these plates is the same, as if the shape is made by cutting out from those plates using half of a Koban-shaped object (a half egg-shaped object). The angle thereof forms roughly a quarter of a circle.

[0014] The auxiliary guide member 90 receives at the cross section surfaces of the plates provided therewithin, a sheet protruding from the sheet deceleration means 6a and 6b, as shown in FIG. 4 and FIG. 5.

[0015] By providing the auxiliary guide member 90, the sheet deceleration means 6a and 6b may be smaller than the sheet and thus the sheet folding device 1 may be downsized.

[0016] Further description will be given while referencing FIG. 6. The sheet stocker 2 is a portion for stacking foldable sheets S (standard-size paper in this example) and stocking them. A separating plate 3 made of rubber or the like is provided on an end on the downside along the slope thereof. The sheets S stacked on the sheet stocker 2 are separated by the separating plate 3 and are drawn out one by one from the top sheet S. A sliding plate 4, which guides the sheet S that has passed over the separating plate 3, is provided in front of the sheet stocker 2. A separating plate 5 made of rubber or the like is provided on an end near the sheet stocker 2.

[0017] Other than this friction type, there is also a known air suction type. A friction type, an air suction type, or another means may be employed as a supply means.

[0018] Reference numeral 10 denotes a feed roller, which is provided above the separating plates 3 and 5, for rolling on and making contact with the upper surface of the sheet S that passes the separating plates 3 and 5.

[0019] Reference numeral 11 denotes a driving roller located on the downstream of the sheet S drawn out between the separating plate 5 and the feed roller 10.

[0020] Reference numerals 12, 13 and 14 denote follower rollers, which circumscribe the driving roller 11 and rotate synchronously.

[0021] Reference numerals 15 and 16 denote conveying rollers, which transport the sheet S that has passed between the driving roller 11 and the follower roller 14 to the exit E (this continues to the paper ejection tray 80).

[0022] The rollers 10 to 16 constitute a sheet transportation means for transporting the sheet S along a predetermined route.

[0023] The driving roller 11 and the follower roller 13 are also a folding means for folding a part of the sheet bent by the sheet deceleration means 6a. The driving roller 11 and the follower roller 14 are also a folding means for folding a part of the sheet bent by the sheet deceleration means 6b.

[0024] Reference numeral 17 denotes a motor (sheet transportation means driving part) for rotary driving the driving roller 11 and the conveying roller 15.

[0025] Reference numeral 18 denotes a transmission unit, which transmits the dynamic force of the motor 17. The transmission unit 18 includes a pulley 18a provided along an output shaft of the motor 17, a pulley 18b provided coaxially with the driving roller 11, a gear 18c provided coaxially with the feed roller 10, a gear 18d for outer gearing with the gear 18c, a pulley 18e provided coaxially with the gear 18d, a pulley 18f and a gear 18g provided coaxially with the conveying roller 15, a gear 18h for outer gearing with the gear 18g, a pulley 18i provided coaxially with the gear 18h, a timing belt 18j wound around the pulleys 18a, 18b, 18e and 18i, a pulley 18k provided coaxially with the conveying roller 16, and a flat belt 18n wound around the pulleys 18f and 18k.

[0026] Rotating the motor 17 allows simultaneous rotation of not only the feed roller 10 and the driving roller 11, but the follower rollers 12, 13 and 14, which circumscribe the driving roller 11, and the conveying rollers 15 and 16 as well. However, the feed roller 10 is made to intermittently rotate as a result of action of a clutch, which is omitted from the drawing, provided coaxially with the feed roller. This allows the sheets S on the sheet stocker 2 to be drawn out one by one at predetermined timings by the intermittently rotating feed roller 10 while consecutively rotating the driving roller 11 and the follower rollers 12, 13 and 14.

[0027] Reference numeral 19 denotes a conveyance path for leading the sheet having passed between the driving roller 11 and the follower roller 14 to the exit E. The conveyance path 19 includes paired upper and lower plates 19a and 19b that face each other in parallel and close proximity. The lower plate 19b is partially notched so as to expose the peripheries of the conveying rollers 15 and 16.

[0028] Reference numerals 6a and 6b respectively denote a sheet deceleration means. In FIG. 6, the sheet deceleration means 6a and 6b are arranged diagonally upward and diagonally downward, respectively, at locations facing the periphery of the driving roller 11. The

angle between the sheet deceleration means 6a and 6b is approximately 90 degrees. The sheet deceleration means 6a and 6b temporarily decelerate the sheet S being transported by the sheet transportation means, so as to bend the sheet S. Note that 'deceleration' includes completely stopping the sheet S.

[0029] The upper sheet deceleration means 6a decelerates the sheet S fed between the driving roller 11 and the follower roller 12. The lower sheet deceleration means 6b decelerates the sheet S fed between the driving roller 11 and the follower roller 13.

[0030] FIGS. 7 to 9 are the schematic diagrams of the sheet deceleration means 6a and 6b. As the sheet deceleration means 6a and 6b are the same, the signs 'a' and 'b' are omitted from the following description when differentiation therebetween is unnecessary.

[0031] The sheet deceleration means 6 includes an upper guide plate 61 and a lower guide plate 62, which face each other in parallel and close proximity via a gap G that allows the sheet S to enter. The upper guide plate 61 and the lower guide plate 62 are formed by pressing a steel sheet etc. The gap G formed between the upper guide plate 61 and the lower guide plate 62 is approximately 1 to 3 mm, for example.

[0032] Reference numeral 63 denotes a rubber pad pressing the sheet S that has entered the gap G onto the inner side (top side of the lower guide plate 62 in this example) of the gap G along the thickness thereof. The pad 63 is provided on the receiving end side of the gap G where the sheet S enters and exits, so as to control bending deformation of the sheet S in the gap G. In FIG. 7, the right side is the traveling direction of the sheet S. When the sheet S is folded, it returns to the opposite side from the traveling direction.

[0033] Reference numeral 64 denotes a pad transfer means for transferring the pad 63 between predetermined waiting and pressing locations. FIG. 7 illustrates the waiting location of the pad 63. The waiting location and the pressing location will be described in detail later.

[0034] The pad transfer means 64 includes a solenoid 65, which is deployed on the upper guide plate 61 as a driving source, a pad fixing bar 66, which is attached to the bottom of the pad 63, and a transmission link 67, which transmits a stretching force from the solenoid 65 to the pad fixing bar 66.

[0035] As shown in FIG. 8 and FIG. 9, the pad fixing bar 66 extends along the route orthogonal to the traveling direction of the sheet entering the gap G along the upper guide plate 61. The extending direction of the pad fixing bar 66 is parallel to the end of the sheet S. A bracket 66a is attached to the middle of the pad fixing bar 66. Paired brackets 66b are attached on either end along the length of the pad fixing bar 66. Note that in FIG. 8, hatching of the portion of the pad fixing bar 66 is for demonstrating the pad fixing bar 66 and is not a cross section.

[0036] While FIG. 8 and FIG. 9 show the pressing location, the entire surface of the pad 63 makes contact with the top surface of the sheet S or the inner surface

of the lower guide plate 62. The pressing location in FIG. 8 and FIG. 9 is slightly different from the pressing location described in FIG. 11.

[0037] On the other hand, a long hole 61a resulting from cutting out a portion for the pad fixing bar 66 to be deployed, and brackets 61b and 61b, which result from bending up both ends of the long hole 61a, are formed on the upper guide plate 61. The brackets 61b and 61b and the brackets 66b and 66b are connected by pivots 68 and 68, respectively. An extension rod 65a for the solenoid 65 and the bracket 66a are connected by the transmission link 67. When the solenoid 65 is driven so as to extend, the pad fixing bar 66 rotates around the pivots 68 (carries out circular movement). This moves the pad 63 between the waiting location and the pressing location.

[0038] The brackets 61b may be metal blocks instead of lanced claws.

[0039] A coil spring 69 is provided to the extension rod 65a. Due to the resilience of this spring, the pad 63 is at the waiting location when the solenoid 65 is not being driven. When the solenoid 65 is driven, the extension rod 65a overcomes the resilience of the spring 69 and shortens, resulting in movement of the pad 63 to the pressing location. When there is no driving current, the solenoid 65 allows the resilience of the spring 69 to extend the extension rod 65a, resulting in movement of the pad 63 to the waiting location.

[0040] As shown in FIG. 8, a sheet entry sensor 7 is provided on the upper guide plate 61. This sensor 7 detects the end of the sheet entering the gap G. The sheet entry sensor 7 is a reflection type photoelectric switch, for example.

[0041] Description of the waiting location and the pressing location of the pad 63 will be described while referencing FIG. 10 and FIG. 11.

[0042] In the following description, the pad 63 (pressing member) and the pad fixing bar 66 (pressing member attachment) are depicted collectively as 'stopping members'.

[0043] Thickness of the pad 63 is 'a' in FIG. 11(a). The pad 63 is provided on the end (bottom) of the pad fixing bar 66 near the sheet S. The pad fixing bar 66 is held rotatably at a fulcrum FC. The fulcrum FC corresponds to the pivot 68.

[0044] AP denotes the point of action of the driving force of the solenoid 65, and F denotes acting force.

[0045] In FIG. 10 and FIG. 11(a), the stopping members 63 and 66 are at the waiting location. That is, the pad 63 is not touching the sheet S. Reference numeral 61c in FIG. 10 denotes a stopping member stopper for keeping the stopping members 63 and 66 at the waiting location.

[0046] As shown in FIG. 11(a), at the waiting location, an angle made by a straight line of the surface of the pad 63 and the traveling direction of the sheet S is approximately 55 degrees.

[0047] In FIG. 11(b), the solenoid 65 is driven and the

stopping members 63 and 66 are thus moved to the pressing location as indicated by a dotted line. That is, the sheet S is being pressed onto the inner surface of the lower guide plate 62 by an edge ED1 of the pad 63. Display of the lower guide plate 62 is omitted from FIG. 11.

[0048] The edge ED1 is on the farther end from the entry location of the sheet S, of the two edges of the pad 63 that are along the traveling direction of the sheet S. The edge ED1 touches the sheet S because the sum of the thickness a of the pad 63 and length c from the end surface (bottom) touching the sheet S of the pad fixing bar 66 to the fulcrum FC is slightly smaller than distance h from the fulcrum FC to the sheet S.

[0049] As shown in FIG. 11(b), at the pressing location, an angle made by a straight line of the surface of the pad 63 and the traveling direction of the sheet S is approximately 76 degrees. Difference between angles at the waiting location and the pressing location is approximately 20 degrees.

[0050] The stopping members 63 and 66 move from the waiting location to the pressing location by rotating approximately 20 degrees in the same direction as the traveling direction of the sheet S, and return from the pressing location to the waiting location by rotating approximately 20 degrees in the opposite direction to the traveling direction of the sheet S.

[0051] Length b of the pad 63 is shorter than length d of the end surface of the pad fixing bar 66. The pad 63 is provided near an end of the pad fixing bar 66 to which the sheet S enters first. Therefore, an edge ED2 (edge of the pressing member attachment), which is on the opposite side to the sheet S entry side of the end surface of the pad 63, is not covered by the pad 63. Therefore, the stopping members 63 and 66 of FIGS. 10, 11(a) and 11(b) have the two edges ED1 and ED2.

[0052] At the waiting location, neither of the two edges ED 1 or ED2 is touching the sheet S (pressing against it). At the pressing location, the edge ED1 is touching the sheet S but the edge ED2 is not.

[0053] If both of the two edges ED 1 or ED2 at the pressing location are touching the sheet S, as in FIG. 12(a), and if the pad 63 is worn down, the edge ED2 of the metal part makes contact with the sheet S first, as in FIG. 12(b), and there is a danger that the sheet S cannot be stopped. There is also a danger of damaging the sheet S.

[0054] Therefore, while the edge ED1 is touching the sheet S at the pressing location, as shown in FIG. 11(b), even if the pad 63 has been worn down during the life expectancy of the product or between overhaul procedures, the thickness a of the pad 63 should be selected such that the edge ED2 does not touch the sheet S.

[0055] The stopping members 63 and 66 pressing as in FIG. 11(b) bring about the following effects.

1) Since the pad 63 is structured so as to move in a circular manner and the sheet S is braked by the

edge ED1, the sheet may be securely held and sufficiently decelerated even when the sheet S is thick and moves fast. The pad 63 is pulled in the traveling direction of the sheet S by frictional force occurring between the sheets S as well as by the driving force of the solenoid 65, and the pad 63 thereby moves further in a circular manner. As a result, since the pad 63 is further strongly pressed against the sheet S, a greater braking force may be obtained. Application of the brake on the edge ED1 allows effective deceleration utilizing the traveling force of the sheet S.

2) By providing the stopping members 63 and 66 with the two edges ED1 and ED2, the sheet S is not blocked from traveling when returning to the opposite direction to the traveling direction nor is the sheet S damaged. While the sheet S travels along the bottom surface (inner surface of the lower guide plate 62) when advancing in the traveling direction, it travels along the top surface (surface of the pad 63) when returning in the opposite direction. As the pad 63 is not between the edges ED1 and ED2 at this time, blockage of traveling of the sheet S is reduced.

3) The angle made by the straight line perpendicular to the surface of the pad 63 and the traveling direction of the sheet S is made smaller than 90 degrees at the pressing location, and thus sufficient deceleration of the sheet S and security of a stable folding location are possible. If the angle becomes 90 degrees and the entire surface of the pad 63 touches the sheet S, a stable folding location cannot be secured. If the angle exceeds 90 degrees, the sheet S cannot be stopped. Contrary to the above effect 1, braking becomes weaker due to the traveling force of the sheet S.

[0056] FIG. 11(c) illustrates an example where the length b of the pad 63 is the same as the length d of the end surface of the pad fixing bar 66. There is no edge ED2 in this example. The working example of FIG. 11(c) does not bring about the above-given effect 2, but does lead to the effects 1 and 3.

[0057] A control system of the device according to the embodiment of the present invention will be described while referencing FIG. 13.

[0058] CONT denotes a control unit for controlling the solenoids 65a and 65b and the motor 17 based on signals from an operation panel PAN and a plurality of sensors. The control unit CONT includes a CPU, ROM, RAM, and I/O ports. Controlling is carried out by the CPU executing a program stored in the ROM.

[0059] A signal for instructing a folding method for a sheet S, for example, is transmitted from the operation panel PAN. Folding methods will be described while referencing FIG. 20 and the description thereof.

[0060] Sensors connected to the control unit CON are given below.

[0061] A sheet size sensor SS is for detecting the size

of a sheet S placed on the sheet stocker 2. Detected sizes are A4, A3, etc. The sheet size sensor SS is well known to those skilled in the art and therefore detailed description thereof is omitted.

[0062] Note that the size of the sheet S may be input from the operation panel PAN instead of using the sheet size sensor SS. There are cases when provision of the sheet size sensor SS is unnecessary.

[0063] A paper feed sensor FS is for detecting that the sheet S has been loaded onto the sheet transportation means 10 to 16. The paper feed sensor FS is an optical sensor (photointerrupter or the like), for example, and is provided near the separating plate 3 or the feed roller 10, for example.

[0064] Sheet entry sensors 7a and 7b are for detecting entry of the sheet S to the sheet deceleration means 6a and 6b, respectively. An example of installation locations is given in FIG. 8.

[0065] A paper ejection sensor ES is for detecting ejection of a folded sheet S. The paper ejection sensor ES is provided at the exit E.

[0066] A rotary encoder RE is a sensor for detecting the amount of rotation of the driving roller 11. A rotating shaft of the rotary encoder RE is connected to the rotating shaft of the driving roller 11 directly or via a transmission mechanism such as a gear or the like. When the driving roller 11 is rotated, the rotary encoder RE outputs a pulse in compliance with the rotation angle. For example, the driving roller 11 outputs a single pulse for every $\Delta\theta$ rotation. Counting the number of pulses may give the rotation angle of the driving roller 11. The distance moved by the sheet S may also be known based on the number of pulses.

[0067] Control of the stopping members 63 and 66 will be described while referencing FIG. 14. FIG. 14 illustrates a control system of the sheet deceleration means 6a or the control system of the sheet deceleration means 6b. Content of controlling both means is almost the same, and thus the sheet deceleration means 6a and 6b are not differentiated nor are 'a' and 'b' notated in the following description.

[0068] The control system of FIG. 14 is implemented by the CPU executing a program. The control system may also be implemented by hardware such as an IC.

[0069] Reference numeral 100 denotes a solenoid on-signal generator, which controls so as to start driving the solenoid 65 at a time (t1 in FIG. 15) after a predetermined period of time (T1 in FIG. 15 or pulse number PN1, or otherwise a corrected pulse number PN1' when correction described later has been performed) has elapsed from a time (t0 in FIG. 15) when entry of the sheet S (end of the sheet S) is detected by the sheet entry sensor 7.

[0070] Reference numeral 101 denotes a solenoid driving time setting part, which sets a period of time (T2 in FIG. 15) that the solenoid 65 is driven and controls so as to stop driving the solenoid 65 at a time (t2 in FIG. 15) after this period of time has elapsed.

[0071] Reference numeral 102 denotes a velocity cal-

ulation unit, which calculates the driving velocity of the motor 17 based on drive information (e.g., electric current) of the motor 17. For example, when driving currents are I_0 , I_1 and I_2 , it can be known in advance that the driving velocities are v_0 , v_1 and v_2 respectively, thereby allowing calculation of the velocity utilizing this information.

[0072] SW denotes a switch for turning on and off a current flowing from a power source PS to the solenoid 65. The switch SW turns on according to an output of the solenoid on-signal generator 100 and turns off according to an output of the solenoid driving time setting part 101.

[0073] The solenoid on-signal generator 100 includes a solenoid on-location setting part (drive starting information setting part) 1001, which sets a drive starting time for the solenoid (stopping member driving part) 65, which drives the stopping members 63 and 66, based on an instruction on folding method for a sheet S from the operation panel PAN and an output from the sheet size sensor SS, a counter 1002, which starts counting output pulses from the rotary encoder RE when the sheet entry sensor 7 has detected the sheet S, a comparator 1003, which compares the counter 1002 to output from the solenoid on-location setting part 1001 and outputs an on signal to the switch SW when they coincide, and a corrector (correction table) 1004, which stores an adjustment time specified in accordance with the driving velocity of the motor (sheet transportation means driving part) 17.

[0074] The solenoid on-location setting part 1001 establishes a folding location based on aspects of the folding method (twofold, threefold, etc.) and size (A3, A4, etc.) of the sheet S. Since the procedure of establishing a folding location is well known to those skilled in the art, description thereof is omitted. The folding location which is the output of the solenoid on-location setting part 1001 is expressed as the output pulse number PN1 (the corrected pulse number PN1' when correction has been performed) of the rotary encoder RE.

[0075] The counter counts the number of output pulses from time t_0 and onward. The comparator 1003 turns on the solenoid 65 when the counted number of pulses becomes PN1 (or PN1'). The time T1 corresponds to time required for the rotary encoder RE to output PN1 (or PN1') number of pulses. While the location (corresponds to PN1 or PN1') of the sheet S, which is braked by the stopping members 63 and 66, does not change, the period of time T1 changes depending on the rotating speed of the motor 17. The solenoid on-location setting part 1001 may be interpreted as setting times for turning on the solenoid 65 in accordance with the folding location.

[0076] Meanwhile, there is a predetermined time delay ΔT from when the solenoid 65 is turned on to when a brake force is applied by the stopping members 63 and 66. The corrector (correction table) 1004 performs correction for removing adverse effects of ΔT . For example, it has the correction table given in FIG. 16, and corrects the value of PN1 in accordance with the driving velocity

of the motor 17 to PN1'. In the example of FIG. 16, λ_1 is subtracted from PN1 when the driving velocity equals a first velocity. Namely, $PN1' = PN1 - \lambda_1$. This corresponds to the actual period of time from sheet detection to sheet stopping in the case of correction resulting in PN1'. This correction may be performed by the solenoid on-location setting part 1001. Alternatively, it may be added to the output of the counter 1002. The same holds for λ_2 and λ_3 .

[0077] The folding location (pulse number PN1) does not change due to the driving velocity of the motor 17, as described above; however, the corrector 1004 is necessary since the number of pulses generated at the time delay ΔT changes. The corrector 1004 may be interpreted as adjusting times for turning on the solenoid 65 using the adjusted values X1, X2 and X3.

[0078] The adjusted values are established based on the time ΔT required for moving from the waiting location to the pressing location. The greater the driving velocity of the motor 17, the greater the absolute values of the adjusted values. In other words, the higher the driving velocity of the motor 17, the more t_1 approaches t_0 by correction. Supposing delay of the first velocity is ΔT_1 , the number of pulses output by the rotary encoder RE corresponds to the adjusted value (the corrected value) λ_1 .

[0079] The solenoid driving time setting part 101 has a table as given in FIG. 17, for example. According to this drawing, when the sheet S is a first size and the driving velocity of the motor is a first velocity, time T2, which denotes the duration of the solenoid 65 being on, is τ_{11} .

[0080] In FIG. 17, the greater the transporting velocity of the sheet S, the longer the driving time τ , and the larger the size (mass) of the sheet S, the longer the driving time τ . When size increases in order from the first size to fourth size and velocity increases in order from the first velocity to third velocity, relationships: $\tau_{11} < \tau_{12} < \tau_{13} < \tau_{14}$ and $\tau_{11} < \tau_{21} < \tau_{31}$ hold true.

[0081] Note that even if the mass of the sheet S is different, the driving time of the solenoid 65 may be not changed. In this case, $\tau_{11} = \tau_{12} = \tau_{13} = \tau_{14}$.

[0082] The stopping members 63 and 66 are for decelerating a sheet S, bending the sheet S, and folding the bent place using the folding means (the driving roller 11 and the follower roller 13). In order to achieve this aim, the stopping members 63 and 66 need to sufficiently decelerate the sheet S. Time necessary for deceleration is expressed as a function of size (mass) of the sheet S and travel speed thereof. Since kinetic energy of the sheet S is proportional to the mass and also proportional to the square of the travel speed, the driving time τ in the table of FIG. 17 is established such that the longer the time, the greater the transporting velocity of the sheet S, and the longer the time, the larger the size of the sheet S.

[0083] Note that when the driving time τ becomes too long, the sheet S is blocked from moving to the folding means. It is desirable that the driving time τ is long enough to achieve the above-given aim and bend the sheet S,

and short enough such that it does not block the sheet S from moving to the folding means.

[0084] The solenoid on-signal generator 100 sets a drive start time based on the output of the paper feed sensor FS instead of the sheet entry sensor 7 when the size of the sheet S is smaller than a predetermined threshold. The processing flowchart is given in FIG. 18.

[0085] When the sheet S is small, merely driving the stopping members 63 and 66 based on the output from the sheet entry sensor 7 may not be enough. This is when T1 in FIG. 15 is shorter than or approximately the same as the time delay ΔT . At this time, if the driving start time is set based on the output of the paper feeder sensor FS, T1 can be made sufficiently long, and thus the stopping members 63 and 66 may make contact at an appropriate location.

[0086] The aforementioned threshold is established based on the relationship between T1 and ΔT , for example. For example, when the corrected result from the corrector 1004 is zero or smaller than a predetermined value (value with an allowance for heightening reliability), the output of the paper feeder sensor FS is used.

[0087] Operation of the sheet folding device including the sheet deceleration means 6a and 6b configured as described above will be described.

[0088] FIG. 19 illustrates that the pad 63 of both of the sheet deceleration means 6a and 6b is at the pressing location; however, in actuality, they are at either the waiting location or the pressing location depending on the situation, as described below.

[0089] In FIG. 19, the sheet S first passes between the driving roller 11 and the follower roller 12 and is fed into the gap G of the sheet deceleration means 6a located above them.

[0090] At this time, the pad 63 is at the waiting location and allows entry of the sheet S into the gap G.

[0091] When the sheet S is detected by the sheet entry sensor 7, the solenoid 65 is driven based on that detection signal, thereby moving the pad 63 to the pressing location.

[0092] The sheet S is pressed onto the inner surface of the gap G by the pad 63. The sheet S is then sandwiched between the pad 63 and the lower guide plate 62 and stopped from traveling.

[0093] The back end side of the sheet S is between the driving roller 11 and the follower roller 12 and is continued to be sent forward (downstream) from these rollers 11 and 12. The sheet S is bent downward between the driving roller 11 and the pad 63. The bent portion Sa is caught between the driving roller 11 and the follower roller 13.

[0094] The bent portion Sa of the sheet S is folded by the driving roller 11 and the follower roller 13, and the sheet S with the bent portion as the front end is fed into the gap G of the sheet deceleration means 6b located below.

[0095] In the same manner as with the sheet deceleration means 6a, the sheet S is bent and the bent portion

Sb is caught between the driving roller 11 and the follower roller 14.

[0096] The sheet S that has passed between the driving roller 11 and the follower roller 14 is ejected to the outside through the conveyance path 19.

[0097] The sheet folding device according to the embodiment of the present invention allows various folding methods illustrated in FIG. 20. FIG. 20(a) illustrates an outer threefold method, FIG. 20(b) illustrates an inner threefold method, and FIG. 20(c) illustrates a fourfold method.

[0098] A shutter device, omitted from the drawing, adjacent to either one of the sheet deceleration means 6a and 6b may be provided so as to prohibit entry of the sheet S into the gap G such that the sheet S is decelerated only by the other sheet decelerating means, thereby folding the sheet in two as shown in FIG. 20(d).

[0099] Which folding method of FIG. 20 is used depends on the operating timing of the pad 63. The operating timing is set by the solenoid on-signal generator 100.

[0100] The present invention is not limited to the configuration given above. Alternatively, for example, the pad 63 and its transfer means 64 may be provided on the bottom side of the lower guide plate 62 such that the sheet S that has entered into the gap G will be pressed against the bottom (inner surface) of the upper guide plate 61 by the pad 63.

[0101] The paired upper and lower guide members forming the gap G are not limited to plate materials such as the upper guide plate 61 and the lower guide plate 62. The guide members may be configured by stacking and arranging in parallel a plurality of bars.

[0102] As shown in FIG. 8 and FIG. 9, the pivots 68 and 68 for the pad fixing bar 66 are held freely pivoting by the brackets 61b and 61b of the upper guide plate 61, respectively. The brackets 61b and 61b are integrally configured with the upper guide plate 61 as one body, and therefore, the pad fixing bar 66 has a fixed positional relationship with the upper guide plate 61 and the lower guide plate 62 without moving except for rotating on the pivots 68 and 68. That is, the position of the pad fixing bar 66 is fixed. This can also be said about the relationship with the sheet S passing therebetween.

[0103] As shown in FIG. 11, the pad 63 displays a braking force by making contact with the sheet S so as to stop the sheet S. Contact between the pad 63 and the sheet S favorably occurs along the length (perpendicular to the travelling direction of the sheet S and perpendicular to FIG. 11) of the pad 63 at the same time and degree. In other words, it is favorable that the state shown in FIG. 11(b) occurs simultaneously at any arbitrary point on the pad 63.

[0104] Even if the above conditions are not satisfied, such as one end of the pad 63 is in contact with the sheet S but the other end has not made contact yet, the sheet S is stopped on said one end while the sheet is not stopped sufficiently on said other end, and could still be

moving. This means that the sheet moves at an angle, that is, oblique motion occurs. As a result, a phenomenon that endpoints of the folded sheet S do not match occurs. This leads to decrease in quality of sheet folding. This is not a favorable phenomenon and should be improved.

[0105] In order to satisfy the above conditions, the pad fixing bar 66 should be accurately attached in parallel to the upper guide plate 61 and the lower guide plate 62. However, a slight error occurs due to insufficient machining precision. Moreover, the above conditions are also not satisfied when the pad 63 is worn down nonuniformly due to use over a long period of time. If the above conditions are not satisfied even a little, the above problematic phenomenon occurs. The above problematic phenomenon occurs even if, for example, difference between the distance from the pivot 68 on one end of the pad fixing bar 66 to the lower guide plate 62 and distance from the pivot 68 on the other end to the same is approximately 0.5mm.

[0106] FIG. 21 to FIG. 24 show a deceleration means 6 including a mechanism that can satisfy the above conditions and keep the above problematic phenomenon from occurring. This deceleration means 6 makes contact between the pad 63 and the sheet S along the length thereof occur at the same time and degree.

[0107] FIG. 21 is a planar view of the deceleration means 6 according to a modification; FIG. 22 is a front view of the same; FIG. 23 is a right side view of the same; and FIG. 24 is an exploded view of the same.

[0108] In these drawings, the same reference numerals are given to the same or equivalent elements shown in FIG. 7 to FIG. 10, and description thereof is omitted.

[0109] CA denotes a seesaw fulcrum (the rotating shaft of the pad fixing bar 66).

[0110] Reference numeral 161 denotes a pad fixing bar holder attached to a seesaw mechanism attachment 61V, which is made by bending the ends of the upper guide plate 61 into a right angle. The pad fixing bar holder 161 includes side surfaces 161b and 161b parallel to each other, each provided with a hole 161h for the pivot 68, and a base 161c facing the seesaw mechanism attachment 61V while supporting the side surfaces. In the example of this drawing, the pad fixing bar holder 161 is made by bending a plate-like material.

[0111] The pad fixing bar holder 161 is attached to the seesaw mechanism attachment 61V by two screws (omitted from the drawing). These screws are fixed to a mounting plate 162 via collars C2 and C2, respectively. Holes (illustrated in the drawing but without reference numerals) in the base 161c for the collars C2 and C2 to pass through are slightly larger than the collars C2 and C2, thus allowing the pad fixing bar holder 161 to move a little against the seesaw mechanism attachment 61V.

[0112] Sufficiently large holes (illustrated in the drawing but without reference numerals) for a transmission link 67 and an extension rod 65a to pass through are opened at nearly the center of the base 161c and the seesaw mechanism attachment 61V, respectively. A col-

lar 163 passes through this hole in the base 161c so as to be inserted in the hole of the seesaw mechanism attachment 61V. The collar 163 is pressed by the mounting plate 162 and therefore does not come out. The collar 163 also has a large enough hole for the transmission link 67 and the extension rod 65a to pass through. The collar 163 allows the pad fixing bar holder 161 to rotate. Rotation is centered around the transmission link 67 and the extension rod 65a, that is, the drive shaft of the solenoid 65.

[0113] As a result, the pad fixing bar 66 is supported by a fulcrum CA at a predetermined position thereof (e.g., center), and is thus capable of moving around this fulcrum CA. The rotating shaft is parallel to the travelling direction of the sheet S. In the above example, the rotating shaft is the drive shaft of the solenoid 65. A mere minimal rotatable range is sufficient, such as, for example, approximately 0.5mm at the ends of the pad fixing bar 66.

[0114] In the above example, friction adding means 164 and 164 are provided on the outer sides of the collars C2 and C2, respectively. Each of the friction adding means 164 includes a screw 164a, a coil spring 164b, and a washer 164c. The seesaw mechanism attachment 61V has holes (illustrated in the drawing but without reference numerals) larger than the screws 164a, and via these holes, the screws 164a are fixed to screw holes (illustrated in the drawing but without reference numerals) of the base 161c. While the friction adding means 164 do not prevent the pad fixing bar holder 161 from moving, the pad fixing bar holder 161 does not move easily due to frictional force occurring between the washers 164c and the seesaw mechanism attachment 61V. This frictional force may be adjusted by turning the screws 164a. The friction adding means 164 are for keeping the pad fixing bar 66 from freely moving around. The friction adding means 164 drive the solenoid 65 to make the sheet S touch the pad 63, thereby adding a predetermined load F on the sheet S such that the pad fixing bar 66 rotates for the first time when reaction thereto exceeds the frictional force. A minimal required force for moving the pad fixing bar 66 is set as threshold Fth. The threshold Fth corresponds to the frictional force and can be adjusted by the screws 164a.

[0115] The friction adding means 164 may be provided on the side surfaces 161b, respectively.

[0116] The friction adding means 164 may apply friction to the collar 163. For example, one or more brake-shoes making contact with the side surface of the collar 163 may be provided so as to adjust contact pressure thereof.

[0117] The friction adding means 164 may also put a sponge or resin, etc. in direct contact with the pad fixing bar holder 161.

[0118] The friction adding means 164 may also use electromagnetic force rather than mechanical force. For example, a permanent magnet or an electromagnet is provided to the pad fixing bar holder 161, a permanent magnet or an electromagnet is provided to the upper

guide plate 61 or the lower guide plate 62, and the suction force and the repulsive force therebetween is used so as to adjust the mobility of the pad fixing bar 66.

[0119] FIG. 25 is an operational schematic diagram of the above example. This drawing is a front view of the pad fixing bar 66 viewed in the travelling direction of the sheet S. Movement of the pad fixing bar 66 viewed from the side is the same as in FIG. 11.

[0120] CA denotes a rotating shaft/fulcrum. In this example, it is a drive shaft of the solenoid 65.

[0121] The pad fixing bar 66 moves as a seesaw with CA as the fulcrum. This makes distance between the pad 63 and the sheet S the same at all points. As a result, contact between the pad 63 and the sheet S along the length thereof occurs at the same time and degree. The action of the friction adding means 164 makes the pad fixing bar 66 move when a load F equal to or greater than the threshold Fth is applied. Even if an operator carelessly touches the pad fixing bar 66 or the pad fixing bar holder 161 when opening the cover so as to expose the deceleration means 6 for maintenance, it will not move as long as the force at this time is smaller than the threshold Fth.

[0122] The threshold Fth is 1000gf to 1500gf, for example. Fluctuation in degree of skew occurs if the threshold Fth is too small, and too much time is necessary for the seesaw motion to finish if it is too large. Therefore, many sheets S are consumed until the above conditions are fulfilled. It is favorable to set the threshold Fth so as to satisfy the conditions of controlling skew and making the number of sheets consumed less than a predetermined number until the seesaw motion is finished.

[0123] The load F applied to the sheets S from the pad 63 is not uniform mainly due to speed, weight, and ream weight of the sheets S. Force making the sheet S stand still is thought to be mainly due to force generated from the pad 63 receiving traveling force of the sheet S (same effect as that made by a wedge). This force changes with time. Note that the load F and the strength of the solenoid 65 do not have much relevance to each other. The role of the solenoid 65 is to adhere the pad 63 to the sheet S, and the sheet S will not stand still only by the force of the solenoid 65.

[0124] When there is a plurality of sheet feeding speeds of the sheet folding device to select from, the threshold Fth should be set so as to satisfy the above conditions at the slowest speed, and thus at a speed (slowest) with the smallest load F. If the seesaw mechanism acts even when the load is small, it acts adequately even when the load is large, and contact between the pad 63 and the sheet S along the length thereof occurs at the same time and degree. Since the effect of reduction in skew by the seesaw mechanism increases as the load F is increased, the effect of reduction in skew at other speeds can also be achieved as long as it is made that the effect of reduction in skew even at the slowest speed is achieved.

[0125] FIG. 26 gives the observation results of the de-

celeration means 6 of FIG. 21 to FIG. 24. This drawing gives the measurement results of a case of raising the left end of the pad fixing bar 66 of the sheet deceleration means 6a on the upper side, as viewed from the front thereof, by 0.5mm, and a case of raising the right end of the same by 0.5mm. However, this 0.5mm is an offset quantity, where 0mm indicates a state of distance between the pad 63 and the sheet S being the same at all points.

[0126] The horizontal axis of FIG. 26 gives folding times (the number of sheets). This chart illustrates an example of folding twenty sheets S. The vertical axis gives the degree of skew (units of mm), which corresponds to x in FIG. 27. The solid line in FIG. 27 indicates a sheet S without any skew, and the dotted line indicates a sheet S to which skew has occurred. The right side is positive and the left side is negative in the travelling direction of the sheet S.

[0127] As is evident from FIG. 26, the degree of skew for five sheets or more is 0.5mm or less, which is stable.

[0128] According to the deceleration means 6 of FIG. 21 to FIG. 24, contact between the pad 63 and the sheet S is automatically adjusted such that it occurs along the length of the pad 63 at the same time and degree. Skew does not occur or is miniscule, and thus reduction in quality of sheet folding does not occur.

[0129] The deceleration means 6 of FIG. 21 to FIG. 24 allows provision of excellent quality sheet folding and absorption of dimensional error generating in the manufacturing process and aged deterioration.

DESCRIPTION OF REFERENCE NUMERALS

[0130]

- 35 6a, 6b: sheet deceleration means
- 7, 7a, 7b: sheet entry sensor
- 11: driving roller (sheet transportation means, sheet folding means)
- 40 12: follower roller (sheet transportation means)
- 13: follower roller (sheet transportation means, sheet folding means)
- 14: follower roller (sheet transportation means, sheet folding means)
- 45 17: motor (sheet transportation means driving part)
- 61: upper guide plate
- 62: lower guide plate (guide member)
- 63: pad (pressing member, stopping member)
- 64: pad transfer means
- 50 65: solenoid (stopping member driving part)
- 66: pad fixing bar (pressing member attachment, stopping member)
- 161: pad fixing bar holder
- 163: collar
- 55 164: friction adding means
- 100: solenoid on-signal generator
- 1001: solenoid on-location setting part (drive starting information setting part)

1002: counter
 1003: comparator
 1004: corrector
 101: solenoid driving time setting part (driving time setting part)
 CA: rotating shaft/fulcrum
 CONT: controlling unit
 ES: paper ejection sensor
 FS: paper feed sensor
 G: gap
 PS: power supply
 RE: rotary encoder
 S: sheet
 SS: sheet size sensor
 SW: switch

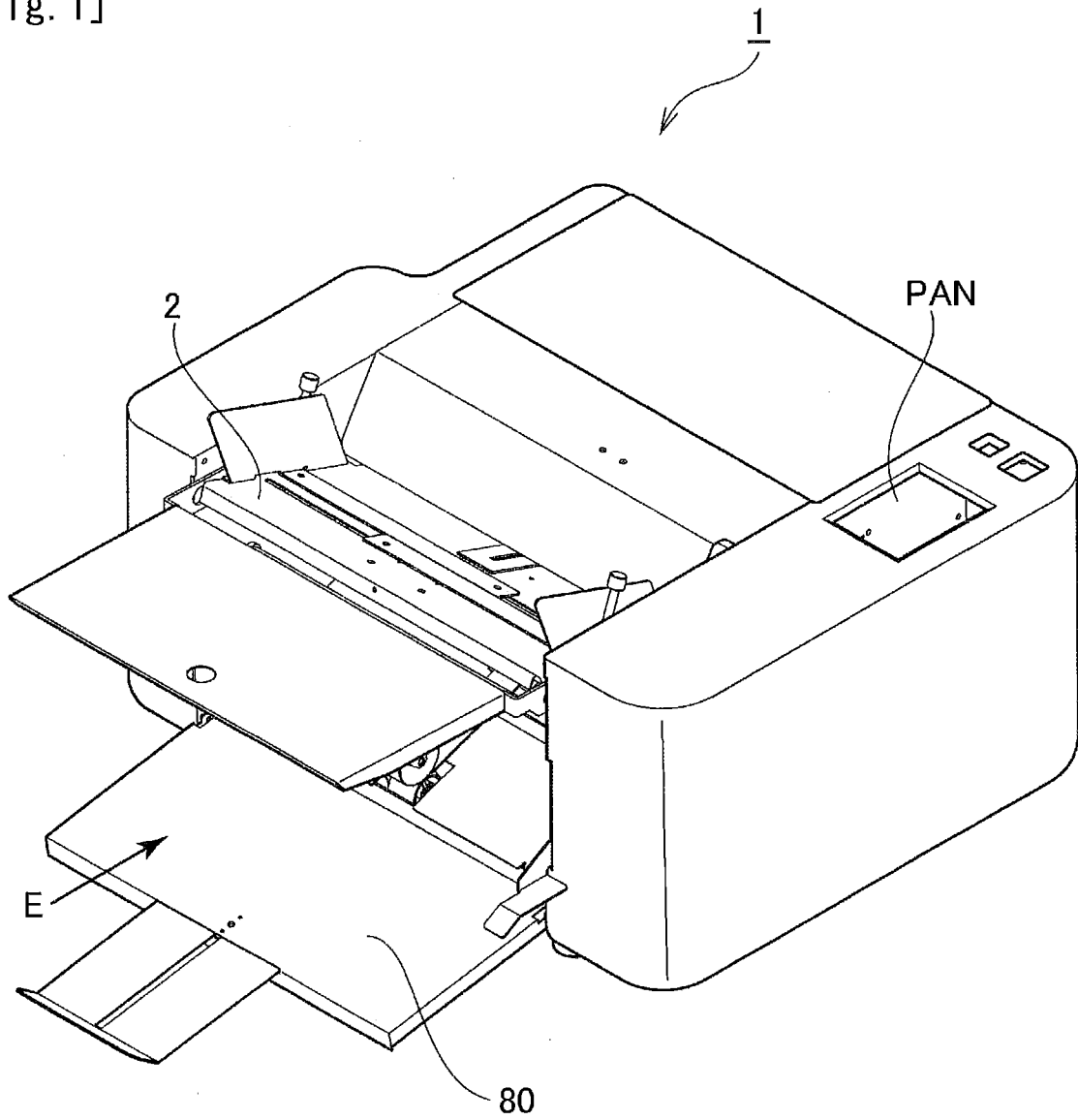
Claims

1. A sheet folding device comprising: sheet transportation means for transporting a sheet along a predetermined route; sheet deceleration means for decelerating at least a part of the sheet while being transported by the sheet transportation means; folding means for folding a part of the sheet that is bent as the result of deceleration by the sheet deceleration means; and a control unit for controlling the sheet deceleration means; wherein
 the sheet deceleration means comprises
 a guide member for receiving the sheet while the sheet is being transported by the sheet transportation means;
 a stopping member that comprises: a plate-like pressing member having a predetermined thickness and a pressing member attachment having the pressing member on an end surface facing the sheet and is rotatably held at a predetermined fulcrum, wherein an edge of the pressing member presses the sheet traveling along the guide member against the guide member; and
 a stopping member driving part for rotating the stopping member around the fulcrum; wherein the stopping member is positioned at a waiting location where the pressing member does not touch the sheet or at a pressing location where the edge of the pressing member touches the sheet but the entire surface of the pressing member does not touch the sheet;
 the stopping member moves from the waiting location to the pressing location by rotating in the same direction as the traveling direction of the sheet, and returns from the pressing location to the waiting location by rotating in the opposite direction to the traveling direction of the sheet;
 the stopping member driving part rotates the stopping member from the waiting location to the pressing location in compliance with an in-

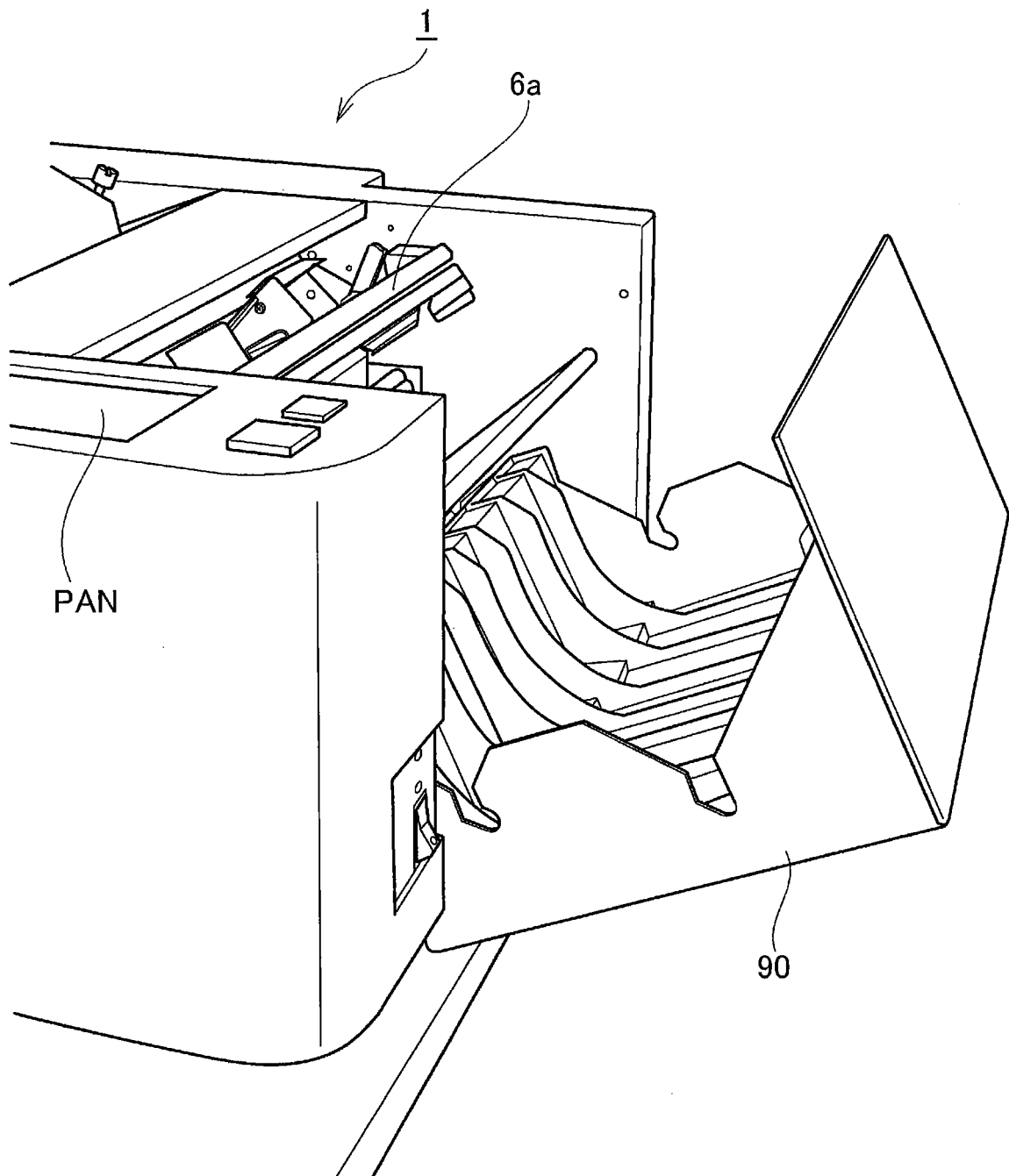
struction from the control unit;
 the stopping member is held so as to rotate along a parallel axis to the travelling direction of the sheet; and
 the stopping member rotates due to a reaction to the sheet being pressed against the guide member by an edge of the stopping member.

2. The sheet folding device of Claim 1, further comprising friction adding means for adding a predetermined frictional force to the stopping member such that the stopping member does not rotate due to the reaction that is smaller than a predetermined threshold F_{th} .
3. The sheet folding device of Claim 2, wherein the sheet transportation means is for transporting the sheet at any one of predetermined multiple speeds, and
 the threshold F_{th} is specified such that the stopping member rotates due to the reaction in the case of transporting the sheet at the slowest speed of the multiple speeds.

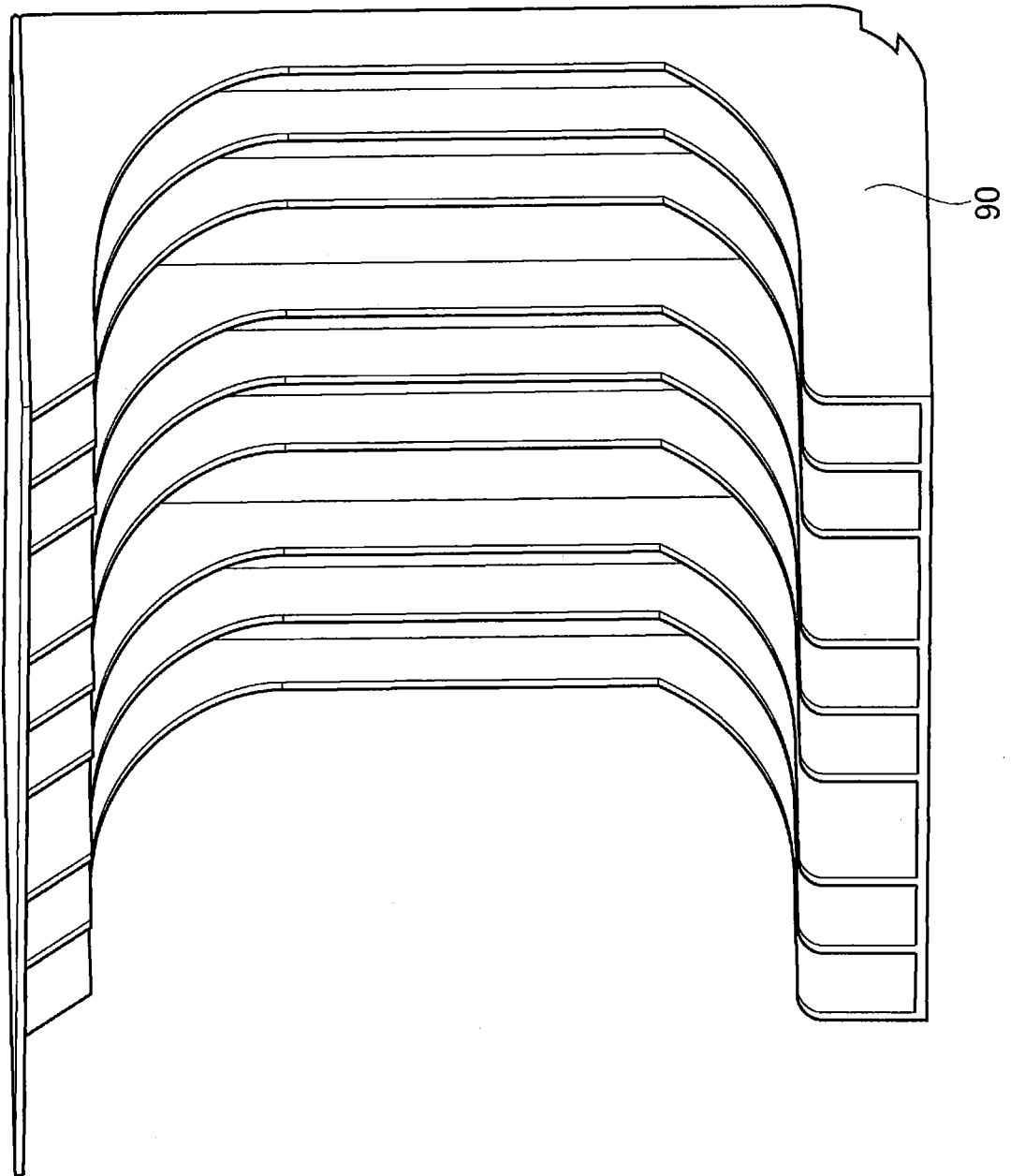
[Fig. 1]



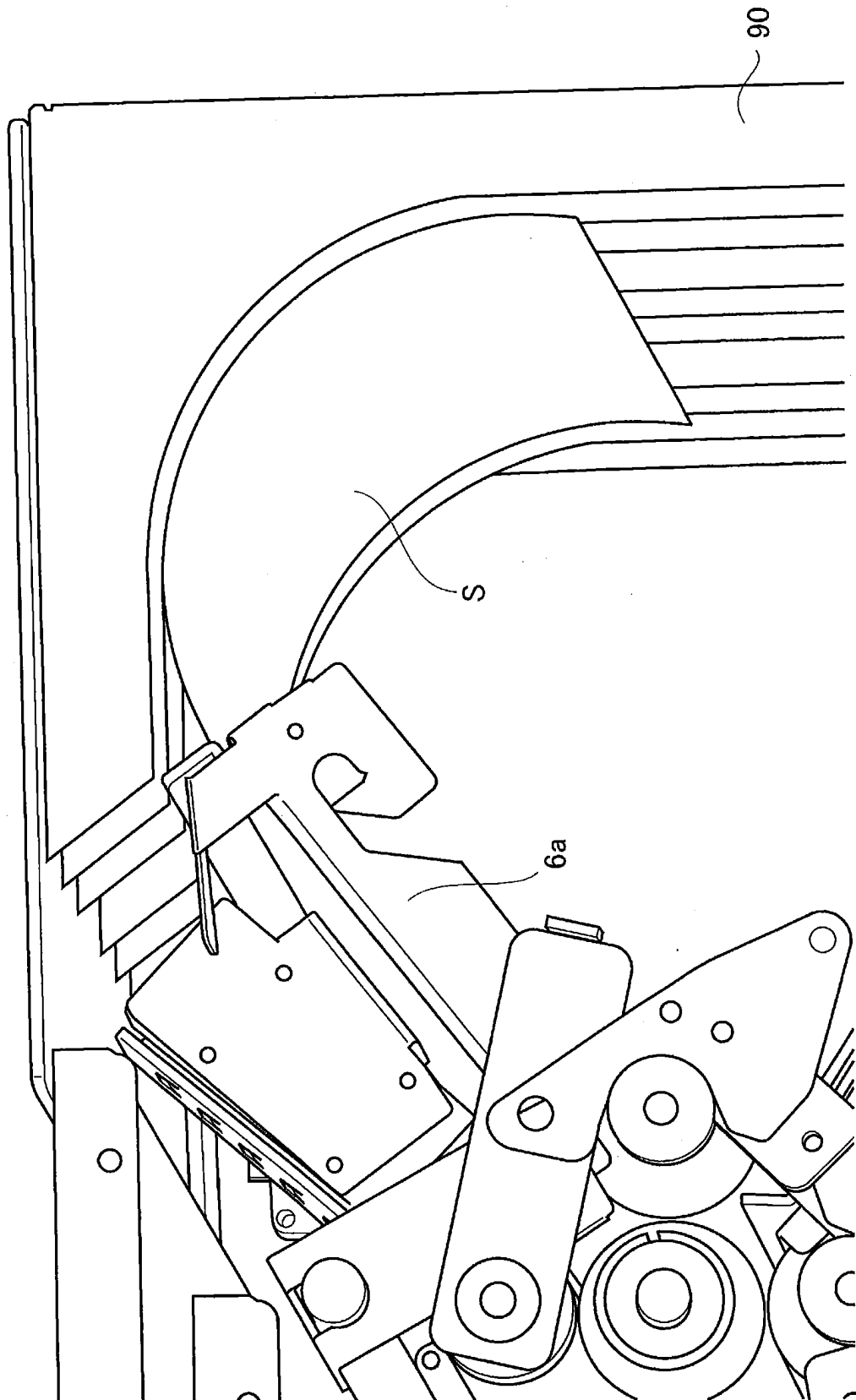
[Fig. 2]



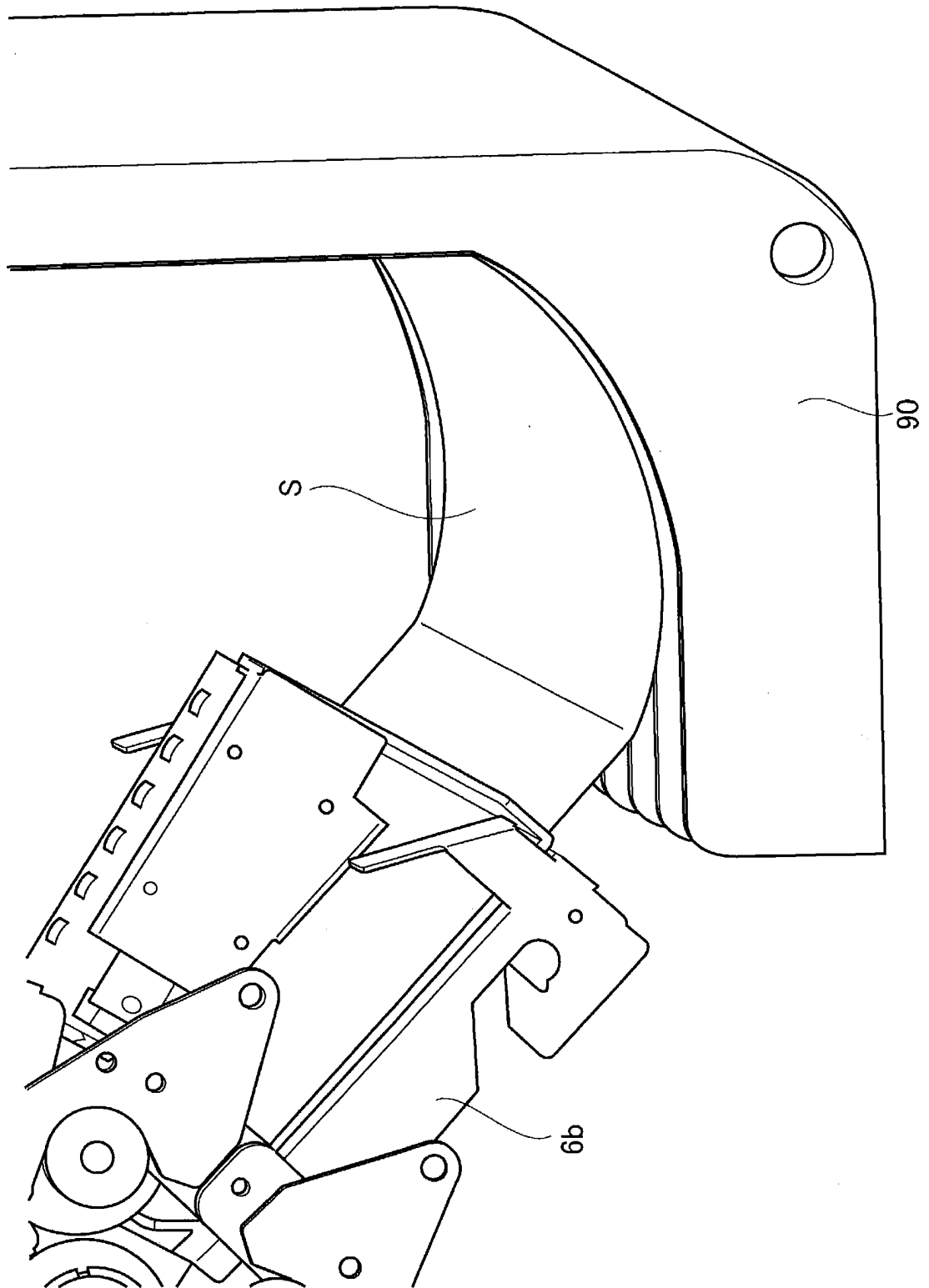
[Fig. 3]



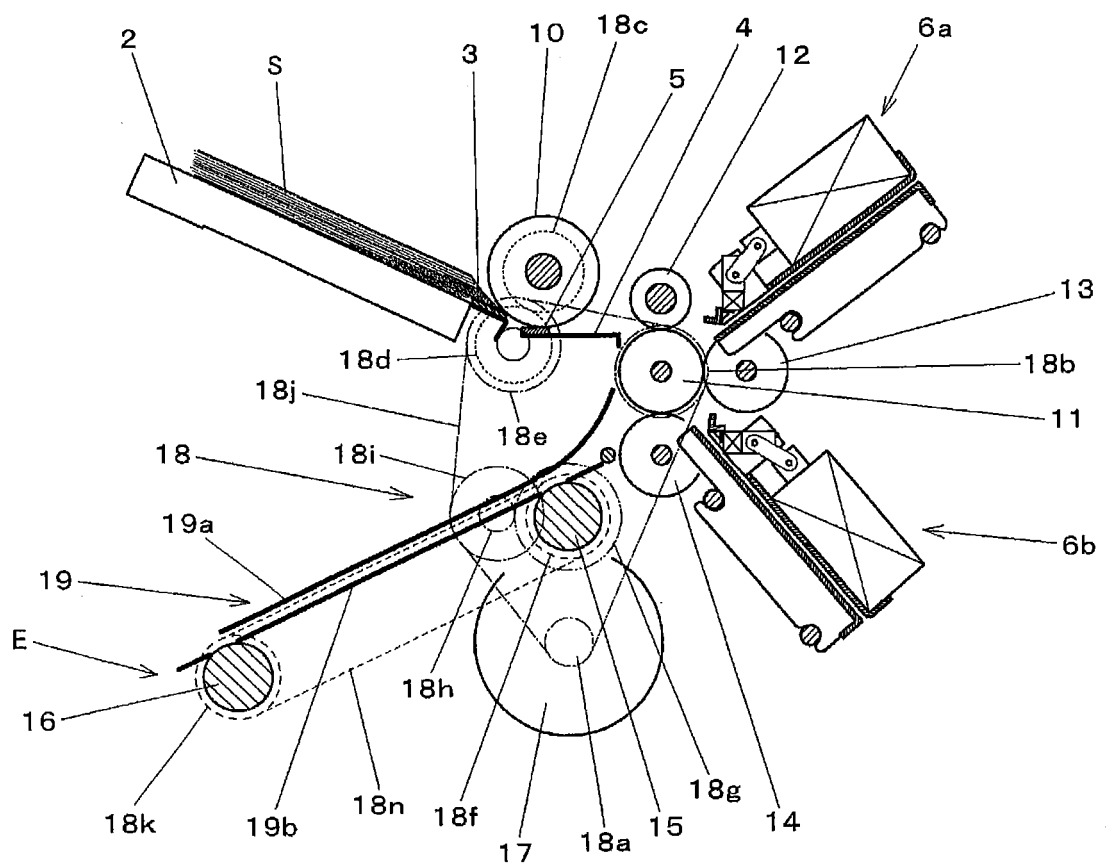
[Fig. 4]



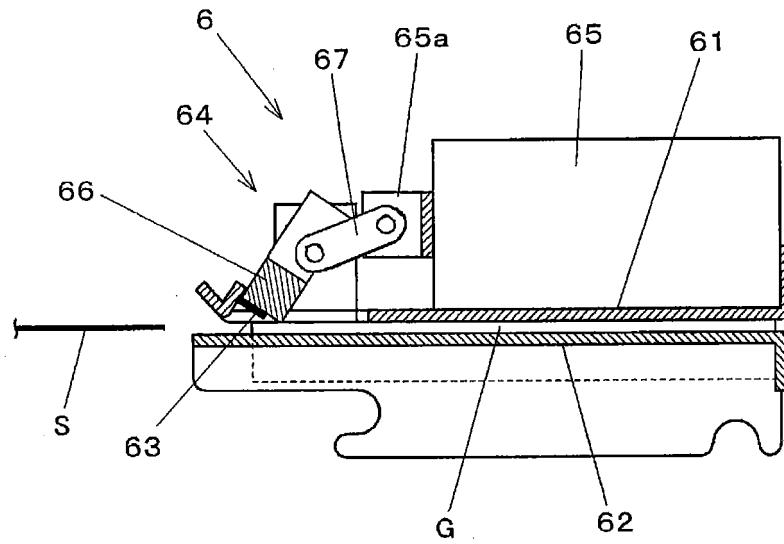
[Fig. 5]



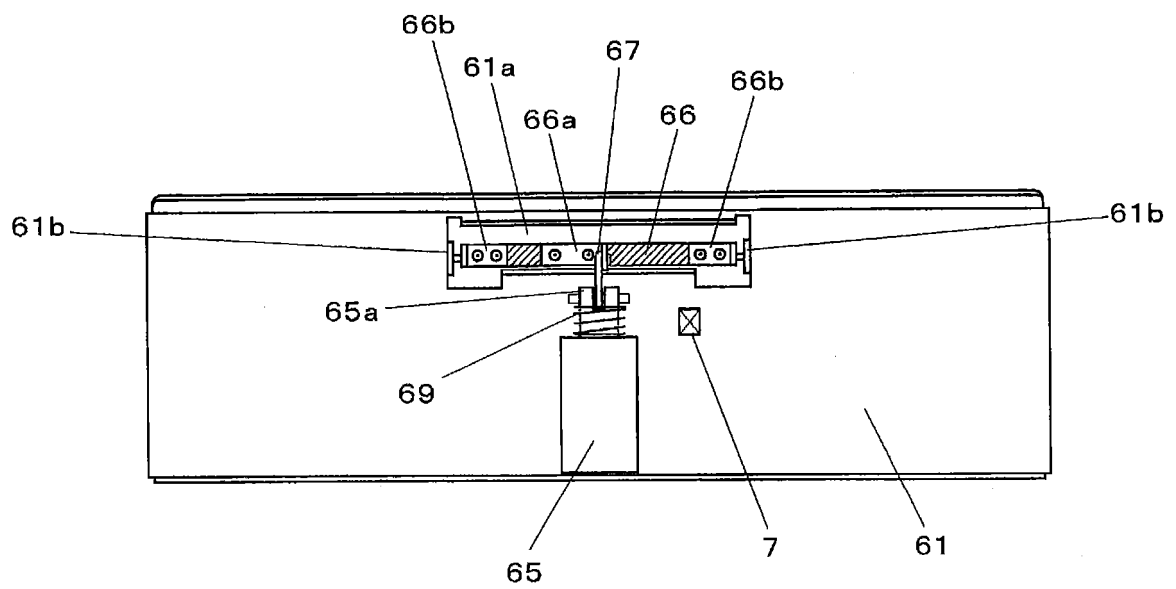
[Fig. 6]



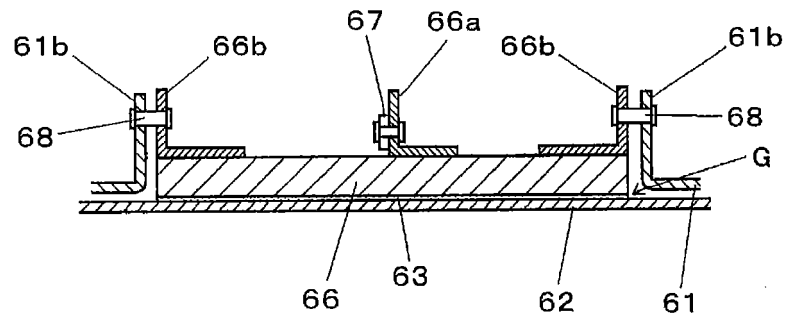
[Fig. 7]



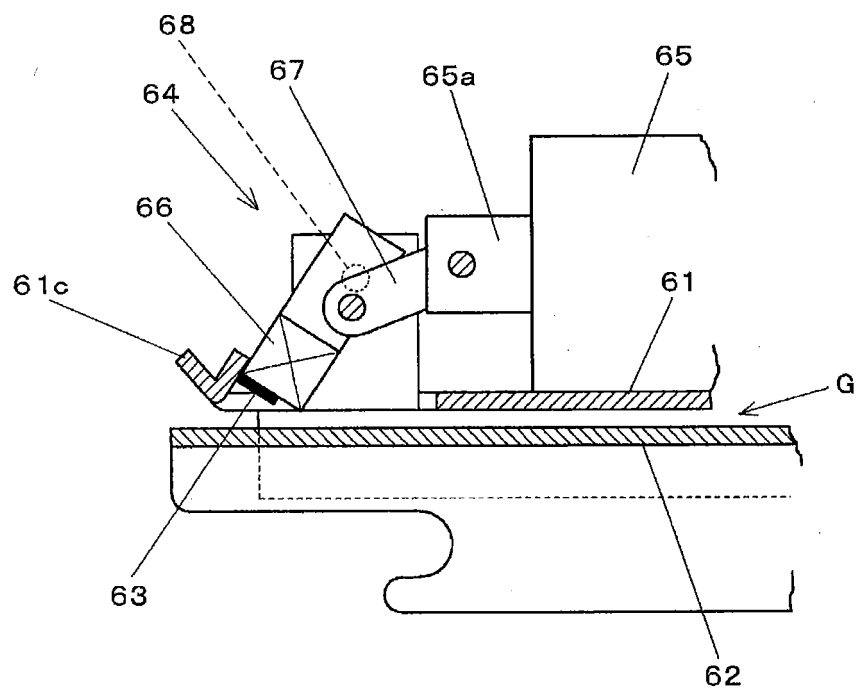
[Fig. 8]



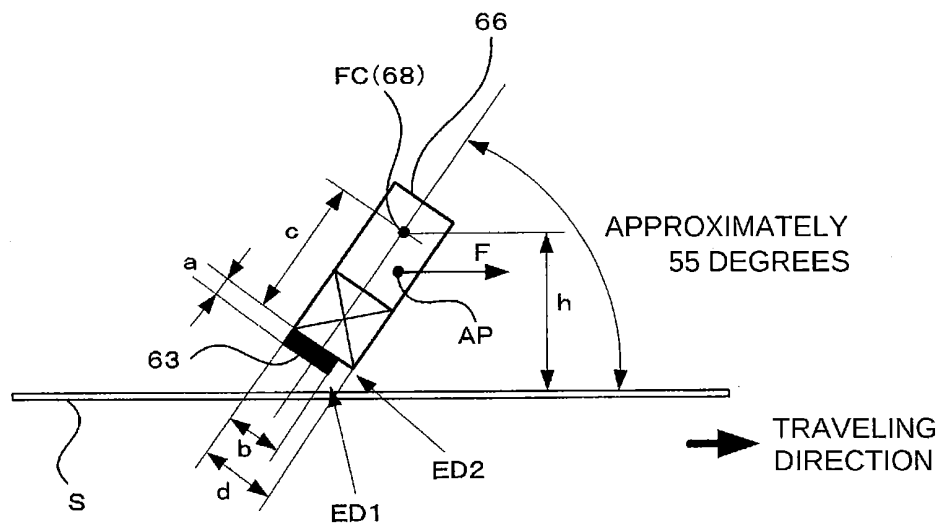
[Fig. 9]



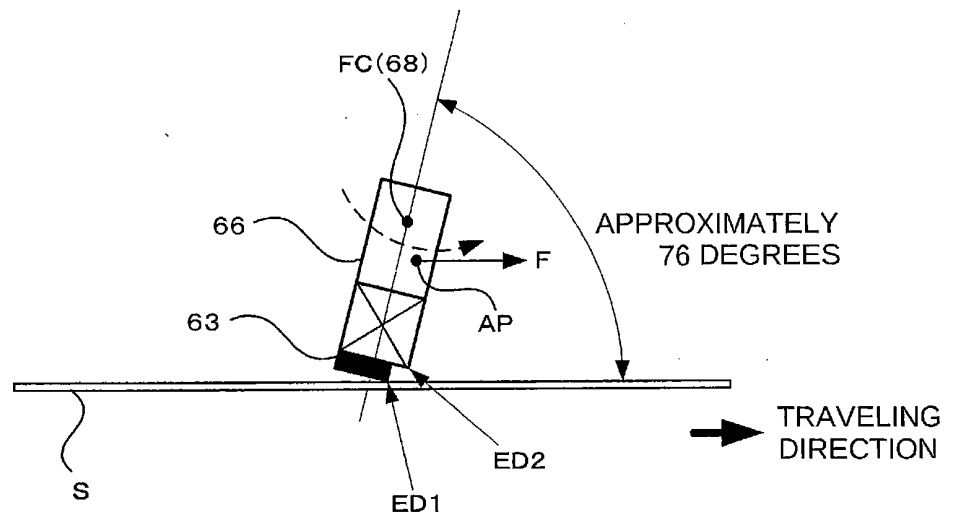
[Fig. 10]



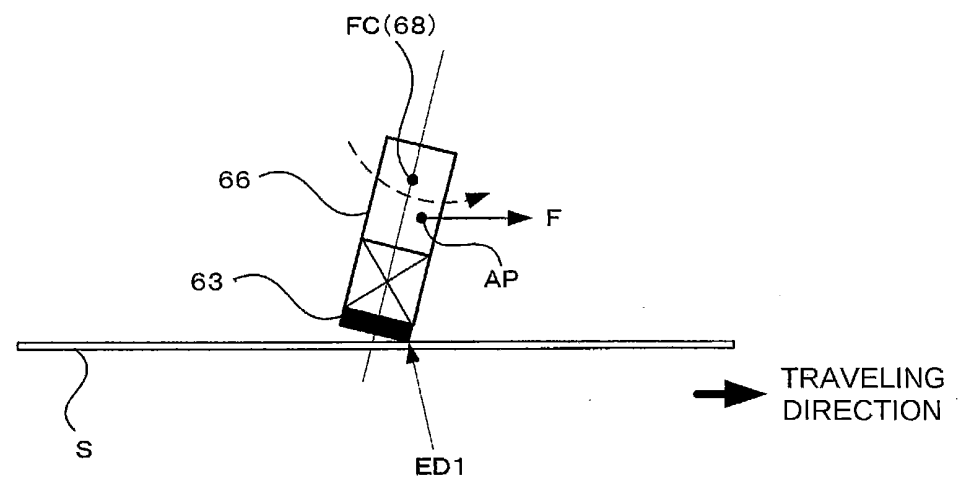
[Fig. 11(a)]



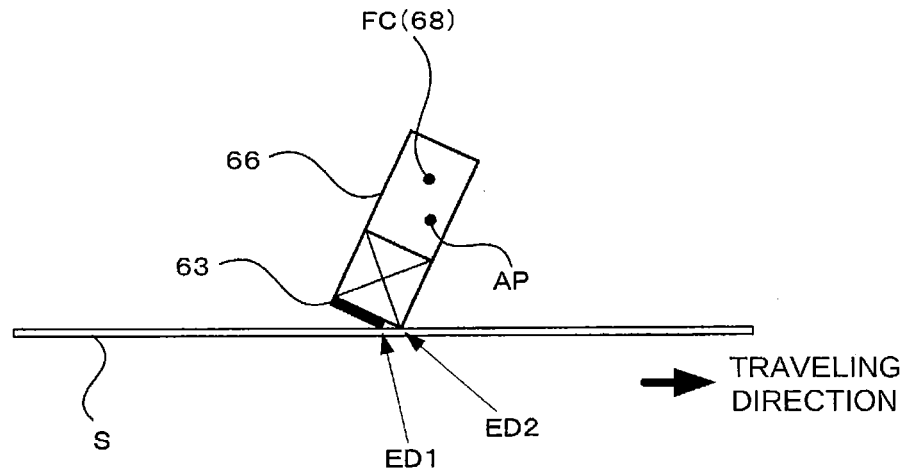
[Fig. 11(b)]



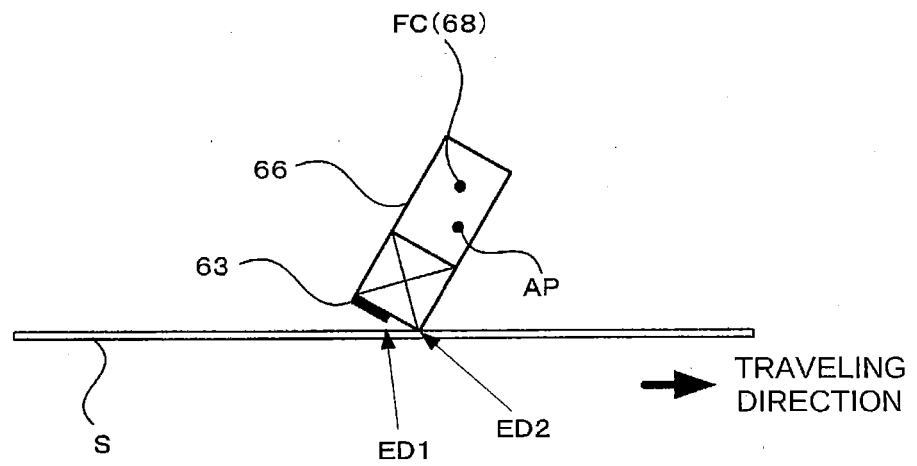
[Fig. 11(c)]



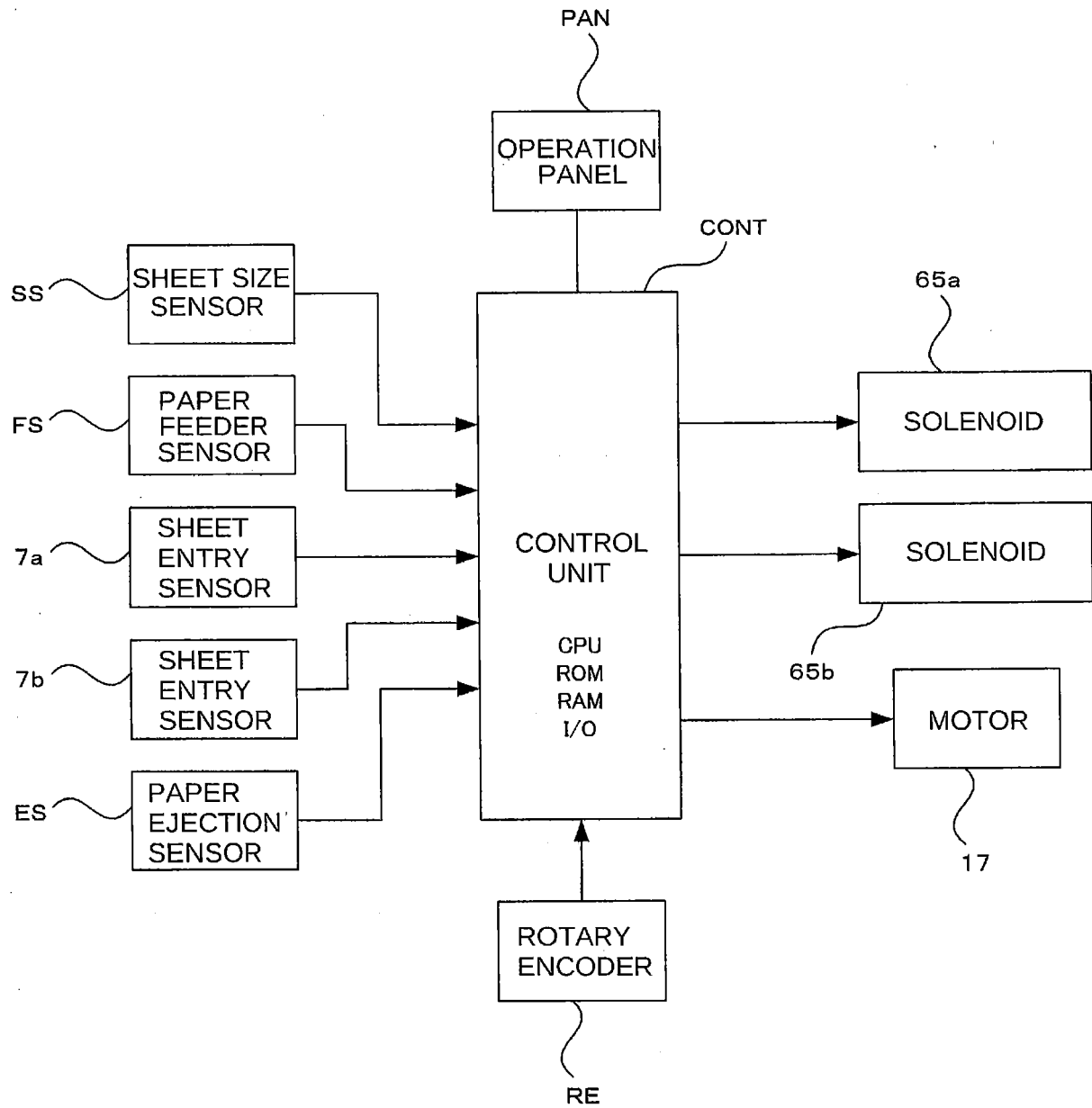
[Fig. 12(a)]



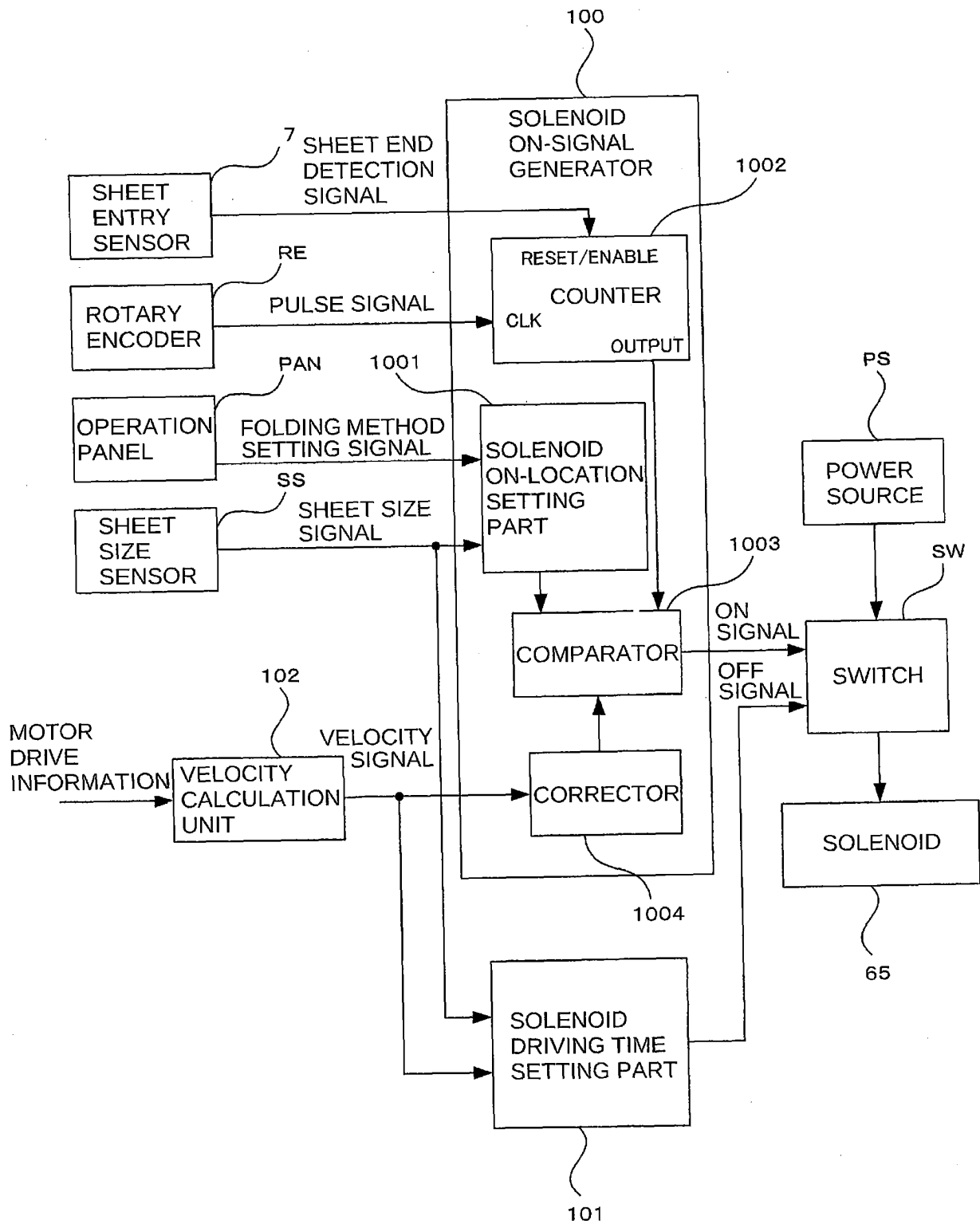
[Fig. 12(b)]



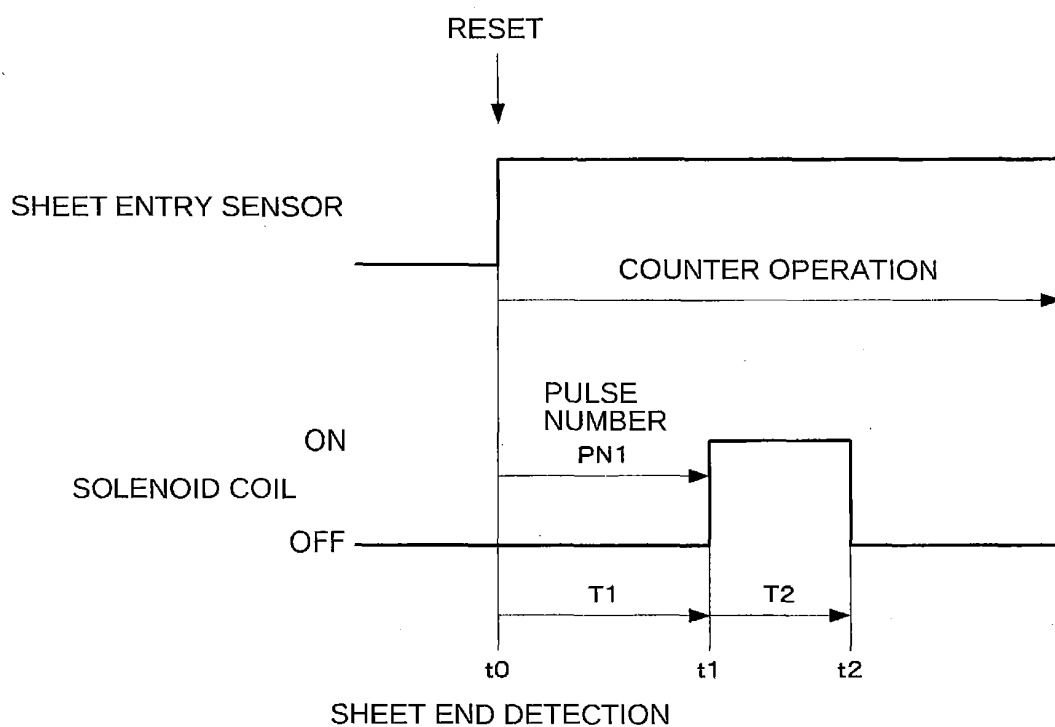
[Fig. 13]



[Fig. 14]



[Fig. 15]



[Fig. 16]

CORRECTION TABLE

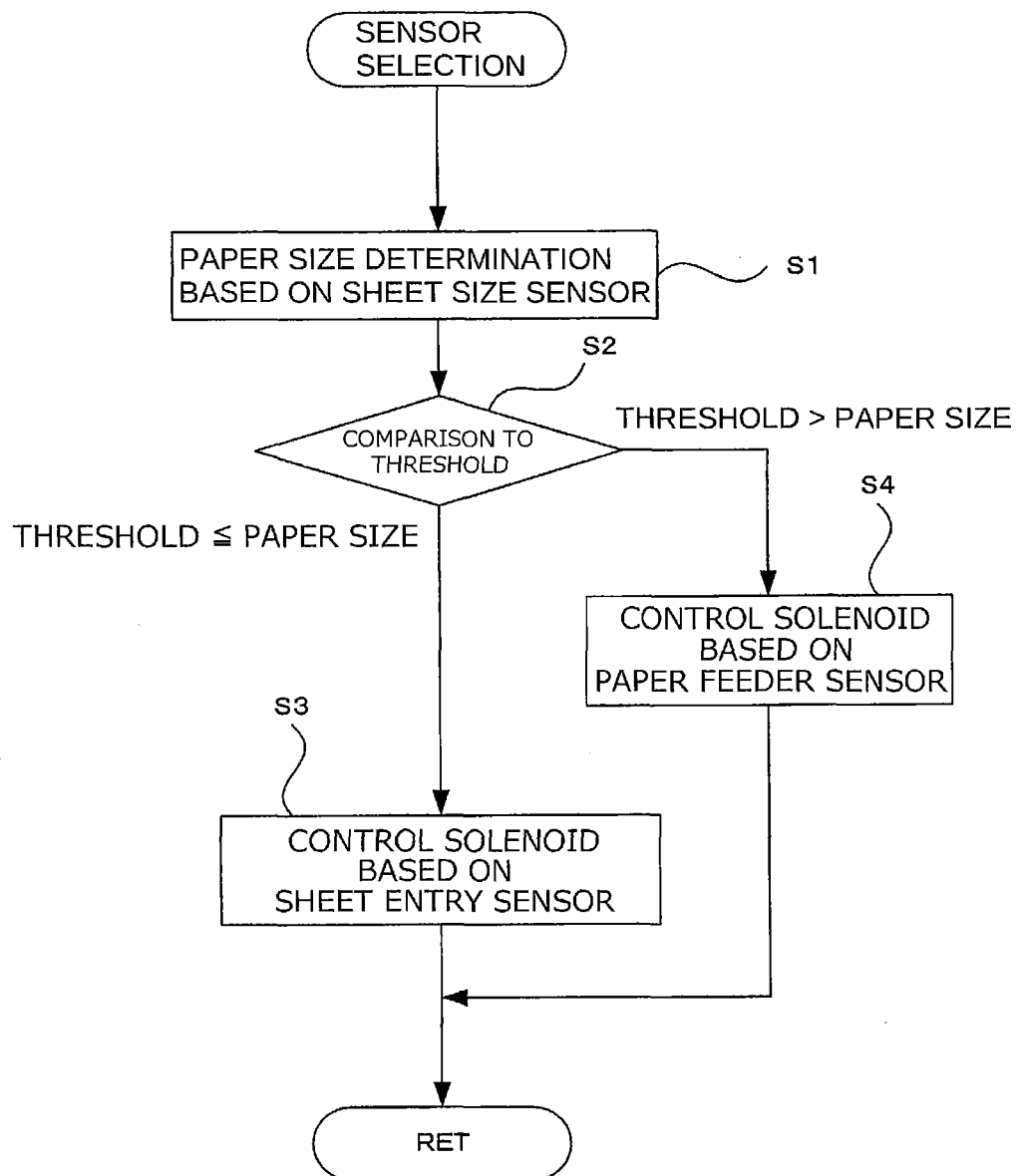
VELOCITY		
FIRST VELOCITY	SECOND VELOCITY	THIRD VELOCITY
$\lambda 1$	$\lambda 2$	$\lambda 3$

[Fig. 17]

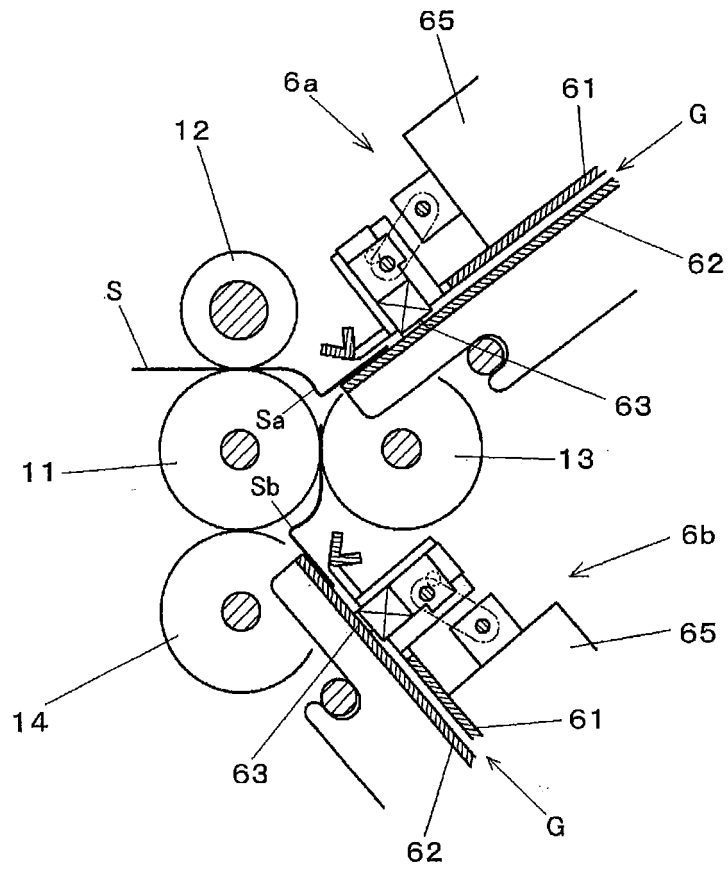
SOLENOID DRIVING TIME
SETTING TABLE

		SHEET SIZE SIGNAL			
		FIRST SIZE	SECOND SIZE	THIRD SIZE	FOURTH SIZE
VELOCITY	FIRST VELOCITY	$\tau 11$	$\tau 12$	$\tau 13$	$\tau 14$
	SECOND VELOCITY	$\tau 21$	$\tau 22$	$\tau 23$	$\tau 24$
	THIRD VELOCITY	$\tau 31$	$\tau 32$	$\tau 33$	$\tau 34$

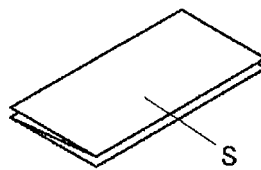
[Fig. 18]



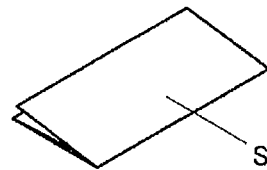
[Fig. 19]



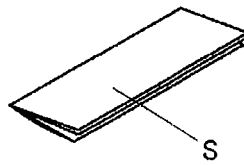
[Fig. 20 (a)]



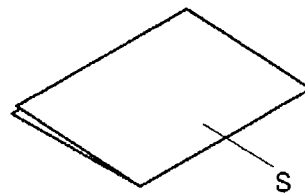
[Fig. 20 (b)]



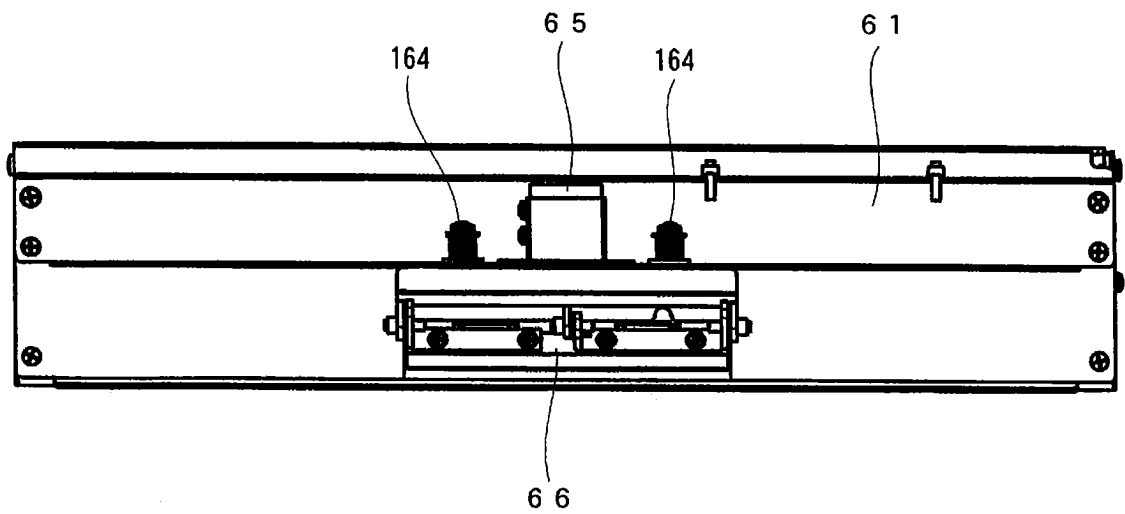
[Fig. 20 (c)]



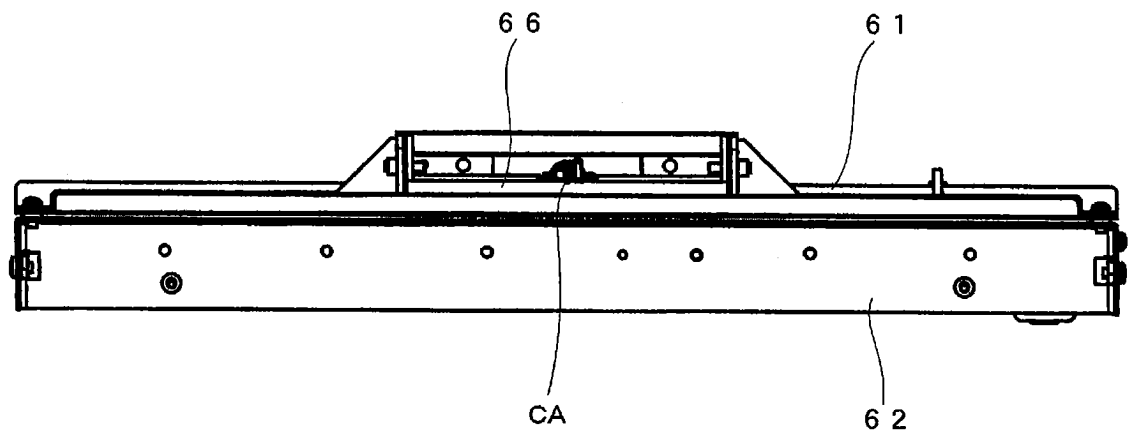
[Fig. 20 (d)]



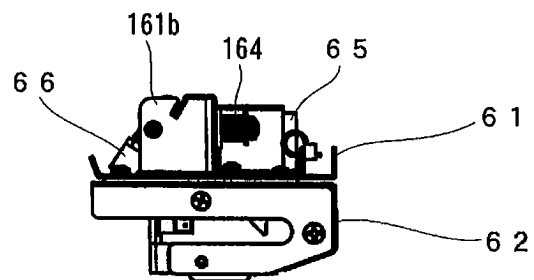
[Fig. 21]



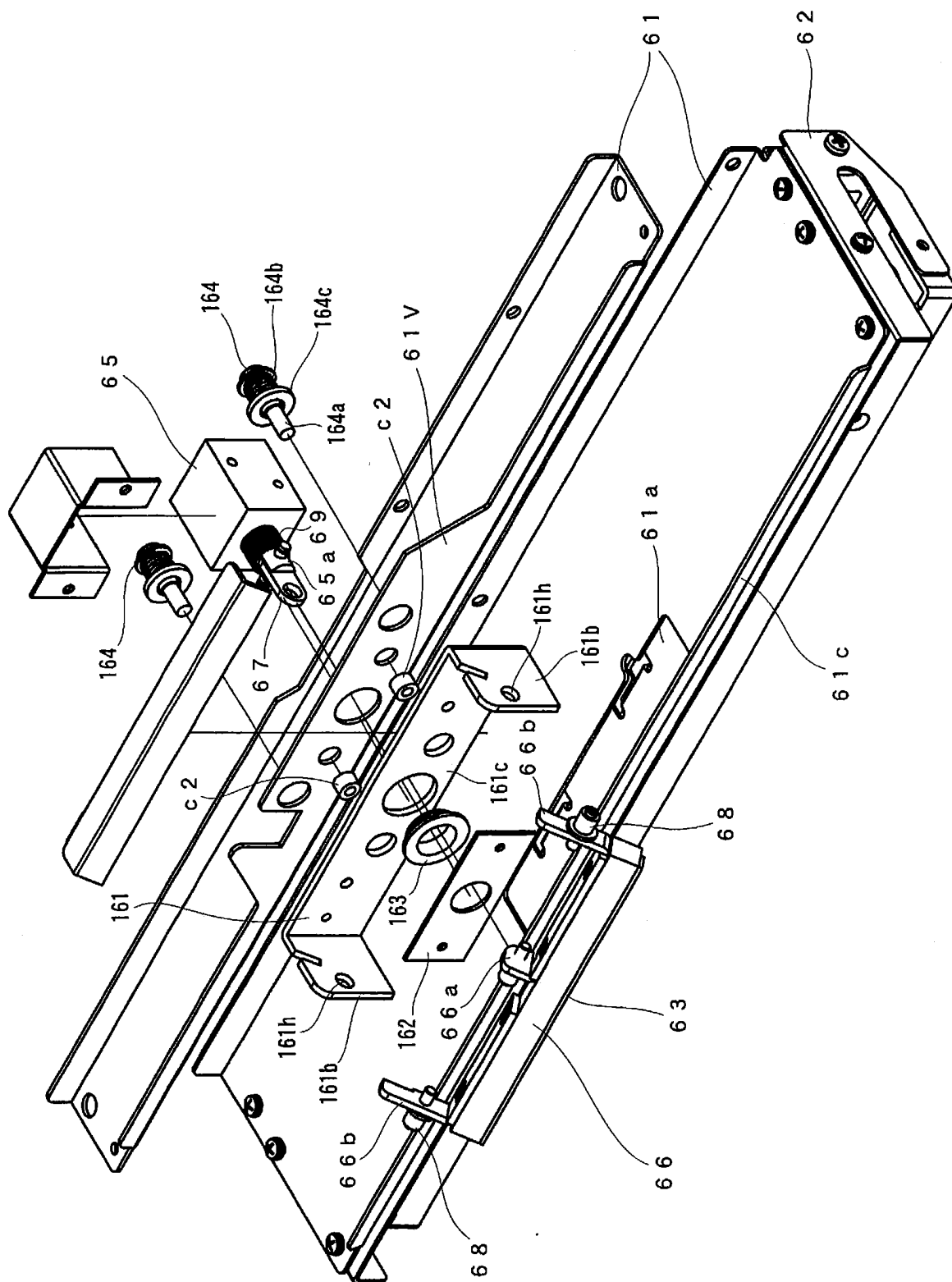
[Fig. 22]



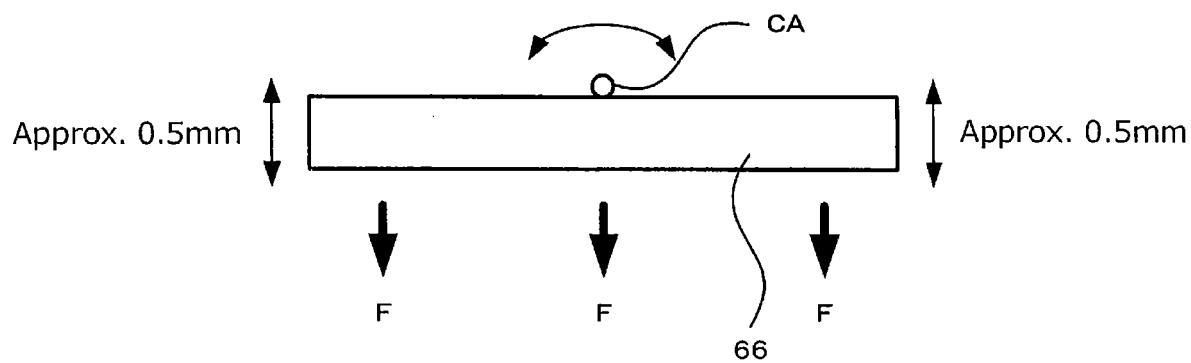
[Fig. 23]



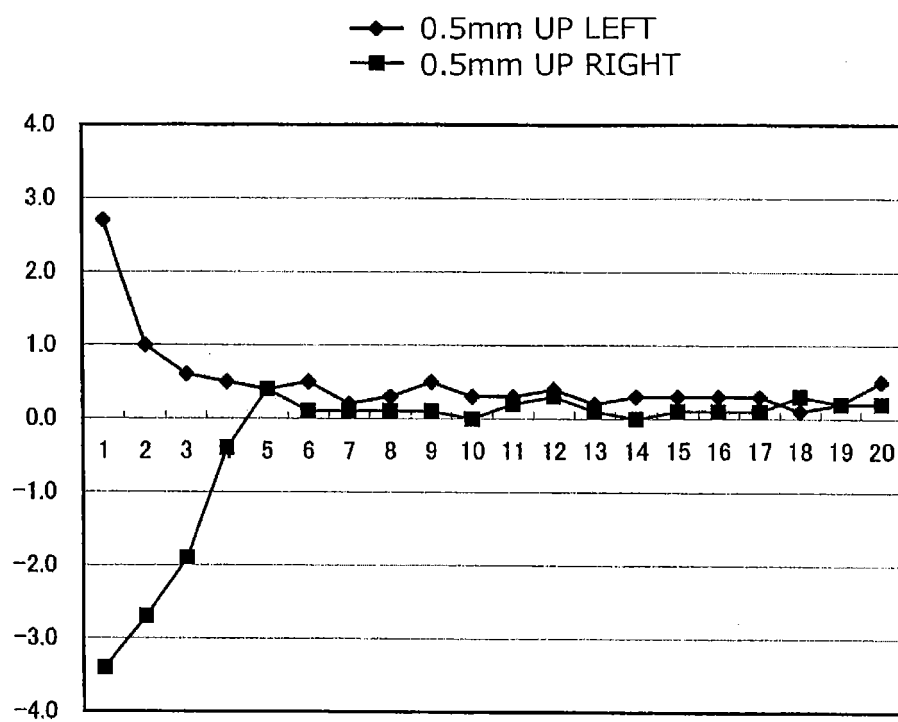
[Fig. 24]



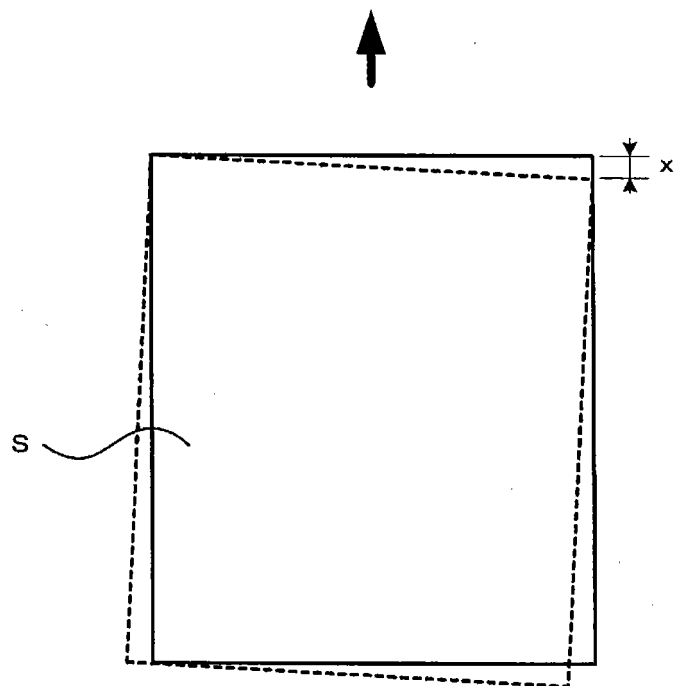
[Fig. 25]



[Fig. 26]



[Fig. 27]



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2013/076502

A. CLASSIFICATION OF SUBJECT MATTER

B65H45/16(2006.01) i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

B65H37/00-37/06, 45/00-47/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2013

Kokai Jitsuyo Shinan Koho 1971-2013 Toroku Jitsuyo Shinan Koho 1994-2013

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 2013/005296 A1 (Taiyogiken Co., Ltd.), 10 January 2013 (10.01.2013), paragraphs [0001], [0018] to [0044]; fig. 1 to 8 (Family: none)	1-3
A	JP 2006-347692 A (Nisca Corp.), 28 December 2006 (28.12.2006), paragraphs [0098] to [0102]; fig. 16A, 16B & US 2007/0009298 A1	1-3
A	JP 11-106127 A (Minolta Co., Ltd.), 20 April 1999 (20.04.1999), paragraphs [0067] to [0074]; fig. 7 (Family: none)	1-3

☒ Further documents are listed in the continuation of Box C.
 ☐ See patent family annex.

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"&" document member of the same patent family

Date of the actual completion of the international search
08 November, 2013 (08.11.13)Date of mailing of the international search report
19 November, 2013 (19.11.13)Name and mailing address of the ISA/
Japanese Patent Office

Authorized officer

Facsimile No.

Telephone No.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2013/076502

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 60-023253 A (Fuji Xerox Co., Ltd.), 05 February 1985 (05.02.1985), entire text; all drawings (Family: none)	1-3

Form PCT/ISA/210 (continuation of second sheet) (July 2009)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP HEI05238637 A [0003]
- JP SHO6023253 A [0003]
- JP SHO6341377 A [0003]
- US 3797820 A [0003]