



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
14.08.2013 Bulletin 2013/33

(51) Int Cl.:
G07D 11/00 (2006.01)

(21) Application number: **12193950.8**

(22) Date of filing: **23.11.2012**

(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

(30) Priority: **07.02.2012 JP 2012024482**

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(54) **Bill cassette and method of adjusting bill length of bill cassette**

(57) To handle currency bills of differing sizes, a bill cassette (45) set removably in a bill recycling unit (20), includes a stage (84) on which bills are placed that moves up and down in the bill cassette (45), regulating members (94-1,94-2,94-3) that push the bills stacked on the stage (84) to a bill conveying direction so as to regulate the bills, and a regulating member driving unit that drives the regulating members (94-1,94-2,94-3) so that the regulating members (94-1,94-2,94-3) push the bills by a distance corresponding to a denomination of the bills.

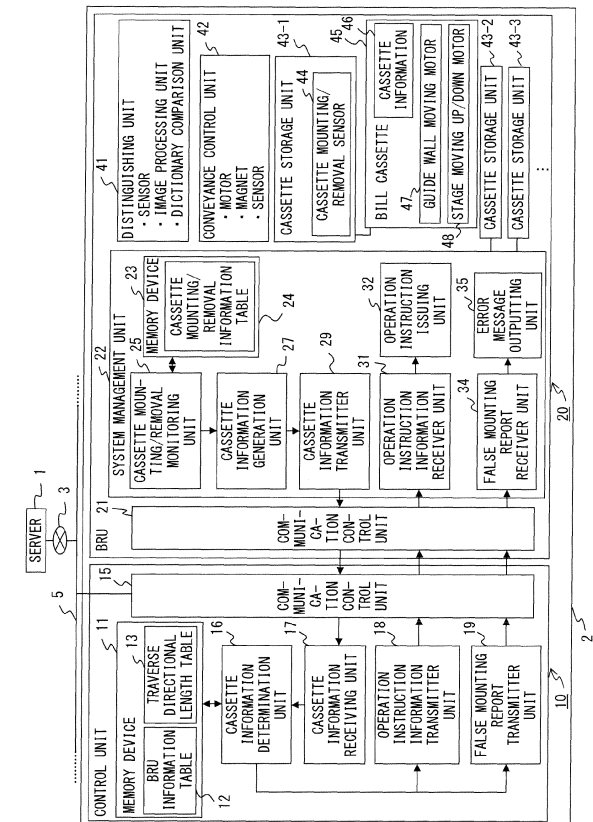


FIG. 1

Description

Field of the Invention

5 **[0001]** The present invention relates to a bill cassette and a method of adjusting the bill length of the bill cassette, and particularly to a bill cassette that is removably set in a bill recycling unit for handling a plurality of types of bills, having differing widths, and a method of adjusting the bill length of the bill cassette.

Background of the Invention

10 **[0002]** All bills circulated in Japan, i.e. 10000 yen, 5000 yen, 2000 yen, and 1000 yen bills, have the same transverse directional length, 76mm.

15 **[0003]** By contrast, in the euro area, 5 euro, 10 euro, 20 euro, 50 euro, 100 euro, 200 euro, and 500 euro bills are circulated, and they have different sizes in the transverse direction (widths or heights), being within a range between 62mm (5 euro bill) and 82mm (100 euro, 200 euro, and 500 euro bills).

20 **[0004]** Accordingly, in the euro area, the widths, or in other words the lengths in the transverse direction (referred to as "transverse directional length", hereinafter) of bill cassettes for storing bills are adjusted to respond to various denominations by manually adjusting the heights of guides provided to the back surface of the cassette cover before shipment from a factory.

25 **[0005]** Note that a guide is referred to as a regulating member or a guide wall in the explanations below. This is because when a plurality of plate-shaped regulating members are arranged at a plurality of positions, these regulating members work together as a wall so as to push on stacked bills.

30 **[0006]** As a method of specifying the denomination of bills stored in a bill cassette, there is a bill cassette that is specified as one for handling a plurality of types of bills in addition to one for handling bills of a single denomination. In such a case, the heights of guides are manually adjusted before shipment from a factory so that the adjusted guides are at the level corresponding to the widest or tallest bill (the bill having the greatest transverse directional length) among such a plurality of types of bills.

35 **[0007]** Recycling units installed in convenience stores or the like are configured to allow at least one bill cassette to be set inside removably for storing various denominations of bills.

40 **[0008]** As described above, when bill cassettes are shipped from factories, they receive adjustments by which a guide is set to a level for a specific type of bill or a guide is set to respond to a plurality of types of bills.

45 **[0009]** This causes a problem whereby when a bank clerk does not know the denomination of the bill cassette, he or she sets a bill cassette for a wrong denomination instead of a bill cassette for the denomination (denomination set at the point of shipment from factory) that is intended to be set at a prescribed position in the bill recycling unit.

50 **[0010]** In other words, the size of the interspace in a bill cassette set at the shipment from a factory does not correspond to the transverse directional length of bills that are to be stored at the set position (bill cassette storage unit) in a bill recycling unit (the interspace is greater or smaller than the transverse directional length of bills), which causes problems during operations.

55 **[0011]** Specifically, a case can happen in which the size of the interspace adjusted at the shipment from a factory is greater than the transverse directional length of bills to be stored at the set position in the bill recycling unit.

60 **[0012]** An exemplary case is that a bill cassette that has been adjusted for 500 euro bills (82mm in the transverse directional length) is set to a position to which a bill cassette for 20 euro bills (72mm in the transverse directional length) should be set (mounted).

65 **[0013]** In such a case, as shown in the side view showing a bill cassette 200 in Fig. 19, there is a margin for operations of storing bills in the bill cassette 200, and there will be no problems.

70 **[0014]** However, if bills stored in the bill cassette 200 are not positioned along the bill conveying direction (transverse direction) in the bill storage region and they have been shifted to the far side (left side in Fig. 19), a conveying roller (feed out roller) rolls without contacting the bills so that a feed-out failure will tend to occur when stored bills (bills placed on a stage 202) are to be fed out.

75 **[0015]** It can also happen that the size of the interspace in a bill cassette that received adjustment before the shipment is smaller than the transverse directional length of bills that are to be stored at the setting position of the cassette in the bill recycling unit.

80 **[0016]** An exemplary case is that a bill cassette adjusted for 20 euro bills (72mm in the transverse directional length) is set (mounted) to a position that is intended to be used by a bill cassette for 500 euro bills (82mm in the transverse directional length).

85 **[0017]** In such a case, as shown in the side view of a bill cassette 205 shown in Fig. 20, the length of the storage region in the bill conveying direction (transverse direction) of the bill cassette 205 is too small so that stored bills (bills placed on a stage 206) bend in the transverse direction in the storage region in the bill cassette 205, becoming obstacles

to the moving up and down of the stage 206, which is problematic.

[0018] As related art, Patent Document 1 discloses a paper sheet processing apparatus that allows manual adjustment of the width of a cartridge for receiving bills (paper sheets). This apparatus automatically detects the amount of the width adjustment of a mounted cartridge, and an error message is output about a cartridge having an inappropriate adjustment value. The technique of Patent Document 1 also requires manual operations, failing to reduce the labor related to mounting and removing of a cartridge (bill cassette).

[0019] Also, Patent Document 2 discloses a technique of adjusting the width of a bill storage unit in accordance with denominations.

[0020] However, in bill recycling units, bills are conveyed in their transverse direction so as to save the size of bill recycling units. Patent Document 2 adjusts the width of a bill storage unit in order to align bills in the longitudinal direction. The technique disclosed by Patent Document 2 is based on an assumption that the technique is used in Japan, and because all denominations of bills circulated in Japan have the same transverse directional length, 76mm, the above described problem caused by the variety in transverse directional lengths depending upon denominations will not emerge.

Patent Document 1: Japanese Laid-open Patent Publication No. 2001-101479

Patent Document 2: Japanese Laid-open Patent Publication No. 2003-323658

Summary of the Invention

[0021] The present invention has been made in order to solve the above problems, and it is an object of the present invention to provide a bill cassette that can be set removably in a bill recycling unit that is able to handle a plurality of bills having different sizes in transverse directions, and to provide a method of adjusting a length along a bill conveying direction of a bill storage region in a bill cassette.

[0022] A proposed bill cassette is a bill cassette that is removably set in a bill recycling unit, including a stage on which bills are placed and that moves up and down in the bill cassette, regulating members that push the bills stacked on the stage to a bill conveying direction so as to regulate the bills, and a regulating member driving unit that drives the regulating members so that the regulating members push the bills by a distance corresponding to the denomination of the bills.

[0023] A proposed method of adjusting a length along a bill conveying direction of a bill storage region in a bill cassette is executed by the bill cassette and instruction information transmitted from a server.

[0024] The bill cassette is removably set in a cassette storage unit in a bill input/output machine, and includes regulating members that push the stored bills in a bill conveying direction, and a regulating member driving unit that drives the regulating members. The server is connected to the bill input/output machine via a network.

[0025] According to this adjustment method, a fact that the bill cassette has been mounted to a mounting position of the cassette storage unit of the bill recycling unit in the bill input/output machine is transmitted from the bill input/output machine to the server, instruction information for controlling the pushing distance of the regulating members of the bill cassette is transmitted from server to the bill input/output machine so that the pushing distance corresponds to the mounting position, and the bill input/output machine controls the pushing distance of the regulating members of the bill cassette in accordance with received instruction information.

Effect

[0026] In a proposed bill cassette, the regulating member driving unit drives the regulating members that push the stacked bills to a bill conveying direction so as to regulate the bills in such a manner that the regulating members push the bills by a distance corresponding to the denomination of the bills. Accordingly, when the length of the bill storage region in the bill conveying direction (transverse directional length) is adjusted in accordance with the denomination of bills to be stored in the bill cassette, a plurality of types of bills different in the size of the short side can be handled.

Brief Description of the Drawings

[0027]

Fig. 1 is a functional block diagram showing a system for adjusting the width of interspaces of a bill cassette according to an embodiment of the present invention;

Fig. 2 shows the transverse direction (width or height) and the longitudinal direction (length) of a bill;

Fig. 3A shows a data structure of a transverse directional length table;

Fig. 3B shows a data configuration of a bill recycling unit (BRU) information table;

Fig. 4 shows a data structure of a cassette mounting/removing information table;

Fig. 5 shows a data configuration of a cassette information packet;

Fig. 6 shows a data structure of an operation instruction information packet;

Fig. 7 shows a data structure of a false mounting report packet;

Fig. 8 is a sectional view showing the bill recycling unit (BRU) according to the present embodiment;

Fig. 9 is a front view showing a main body of a bill cassette according to the present embodiment with the cover having been removed;

Fig. 10 is a front view showing the cover unit, seen from the inside, of a bill cassette according to the present embodiment;

Fig. 11 shows the bill cassette shown in Fig. 9 seen from above with the cover unit having been attached to it;

Fig. 12 shows a side view showing the bill cassette shown in Fig. 9 seen from the side with the cover unit having been attached to it;

Fig. 13 shows a comparison between the bill cassette according to the present embodiment before having been attached to the bill recycling unit (BRU) and the bill cassette according to the present embodiment after being attached to the BRU;

Fig. 14A shows a side sectional view showing the initial state of the cover unit of the bill cassette according to the present embodiment;

Fig. 14B shows a side sectional view showing the cover unit of a bill cassette after being adjusted according to the present embodiment;

Fig. 15 is a cross sectional view showing the cover unit of the bill cassette seen from above according to the present embodiment;

Fig. 16A shows a system flowchart for an automatic position adjusting process of regulating members of the bill cassette according to the present embodiment;

Fig. 16B is a detailed flowchart of step S9 shown in Fig. 16A;

Fig. 17 shows operations of the bill cassette according to the present embodiment performed when a plurality of denominations are to be stored;

Fig. 18 is a flowchart for a recovering process performed when a feed-out error has occurred in a bill cassette for storing a plurality of denominations according to the present embodiment;

Fig. 19 is a side view of the bill cassette showing a problem occurring when the size of the interspace of the bill cassette adjusted at the time of shipment from the factory is greater than the transverse directional length of bills to be stored at the set position (bill cassette storage unit) in the bill recycling unit (BRU); and

Fig. 20 is a side view of a bill cassette showing a problem occurring when the size of the interspace of the bill cassette adjusted at the time of shipment from the factory is smaller than the transverse directional length of bills to be stored at the set position (bill cassette storage unit) in the bill recycling unit (BRU).

Detailed Description of the embodiments

[0028] Hereinafter, embodiments according to the present invention will be explained in detail by referring to the drawings.

[0029] Fig. 1 is a functional block diagram showing a system for adjusting the width of interspaces of a bill cassette according to an embodiment of the present invention.

[0030] As shown in Fig. 1, the present system includes a control unit 10, a bill input/output machine 2 that represents functions of a server 1 (host device), and a bill recycling unit (BRU) 20. The control unit 10 and the BRU 20 are connected to each other via a communication network 5. The server 1 and the bill input/output machine 2 are connected to each other via an external network 3.

[0031] The control unit 10 includes a memory device 11, a communication control unit 15, a cassette information determination unit 16, a cassette information receiving unit 17, an operation instruction information transmitter unit 18, and a false mounting report transmitter unit 19.

[0032] The memory device 11 stores a BRU information table 12 and a transverse directional length table 13.

[0033] The BRU information table 12 may also be downloaded from the server 1 on an as-needed basis, and may also be set in the bill input/output machine 2.

[0034] The BRU 20 includes a communication control unit 21, a system management unit 22, a distinguishing unit 41, a conveyance control unit 42, and cassette storage unit 43-1 through 43-3.

[0035] The system management unit 22 shown in Fig. 1 includes a memory device 23, a cassette mounting/removal monitoring unit 25, a cassette information generation unit 27, a cassette information transmitter unit 29, an operation instruction information receiver unit 31, an operation instruction issuing unit 32, a false mounting report receiver unit 34, and an error message outputting unit 35.

[0036] Euro bills circulating in the euro zone have different transverse directional lengths (widths) depending upon the denominations, as described above.

[0037] In order to save the labor of manually adjusting the length in the bill conveying direction in the bill storage region

of the bill cassette before shipment so that the adjusted length corresponds to the transverse directional length of bills to be stored, the present embodiment has provided a guide wall for adjusting the length in the bill conveying direction in the bill storage region of a bill cassette and a moving mechanism such as a motor for moving that guide wall.

[0038] The cassette storage unit 43-1 through 43-3 shown in Fig. 1 each have vacant spaces for storing bill cassettes, and cassette mounting/removal sensors for detecting mounting and removing of the bill cassettes, terminals (not shown) for supplying power to various motors in the bill cassettes, and the like around the vacant spaces.

[0039] Fig. 1 shows a state where a bill cassette 45 has been mounted to the cassette storage unit 43-1.

[0040] This bill cassette 45 takes bills that have been conveyed in the transverse direction into the inside of itself by using an upper conveying roller pair (not shown), so as to stack and store them.

[0041] The bill cassette 45 includes a memory device (not shown), and that memory device stores cassette information 46 containing guide position information representing the position of the guide wall that was automatically adjusted by the driving of a guide wall moving motor 47 of the above movement mechanism before shipment, information of denomination to be stored by the bill cassette 45, and the like.

[0042] The bill cassette 45 also includes a stage (not shown in Fig. 1) on which stored bills are placed in a stacked manner. Driving a stage up/down movement motor 48 can move the stage up and down together with bills stacked on it.

[0043] Operations of the respective units in Fig. 1 will be explained below by using an example of mounting the bill cassette 45 onto the cassette storage unit 43-1 of the BRU 20.

[0044] In such a case, the cassette mounting/removal monitoring unit 25 detects that the bill cassette 45 has been mounted onto the cassette storage unit 43-1 according to a detection signal from a cassette mounting/removal sensor 44 set in the vicinity of the vacant space of the cassette storage unit 43-1.

[0045] A case where a bill cassette is newly mounted onto a cassette storage unit not having cassettes or a case where that bill cassette has been removed from the cassette storage unit are herein referred to as "change of status".

[0046] When the cassette mounting/removal monitoring unit 25 has detected a "change of status", what is detected is reflected on a cassette mounting/removal information table 24 shown in Fig. 4.

[0047] Fig. 4 shows a data structure of a cassette mounting/removing information table.

[0048] As shown in Fig. 4, the cassette mounting/removal information table 24 has three items, a cassette position ID 24-1, a currently mounted flag 24-2, and a previously mounted flag 24-3.

[0049] The cassette position ID 24-1 is information for identifying respective cassettes in the BRU 20. In this example, the BRU 20 has three cassette storage unit 43-1 through 43-3, and they are assigned the IDs "001", "002" and "003".

[0050] When a "change of status" has been detected, information representing the status after the change is written to the currently mounted flag 24-2 (mounting is "ON" and removing is "OFF" in this example).

[0051] At the timing that data is written as the item of the currently mounted flag 24-2, that data that was written as the item of the currently mounted flag 24-2 is shifted to the item of the previously mounted flag 24-3 of the same (row) record.

[0052] Once a "change of status" is detected, a "report of status continuation" is given from the cassette mounting/removal monitoring unit 25 to the cassette mounting/removal information table 24 in Fig. 4 a prescribed time period (several tens of seconds for example) after the detection time.

[0053] As long as a cassette is not removed immediately after the mounting or is not mounted immediately after the removal, this "report of status continuation" is given to the cassette mounting/removal information table 24 and data updating is performed on the cassette mounting/removal information table 24 in accordance with the report.

[0054] As a result of this, when a bill cassette has been mounted (when it is kept in a mounted state for several tens of seconds), the values of the currently mounted flag 24-2 and the previously mounted flag 24-3 in the record are set to "ON".

[0055] Also, when the bill cassette is removed (when a status without cassettes has continued for several tens of seconds), the values of the currently mounted flag 24-2 and the previously mounted flag 24-3 in the record are set to "OFF".

[0056] This is one of the methods of managing the status (mounted or removed) of bill cassettes at positions of respective cassette storage units in the BRU 20 by categorizing the status into four cases, "immediately after mounting", "prescribed period has elapsed after mounting", "immediately after removing", and "prescribed period has elapsed after removing".

[0057] Next, the cassette mounting/removal monitoring unit 25 shown in Fig. 1 activates the cassette information generation unit 27 when a bill cassette has been mounted, and generates a cassette information packet 53 as shown in Fig. 5 so as to transmit the packet to the control unit 10 via the cassette information transmitter unit 29 and the communication control unit 21.

[0058] Fig. 5 shows a data configuration of a cassette information packet.

[0059] As shown in Fig. 5, the cassette information packet 53 has identification information 53-1 of a packet (which indicates that the information is cassette information), a BRU-ID 53-2 (ID of the BRU), a cassette position ID 53-3, a cassette ID 53-4 (ID of a mounted bill cassette), denomination information 53-5, and guide position information 53-6.

[0060] The cassette information receiving unit 17 of the control unit 10 receives the cassette information packet 53

via the communication control unit 15, and feeds the received cassette information packet 53 to the cassette information determination unit 16.

[0061] The cassette information determination unit 16 refers to the BRU information table 12 and the transverse directional length table 13 stored in the memory device 11, analyzes the content of the received cassette information packet 53, and determines whether or not the bill cassette has been mounted onto the right position in the BRU, and whether or not the size of stored bills and the guide position correspond to each other, and other factors.

[0062] In the present embodiment, explanations will be given for two examples, i.e., operation instructions on how much the guide walls are to be moved, and a false mounting report that calls for attention to the fact that a bill cassette has been mounted onto a wrong position. However, the scope of the present invention is not limited to these examples.

[0063] Fig. 3A shows a data structure of the transverse directional length table.

[0064] As shown in Fig. 3A, the transverse directional length table 13 has two items, i.e., denomination (of euro) 13-1, and transverse directional length (of bills of that denomination) in units of millimeters 13-2. Note that Fig. 2 shows the transverse direction and the longitudinal direction of a bill 51 for confirmation.

[0065] Fig. 3B shows a data configuration of the BRU information table 12.

[0066] As shown in Fig. 3B, the BRU information table 12 has three items, a BRU-ID 12-1 (which is the ID of the BRU), a cassette position ID (which is an ID for identifying a cassette storage unit in the BRU) 12-2, and a denomination 12-2.

[0067] As described above, when the cassette information determination unit 16 has received the cassette information packet 53, the cassette information determination unit 16 searches the BRU information table 12 shown in Fig. 3B using as a key the BRU-ID 53-2 of the received cassette information packet 53, and searches the row of the hit BRU-ID 12-1 for the cassette position ID 12-2 using the cassette position ID 53-3 in the cassette information packet 53 as a key, obtains the value set as a denomination 12-3 in the row of the hit cassette position ID 12-2, and compares this value with the value in the denomination information 53-5 of the packet 53.

[0068] When the compared values are equal to each other, this means that the bill cassette has been set at a right position, and accordingly the cassette information determination unit 16 only moves the guide wall to the position corresponding to the denomination. In such a case, the operation instruction information transmitter unit 18 generates an operation instruction information packet 55 as shown in Fig. 6, and transmits this packet to the BRU 20 via the communication control unit 15.

[0069] Fig. 6 shows a data structure of an operation instruction information packet.

[0070] As shown in Fig. 6, the operation instruction information packet 55 contains items of packet identification information 55-1 (which indicates that the information is operation instruction information), a BRU-ID 55-2, a cassette position ID 55-3, a cassette ID 55-4, and a guide wall movement distance 55-5.

[0071] Also, when the value of the denomination 12-3 and the value of the denomination information 53-5 of the cassette information packet 53 do not correspond to each other, this means that the bill cassette is not set at a right position, and accordingly the cassette information determination unit 16 has to report this fact to the BRU 20 (by, for example, representing the denomination that is inherently set at that position). In such a case, the false mounting report transmitter unit 19 generates a false mounting report packet 57 as shown in Fig. 7, and reports the packet to the BRU 20 via the communication control unit 15.

[0072] Fig. 7 shows a data structure of a false mounting report packet.

[0073] As shown in Fig. 7, the false mounting report packet 57 contains items of packet identification information 57-1 (which indicates that that packet is for reporting false mounting), a BRU-ID 57-2, a cassette position ID 57-3, a cassette ID 57-4, and denomination information 57-5 (that is to be inherently set).

[0074] Hereinabove, explanations have mainly been given to the functions of the BRU 20. Hereinafter, explanations will be given to hardware configurations of the BRU 20.

[0075] Fig. 8 is a sectional view showing the BRU 20 according to the present embodiment.

[0076] As shown in Fig. 8, the BRU 20 includes a shutter 61 that can open and close, a money input/output unit 62, a returned bill holding unit 63, conveying paths 65-1, 65-2,..... for connecting respective units, cassette storage unit 43-1, 43-2, and 43-3 that the bill cassette 45 can be attached to and removed from, a distinguishing unit 41 for distinguishing counterfeit bills from authentic bills when such bill cassettes are input, a left-behind bill retrieving unit 67, a reject A71, a reject B68, a temporary holding unit 72, and a test bill setting unit 73.

[0077] When bills have been input, each of those bills that have been input to the money input/output unit 62 is fed out onto the conveying paths 65-1, 65-2, 65-3, and 65-4, reaches the inlet port of the distinguishing unit 41, enters the distinguishing unit 41, is conveyed on the conveying path 65-5 in the distinguishing unit 41, has the image on its surface picked up by an image processing unit (not shown) in the distinguishing unit 41, and is subject to determination of whether it is an authentic bill or a counterfeit bill in accordance with a comparison between the picked up image and an image in a dictionary performed by a dictionary comparison unit (not shown).

[0078] When a bill has been determined to be "authentic" as a result of the determination, that bill is fed out from the distinguishing unit 41, and is conveyed on conveying paths 65-6, 65-27, 65-28, and 65-29 so as to be accommodated in the temporary holding unit 72.

[0079] Thereafter, each bill is fed out from the temporary holding unit 72, and is conveyed on the conveying paths 65-29, 65-31, 65-2, 65-3, 65-4, 65-5, 65-6, 65-7, 65-9, and 65-16, and reaches the inlet port of the cassette storage unit 43-1.

[0080] Thereafter, when the destination bill cassette is the cassette storage unit 43-1, the bills are accommodated in the cassette storage unit 43-1 through the conveying path 65-17.

[0081] When the destination bill cassette is the cassette storage unit 43-2, the bills are accommodated in the cassette storage unit 43-2 through the conveying paths 65-19 and 65-20.

[0082] When the destination bill cassette is the cassette storage unit 43-3, the bills are accommodated in the cassette storage unit 43-3 through the conveying paths 65-19, 65-22, and 65-23.

[0083] When the above determination result indicates that the bill is "counterfeit", or "needs to be replaced with a new one due to overuse", the bill is conveyed on the conveying paths 65-6, 65-7, 65-9, and 65-10, and is accommodated in the left-behind bill retrieving unit 67 after being conveyed on the conveying path 65-11, is accommodated in the reject B68 after being conveyed on the conveying paths 65-12 and 65-13, or is accommodated in the reject A71 after being conveyed on the conveying paths 65-12 and 65-14.

[0084] When bills are to be output, bills reach the distinguishing unit 41 by being conveyed on, for example, the conveying paths 65-18, 65-19, 65-22, and 65-26, are fed out from the distinguishing unit 41 after being conveyed on the conveying path 65-5 in the distinguishing unit 41, are accommodated on the returned bill holding unit 63 after being conveyed on the conveying paths 65-6, 65-7, and 65-8, and are fed out to the money input/output unit 62.

[0085] This applies to the feeding out of bills from the cassette storage unit 43-2 or 43-3.

[0086] Fig. 9 is a front view showing the main body of a bill cassette according to the present embodiment with the cover having been removed.

[0087] As shown in Fig. 9, a main body unit 81 opposite to the cover unit (not shown) of a bill cassette has a projection unit 82 provided to an upper side plane, a stage 84, stage side members 84-1 and 84-2 that fit, with clearance, with a regulating member for regulating the bill length along the three conveying directions and that form guide walls provided to the opposed cover unit, a stage supporting base 85, and a rail 87 for determining the directions along which the stage 84 and the stage supporting base 85 move up and down.

[0088] The projection unit 82 has a terminal unit (not shown) on the side of the main body unit 81 that can be connected to the terminal unit (not shown) on the main body side of the BRU 20 so that electric power is supplied to a stage up/down movement motor (not shown) for moving the stage 84 up and down and the stage supporting base 85 along the rail 87 and various mechanisms included in the bill cassette 45.

[0089] Fig. 10 is a front view showing the cover unit, as seen from the inside, of a bill cassette according to the present invention.

[0090] As shown in Fig. 10, a cover unit 92 has, at its center, a regulating member 94-1 that is narrow and long in the vertical direction as part of the guide wall, and that has flat ends. The cover unit 92 also has, on both sides, flat regulating members 94-2 and 94-3 that have great width in the horizontal directions.

[0091] These regulating members 94-1, 94-2, and 94-3 are set on a plate shaped supporting board 96.

[0092] Note, that although Fig. 10 does not explicitly indicate it, a dimple 107 set on the side of the cover unit 92 of the supporting board 96 and a dimple 108 set on a casing 98 of the cover unit 92 are opposed to each other, and there is a movement mechanism (a linking mechanism of center cross type, for example) provided between the dimples.

[0093] Thereby, the regulating members 94-1 through 94-3 incorporated into the supporting board 96 operate as a guide wall so that they pack bills stored in the bill cassette in the transverse direction with respect to the casing 98 of the cover unit 92, and the ends of the stacked bills abut against an end-abutting plane 99 to which the stage 84 has been attached, and are positioned in the conveying direction (transverse direction).

[0094] The regulating members 94-1 through 94-3 are fixed onto the supporting board 96 by fixation elements 101-1, 101-2, 101-3, 101-4, 101-5, 101-6, 101-7, 101-8, and 101-9 such as screws.

[0095] Fig. 11 shows the bill cassette shown in Fig. 9 seen from above with the cover unit attached to it.

[0096] As described above, the casing 98 exists, and the supporting board 96 is set inside the casing 98 using a link mechanism (not shown).

[0097] Also, regulating members 94-1 through 94-3 are fixed on the supporting board 96. The regulating members and an end of stacked bills 100 are apart from each other with an interval a. This interval a represents the margin of the storage region.

[0098] In other words, distance b between the end-abutting plane 99 on the side of the stage 84 and the regulating members 94-1 through 94-3 is given by "length in the conveyed direction of stored bills (transverse direction in this case) + margin a". Note that the value of margin a is for example 2mm through 3mm.

[0099] Fig. 12 shows a side view showing the bill cassette shown in Fig. 9 with the cover unit attached to it.

[0100] Fig. 13 shows a comparison between a bill cassette according to the present embodiment before being attached to the BRU 20 and a bill cassette according to the present embodiment after being attached to the BRU 20.

[0101] In the example shown in Fig. 13, the distances between the regulating members 94-1 through 94-3 in the bill

cassette and the end-abutting plane 99 on the side of the stage 84 are set to be greater than "transverse directional length of a bill to be stored (or stored bill) + margin a" (i.e., distance b described above).

[0102] An example is a case where shipment was performed without adjustment.

[0103] By contrast, on the right hand side in Fig. 13, the distances between the regulating members 94-1 through 94-3 in the bill cassette and the end-abutting plane 99 on the side of the stage 84 are set to be a "transverse directional length of a bill to be stored (or stored bill) + margin a", i.e., direction b, and the regulating members 94-1 through 94-3 have been moved to the bill conveying direction, reducing the interval.

[0104] Fig. 14A shows a side sectional view showing the initial state of the cover unit of a bill cassette according to the present embodiment.

[0105] A regulating member driving mechanism includes a center cross link mechanism and a power source 110.

[0106] On both sides of the dimples 107 and 108 provided on the casing 98 and the supporting board 96, two links 103 and 104 that cross each other are fixed or pivotally supported by a plurality of pins, and thereby a center cross link mechanism is configured.

[0107] The power source 110 is incorporated at the side of the cover unit, and is constituted by a driving motor 114, a pinion 112, and a connection unit 106.

[0108] The connection unit 106 includes a rack 111, and this rack 111 is engaged with the pinion 112.

[0109] The tip of the connection unit 106 is inserted into a pin 103-2 that pivotally supports an end of the link 103.

[0110] A disk 118 having a pulley 119 and a slit 117 has an axis coaxial with the output axis of the driving motor 114, and rotates in the same direction in accordance with the rotation of the driving motor 114.

[0111] A racing sensor 115 detects passing of the slit 117 of the disk 118 so as to detect racing, and the amount of racing is regarded as rotations that did not cause movement of a connection unit. A connection unit will be described later.

[0112] The pinion 112 that is rotated by the pulley 119 through a belt 121 is engaged with a rack 111 formed on the connection unit 106.

[0113] For attaching links to the regulating member driving mechanism, the dimple 108 is formed on the side of the casing 98, and the dimple 107 is formed on the back surface of the supporting board 96 that supports the regulating members 94-1 through 94-3.

[0114] The links 103 and 104 cross each other at their center, and a pin 102 is inserted into them at the crossing point in order to pivotally support them. Also, as shown in Fig. 15, the crossing links 103 and 104 also exist on the other side, and accordingly, the pin 102 pierces both crossing points of the crossing links provided on both sides of the dimples 107 and 108.

[0115] One end of the link 104 is inserted into a pin 104-1, and the pin 104-1 is further inserted into a hole provided on the side lower end portion of the dimple 108 provided on the casing 98 for pivotally supporting it.

[0116] The other end of the link 104 is inserted into a pin 104-2, and the pin 104-2 is further inserted into a long-hole shaped dimple provided on the upper side portion of the dimple 107 provided on the back surface of the supporting board 96 so as to pivotally support the links in such a manner that the links can move in the horizontal directions.

[0117] One end of the link 103 is inserted into a pin 103-1, and the pin 103-1 is further inserted into a hole provided on the lower end side portion of the dimple provided on the back surface of the supporting board 96 for pivotally supporting it.

[0118] The other end of the link 103 is inserted into a pin 103-2, and the pin 103-2 is further inserted into a long-hole shaped dimple provided on the upper end of a side plane of the dimple 108 provided on the casing 98 so as to pivotally support the links in such a manner that the links can move in the horizontal directions.

[0119] In the above configuration, when the output axis of the driving motor 114 rotates in the counterclockwise direction in the state shown in Fig. 14A, the connection unit 106 that engages the rack 111 with the pinion 112 moves downward, and the pin 103-2 that pivotally supports the upper end of the link 103 moves downward the long-hole shaped dimple provided on the upper end side of the dimple 108 of the casing 98.

[0120] Accompanying this, the pin 104-2 pivotally supporting the upper end portion of the link 104 moves downward the long-hole shaped dimple provided on the upper end side of the dimple 107 of the back surface of the supporting board 96. As a result of this, the center cross link mechanism shifts from the retracted state (initial state) shown in Fig. 14A to the pushed-out state shown in Fig. 14B.

[0121] When the output axis of the driving motor 114 rotates in the clockwise direction in the state shown in Fig. 14B, the connection unit 106 that engages the rack 111 with the pinion 112 moves upward, and the pin 103-2 pivotally supporting the upper end of the link 103 moves upward the long-hole shaped dimple provided on the upper end side of the dimple 108 of the casing 98.

[0122] Accompanying this, the pin 104-2 pivotally supporting the upper end of the link 104 moves upward the long-hole shaped dimple provided on the upper end side of the dimple 107 of the back surface of the supporting board 96. As a result of this, the center cross link mechanism shifts from the pulled-out state shown in Fig. 14B into a retracted state (initial state) shown in Fig. 14A.

[0123] Fig. 16A shows a system flowchart for an automatic position adjusting process of the regulating member of a

bill cassette according to the present embodiment. The process of this flowchart is executed by the BRU 20 and the control unit 10.

[0124] Steps S1 and S2 are processed on the side of the BRU 20.

[0125] In step S1 in Fig. 16A, it is determined whether or not the current timing is immediately after a bill cassette has been set (mounted onto the BRU 20).

[0126] On the above described cassette mounting/removal information table 24, if the value of the previously mounted flag 24-3 is "OFF" and the value of the currently mounted flag 24-2 is "ON" for the cassette position ID 24-1 of the target cassette, it is determined to be "immediately after mounting".

[0127] When it is determined that the current timing is immediately after the mounting of a bill cassette in step S1 (Yes in the determination in step S1), the cassette information generation unit 27 generates in step S2 the cassette information packet 53 as shown in Fig. 5, and the cassette information transmitter unit 29 transmits the generated cassette information packet 53 to the control unit 10.

[0128] Steps S3 through S7 are processes on the side of the control unit 10.

[0129] In step S3, the cassette information receiving unit 17 of the control unit 10 determines whether or not the cassette information packet 53 has been received.

[0130] As long as the cassette information packet 53 is determined to not be received (as long as the result of the determination in step S1 is No), the determination in step S3 is continued.

[0131] When it has been determined in step S3 that the cassette information packet 53 was received (Yes in the determination in step S1), the cassette information determination unit 16 refers to the BRU information table 12 and the transverse directional length table 13, and analyzes the contents of the cassette information packet 53 in step S4.

[0132] In step S5, the process branches in accordance with the result of the analysis.

[0133] In other words, as described above, when the cassette information determination unit 16 has received the cassette information packet 53, the cassette information determination unit 16 searches the BRU information table 12 in Fig. 3B using the BRU-ID 53-2 of the cassette information packet 53 as a key, searches the row of hit BRU-ID 12-1 for the cassette position ID 12-2 using the cassette position ID 53-3 in the cassette information packet 53 as a key, obtains a value set in the denomination 12-3 for the row of the hit cassette position ID 12-2, and compares the obtained value and the value of the denomination 53-5 of the cassette information packet 53.

[0134] When the compared values are equal to each other, this means that the bill cassette has been set at a correct position, and accordingly the determination unit 16 only moves the regulating members 94-1 through 94-3 (the supporting board 96) to the positions corresponding to the denominations. In such a case, the process proceeds to step S7, and the operation instruction information transmitter unit 18 generates an operation instruction information packet 55 as shown in Fig. 6, and transmits this packet to the BRU 20.

[0135] When the value of the denomination 12-3 and the value of the denomination information 53-5 of the cassette information packet 53 do not correspond to each other, this means that the bill cassette is not set at a correct position, and the cassette information determination unit 16 has to report this fact to the BRU 20 (by, for example, representing the denomination that is inherently set at that position). In such a case, the process proceeds to step S6, and the false mounting report transmitter unit 19 generates a false mounting report packet 57 as shown in Fig. 7 and reports the packet to the BRU 20.

[0136] Steps S8 through S11 in Fig. 16A are processes on the side of the BRU 20.

[0137] In step S8, the operation instruction information receiver unit 31 determines whether or not the operation instruction information packet 55 has been received.

[0138] When it has been determined in step S8 that the operation instruction information packet 55 was received (Yes in the determination in step S8), a guide position adjusting process is performed in step S9, and the process returns to step S1.

[0139] When it has been determined in step S8 that the operation instruction information packet 55 was not received (No in the determination in step S8), the false mounting report receiver unit 34 determines in step S10 whether or not the false mounting report packet 57 was received.

[0140] When it has been determined in step S10 that the false mounting report packet 57 was received (Yes in the determination in step S10), a false mounting report process (outputting of an error message indicating that a wrong cassette has been mounted, or the like) is performed in step S11, and the process returns to step S1.

[0141] When it has been determined in step S10 that the false mounting report packet 57 was not received (No in the determination in step S10), the process returns to one of the packet waiting states, which starts from step S8.

[0142] Fig. 16B is a detailed flowchart of step S9 shown in Fig. 16A.

[0143] In step S9-1, which has been activated by the "Yes" determination in step S8 shown in Fig. 16A, the positions of the regulating members (guide wall position) are checked.

[0144] For example, it is determined whether or not the guide wall movement distance 55-5 in the operation instruction information packet 55 and the guide position information in the cassette information 46 stored in the memory device included in the bill cassette 45 correspond to each other.

[0145] When the check in step S9-1 has determined that the positions have already been set to the adjusted position, the process returns to step S1 in Fig. 16A.

[0146] When the check in step S9-1 has determined that the positions have not been adjusted and require adjustments, the guide wall movement distance 55-5 in the operation instruction information packet 55 is obtained as the regulating member movement distance in step S9-2, the driving mechanism is driven in accordance with the obtained regulating member movement distance so as to push the regulating members 94-1 through 94-3 in step S9-3 in the horizontal direction (bill conveying direction) by a necessary movement distance, and the movement distance is written to the guide position information in the cassette information 46 so as to update, in step S9-4, the guide position information. Thereafter, the process proceeds to step S1 in Fig. 16A.

[0147] In the setting of denominations for a bill cassette, not only one denomination, but also a plurality of denominations can be set.

[0148] In a case of a bill cassette that has been set to accommodate a plurality of denominations, the length of the bill storage region in the bill conveying direction (transverse direction) is adjusted in response to the bill having the largest transverse directional length.

[0149] Accordingly, in a bill cassette for storing a plurality of denominations, when bills of denominations having smaller transverse directional lengths are stored, a situation can sometimes happen in which bills are pushed to the side of the regulating members 94-1 through 94-3, which are located opposite to a bill feeding out position A, so that the bills' edges on the side of position A in the transverse direction of bill are apart from the bill feeding out position A, as denoted by "S21" in Fig. 17.

[0150] When bills are on the side of the regulating members 94-1 through 94-3 when they are to be fed out, they cannot be fed out properly, causing a feed out failure.

[0151] Even if a feed out retry operation is performed in a case as indicated by "S21" in Fig. 17, bills cannot be fed out, and accordingly the following operations of S22 through S25 shown in Fig. 17 are performed in order to reduce the chances of occurrences of feed out failures.

[0152] In other words, the edges of bills stacked on the stage 84 are contacted at three points in the state indicated by S22 in Fig. 17 so that the regulating members 94-1 through 94-3 for regulating the stacked bills are returned to the positions shown in Fig. 14A from the positions shown in Fig. 14B by driving the above driving mechanism, thereby making the regulating members retract to the initial positions. Also, the stage 84 is made to move down by a prescribed length.

[0153] Thereafter, as indicated by S23 in Fig. 17, the distance between the edge position of the guide wall (regulating members 94-1 through 94-3) and the end-abutting plane 99 is adjusted to be equal to the largest one of the transverse directional lengths among denominations that can be used in the bill cassette, and then the wall is retracted by the length of the margin (approximately 2mm through 3mm) in step S24.

[0154] Thereafter, as indicated by S25 shown in Fig. 17, the stage 84 moves up to the feeding out position, and bills are fed out.

[0155] Fig. 18 is a flowchart for a recovering process performed when a feed-out error has occurred in a bill cassette for storing a plurality of denominations according to the present embodiment.

[0156] In step S31 shown in Fig. 18, whether or not the number of bills stored in the bill cassette is smaller than a threshold is determined.

[0157] When the number of bills has been determined in step S31 to not be smaller than a threshold (No in the determination in step S31), this means that the cassette is full of bills, and the process terminates.

[0158] When the number of bills has been determined in step S31 to be smaller than a threshold (Yes in the determination in step S31), it is determined in step S32 whether or not the stage 84 is being pressed and has reached the lower end in accordance with the sensor state.

[0159] This means that the cassette is determined to be full of bills if the pressure is determined to be equal to or higher than a prescribed value by the pressure sensor (not shown) and the lower end sensor (not shown) has detected that the position of the stage 84 has reached the lower end.

[0160] When it has been determined in step S32 that the stage is being pressed and has reached the lower end (Yes in the determination in step S32), this means that the cassette is full of bills, and the process terminates.

[0161] When it has been determined in step S32 that the stage is not being pressed or the stage has not reached the lower end (No in the determination in step S32), the guide wall (the supporting board 96 to which the regulating members 94-1 through 94-3 have been attached) is retracted to the initial position in step S33.

[0162] In the subsequent step, S34, the stage 84 is made to move down by a prescribed length. When the stage 84 can move down, the determination result is Yes, and when the stage 84 cannot move down, the determination result is No.

[0163] When it has been determined in step S34 that the stage was not able to move down by a prescribed length (No in the determination), this means that the bill cassette is not full of bills but has bills at a rate higher than a prescribed rate, and the process of this flowchart is terminated.

[0164] When it has been determined in step S34 that the stage was able to move down by a prescribed length (Yes

in the determination), the guide wall movement distance is calculated by using the following equation in step S35.

movement distance = (length of the bill conveying distance in the bill storage region) – (largest transverse
directional length among denominations used in a bill cassette)

[0165] In the subsequent step, S36, the guide wall is moved by the calculated movement distance by being driven by the power source 110. of the center cross link mechanism.

[0166] Next, in step S37, the retracting by the length of the interspace (margin) is performed. This is performed in order to prevent media (bills) from being interfered with by the guides (regulating members) when the stage 84 moves up.

[0167] In step S38, the positions of the guides (regulating members) that have received adjustment after movement are stored in the cassette information 46 of the bill cassette 45 shown in Fig. 1.

[0168] Next, in step S39, the stage 84 moves up until the pressure sensor detects this moving up. When the pressure sensor succeeds in sensing the moving up, the determination result is Yes, and when it fails, the determination result is No.

[0169] By performing the above processes, it is possible to reduce feed out failures that can occur when bills are fed out.

Claims

1. A bill cassette (45) set removably in a bill recycling unit (20), comprising:

a stage (84) on which bills are placed and that moves up and down in the bill cassette (45);
regulating members (94-1,94-2,94-3) that push the bills stacked on the stage (84) in a bill conveying direction so as to regulate the bills; and
a regulating member driving unit that drives the regulating members(94-1,94-2,94-3) so that the regulating members (94-1,94-2,94-3) push the bills by a distance corresponding to a denomination of the bills.

2. The bill cassette (45) according to claim 1, wherein:

the regulating member driving unit has a center cross link mechanism and a power source (110); and
in a dimple(108) formed on a casing (98) of a cover unit (92) of the bill cassette (45)and a dimple (107) formed on a back surface of a supporting board (96) of the regulating members (94-1,94-2,94-3), the center cross link mechanism:

makes a first link (104) and a second link (103) cross each other at a center of a side plane of each dimple, and inserts a first pin (102) into the crossing portion so as to pivotally support the first link (104) and the second link (103);

inserts one end of the first link (104) into a second pin (104-1) , and further inserts the second pin (104-1) into a hole formed on a lower edge of a side plane of the dimple (108) formed on the casing (98) of the cover unit (92) so as to pivotally support the first link (104);

inserts the other end of the first link (104) into a third pin (104-2), and further inserts the third pin (104-2) into a long-hole shaped dimple formed on an upper edge of a side plane of the dimple (107) formed on the back plane of the supporting plate (96) so as to pivotally support the first link (104) so that upward and downward movement is possible;

inserts an end of the second link (103) into a fourth pin (103-1), and further inserts the fourth pin (103-1) into a hole formed on a lower edge of a side plane of the dimple (107) formed on the back plane of the supporting plate (96);

inserts the other end of the second link (103) into a fifth pin (103-2), and further inserts the fifth pin (103-2) into a long-hole shaped dimple formed on an upper edge of the side plane of the dimple (108) formed on the casing (98) so as to pivotally support the second link (103)so that upward and downward movement is possible;

the power source (110) has a driving motor (114), a pinion (112)rotated by the driving motor (114), and a connection unit (106) having a rack (111) that is engaged with the pinion (112);

the connection unit (106) moves upward or downward accompanying rotation of an output shaft of the driving motor (114), and the fifth pin (103-2) that pivotally supports the upper end of the second link (103) moves upward or downward in the long-hole shaped dimple formed on the upper end side of the dimple (108) formed on the casing (98);

the third pin (104-2) that pivotally supports the upper end of the first link (104) moves upward or downward in the long-hole shaped dimple formed on the upper end side of the dimple (107) on the back plane of the supporting plate (96); and
the center cross link mechanism performs shifting between a retracted state, in which bills are not pushed, and a pushing state.

3. The bill cassette (45) according to claim 1 or 2, wherein:

the regulating member driving unit drives the regulating members (94-1,94-2,94-3) so that the regulating members (94-1,94-2,94-3) push bills by a distance that is set in accordance with a position in a cassette storage unit (43-1) for storing the bill cassette (45) in the bill recycling unit (20).

4. A method of adjusting a length along a bill conveying direction of a bill storage region in a bill cassette (45), said method being executed by the bill cassette (45) set removably in a cassette storage unit (43-1) in a bill recycling unit (20) having regulating members (94-1,94-2,94-3) for pushing stored bills to a bill conveying direction, by a regulating member driving unit for driving the regulating members (94-1,94-2,94-3), by the bill recycling unit (20), and by a control unit (10) for controlling the bill recycling unit (20), comprising:

transmitting, from the bill recycling unit (20) to the control unit (10), a fact that the bill cassette (45) has been mounted to a mounting position of the cassette storage unit (43-1) of the bill recycling unit (20);
transmitting, from the control unit (10) to the bill recycling unit (20), instruction information (55) for controlling a pushing distance of the regulating members (94-1,94-2,94-3) of the bill cassette (45) so that the pushing distance corresponds to the mounting position; and
making the bill recycling unit control (20) the pushing distance of the regulating members (94-1,94-2,94-3) of the bill

cassette (45) in accordance with received instruction information (55).

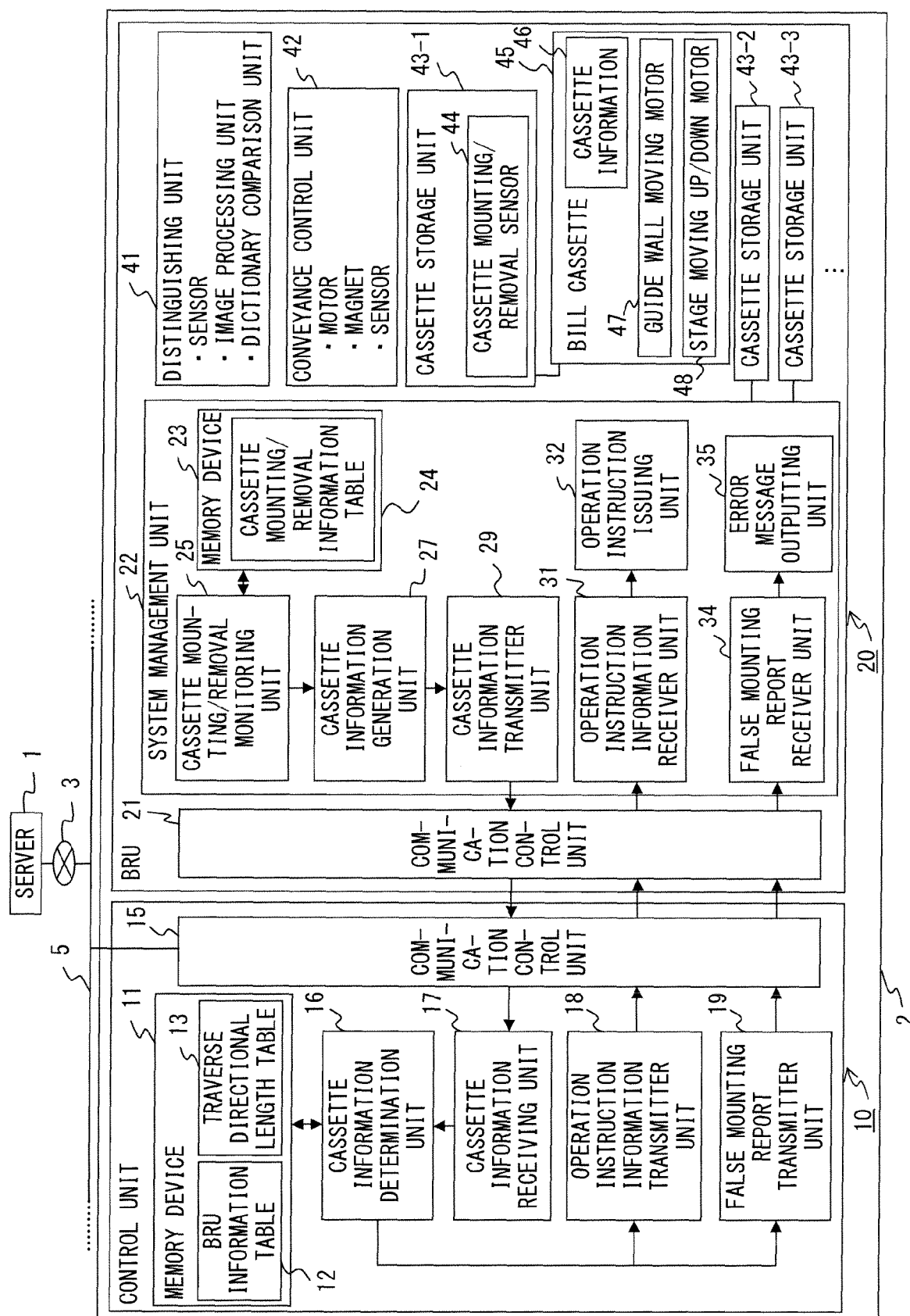
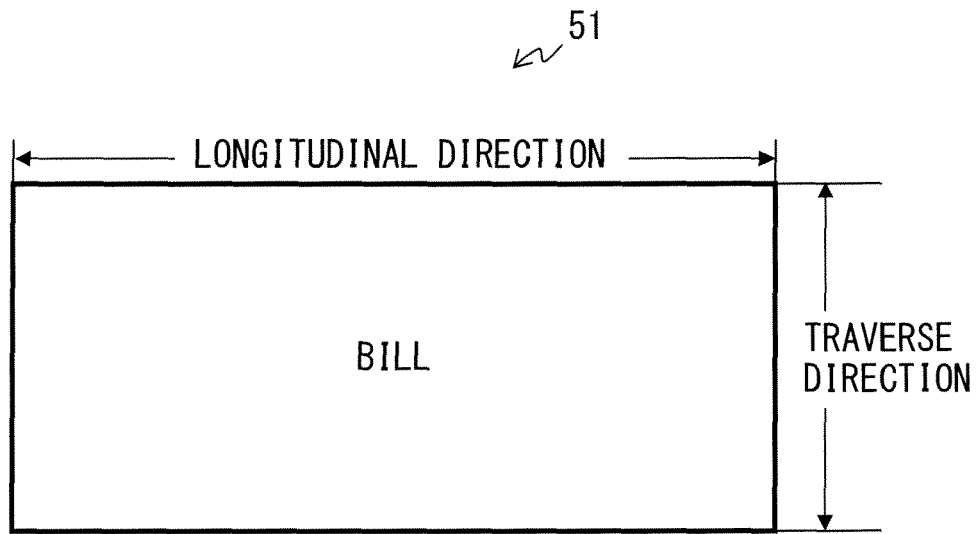


FIG. 1



F I G. 2

13
↙ ↘
13-1 13-2

DENOMINATION	TRAVERSE DIRECTIONAL LENGTH (mm)
5 EURO	62
10 EURO	67
20 EURO	72
50 EURO	77
100 EURO	82
200 EURO	82
500 EURO	82

F I G. 3 A

12-1 BRU-ID	12-2 CASSETTE POSITION ID	12-3 DENOMINATION
1000001	001	5 EURO
	002	10 EURO
	003	20 EURO AND 50 EURO IN MIXED STATE
⋮	⋮	⋮

FIG. 3B

24

24-1	24-2	24-3
CASSETTE POSITION ID	CURRENTLY MOUNTED FLAG	PREVIOUSLY MOUNTED FLAG
001	ON	OFF
002	OFF	OFF
003	ON	ON

FIG. 4

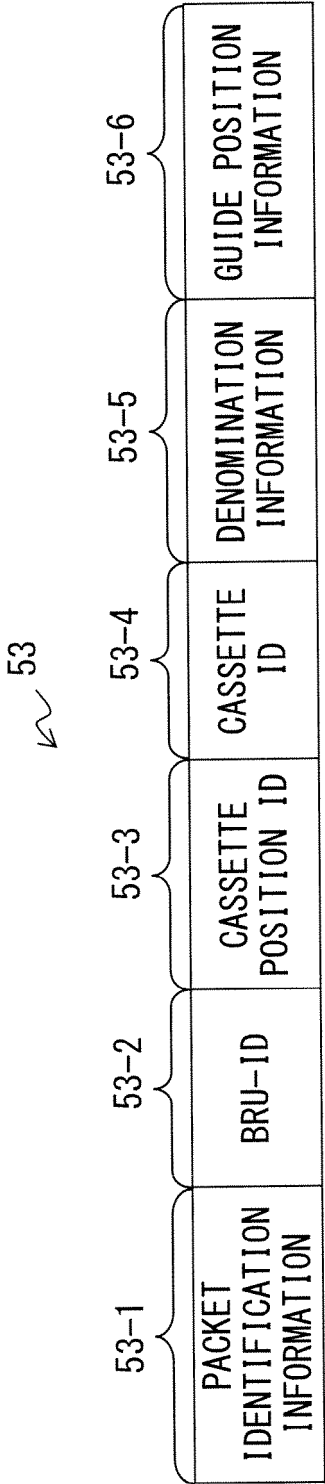


FIG. 5

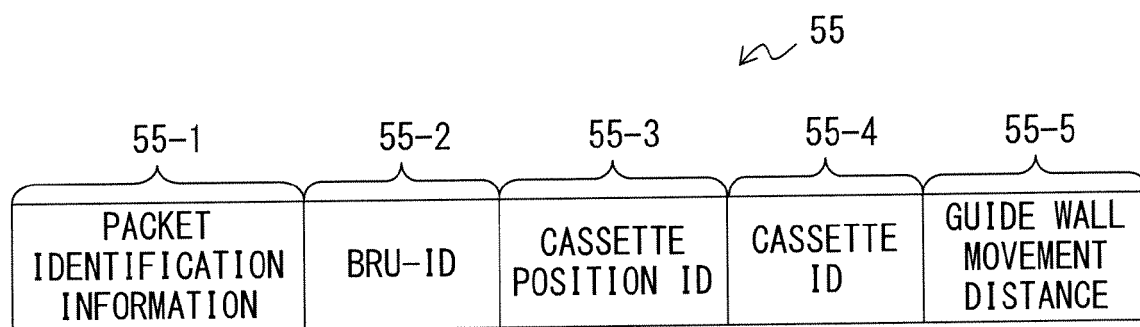


FIG. 6

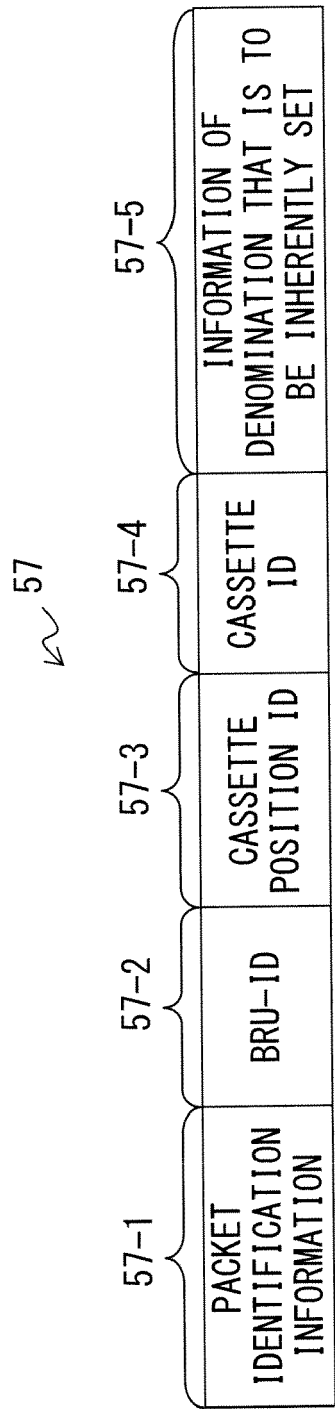


FIG. 7

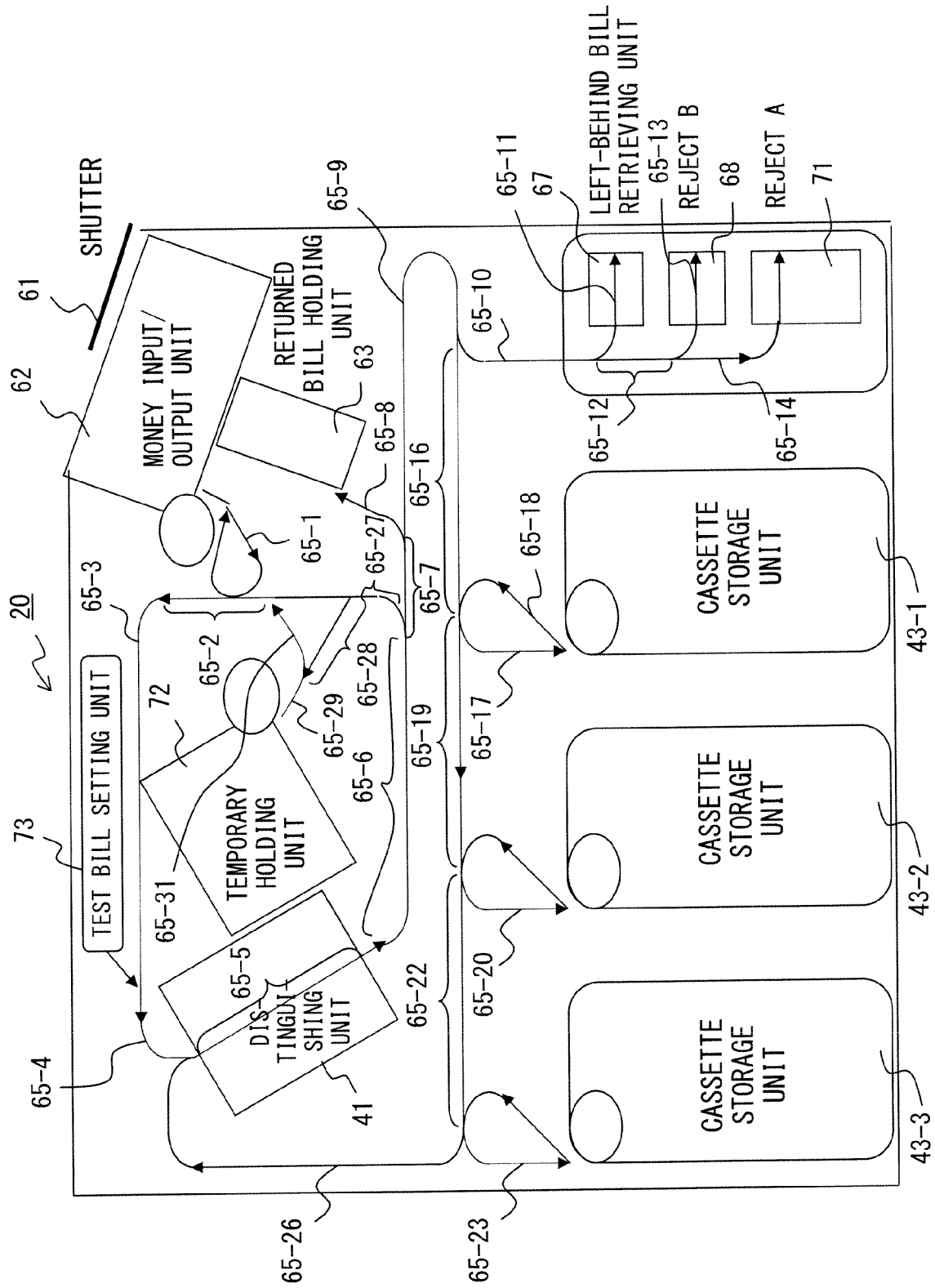


FIG. 8

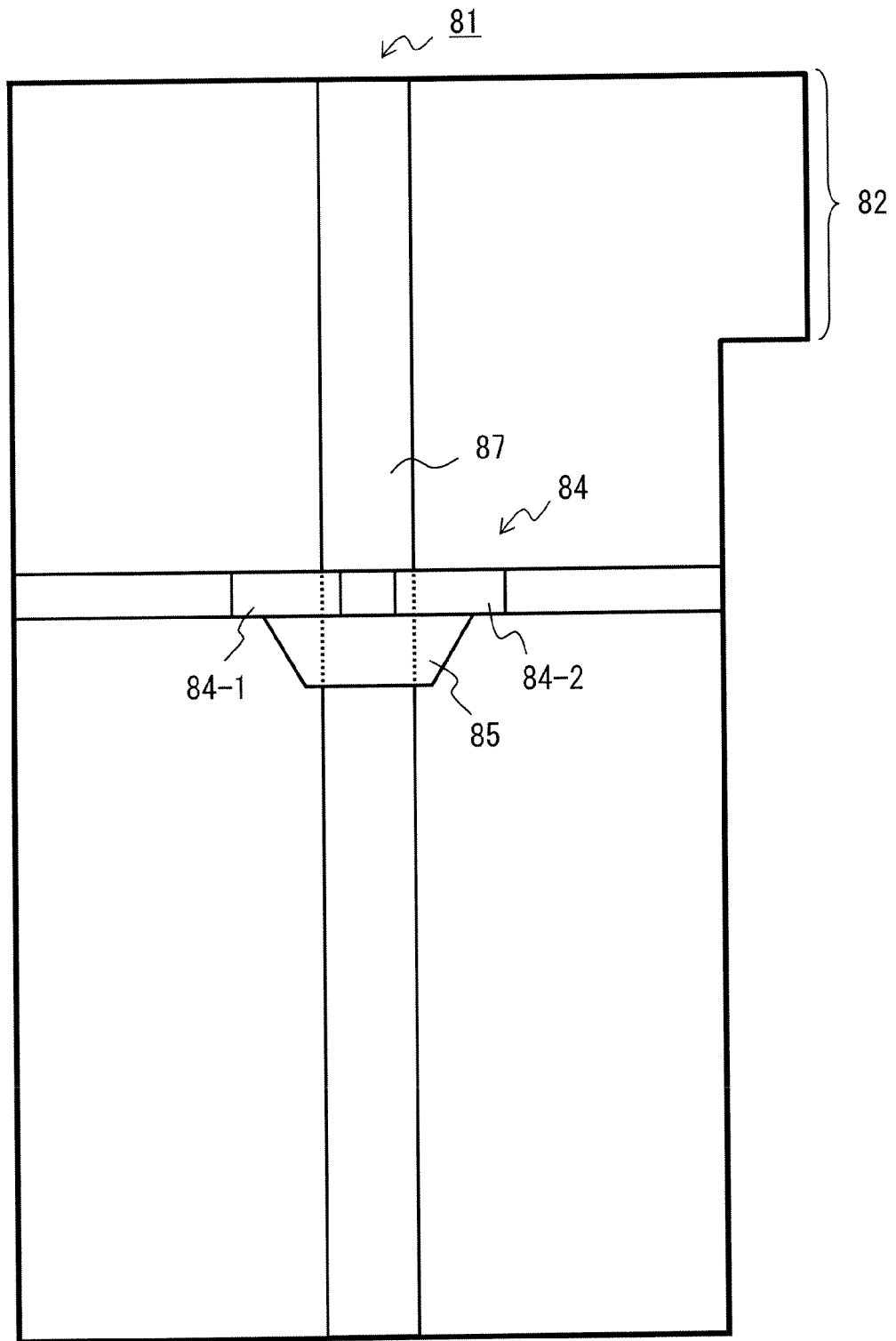


FIG. 9

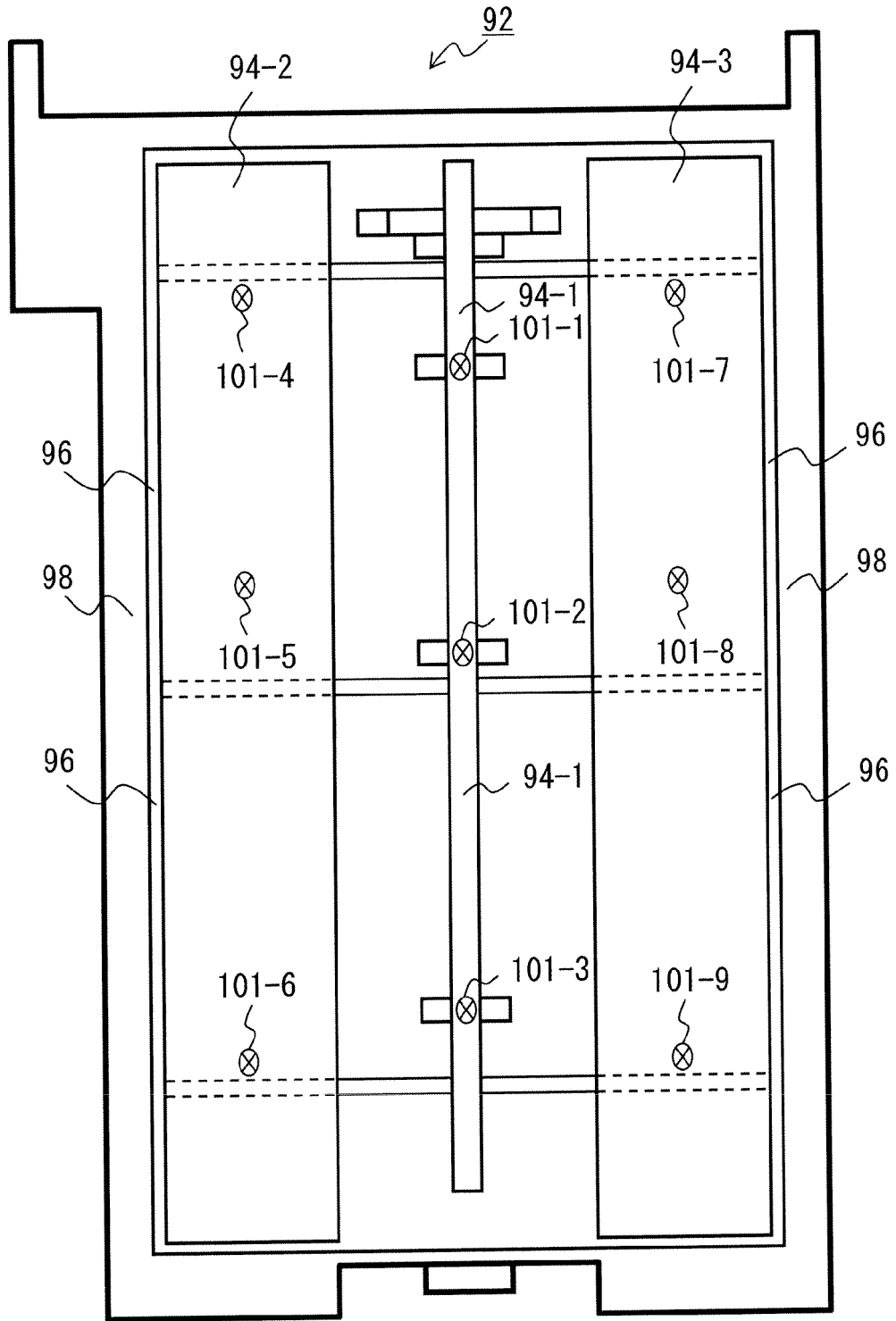


FIG. 10

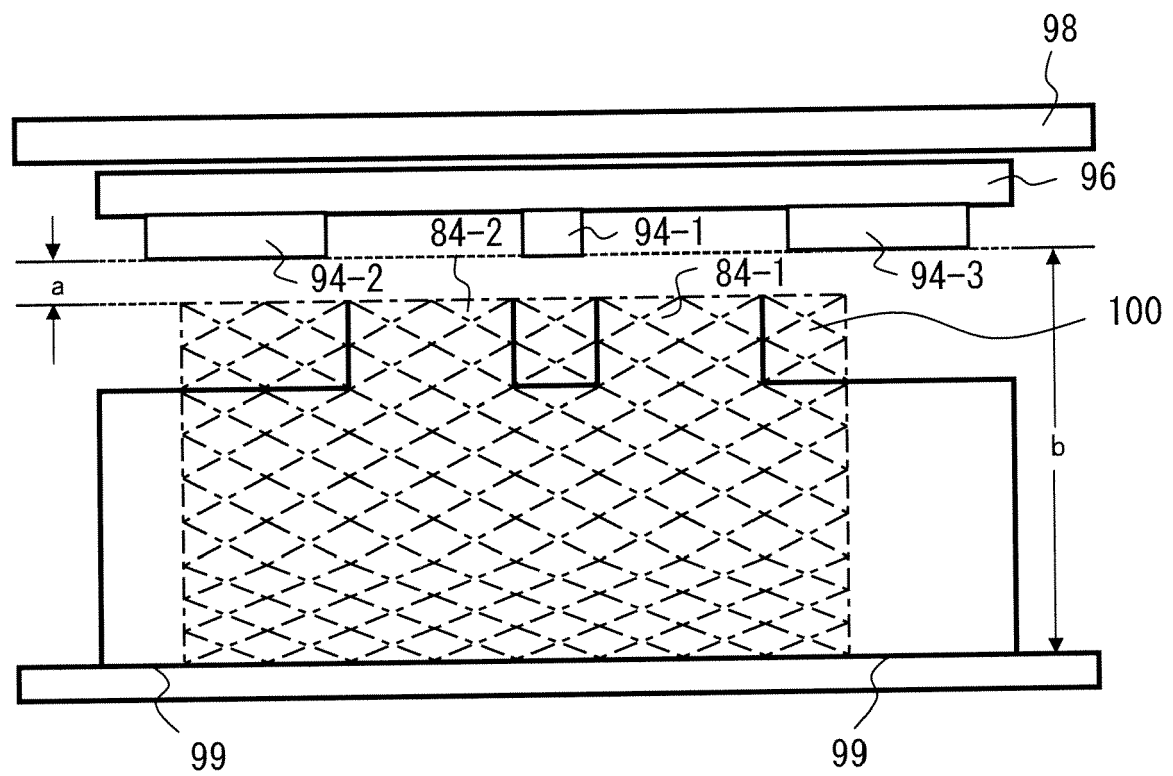


FIG. 11

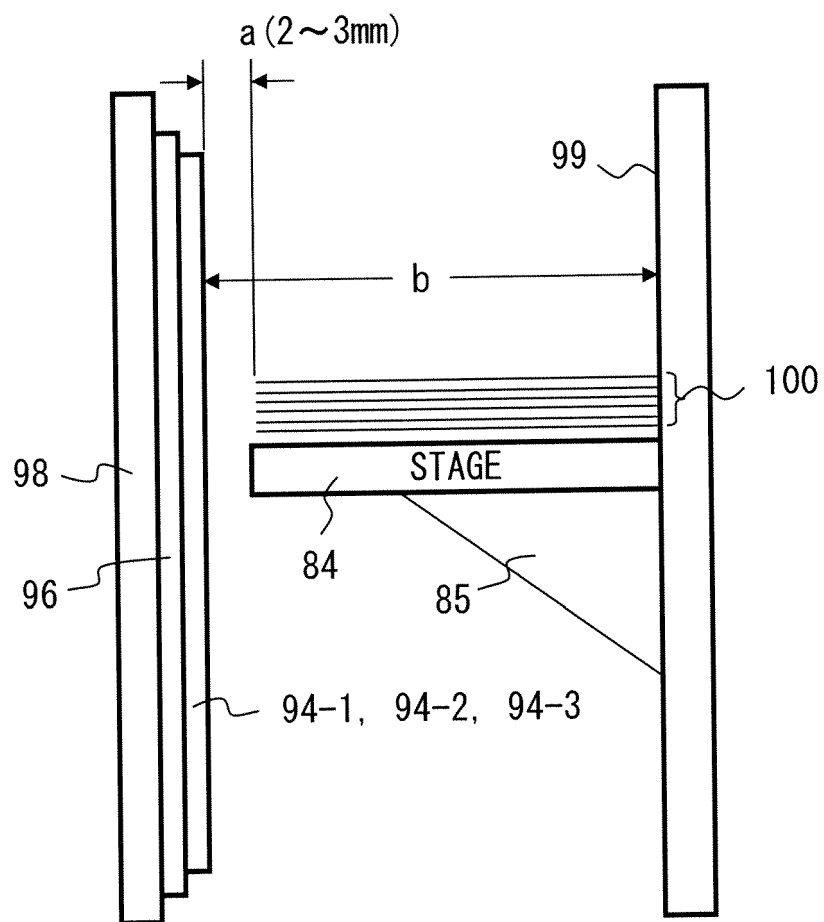
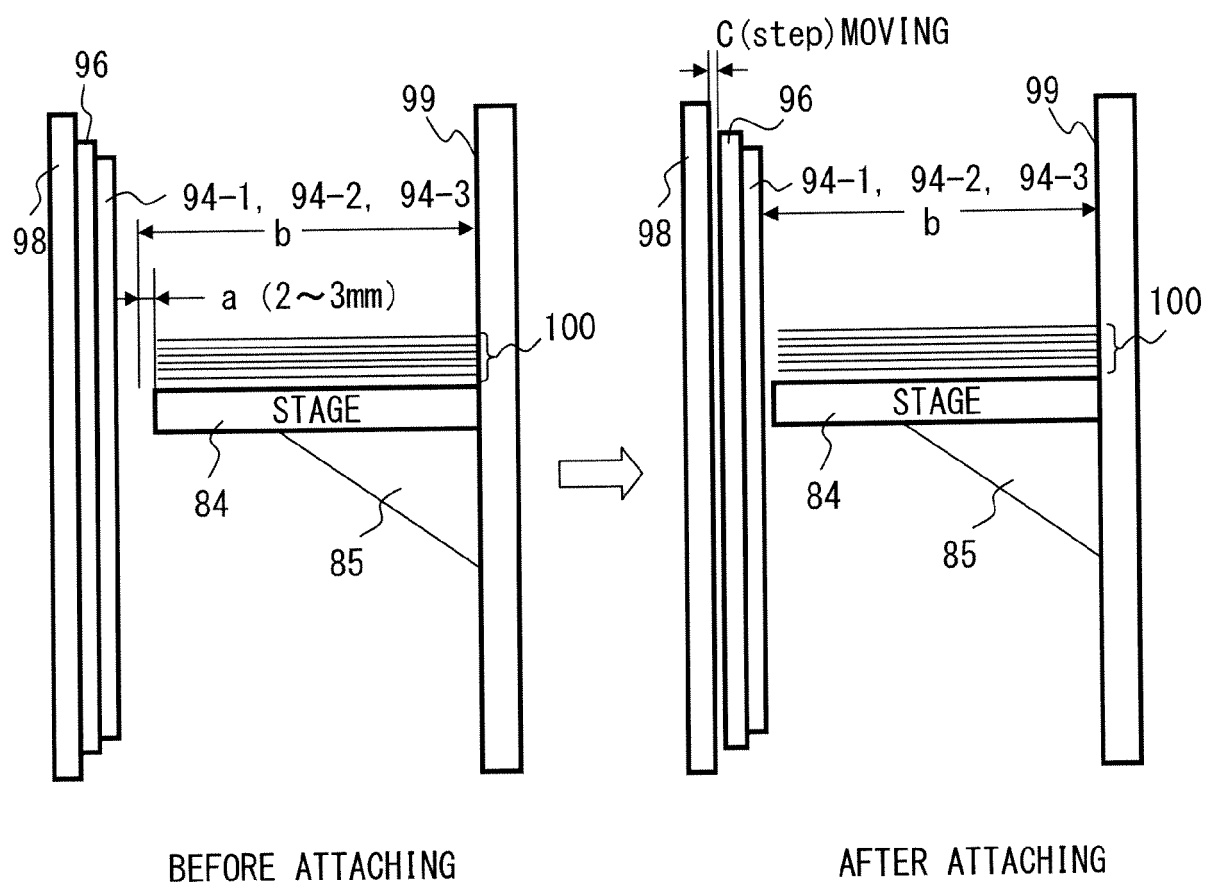


FIG. 12



F I G. 1 3

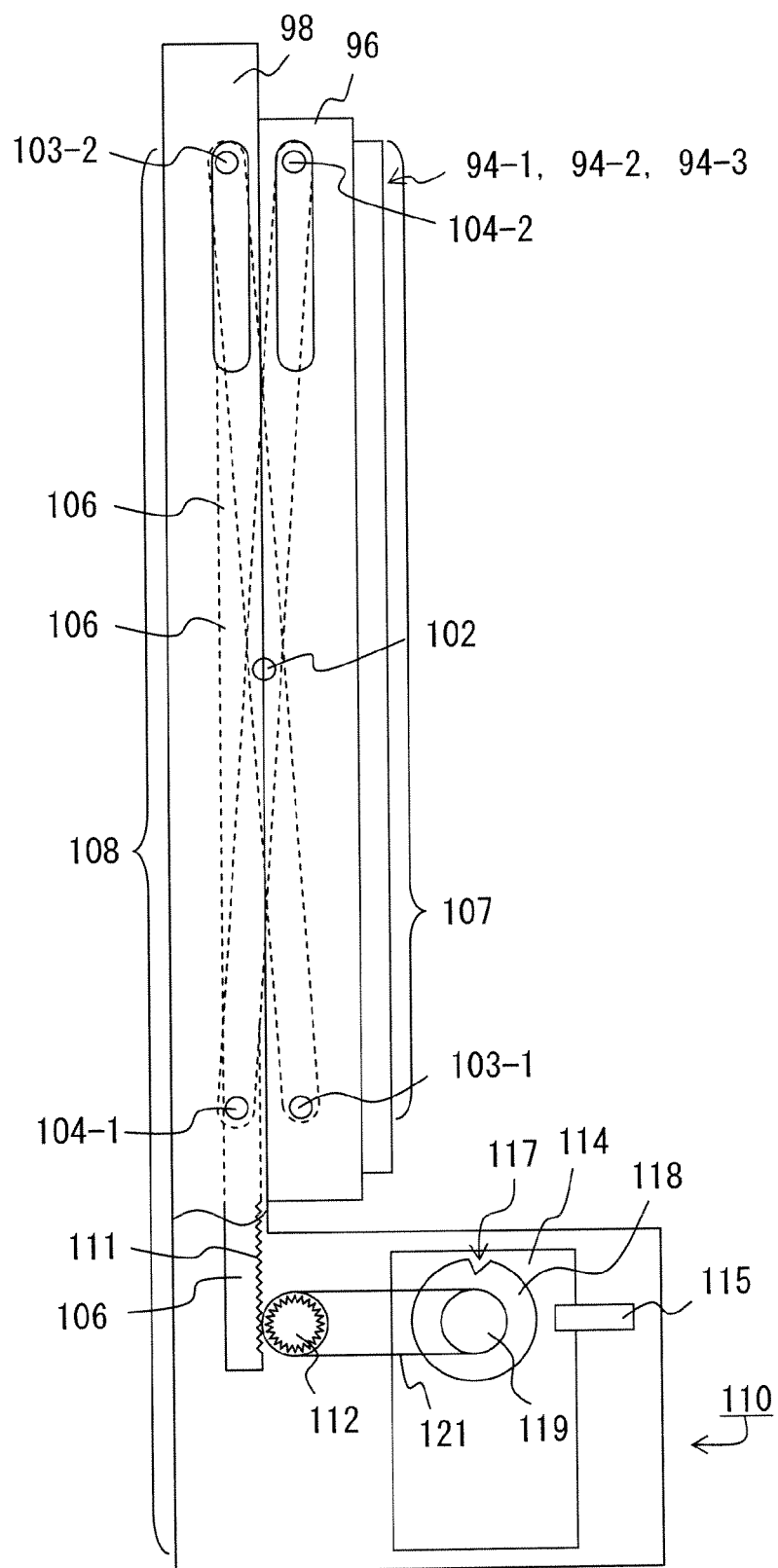


FIG. 14A

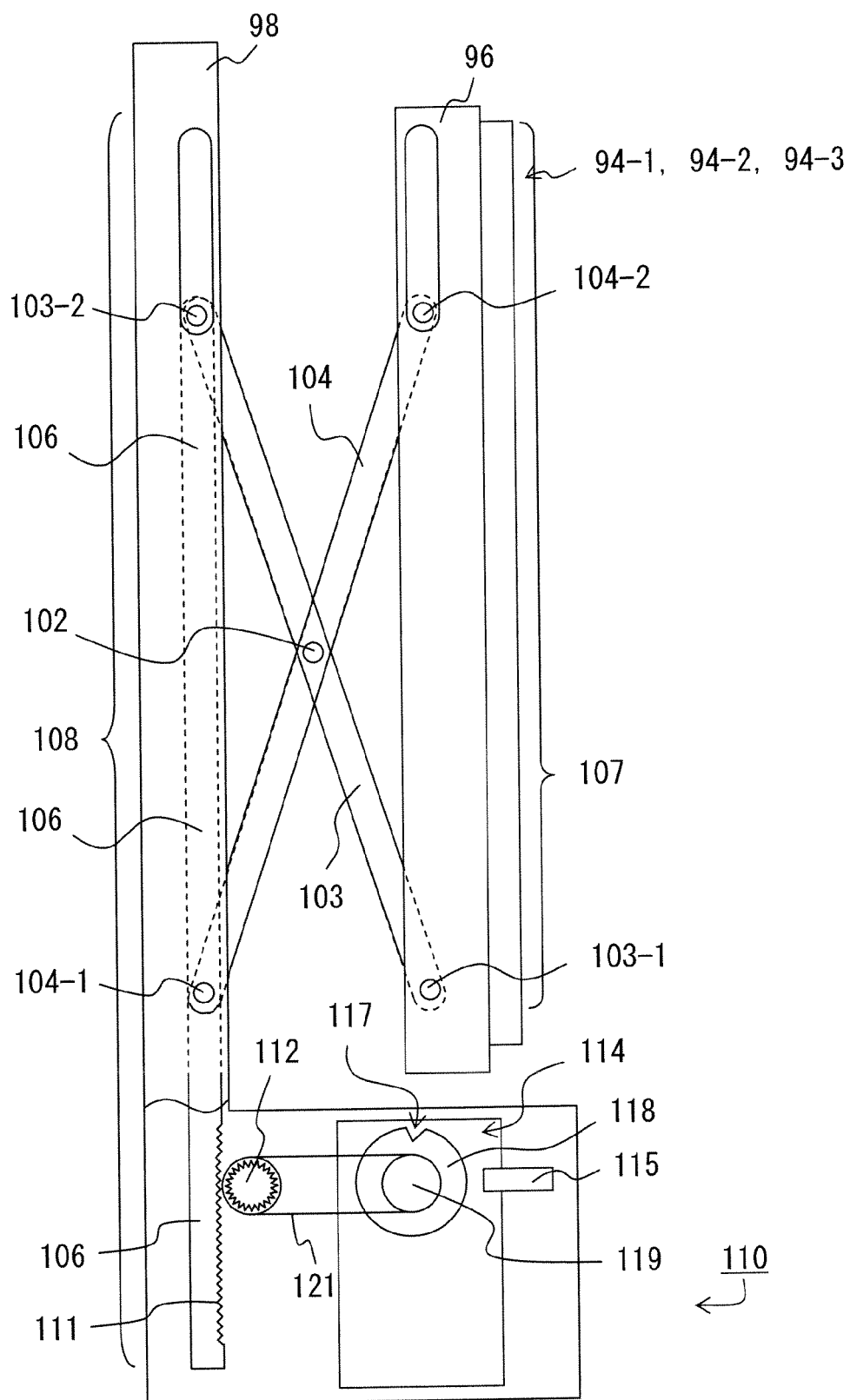


FIG. 14B

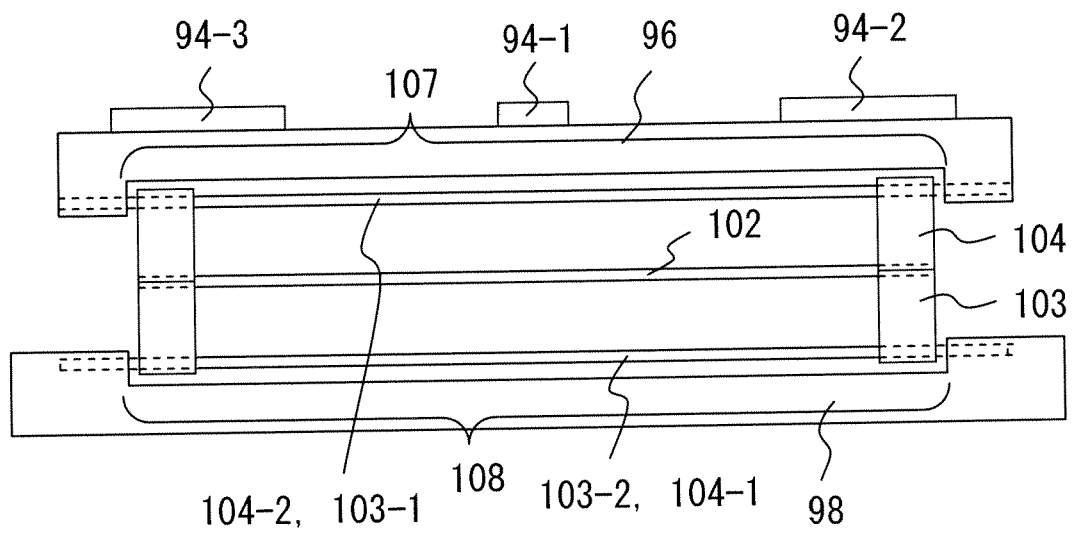


FIG. 15

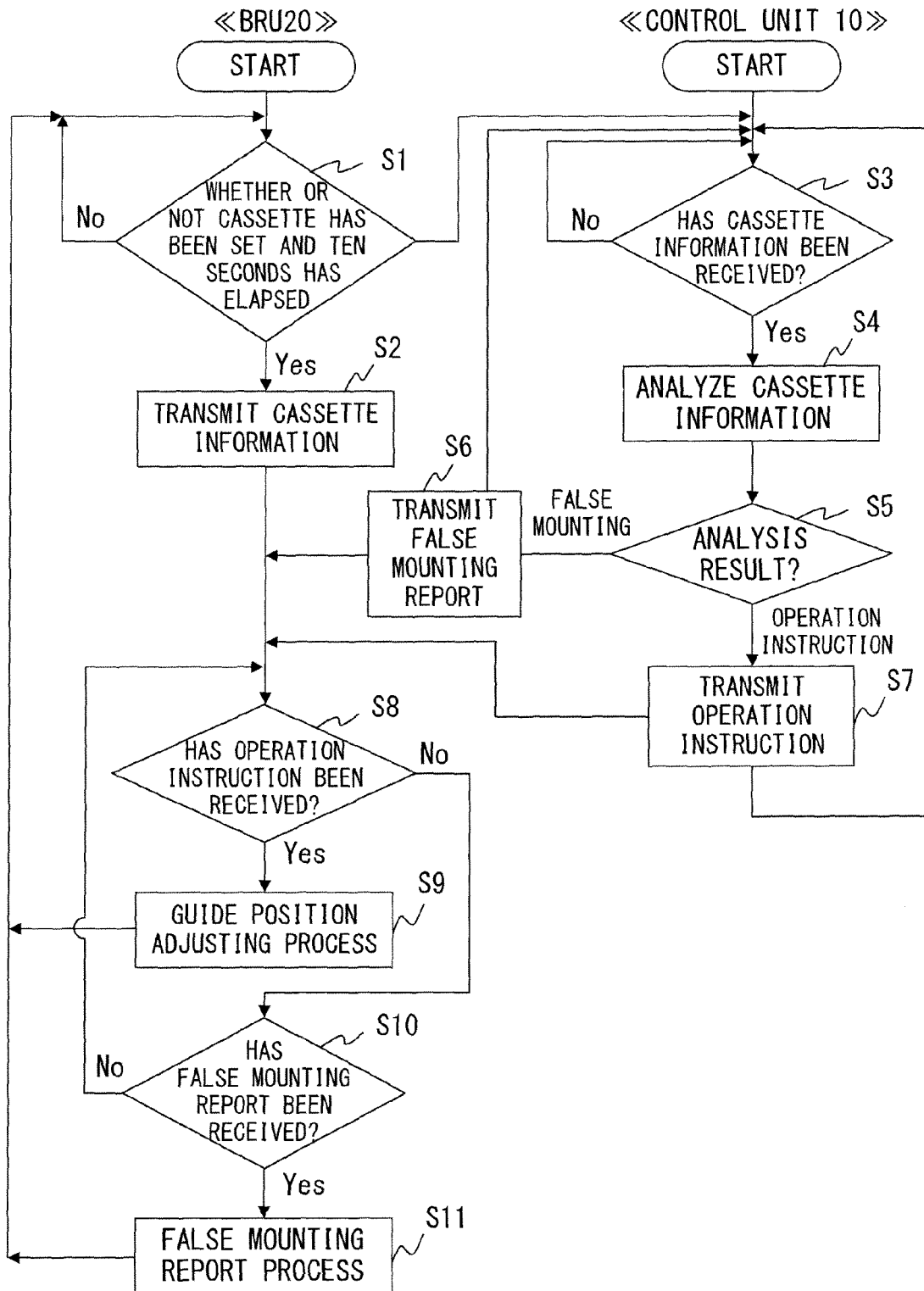


FIG. 16A

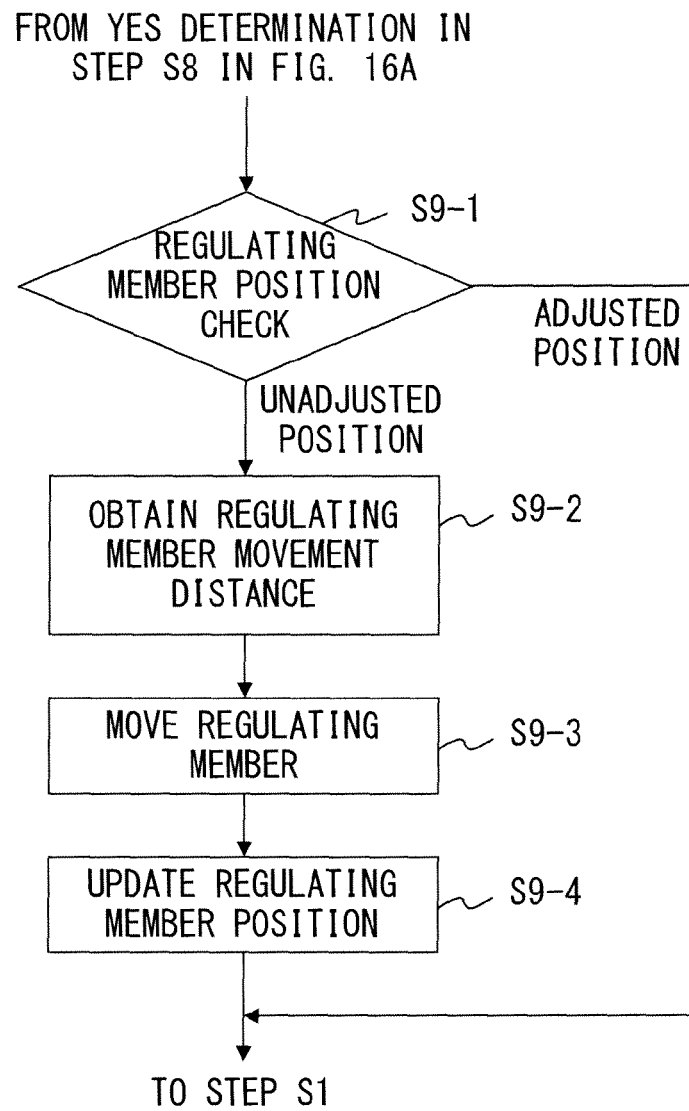


FIG. 16B

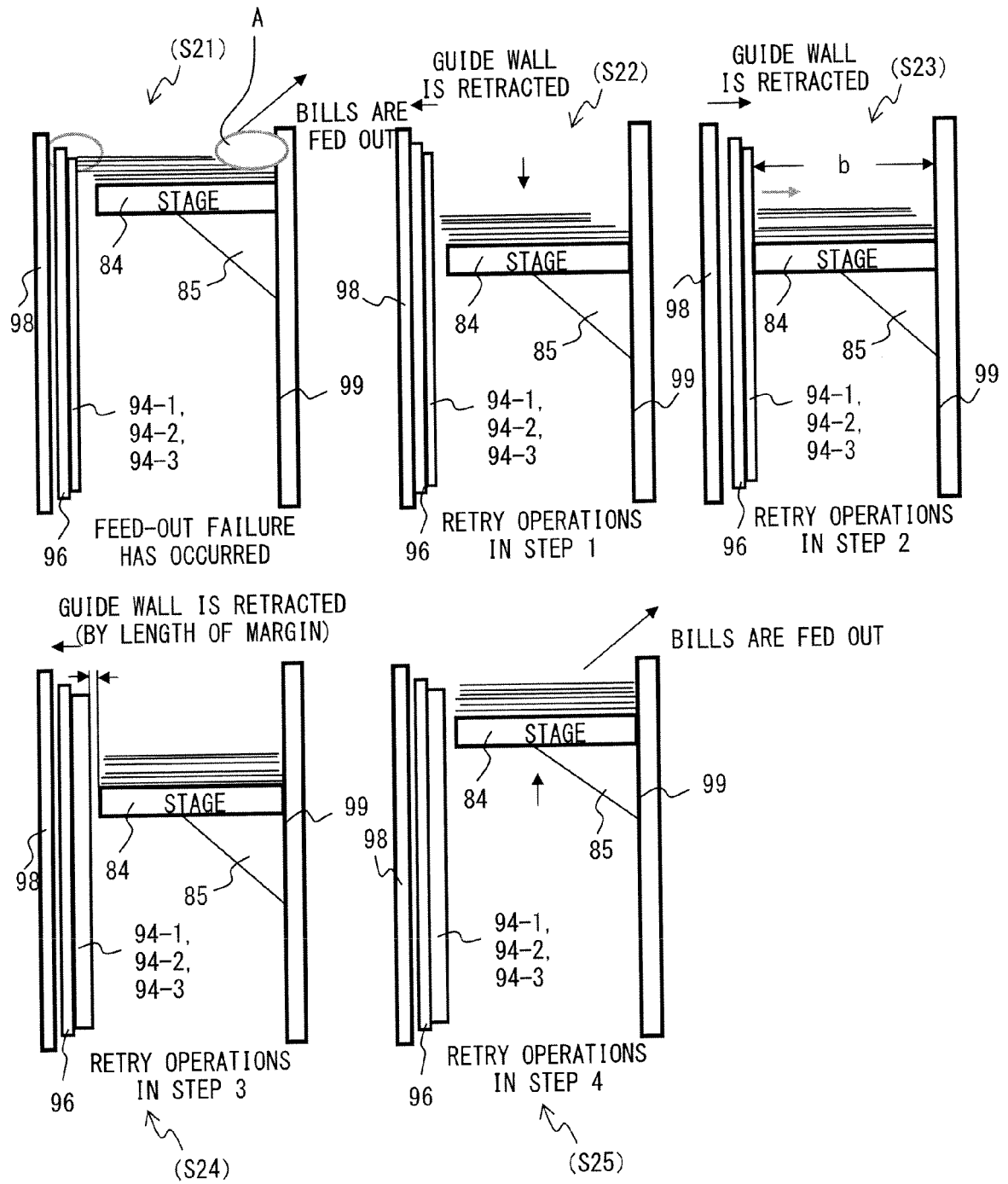


FIG. 17

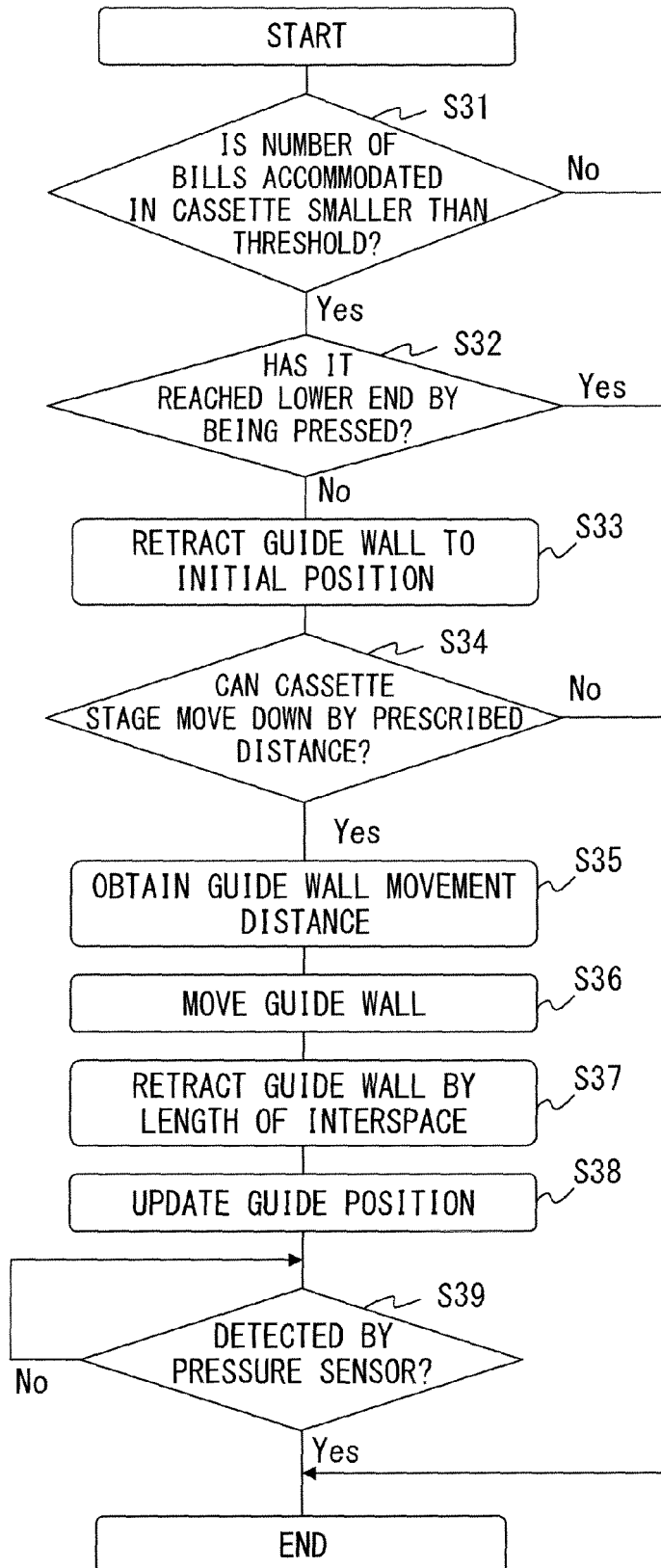
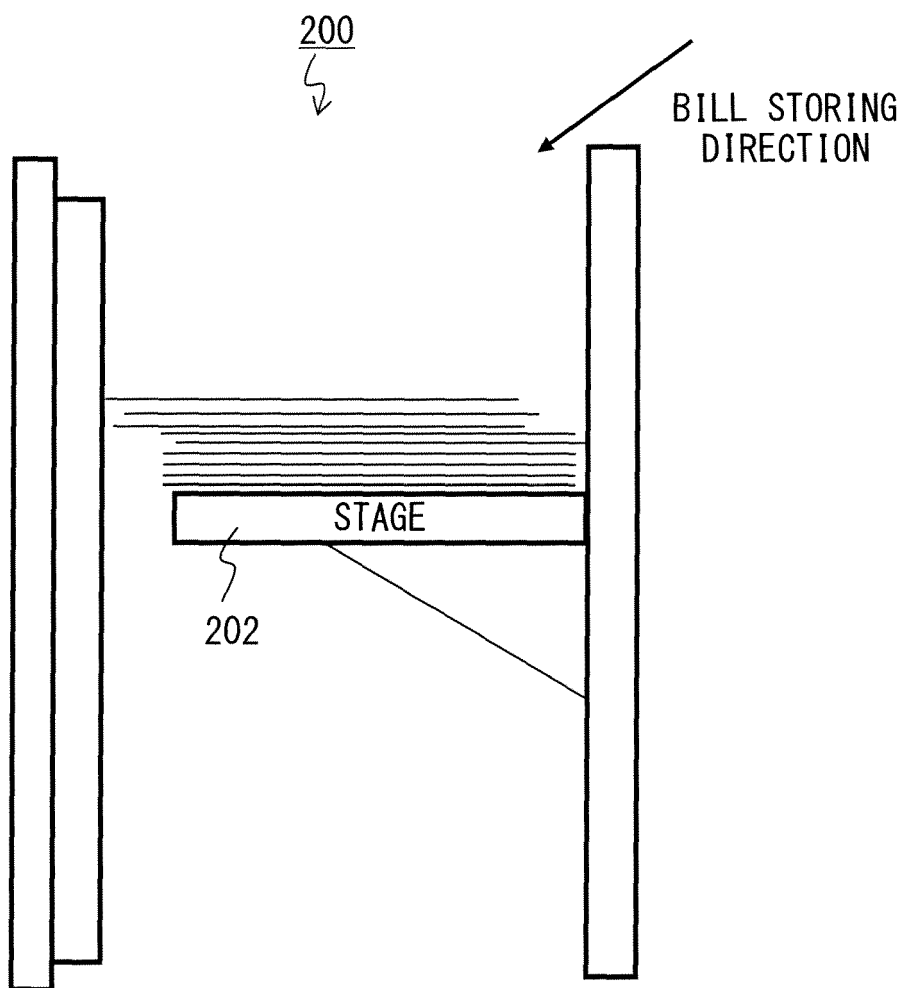
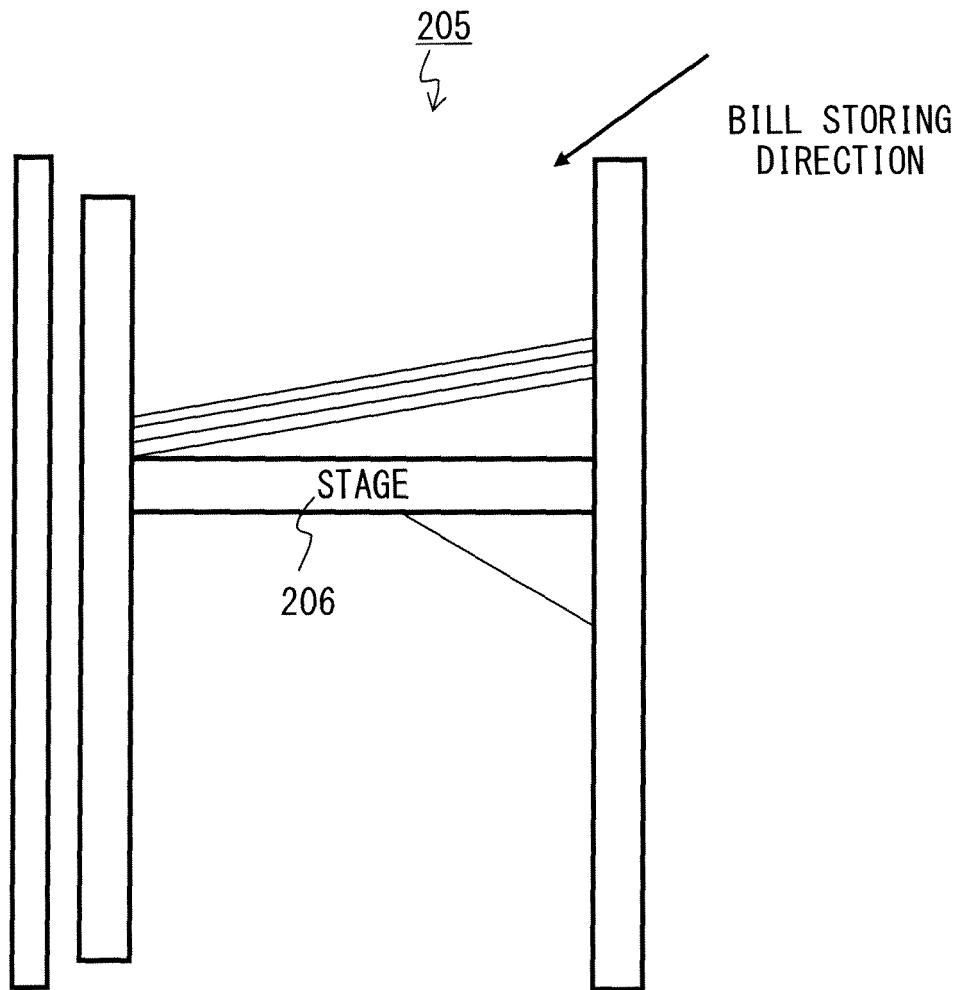


FIG. 18



WHEN CASSETTE HAVING LONG TRAVERSE
LENGTH HAS BEEN WRONGLY SET

F I G . 1 9



WHEN CASSETTE HAVING SHORT TRAVERSE
LENGTH HAS BEEN WRONGLY SET

F I G. 2 0

REFERENCES CITED IN THE DESCRIPTION

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