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(54) **PAPER SHEET PROCESSING DEVICE**

VORRICHTUNG ZUR PAPIERBLATTVERARBEITUNG

DISPOSITIF DE TRAITEMENT DE FEUILLES DE PAPIER

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Description

Technical Field

[0001] This invention relates to a paper sheet processing device for processing sheets of paper such as paper currencies. A generic device is for instance known from EP 2 187 360 A1.

Background Art

[0002] Automatic teller machines such as ATMs and CDs for executing deposition transactions and withdrawal transactions of paper currencies are known as paper sheet processing devices or apparatus of this type. They are installed in financial institutions, convenience stores, and so on. For example, a paper currency processing device mounted in an automatic teller machine has a paper currency deposit-withdrawal slot for delivering paper currencies for money withdrawal to the user and paying out paper currencies one by one after they have been inserted for deposit, a paper currency discrimination portion for discriminating paper currencies deposited or withdrawn, a temporal storage portion for once receiving deposited paper currencies, a plurality of paper currency storage portions for sorting the deposited paper currencies, receiving them, stocking them, and paying them out as withdrawn paper currencies, and a paper currency transport path connecting the above-described various portions, as set forth in patent literature 1.

[0003] Furthermore, in the above-described paper currency processing device, the paper currency deposit-withdrawal slot, paper currency discrimination portion, and paper currency temporal storage portion are mounted together to constitute an upper unit. The plural paper currency storage portions are mounted to a tray to form a lower unit. These are accommodated in an enclosure. A guide mechanism utilizing rails is arranged among the enclosure, the upper unit, and the lower unit such that the upper and lower units can be drawn out of the enclosure. Consequently, the device copes with maintenance, reloading of paper currencies, the multiplicities of denominations, and large capacities.

[0004] However, each individual unit of the above-described enclosure tends to be different slightly in dimension because of production tolerance. Especially, there is the problem that the horizontal gaps among the enclosure, upper unit, and lower unit require high dimensional accuracy to permit the upper and lower units to be drawn out smoothly, whereby the device is difficult to fabricate. Further different guide mechanisms are known from US 3087771, EP 1 056 369 A1, CH 269462 A and DE 28 13 778 A1.

Citation List

Patent Literature

[0005] Patent Literature 1: JP-A-9-44723

Summary of Invention

Technical Problem

[0006] In view of the foregoing problem, this invention realizes a paper sheet processing device of a simple configuration equipped with a unit guide mechanism which permits a paper currency unit for handling paper currencies or other sheets of paper to be drawn out and received smoothly.

Solution to Problem

[0007] The present invention has been made to solve at least a part of the foregoing problems by providing a paper sheet processing device having the features of independent claim 1. Preferred embodiments are described in the dependent claims. It can be implemented as the following embodiments or examples of application.

Brief Description of Drawings

[0008]

FIG. 1 is a perspective view showing the outer appearance of an automatic teller machine equipped with a paper currency processing device acting as a paper sheet processing device.
FIG. 2 is a side elevation in cross section schematically showing the configuration of the paper currency processing device.

FIG. 3 is a cross-sectional view illustrating a connecting transport mechanism and a branching connecting mechanism.
FIG. 4 is an explanatory view illustrating the operation of the configuration of FIG. 3.
FIG. 5 is a perspective view showing a state in which the paper currency processing unit has been pulled out of an enclosure.
FIG. 6 is a perspective view showing a state in which a paper currency storage unit has been pulled out of the enclosure.
FIG. 7A is a schematic block diagram illustrating a unit guide mechanism.
FIG. 7B is an exploded perspective view of a left-side sliding mechanism of a first sliding mechanism.
FIG. 7C is a cross-sectional view illustrating the configuration around a first distance adjusting portion.
FIG. 7D is an exploded perspective view of a second sliding mechanism.
FIG. 7E is an explanatory view illustrating a pull-out operation of the paper currency processing unit and so on of the paper currency processing device.
FIG. 7F is an explanatory view illustrating a cooperative guide mechanism.
FIG. 8 is an explanatory view illustrating a main portion of the cooperative guide mechanism.
FIG. 9 is an explanatory view illustrating the configuration of the cooperative guide mechanism.
FIG. 10 is an explanatory view illustrating a positioning mechanism of the cooperative guide mechanism.
FIG. 11 is an explanatory view illustrating the operation of the positioning mechanism of the cooperative guide mechanism.
FIG. 12 is an explanatory view illustrating a horizontal guide mechanism of the cooperative guide mechanism.
FIG. 13 is an explanatory view illustrating the operation of the horizontal guide mechanism.
FIG. 14 is an explanatory view illustrating the operation of the cooperative guide mechanism.
FIG. 15 is an explanatory view illustrating the operation subsequent to FIG. 14.
FIG. 16 is an explanatory view illustrating the operation subsequent to FIG. 15.
FIG. 17 is an explanatory view illustrating the operation subsequent to FIG. 16.
FIG. 18 is an explanatory view illustrating the operation subsequent to FIG. 17.
FIG. 19 is an explanatory view illustrating the operation subsequent to FIG. 18.
FIG. 20 is an explanatory view illustrating the operation subsequent to FIG. 19.
FIG. 21 is an explanatory view illustrating the operation subsequent to FIG. 20.
FIG. 22 is an explanatory view illustrating the operation subsequent to FIG. 21.
FIG. 23 is an explanatory view illustrating the operation subsequent to FIG. 22.
FIG. 24 is a side elevation showing a lock mechanism.
FIG. 25 is an exploded perspective view of the lock mechanism.
FIG. 26 is an explanatory view illustrating the operation of the lock mechanism.
FIG. 27 is an explanatory view illustrating the operation subsequent to FIG. 26.
FIG. 28 is an explanatory view illustrating the operation subsequent to FIG. 27.
FIG. 29 is an explanatory view illustrating the operation subsequent to FIG. 28.
FIG. 30 is an explanatory view illustrating the operation subsequent to FIG. 29.
FIG. 31 is an explanatory view illustrating the operation subsequent to FIG. 30.
FIG. 32 is an explanatory view illustrating the operation subsequent to FIG. 31.
FIG. 33 is an explanatory view illustrating the operation subsequent to FIG. 32.
FIG. 34 is an explanatory view illustrating the operation subsequent to FIG. 33.
FIG. 35 is an explanatory view illustrating the operation subsequent to FIG. 34.
FIG. 36 is an explanatory view illustrating a work for mounting a paper currency processing unit associated with other embodiment to a first guided portion.

Description of Embodiments

(1) Schematic Configuration of Automatic Teller Machine 101

[0009] One embodiment of the present invention is hereinafter described with reference to drawings. FIG. 1 is a perspective view showing the outer appearance of an automatic teller machine 101 equipped with a paper currency handling apparatus 1 acting as a device or apparatus for processing sheets of paper. The automatic teller machine 101 is an apparatus which is managed by a financial institution such as a bank and which executes various kinds of transactions in response to user's (client's) manipulations. The machine performs processing such as user's deposit, payment, bank transfer, and so on while using a card, paper currencies, or a receipt as a medium. The automatic teller machine 101 is stored in a storage space 102S within an enclosure 102. The enclosure 102 is surrounded by an enclosure body 104 and a door 106 that opens and closes the rear opening of the enclosure body 104. The paper currency handling apparatus

1, a receipt handling mechanism 110, a client control portion 120, and a coin handling device 130 are received within the enclosure 102. The paper currency handling apparatus 1 is a device which is located in a lower part of the automatic teller machine 101 as viewed in the figure and which handles paper currencies. The card-receipt handling mechanism 110 is a device which is disposed in a higher part of the automatic teller machine 101 and which processes a user's card, prints characters on a transaction receipt, and delivers the receipt. The client control portion 120 is a device for displaying the contents of a transaction in front of the front part of the device and permitting inputs. The coin handling device 130 is a device which is located in a lower part of the automatic teller machine 101 and which handles coins. Furthermore, the automatic teller machine 101 has a power supply unit, a body control unit for controlling the whole automatic teller machine 101, and a body control portion (not shown) having various mechanisms connected by lines such as USB in an unillustrated manner.

(2) Configuration of Paper Currency Handling Apparatus 1

[0010] The paper currency handling apparatus 1 has a paper currency handling unit 10 (unit for processing sheets of paper) disposed in a higher portion, a paper currency storage unit 30 (unit for receiving sheets of paper) disposed in a lower portion, and a control unit (not shown) controlling both units. The paper currency handling unit 10 and the paper currency storage unit 30 are stored in such a way that these units 10 and 30 can be taken out of the enclosure 102 by opening the door 106 of the enclosure 102. Storage mechanisms of the paper currency handling unit 10 and the paper currency storage unit 30 will be described later.

[0011] FIG. 2 is a side elevation in cross section schematically showing the configuration of the paper currency handling apparatus 1.

(2)-1 Configuration of Paper Currency Handling Unit 10

[0012] Generally, the paper currency handling unit 10 has mechanisms necessary to exchange paper currencies with a user, and is equipped with a paper currency deposit-withdrawal slot 20, a paper currency discrimination portion 22, a temporal storage portion 23, an upper unit transport mechanism 26 for conveying paper currencies between various portions, and a connecting transport mechanism 27 for sending the paper currencies delivered from the upper unit transport mechanism 26 to the paper currency storage unit 30.

[0013] The paper currency deposit-withdrawal slot 20 has a money deposit portion permitting a user to make a deposit of paper currencies, a money payment portion for delivering paper currencies, and other portions. The paper currency discrimination portion 22 is a mechanism that identifies or discriminates the denomination of each paper currency, makes a decision as to whether it is genuine or counterfeit, and judges whether or not it should be rejected and which outputs the results of the identification or discrimination to the control unit. The configuration of the discrimination portion utilizes various kinds of information such as image data obtained by scanning each paper currency, topographical profile of the surface of the currency, magnetic characteristics, and optical characteristics responsive to ultraviolet radiation or the like. A rejected paper currency is either a paper currency judged to be substandard as a result of a decision made as to whether it is genuine or counterfeit or a paper currency whose genuineness is not determined because a part of the paper currency is overlapped on another part or the paper currency is folded. The temporal storage portion 23 is a mechanism that temporarily stores paper currencies during a process for conveying paper currencies between the paper currency deposit-withdrawal portion and the paper currency storage unit 30.

[0014] The upper unit transport mechanism 26 is a mechanism that transports paper currencies by rotationally driving rollers (not shown). The transport mechanism has a deposit transport path 26a for transporting paper currencies inserted in the money deposit portion of the paper currency deposit-withdrawal slot 20, a withdrawal transport path 26b for paying out paper currencies into a money delivery portion, a discrimination transport path 26c for passing paper currencies through the paper currency discrimination portion 22, and a temporal storage transport path 26d for conveying paper currencies into the temporal storage portion 23. The discrimination transport path 26c, the temporal storage transport path, and so on are designed to be capable of transporting paper currencies bidirectionally. Gates (not shown) are disposed at the branching locations of the transport paths to switch the direction of transportation of paper currencies in the transport paths. Furthermore, sensors are disposed in the transport paths to detect passage of paper currencies. Detecting signals from these sensors are sent to the control unit to use them in judging passage and presence or absence of paper currencies.

(2)-2 Configuration of Paper Currency Storage Unit 30

[0015] In FIGS. 1 and 2, the paper currency storage unit 30 has a storage body 31 and a paper currency storage portion 32 (portion for accommodating sheets of paper). The storage body 31 is a boxlike body having an open top side. The paper currency storage portion 32 is received in the storage space within the storage body. The paper currency

storage portion 32 has five paper currency receiving sections 32a-32e which are substantially identical in configuration. Each receiving section has a storage box forming the paper currency storage space receiving paper currencies, rollers disposed on top of the storage portion, sensors, and so on. Each of the paper currency receiving sections 32a-32e brings paper currencies sent from the paper handling unit 10 into the paper currency storage space and has a mechanism for conveying the received paper currencies bidirectionally relative to the paper currency handling unit 10 by means of a transport mechanism such as rollers. Such paper currency receiving sections 32a-32e can treat different kinds of paper currencies in use. For example, these can be used as paper currency stocks for receiving 10,000 yen notes, 5,000 yen notes, 1,000 yen notes, and 2,000 yen notes or as reject storages for receiving paper currencies rejected as described above.

(2)-3 Cooperative Mechanism between Paper Currency Handling Unit 10 and Paper Currency Storage Unit 30

[0016] In FIG. 2, the connecting transport mechanism 27 has a main transport path 28 and auxiliary transport paths 28a-28e branching from the main transport path 28 into the paper currency storage sections 32, and bidirectionally transports paper currencies relative to the paper currency receiving sections 32a-32e.

[0017] FIGS. 3 and 4 are cross-sectional views showing the vicinities of the branching portions of the connecting transport mechanism 27. In FIG. 3, branching connecting mechanisms 40 are disposed in the branching portions of the connecting transport mechanism 27. Here, only the auxiliary transport path 28e connected with the paper currency receiving section 32e is described out of the branching connecting mechanism 40. The branching connecting mechanism 40 has a gate 41, a set of rollers 42 consisting of plural rollers for guiding paper currencies to the auxiliary transport path 28e, and a connecting mechanism 45. The gate 41 is an L-shaped member which is located at the branching location and driven by a driving device (not shown) such as a solenoid. As a result, the L-shaped member is so switched that it transports paper currencies transported to the main transport path 28 along the rollers 42 and bidirectionally relative to the auxiliary transport path 28e. The gate 41 (indicated by the solid line) of FIG. 3 is in a position where the path is switched to the auxiliary transport path 28e. The gate 41 indicated by the chain double-dashed lines is in a position used to transport paper currencies to the other auxiliary transport paths 28a-28d.

[0018] The connecting mechanism 45 has an upstream guide portion 46 and a downstream guide portion 48. The upstream guide portion 46 has a guide body 46a. The guide body 46a has a guide groove 46b formed along the auxiliary transport path 28a. Paper currencies are transported along this guide groove 46b. The downstream guide portion 48 has a guide body 48a disposed on a side of the paper currency storage portion 32. The guide body 48a has a guide groove 48b formed along the auxiliary transport path 28e. Paper currencies are transported along this guide groove 48b. The upstream guide portion 46 and downstream guide portion 48 are tooth shaped. Their connected locations, i.e., a lower portion of the upstream guide portion 46 and an upper portion of the downstream guide portion 48, interdigitate between their teeth. The guide grooves 46b and 48b formed by an unbroken wall surface form a part of the auxiliary transport path 28e.

[0019] The upstream guide portion 46 is rotatable by a rotary shaft 47a. The rotary shaft 47a can be rotated by receiving a driving force of the motor drive shaft 47b of a motor (not shown). Accordingly, in the connecting mechanism 45, when no electric power is supplied to the motor or the motor is reset, the upstream guide portion 46 moves as shown in FIG. 4, so that the downstream guide portion 48 does not overlap the upper portion. This results in a non-connected mode (non-connected position). Since electric power is supplied to the motor, a connection mode (connected position) shown in FIG. 3 is entered.

(2)-4 Schematic Operation of Paper Currency Handling Apparatus 1

[0020] In FIG. 2, during depositing processing, paper currencies inserted in the money deposit portion of the paper currency deposit-withdrawal slot 20 are separated one by one in the paper currency deposit-withdrawal slot 20 and paid out. They are transported into the paper currency discrimination portion 22 through the deposit transport path 26a and the withdrawal transport path 26b. Then, the paper currencies are transported to the temporal storage portion 23 through the temporal storage transport path 26d. At this time, passing paper currencies are counted and discriminated by the paper currency discrimination portion 22. The paper currencies staying in the temporal storage portion 23 are separated one by one and paid out after the transaction amount is confirmed. The currencies are then passed through the discrimination transport path 26c and again counted and discriminated by the paper currency discrimination portion 22. The currencies reach the connecting transport mechanism 27 and thence are transported to any one of the paper currency storage sections 32 (32a-32e) specified by the body control portion. In consequence, the deposit transaction ends.

[0021] During withdrawal processing, paper currencies are delivered from the paper currency storage portion 32 while being separated one by one under instructions from the body control portion. The paper currencies pass through the connecting transport mechanism 27 and through the discrimination transport path 26c of the upper unit transport mechanism 26 and are discriminated and counted by the paper currency discrimination portion 22. Then, they arrive at the

withdrawal portion of the paper currency deposit-withdrawal slot 20 through the withdrawal transport path 26b, and are delivered to the client. As a consequence, the withdrawal transaction ends.

(3) Unit Guide Mechanism 50

[0022] FIG. 5 is a perspective view showing a state in which the paper currency handling unit 10 has been pulled out of the enclosure 102 via a unit guide mechanism 50. FIG. 6 is a perspective view showing a state in which the paper currency storage unit 30 has been pulled out of the enclosure 102 via the unit guide mechanism 50. FIG. 7A is a schematic block diagram illustrating the unit guide mechanism 50. In FIG. 7A, the unit guide mechanism 50 has a first sliding mechanism 151 and a second sliding mechanism 171. The first sliding mechanism 151 is a mechanism which is disposed between the both sides of the paper currency handling unit 10 and the inner wall of the enclosure 102 and which is used to pull the paper currency handling unit 10 out of the enclosure 102. The second sliding mechanism 171 is a mechanism which is disposed between the both sides of the paper currency storage unit 30 and the inner wall of the enclosure 102 and which is used to pull the paper currency storage unit 30 from the enclosure 102. The first sliding mechanism 151 has a left-side sliding mechanism 151L disposed on the left side of the paper currency handling unit 10 as viewed in the figure and a right-side sliding mechanism 151R disposed on the right side of the paper currency handling unit 10 as viewed in the figure. The sliding mechanism 151 supports the paper currency handling unit 10 such that this unit can slide horizontally relative to the enclosure 102. The second sliding mechanism 171 has a left-side sliding mechanism 171L disposed on the left side of the paper currency storage unit 30 as viewed in the figure and a right-side sliding mechanism 171R disposed on the right side of the paper currency storage unit 30 as viewed in the figure. The second sliding mechanism supports the paper currency storage unit 30 such that it can slide horizontally relative to the enclosure 102.

[0023] FIG. 7B is an exploded perspective view of the left-side sliding mechanism 151L of the first sliding mechanism 151. The left-side sliding mechanism 151L has a first guide portion 152, a first guided portion 162, and a first connecting mechanism 164. The first guide portion 152 has a guide support upper frame 153, a guide support lower frame 154, and rails 155a, 155b on which multiple rollers are arranged between the guide support upper frame 153 and the guide support lower frame 154. A gap Sp is formed between the rail 155a and the rail 155b to permit the first guided portion 162 to be inserted. The guide support upper frame 153 and the guide support lower frame 154 are fixedly secured to the inner wall of the enclosure 102 by means of securing members 153n and 154n, respectively.

[0024] The first guided portion 162 has a guide base portion 162a formed to have a rectangular cross section and a guide piece 162b extending from an end portion of the guide base portion 162a. The guide base portion 162a is disposed in the gap Sp between the rail 155a and the rail 155b. The guide piece 162b is prevented from coming off by the rails 155a and 155b. Consequently, the guided portion 162 is supported to be slidable horizontally relative to the first guide portion 152.

[0025] The first connecting mechanism 164 is a mechanism which adjusts the horizontal position of the first guided portion 162 relative to the outer wall of the paper currency handling unit 10, and has a connecting member 165 and a first distance adjusting portion 168. The connecting member 165 has a horizontal portion 166 and a vertical portion 167. The connecting portion is bent at right angles and thus is formed like the letter L. An end portion of the horizontal portion 166 is inserted in a slit 10d of a support plate 10c. The vertical portion 167 holds the first guided portion 162 via securing members 162n.

[0026] FIG. 7C is a cross-sectional view illustrating the configuration around the first distance adjusting portion 168. The first distance adjusting portion 168 is a mechanism which connects together the paper currency handling unit 10 and the first guided portion 162 (FIG. 7B) such that they are movable relative to each other horizontally. The first distance adjusting portion has a slot 10h formed in the support plate 10c, tightening holes 166h formed in the horizontal portion 166, securing members 169n being screws, and spacers 169s. The securing members 169n extend through the holes in the spacers 169s and are screwed into the tightening holes 166h in the horizontal portion 166. The securing members 169n and spacers 169s are integral with the connecting member 165. The slot 10h is a hole having an inside diameter greater than the outside diameter of each spacer 169s in the directions of the arrow. A gap Sp3 is secured between the support plate 10c and the spacers 169s to prevent the support plate 10c and the connecting member 165 from touching each other if they move relative to each other horizontally. Consequently, the connecting member 165 is not constrained to the support plate 10c in the directions of the arrow (one side of the horizontal direction). The connecting member is connected while securing movability.

[0027] In FIG. 7A, the right-side sliding mechanism 151R is identical in configuration with the left-side sliding mechanism 151L that does not have the first connecting mechanism 164, and supports the paper currency handling unit 10 so as to be slidable relative to the inner wall of the enclosure 102 on the right side of the paper currency handling unit 10 as viewed in the figure.

[0028] FIG. 7D is an exploded perspective view of the second sliding mechanism 171. The second sliding mechanism 171 is different in terms of the configuration of a second connecting mechanism 184 from the first connecting mechanism

164 (FIG. 7B) of the first sliding mechanism 151.

[0029] The second connecting mechanism 184 is a mechanism which connects a second guided portion 182 with the outer wall of the paper currency storage unit 30 and which is used to adjust the horizontal position. The second connecting mechanism has a first connecting member 185, a second connecting member 186, and a second distance adjusting portion 188. The first connecting member 185 has a vertical plate 185a and horizontal plates 185b disposed parallel from the upper and lower ends of the vertical plate 185a. These are formed integrally and affixed to the storage body 31 of the paper currency storage unit 30 by the vertical plate 185a via securing members 185n. The second connecting member 186 has a vertical plate 186a and horizontal plates 186b disposed parallel from the upper and lower ends of the vertical plate 186a. These are formed integrally and secure the guided portion 182 by the vertical plate 186a via securing members 182n. The second distance adjusting portion 188 is a mechanism which is interposed between the storage body 31 of the paper currency storage unit 30 and the second guided portion 182 and which couples them together. The second adjusting portion 188 has slots 185h formed in the horizontal plates 185b of the first connecting member 185, threaded holes 186h formed in the horizontal plates 186b of the second connecting member 186, securing members 189n, and spacers 189s. With respect to the first connecting member 185 and second connecting member 186, the horizontal plates 185b and the horizontal plates 186b are laid to overlap each other. The securing members 189n extend through the slots 185h and threaded holes 186h and are connected movably. The second distance adjusting portion 188 is similar in configuration with the first distance adjusting portion 168 described in connection with FIG. 7C. Thus, the first connecting member 185 and the second connecting member 186 are coupled together so as to be movable in one horizontal direction.

[0030] In FIG. 7A, the right-side sliding mechanism 171R is identical in configuration with the left-side sliding mechanism 171L not having the second connecting mechanism 184 (FIG. 7C). The inner wall of the enclosure 102 supports the right side of the paper currency storage unit 30 as viewed in the figure such that the storage body 31 of the paper currency storage unit 30 is movable.

[0031] Accordingly, as shown in FIG. 1, the paper currency handling unit 10 can be pulled out via the unit guide mechanism 50 by opening the door 106 of the enclosure 102, gripping a grip 11a of the paper currency handling unit 10, and applying a force to the paper currency handling unit 10 in the front direction as shown in FIG. 5. For instance, jams of paper currencies can be removed by opening the door 106 shown in FIG. 5. Furthermore, as shown in FIG. 6, a work for recovering paper currencies and a work for loading paper currencies can be performed by gripping the grip 31a of the storage body 31, pulling out the storage body 31, and taking out the paper currency storage portion 32.

[0032] When the paper currency handling unit 10 is pulled into or out of the enclosure 102, the first and second connecting mechanisms 164, 184 yield the following advantageous effects owing to adjustments of the horizontal distances to the paper currency handling unit 10 and paper currency storage unit 30. FIG. 7E is an explanatory view illustrating the operation of pulling out the paper currency handling unit 10 and so on of the paper currency handling apparatus 1. Because of widthwise dimensional variations of the enclosure 102, the sliding gaps Ls1 and Ls2 that are gaps between the inner wall of the enclosure 102 and the outer walls of the paper currency handling unit 10 and of the paper currency storage unit 30 may produce a difference in the direction of motion. Such a difference between the sliding gaps Ls1 and Ls2 induces an increase in the frictional force between first and second guide portions 152, 172 and the first and second guided portions 162, 182 when the paper currency handling unit 10 or paper currency storage unit 30 is pulled out or received. However, the first distance adjusting portion 168 absorbs the difference of the sliding gaps Ls1 by varying the gap between the first guide portion 152 and the enclosure 102 or the distance between the first guided portion 162 and the paper currency handling unit 10 as shown in FIG. 7C when a horizontal force applied by the first connecting mechanism 164 is received. Similarly, the second distance adjusting portion 188 absorbs the difference of the sliding gap Ls2 between the enclosure 102 and the paper currency storage unit 30. Increases in the frictional force produced when the first and second guide portions 152, 172 and the first and second guided portions 162, 182 slide are reduced by the operation of the first and second distance adjusting portions 168, 188 to absorb the difference of the sliding gaps Ls1 and Ls2. Consequently, the paper currency handling unit 10 and the paper currency storage unit 30 can be slid smoothly relative to the enclosure 102 with a small operating force.

[0033] In the above embodiment, a configuration in which the first connecting mechanism 164 is connected between the paper currency handling unit 10 and the guided member has been described. The invention is not restricted to this. If the configuration is disposed between the enclosure 102 and the first guide portion 152, the difference of the sliding gap can be absorbed.

[0034] As shown in FIG. 7C, in the first distance adjusting portion 168 of the first connecting mechanism 164, the support plate 10c of the paper currency handling unit 10 is provided with the slot 10h. The invention is not restricted to this. If the configuration can connect the paper currency processing unit and the paper currency storage unit with the guide portion or guided portion so as to be movable horizontally, the slot may be formed on the connecting member side.

(4) Cooperative Guide Mechanism 53

[0035] FIG. 7F is an explanatory view illustrating a cooperative guide mechanism 53 which makes the paper currency storage portion 32 of the paper currency storage unit 30 depend from the paper currency handling unit 10 and which guides the storage portion. FIG. 8 is an explanatory view illustrating the cooperative guide mechanism 53 under the condition in which the paper currency storage portion 32 of the paper currency storage unit 30 has been removed from the paper currency handling unit 10. In FIG. 7F, the cooperative guide mechanism 53 is a mechanism which makes a plurality of paper currency storage portions 32 received in the storage body 31 of the paper currency storage unit 30 depend from the paper currency handling unit 10 and which, when the paper currency handling unit 10 and the paper currency storage unit 30 have moved relative to each other, guides motion of the paper currency storage portion 32 in the up-and-down direction and horizontal direction. The cooperative guide mechanism 53 has a hanging mechanism 54 and a horizontal guide mechanism 57.

(4)-1 Hanging Mechanism 54

[0036] The hanging mechanism 54 has receiving guide rails 54R, 54L fixedly secured to both sides of the side wall of the paper currency handling unit 10 and first rollers 56 mounted to the side wall of a top portion of the paper currency storage portion 32. Each of the receiving guide rails 54R and 54L is an elongated member which is laid substantially over the whole length of the paper currency handling unit 10 in the horizontal direction. The paper currency storage portion 32 depends from these guide rails. The receiving guide rail 54R and the receiving guide rail 54L are different in cross-sectional shape. The receiving guide rail 54L has a rail base portion 54La extending downward from the side wall of the paper currency handling unit 10, a horizontal portion 54Lb bent from the lower end of the rail base portion 54La, and a vertical support portion 54Lc bent upward from an end portion of the horizontal portion 54Lb. The first rollers 56 are rotatably supported to an upper portion of the side walls on both sides of the paper currency storage portion 32. Each first roller 56 is shaped like a pulley and has a tilted groove 56a tilted toward the center. The first rollers 56 roll over the receiving guide rail 54L while the vertical support portion 54Lc of the receiving guide rail 54L is inserted in the tilted groove 56a. On the other hand, the receiving guide rail 54R has a rail base portion 54Ra and a horizontal support portion 54Rb. Since the first rollers 56 are placed on the horizontal support portion 54Rb, the first rollers roll on the receiving guide rail 54R.

[0037] FIG. 9 is an explanatory view illustrating the side of the receiving guide rail 54L out of the hanging mechanism 54 as viewed from a side of the paper currency handling unit 10 and the paper currency storage unit 30. Since the receiving guide rails 54R and 54L are substantially identical in shape in the longitudinal direction, the receiving guide rail 54L is described as a representative. The receiving guide rail 54L has a general portion 54A and tilted guide portions 54B formed on both sides of the general portion 54A. As described previously, the general portion 54A has a linear shape having a cross-sectional shape shown in FIG. 7F. The tilted guide portions 54B are tilted downward from the general portion 54A.

[0038] FIGS. 10 and 11 are explanatory views illustrating a positioning mechanism 55 of the general portion 54A of the receiving guide rail 54L. In FIG. 10, the positioning mechanism 55 consisting of a plurality of positioning portions 55a-55e is formed on top of the general portion 54A. The positioning portions 55a-55e are recesses for placing the paper currency storage sections 32 in position. Because the first rollers 56 enter the recesses, the paper currency storage sections 32 are accurately placed in position relative to the connecting mechanism 45 (see FIG. 3) of the paper currency handling unit 10. The horizontal distance L1 of the positioning portions 55a and 55e is greater than the distance L2 of the positioning portions 55b, 55c, and 55d. Accordingly, as shown in FIG. 11, when the first rollers 56 of the paper currency storage unit 30 leave the positioning mechanism 55, the positioning portions 55a and 55e leave the first rollers 56 later than the positioning portions 55b, 55c, and 55d. The positioning portions are not restricted to recesses. The positioning portions may be protrusions or the like if they are designed to be able to place the first rollers 56 in position.

(4)-2 Horizontal Guide Mechanism 57

[0039] FIG. 12 is a perspective view illustrating a horizontal guide mechanism 57. FIG. 13 is an explanatory view of the vicinities of the horizontal guide mechanism 57 as viewed from above. The horizontal guide mechanism 57 is a mechanism for guiding the paper currency storage portion 32 in the left-and-right direction, and has second rollers 59 mounted to one side wall of the paper currency storage portion 32 and an adjustive guide rail 58 held to the lower surface of the receiving guide rail 54L. The second rollers 59 have a fixture 59a mounted in an L-shaped form on the side wall of the paper currency storage portion 32. The second rollers 59 are supported to a flange 59b of the fixture 59a so as to rotate on a horizontal plane. The adjustive guide rail 58 forms a guide groove 58a. The second rollers 59 are rotatably inserted in the guide groove 58a.

(4)-3 Operation of Unit Guide Mechanism 50

[0040] FIGS. 14-23 are explanatory views illustrating a work for pulling out or receiving the paper currency handling unit 10 and the paper currency storage unit 30.

(a) Operation of Paper Handling Unit 10 for pulling out or receiving units

(a)-1 Pull-out Operation of Paper Currency Handling Unit 10

[0041] As shown in FIG. 14, it is assumed that the paper currency handling unit 10 and the paper currency storage unit 30 are in their storage positions. In these storage positions, as shown in FIG. 10, the five first rollers 56 mounted in the paper currency storage portion 32 are located on the general portion 54A of the receiving guide rail 54R, enter the respective positioning portions 55a-55e of the positioning mechanism 55, and are placed in position. At this time, as shown in FIG. 14, the paper currency storage portion 32 is spaced a distance of Lv from the bottom of the storage body 31 and in a hanging position.

[0042] Then, the connecting mechanism 45 shown in FIG. 4 is placed in a nonconnection mode as shown in FIG. 4 and a lock mechanism 60 (see FIG. 24) brings the paper currency handling unit 10 in a non-lock position as described further later. If the grip 11a (see FIG. 5) of the paper currency handling unit 10 is manually gripped and pulled, the paper currency handling unit 10 moves in the direction of the arrow as shown in FIG. 15. At this time, as shown in FIGS. 10 and 11, the three first rollers 56 out of the five first rollers 56 placed in position in the positioning portions 55a-55e ride along the tilted surfaces 55s of the positioning portions 55b-55d from the initial stage of the operation. After the end of the rising motion, the other two first rollers 56 disengage from the positioning portions 55a and 55e. Since the five first rollers 56 do not leave the positioning mechanism 55 at the same time, the load (operating force) needed during the initial stage of the operation can be reduced.

[0043] As shown in FIG. 15, as the paper currency handling unit 10 moves, the first roller 56 of the paper currency receiving section 32e is guided by the tilted guide portions 54B. Consequently, the paper currency receiving section 32e descends gradually and moves into its retracted position placed on the bottom surface of the storage body 31. If the paper currency handling unit 10 moves after experiencing the states of FIGS. 16 and 17, the paper currency receiving sections 32d, 32c, 32b, and 32b are guided in turn by the tilted guide portions 54B and move into their retracted positions. Consequently, as shown in FIG. 18, the paper currency handling unit 10 is in its pullout position. By pulling out the paper currency handling unit 10 in this way, jams of paper currencies can be removed as described previously.

(a)-2 Receiving Operation of Paper Currency Handling Unit 10

[0044] In order to receive the paper currency handling unit 10 into the enclosure 102, a force is applied in the direction to push it into the paper currency handling unit 10 as shown in FIG. 19. At this time, if the paper currency receiving section 32a positionally deviates in the left-and-right direction as shown in FIG. 13, the second rollers 59 of the horizontal guide mechanism 57 abut against an end portion of the adjustive guide rail 58 and are guided into the guide groove 58a in the adjustive guide rail 58. Consequently, the paper currency storage portion 32 is placed in position horizontally.

[0045] If the first rollers 56 then reach the receiving guide rail 54L (54R), one first roller 56 runs onto the vertical support portion 54Lc of the receiving guide rail 54L as shown in FIG. 7F and first roller 56 runs onto the horizontal support portion 54Rb of the receiving guide rail 54R. As shown in FIG. 19, as the paper currency handling unit 10 moves, the paper currency receiving section 32a is guided by the receiving guide rail 54L (54R) and runs onto the general portion 54A from the tilted guide portion 54B. Furthermore, as the paper currency handling unit 10 moves, the first rollers 56 of the paper currency receiving portions 32b-32e move from the tilted guide portion 54B to the general portion 54A and thus are raised in turn. They are set to be directed at the transport path of the connecting mechanism 45. The storage position of FIG. 14 is reached after passing through the states of FIGS. 17, 16, and 15. At this time, as shown in FIG. 10, the paper currency storage portion 32 is placed in position when the first rollers 56 arrive at the positioning mechanism 55. Then, as shown in FIG. 3, the connecting mechanism 45 is placed in the connection mode. This enables operation of the paper currency handling apparatus 1.

(b) Operation of Paper Currency Storage Unit 30

(b)-1 Pull-out Operation of Paper Currency Storage Unit 30

[0046] In order to pull out the paper currency handling unit 10, the connecting mechanism 45 is placed in the non-connective mode and the lock mechanism 60 is placed in the non-lock position in the same way as for the paper currency storage unit 30. As shown in FIG. 20, if the grip 31a (see FIG. 5) of the paper currency storage unit 30 is gripped by

hand and pulled, the paper currency storage unit 30 moves in the direction of the arrow. At this time, as shown in FIGS. 10 and 11, three first rollers 56 out of the five first rollers 56 placed in position in the positioning portions 55a-55e ascend along the tilted surfaces 55s of the positioning portions 55b-55d from the initial stage of the operation. After completion of the ascending motion, the other two first rollers 56 leave the positioning portions 55a and 55e. Since the five first rollers 56 do not leave the positioning mechanism 55 at the same time, the load (operating force) at the beginning of the operation can be alleviated.

[0047] As shown in FIG. 20, if the paper currency storage unit 30 is pulled out and the first rollers 56 are guided to the tilted guide portions 54B, the paper currency receiving section 32a gradually descends along the tilt of the tilted guide portions 54B and moves into the retracted position placed on the bottom surface of the storage body 31. If the paper currency storage unit 30 experiences the states of FIGS. 21, 22, and 23 and moves, the paper currency receiving sections 32b, 32c, 32d, and 32e are successively guided by the tilted guide portions 54B and move into their retracted positions. Consequently, the paper currency storage unit 30 is in its pullout position. By pulling out the paper currency storage unit 30 in this way and raising it to above the paper currency storage portions 32, they can be taken out of the storage body 31.

(b)-2 Receiving Operation of Paper Currency Storage Unit 30

[0048] In order to receive the paper currency storage unit 30 into the enclosure 102, a force is applied to the paper currency storage unit 30 in the direction to receive it from the state of FIG. 23. At this time, if the paper currency receiving section 32e deviates in position in the left-and-right direction as shown in FIG. 13, it is placed in position horizontally by the horizontal guide mechanism 57. The first rollers 56 run onto the receiving guide rail 54L (54R). As the paper currency storage unit 30 moves, the paper currency receiving section 32a is guided by the receiving guide rail 54L (54R) and runs onto the general portion 54A from the tilted guide portions 54B. If the paper currency storage unit 30 moves further, the first rollers 56 of the paper currency receiving sections 32d-32a move from the tilted guide portions 54B to the general portion 54A in turn and thus are raised. They move into the connection positions and into the storage positions of FIG. 14. At this time, as shown in FIG. 10, the paper currency storage portion 32 is placed in position when the first rollers 56 reach the positioning mechanism 55. As shown in FIG. 5, the connection mechanism 45 is placed in the connection mode. This enables operation of the paper currency handling apparatus 1.

(5) Advantageous Effect 1 of Embodiment

[0049] The configuration of the above-described embodiment yields the following advantageous effects.

(5)-1 As shown in FIGS. 6, 9, and 14-17, if the paper currency storage unit 30 is pulled out of the enclosure 102 via the first sliding mechanism 151 of the unit guide mechanism 50, the paper currency storage unit 30 shifts from a state in which the cooperative guide mechanism 53 raises the paper currency storage portion 32 relative to the storage body 31 to a retracted position where it is placed in the storage body 31. At this time, the paper currency storage portion 32 moves away from the transport path of the connecting mechanism 45 and so the paper currency storage portion 32 can be easily taken out of the storage body 31. Furthermore, the cooperative guide mechanism 53 is not required to have any complex configuration for retracting the paper currency storage portion 32 from the transport path of the connecting mechanism 45 as described in the prior art. Thus, the configuration is simplified.

(5)-2 As shown in FIGS. 9 and 23, when the paper currency storage portion 32 received in the retracted position is moved into the storage position together with the storage body 31, the paper currency storage portion 32 is suspended by the hanging mechanism 54 and moves upward toward the transport path of the connecting mechanism 45 (FIG. 9) along the tilted guide portion 54B. Therefore, the paper currency storage portion 32 and the connected portion of the connecting mechanism 45 can be coupled together at high accuracy with no interference therebetween. Consequently, it is possible to enhance the reliability of the operation of the branching connecting mechanism 40 that conveys paper currencies from the paper currency handling unit 10 to the paper currency storage unit 30.

(5)-3 Advantageous Effects of Horizontal Guide Mechanism 57

As shown in FIG. 13, when the paper currency storage portion 32 deviates in position in the left-and-right direction, the second rollers 59 abut against an end portion of the adjustive guide rail 58 and the horizontal guide mechanism 57 of the cooperative guide mechanism 53 is guided into the guide groove 58a in the adjustive guide rail 58. This assures that the paper currency storage portion 32 is guided in the horizontal direction.

(5)-4 As shown in FIGS. 10 and 11, the first rollers 56 of the positioning mechanism 55 of the cooperative guide mechanism 53 are caused to fall into the recessed positioning portions 55a-55e, respectively, and thus the positioning mechanism places the paper currency storage portion 32 in position. This can enhance the reliability of the connection. Furthermore, the positioning portions 55a-55e have recessed portions which are different in horizontal distance. Since the first rollers 56 do not disengage from the positioning portions simultaneously, the load (operating force) at the beginning of operation can be reduced.

(5)-5 The first rollers 56 on top of the paper currency storage portion 32 move on the receiving guide rail 54L in a lower part of the paper currency handling unit 10. As such, the hanging mechanism 54 permits the paper currency storage portion 32 to move in its direction of motion while the paper currency storage portion 32 is suspended from the storage body 31. One roller of this hanging mechanism 54 is placed in position in the widthwise direction by the receiving guide rail 54L and, therefore, if the sliding gaps Ls1 and Ls2 are absorbed by the distance adjusting portion of the unit guide mechanism 50 during the motion, the paper currency storage portion 32 is placed in position relative to the paper currency handling unit 10. Consequently, the paper currency transport path between the paper currency handling unit 10 and the paper currency storage portion 32 does not deviate in position. Transport of the paper currencies is not hindered.

(6) Lock Mechanism 60

(6)-1 Configuration of Lock Mechanism 60

[0050] FIG. 24 is a side elevation showing the lock mechanism 60. FIG. 25 is an exploded perspective view of the lock mechanism 60. The lock mechanism 60 is a mechanism for locking pullout of the paper currency handling unit 10 and the paper currency storage unit 30. The lock mechanism 60 has a lock pin 61 protruding from the inner wall of the enclosure 102, a first lock mechanism 70 for locking the paper currency handling unit 10, a second lock mechanism 80 for locking the paper currency storage unit 30, and a cooperative lock mechanism 90.

[0051] The first lock mechanism 70 has a first operating portion 72, a first lock member 74, a link member 76, and a spring 78. The first operating portion 72 is supported on a support substrate 62 extending from a lower portion of the paper currency handling unit 10 so as to be rotatable about a rotary shaft 73a. The operating portion is a member which brings the first lock member from a lock position to a non-lock position when this operating portion is operated by a user. The first lock member 74 has a lock plate body 74a, is supported to the support substrate 62 by a rotary shaft 75a, and is biased by the spring 78. The lock plate body 74a has an engagement portion 74b in its upper portion, a stopper portion 74c formed in an end portion, and a tilted surface 74d continuous with the stopper portion 74c. The engagement portion 74b assumes either an engagement position at which the engagement portion engages the lock pin 61 or a non-lock position at which the engagement portion does not engage the pin. The link member 76 is connected to the first operating portion 72 via a connecting shaft 77a and connected to the first lock member 74 via a connecting shaft 77b.

[0052] Accordingly, if an operating force is applied to the first operating portion 72 in the direction of the arrow and rotates about the rotary shaft 73a, the first lock member 74 rotates via the link member 76 about the rotary shaft 75a against the biasing force of the spring 78. In consequence, the lock pin 61 in engagement with the engagement portion 74b can be disengaged.

[0053] The second lock mechanism 80 has a second operating portion 82, a second lock member 84, a kicker member 86, a link member 88, a spring 85b, and a spring 85c. The second operating portion 82 is supported to the support substrate 62 so as to be rotatable about a rotary shaft 83a, and is a member which, when operated by a user, is brought from a lock position to a non-lock position. The second lock member 84 has a lock plate body 84a, and is supported to the support substrate 63 on the side of the paper currency storage unit 30 so as to be rotatable about a rotary shaft 85a. The second lock member is biased by the spring 85b. The lock plate body 84a has an engagement portion 84b, a pushing portion 84c protruding downwardly obliquely from its end portion, a stopper portion 84d formed at the other end, and a tilted surface 84e continuous with the stopper portion 84d. The engagement portion 84b assumes either an engagement position where the engagement portion engages the lock pin 61 or a non-engagement position where the engagement portion does not engage the pin. The kicker member 86 is coupled to the second operating portion 82 via the link member 88. The kicker member 86 has a rodlike kicker body 86a and a kicker portion 86b formed in an end portion of the kicker body 86a. The kicker member is supported so as to be rotatable about a rotary shaft 87a. The link member 88 is coupled to the second operating portion 82 via a connecting shaft 89a, and is rotatably connected to the connecting shaft 89b. Thus, the link member couples together the second operating portion 82 and the kicker member 86.

[0054] Accordingly, if an operating force is applied to the second operating portion 82 in the direction of the arrow to rotate it about the rotary shaft 83a, the kicker member 86 rotates about the rotary shaft 87a via the link member 88 against the biasing force of the spring 85b. Since the kicker portion 86b of the kicker member 86 pushes against the pushing portion 84c of the second lock member 84, the second lock member 84 rotates, disengaging the lock pin 61 from the engagement portion 84b.

[0055] The cooperative lock mechanism 90 has a movable plate 92 rotatably supported by a rotary shaft 93a and a spring 94, and is biased by the spring 94. The movable plate 92 has an abutment portion 92a and a stopper portion 92b formed by a hole. The stopper portion 84d of the second lock member 84 abuts against the abutment portion 92a, thus restricting rotation of the second lock member 84. The stopper portion 74c is inserted in the stopper portion 92b, thus restricting rotation of the first lock member 74.

(6)-2 Operation of Lock Mechanism 60

(a) Pull-out Operation of Paper Currency Handling Unit 10

[0056] It is now assumed that the paper currency handling unit 10 and the paper currency storage unit 30 are in the storage position as shown in FIG. 26. In order to pull out the paper currency handling unit 10, if an end portion of the first operating portion 72 of the first lock mechanism 70 is pulled in the direction of the arrow as shown in FIG. 27, the first operating portion 72 rotates in the same direction about the rotary shaft 73a. One end of the link member 76 is coupled to the first operating portion 72 via the connecting shaft 77a. The other end of the link member 76 is coupled to the first lock member 74 via the connecting shaft 77b. Therefore, the first lock member 74 is rotated about the rotary shaft 75a by an operation to rotate the first operating portion 72. This disengages the engagement portion 74b of the first lock member 74 from the lock pin 61. The first lock mechanism 70 shifts from the lock position to the non-lock position.

[0057] As shown in FIG. 28, if the paper currency handling unit 10 is pulled out, some members of the first lock member 70 and second lock member 80 installed on the paper currency handling unit 10 move in unison. At this time, the second lock member 84 of the second lock mechanism 80 is fixedly secured to the support substrate 63 on the paper currency storage unit 30 side and so the engagement portion 84b stays in the lock position and remains in engagement with the lock pin 61. Pullout of the paper currency storage unit 30 is restricted. Then, as shown in FIG. 29, if the hand is released from the first operating portion 72 of the first lock mechanism 70, the spring 78 rotates the first operating portion 72 about the rotary shaft 73a and returns to its initial position.

[0058] At this time, if the second operating portion 82 of the second lock mechanism 80 is rotationally operated as shown in FIG. 30 to rotate the kicker member 86 via the link member 88, the kicker member 86b does not strike the pushing member 84c of the second lock member 84 and so the second lock member 84 does not rotate. Consequently, the engagement portion 84b does not disengage from the lock pin 61. The paper currency storage unit 30 is kept at the lock position.

[0059] Then, if the paper currency handling unit 10 is pushed in and returned from the pullout position into the storage position as shown in FIG. 31, the first lock mechanism 70 integral with the paper currency handling unit 10 moves in the same direction. If the tilted surface 74d of the first lock member 74 strikes the lock pin 61, the first lock pin 74 rotates about the rotary shaft 75a against the biasing force of the spring 78. The engagement portion 74b comes into engagement with the lock pin 61. Then, the first lock member 74 is rotated in the reverse direction by the biasing force of the spring 78. Consequently, the first lock mechanism 70 shifts into the lock position. Pullout of the paper currency handling unit 10 is restricted.

(b) Pull-out Operation of Paper Currency Storage Unit 30

[0060] As shown in FIG. 26, the paper currency handling unit 10 and the paper currency storage unit 30 are in the storage position. Under this condition, if an end portion of the second operating portion 82 of the second lock mechanism 80 is pulled in the direction of the arrow as shown in FIG. 32 in order to pull out the paper currency handling unit 10, the second operating portion 82 rotates in the same direction about the rotary shaft 83a. One end portion of the link member 88 is coupled to the connecting shaft 89a of the second operating portion 82. Other end portion of the link member 88 is coupled to the connecting shaft 89b. Therefore, rotation of the second operating portion 82 rotates the kicker member 86 about the rotary shaft 87a via the link member 88. The kicker portion 86b of the kicker member 86 pushes against the pushing portion 84c of the second lock member 84. The second lock member 84 rotates about the rotary shaft 87a. This engages the engagement portion 84b of the second lock member 84 from the lock pin 61. The second lock mechanism 80 shifts from the lock position to the non-lock position.

[0061] As shown in FIG. 33, if the paper currency storage unit 30 is pulled out, the second lock member 84 of the second lock mechanism 80 installed on the paper currency storage unit 30 and so on move in unison. At this time, parts including the first lock member 74 integral with the paper currency handling unit 10 stay in the storage position. As shown in FIG. 34, the spring force of the spring 85c returns the second lock member 84 of the second lock mechanism 80. Furthermore, the second operating portion 82 is returned to its original position by the spring 85b.

[0062] As shown in FIG. 35, the movable plate 92 of the cooperative lock mechanism 90 bears against the stopper portion 84d of the second lock member 84. The second lock member 84 moves out of the state in which its rotation is restricted. Therefore, the movable plate is rotated by the spring force of the spring 94. In consequence, the stopper portion 92b of the movable plate 92 enters the stopper portion 84d of the second lock member 84, restricting rotation of the second member 84. Hence, the engagement portion 84b of the second lock member 84 is in engagement with the lock pin 61. Under this condition, if the first operating portion 72 is rotated, rotation of the first lock member 74 is restricted because the stopper 74c interferes with the stopper portion 92b of the movable plate 92. The first lock mechanism 70 is kept at the lock position. If the paper currency storage unit 30 is returned to the storage position, the second lock member 84 returns to the lock position where the lock member engages the lock pin 61.

(7) Advantageous Effect 2 of Embodiment

[0063]

(7)-1 When the paper currency handling unit 10 and the paper currency storage unit 30 are both in the storage position, the lock mechanism 60 operates in such a way that only one of the paper currency handling unit 10 and paper currency storage unit 30 can be pulled out of the enclosure 102. That is, as shown in FIG. 30, when the paper currency handling unit 10 has been pulled out, if the second operating portion 82 of the second lock mechanism 80 is rotationally operated, the kicker portion 86b of the kicker member 86 does not strike the pushing portion 84c of the second lock member 84 and the second lock member 84 cannot be rotated. Therefore, the second lock mechanism 80 is kept at the lock position. On the other hand, when the paper currency storage unit 30 has been pulled out as shown in FIG. 35, the stopper portion 92b of the movable plate 92 of the cooperative lock mechanism 90 engages the stopper portion 84d of the second lock member 84, restricting rotation of the first lock member 74. Therefore, if the first operating portion 72 of the first lock mechanism 70 is rotationally operated, the first lock member 74 cannot be rotated. The first lock mechanism 70 is kept at the lock position.

Since the lock mechanism 60 described so far is so configured that the paper currency handling unit 10 and the paper currency storage unit 30 cannot be moved into the pullout position simultaneously, the lock mechanism yields the following advantageous effects. Where the paper currency handling unit 10 and the paper currency storage unit 30 are configured to be movable on rails disposed in the horizontal direction, if the paper currency handling unit 10 is in the pullout position, for example, the paper currency handling unit 10 tends to tilt, reducing the spacing with the paper currency storage unit 30. To permit the paper currency storage unit 30 to be pulled out smoothly even under such a condition, a large space is needed between the paper handling unit 10 and the paper currency storage unit 30 to prevent interference between them. The large space needs a large distance traveled, in order to move the paper currency storage unit 30 to the connection location of the connecting mechanism 45. Also, the configuration of the connection is complicated. However, according to the above embodiment, the lock mechanism 60 permits only one of the paper currency handling unit 10 and the paper currency storage unit 30 to be pulled out. Hence, it is not necessary to set the spacing between them large: A configuration for connecting the connecting mechanism 45 is simplified. Smooth pull-out operation can be assured.

(7)-2 The first and second locked engagement members are common in the first and second lock mechanisms. The configuration can be simplified.

[0064] For example, the following modifications are also possible. This invention can be applied to apparatus handling various kinds of sheets and leaves of paper such as paper currencies, cards, and paper (such as printed paper).

(8) Upper and Lower Positioning Mechanisms of Unit Guide Mechanism 50B

[0065] FIG. 36 is an explanatory view illustrating a work for mounting a paper currency handling unit 10B to a first guided portion 162B. The present embodiment has features in the configuration of the first guided portion 162B. FIG. 36 is a partially cutaway perspective view showing a state assumed before the paper currency handling unit 10B is mounted to the first guided portion 162B. The first guided portion 162B has a guide base portion 162Ba and a guide piece 162Bb. The guide base portion 162Ba is provided with tightening holes 162Bh and a positioning hole 163B. The tightening holes 162Bh are composed of a first hole 162Bh1, a second hole 162Bh2, and a third hole 162Bh3 which are different in vertical position and arranged obliquely. A securing member 162Bn is inserted in one of the first through third holes 162Bh1-162Bh3 and tightened in the tightening hole 167Bh. The positioning hole 163B is formed of one rectangular hole. A first step portion 163Ba, a second step portion 163Bb, and a third step portion 163Bc are formed in the bottom of the rectangular hole. The first through third step portions 163Ba-163Bc are formed in a stepwise manner so as to be different in vertical and horizontal positions in a corresponding manner to the first through third holes 162Bh1-163Bh3, respectively.

[0066] A work for mounting the first connecting mechanism 164B, which has been mounted on the paper currency handling unit 10B, to the first guided portion 162B is described. The first guided portion 162B is mounted to a first guide portion affixed to an enclosure (not shown). The first guided portion 162B is previously pulled out of the first guide portion. Furthermore, the positioning member 163Bn is previously secured to the connecting member 165B of the first connecting mechanism 164B. The positioning member 163Bn is inserted into the positioning hole 163B while manually holding the paper currency handling unit 10B. At this time, the positioning member 163Bn is placed on any one of the first through third step portions 163Ba-163Bc, and the paper currency handling unit 10B is temporarily placed on the first guided portion 162B. The tightening hole 162Bh is placed in position relative to the tightening hole 167Bh while placing the positioning member 163Bn on any one of the first through third step portions 163Ba-163Bc of the positioning hole 163B. The securing member 162Bn is inserted into any one of the first through third holes 162Bh1-162Bh3 and screwed into

the tightening hole 167Bh, thus securing the connecting member 165B to the first guided portion 162B. This configuration permits the paper currency handling unit 10B to be temporarily placed in or on the first guided portion 162B via the positioning hole 163B and the positioning member 163Bn. Also, the tightening hole 162Bh can be adjusted to the tightening hole 162Bh with three levels of position in the vertical and horizontal directions. This provides excellent workability. The number of stages of the positioning hole 163B is not limited to three. More stages may be formed according to positioning.

Reference Signs List

[0067]

1:	aper currency handling apparatus
10:	aper currency processing unit
10B:	paper currency processing unit
10c:	support plate
10d:	slit
10h:	slot
11a:	grip
20:	paper currency deposit-withdrawal slot
22:	paper currency discrimination portion
23:	temporal storage portion
26:	upper unit transport mechanism
26a:	transport path for money deposit
26b:	transport path for money withdrawal
26c:	transport path for discrimination
26d:	transport path for temporal storage
27:	connecting transport mechanism
28:	main transport path
28a:	auxiliary transport path
28a:	auxiliary transport path
28a:	auxiliary transport path
28e:	auxiliary transport path
30:	paper currency storage unit
31:	storage body
31a:	grip
32:	paper currency storage portion
32a, 32b, 32c, 32d, 32e:	paper currency receiving sections
40:	branching connecting mechanism
41:	gate
42:	rollers
45:	connecting mechanism
46:	upstream guide portion
46a:	guide body
46b, 48b:	guide grooves
47a:	rotary shaft
47b:	motor drive shaft
48:	downstream guide portion
48a:	guide body
50:	unit guide mechanism
50B:	unit guide mechanism
53:	cooperative guide mechanism
54R, 54L:	receiving guide rails
54:	hanging mechanism
54A:	general portion
54B:	tilted guide portions
54La:	rail base portion
54Lb:	horizontal portion
54Lc:	vertical support portion

54Ra:	rail base portion
54Rb:	horiozontal support portion
55a, 55e:	positioning portions
55b, 55c, 55d:	positioning portions
55:	positioning mechanism
55s:	tilted surfaces
56:	first rollers
56a:	tilted groove
57:	horizontal guide mechanism
58:	adjustive guide rail
58a:	guide groove
59:	second rollers
59a:	fixture
59b:	flange
60:	lock mechanism
61:	lock pin
62:	support substrate
63:	support substrate
70:	first lock mechanism
72:	first operating portion
73a:	rotary shaft
74:	first lock member
74a:	lock plate body
74b:	engagement portion
74c:	stopper portion
74d:	tilted surface
75a:	rotary shaft
76:	link member
77a:	connecting shaft
77b:	connecting shaft
78:	spring
80:	second lock mechanism
82:	second operating portion
83a:	rotary shaft
84:	second lock member
84a:	lock plate body
84b:	engagement portion
84c:	pushing portion
84d:	stopper portion
84e:	tilted surface
85a:	rotary shaft
85b:	spring
85c:	spring
86:	kicker member
86a:	kicker body
86b:	kicker portion
87a:	rotary shaft
88:	link member
89a:	connecting shaft
89b:	connecting shaft
90:	cooperative lock mechanism
92:	movable plate
92a:	abutment portion
92b:	stopper portion
93a:	rotary shaft
94:	spring
101:	automatic teller machine
102:	enclosure

102S:	storage space
104:	enclosure body
106:	door
110:	receipt handling mechanism
120:	client control portion
130:	coin handling device
151:	first sliding mechanism
151L:	left-side sliding mechanism
151R:	right-side sliding mechanism
152, 172:	first and second guide portions
153:	guide support upper frame
153n, 154n:	securing members
154:	guide support lower frame
155a, 155b:	rails
162, 182:	first and second guided portions
162Bh1, 162Bh2, 162Bh3:	first through third holes
162B:	first guided portion
162a:	guide base portion
162b:	guide piece
162n:	securing member
162Ba:	guide base portion
162Bb:	guide piece
162Bh:	tightening hole
162Bn:	securing member
163B:	positioning hole
163Ba:	first step portion
163Ba, 163Bb, 163Bc:	first through third step portions
163Bn:	positioning member
164:	first connecting mechanism
164B:	first connecting mechanism
165:	connecting member
165B:	connecting member
166:	horizontal portion
166h:	tightening holes
167:	vertical portion
167Bh:	tightening hole
168:	first and second distance adjusting portions
169n:	securing members
169s:	spacers
171:	second sliding mechanism
171L:	left-side sliding mechanism
171R:	right-side sliding mechanism
182n:	securing members
185:	first connecting member
185a:	vertical plate
185b:	horizontal plates
185h:	slots
185n:	securing member
186:	second connecting member
186a:	vertical plate
186b:	horizontal plates
186h:	threaded holes
189n:	securing members
189s:	spacers

Claims

1. A paper sheet processing device having
a paper currency unit for discriminating sheets of paper inserted or paid out, sorting the discriminated sheets of paper, and storing them,
an enclosure (102) having a storage space (102S) storing the paper currency unit, and a unit guide mechanism (50) interposed in gaps allowing for horizontal sliding of the enclosure (102) and of the paper currency unit and operating to guide the paper currency unit to pull the paper currency unit into and out of the storage space (102S);
characterized in that
said unit guide mechanism (50) has
a guide portion (152, 172) disposed in a horizontal direction along an inner wall of the enclosure (102),
a guided portion (162, 182) disposed on a side of an outer wall of the paper currency unit movably along the guide portion (152, 172), and
a connecting mechanism (168, 188) for connecting together the paper currency unit and the guided portion (162, 182); and

wherein said connecting mechanism (168, 188) has distance adjusting portions for varying the distance between the guided portion (162, 182) and the paper currency unit when receiving a horizontal force by movement of the paper currency unit;
wherein said connecting mechanism has a connecting member (165) connecting together said guided portion (162) and an outer wall of said paper currency unit;
wherein said distance adjusting portions have a securing member (169n) being a screw, which is affixed to the connecting member (165) via a tightening hole (166h) formed in a horizontal portion (166) of the connecting member (165), and a slot (10h) which is formed in a horizontal portion of a support plate (10c) supporting the paper currency unit and in which the securing member (169n) is inserted and a spacer (169s, 189s) for forming a gap (Sp3) from the paper currency unit; and wherein the slot (10h) has a larger diameter than an outer diameter of the spacer (169s, 189s) in a direction perpendicular to the direction in which the paper currency unit moves, and wherein the securing member (169n) then moves through the slot (10h) in a direction perpendicular to the direction of motion of the paper currency unit to thereby make variable the sliding gaps.

2. The paper sheet processing device according to the foregoing claim 1,
wherein said paper currency unit has:

a paper currency processing unit (10) for discriminating sheets of paper inserted or paid out;
a paper sheet storage unit (30) disposed below the paper sheet processing unit (10) and including a plurality of paper sheet storage portions (32) for sorting and storing the discriminated sheets of paper and a storage body (31) for storing the paper sheet storage portions (32); and
a transport mechanism (27) for conveying the sheets of paper bidirectionally between the paper sheet processing unit (10) and the paper sheet storage unit (30) via a transport path (28) connecting together the paper sheet processing unit (10) and the paper sheet storage unit (30); and
wherein said unit guide mechanism (50) has a first sliding mechanism (151) disposed in said gap allowing for sliding of said enclosure (102) and of the paper currency processing unit (10) and
a second sliding mechanism (171) disposed in said gap allowing for sliding of the enclosure (102) and of the paper sheet storage unit (30).

3. The paper sheet processing device set forth in claim 2,
wherein said second sliding mechanism (171) is configured such that said storage body (31) is slidably supported thereby;
wherein said unit guide mechanism (50) has a hanging mechanism (54) including receiving guide rails (54R, 54L) located in a lower part of said paper currency processing unit (10) and disposed in the direction of motion and first rollers (56) mounted on or in the paper currency storage portion (32) and being guided by the receiving guide rails (54R, 54L), the hanging mechanism (54) being so configured that the first rollers (56) move on the receiving guide rails (54R, 54L) while the paper sheet storage portion is suspended by the paper currency processing unit (10); and
wherein said suspending mechanism is so configured that the receiving guide rails (54R, 54L) and the first rollers (56) are disposed on opposite widthwise sides of the paper currency processing unit (10), one first roller (56) is placed in position in a widthwise direction and moves on said receiving guide rails (54R, 54L), and the other first roller (56) moves on the receiving guide rails (54R, 54L) with free play in the widthwise direction on the receiving guide rails (54R, 54L).

Patentansprüche

1. Papierblattverarbeitungsvorrichtung, die Folgendes umfasst:

eine Papiergeldeinheit zum Unterscheiden von Papierblättern, die eingeführt oder ausgezahlt werden, Sortieren der unterschiedenen Papierblätter und Aufbewahren derselben,
eine Umschließung (102), die einen Aufbewahrungsraum (102S), in dem die Papiergeldeinheit aufbewahrt wird, und einen in Zwischenräumen eingeschobenen Einheitsführungsmechanismus (50), der ein horizontales Gleiten der Umschließung (102) und der Papiergeldeinheit ermöglicht und derart arbeitet, dass die Papiergeldeinheit derart geführt wird, dass die Papiergeldeinheit in den Aufbewahrungsraum (102S) und aus diesem heraus gezogen wird;
dadurch gekennzeichnet, dass
der Einheitsführungsmechanismus (50) Folgendes aufweist:

einen Führungsabschnitt (152, 172), der in einer horizontalen Richtung entlang einer Innenwand der Umschließung (102) angeordnet ist,
einen geführten Abschnitt (162, 182), der auf einer Seite einer Außenwand der Papiergeldeinheit entlang des Führungsabschnitts (152, 172) beweglich angeordnet ist, und
einen Verbindungsmechanismus (168, 188) zum Verbinden der Papiergeldeinheit und des geführten Abschnitts (162, 182) miteinander; und

wobei der Verbindungsmechanismus (168, 188) Abstandseinstellabschnitte zum Verändern des Abstands zwischen dem geführten Abschnitt (162, 182) und der Papiergeldeinheit, wenn durch eine Bewegung der Papiergeldeinheit eine horizontale Kraft aufgenommen wird, aufweist;
wobei der Verbindungsmechanismus ein Verbindungselement (165) aufweist, das den geführten Abschnitt (162) und eine Außenwand der Papiergeldeinheit miteinander verbindet;
wobei die Abstandseinstellabschnitte ein Befestigungselement (169n) aufweisen, das eine Schraube ist, die über ein Anzugsloch (166h), das in einem horizontalen Abschnitt (166) des Verbindungselements (165) gebildet ist, und einen Schlitz (10h), der in einem horizontalen Abschnitt einer Trägerplatte (10c) gebildet ist, die die Papiergeldeinheit trägt, und in den das Befestigungselement (169n) eingeführt wird, und ein Abstandselement (169s, 189s) zum Bilden eines Zwischenraums (Sp3) von der Papiergeldeinheit am Verbindungselement (165) arretiert wird; und wobei der Schlitz (10h) in einer Richtung, die zu der Richtung, in der sich die Papiergeldeinheit bewegt, senkrecht ist, einen größeren Durchmesser als ein Außendurchmesser des Abstandselements (169s, 189s) aufweist, und wobei das Befestigungselement (169n) sich daraufhin in einer Richtung, die zur Bewegungsrichtung der Papiergeldeinheit senkrecht ist, durch den Schlitz (10h) bewegt, derart, dass bewirkt wird, dass die Gleitzwischenräume veränderlich sind.

2. Papierblattverarbeitungsvorrichtung nach dem vorhergehenden Anspruch 1,
wobei die Papiergeldeinheit Folgendes aufweist:

eine Papiergeldverarbeitungseinheit (10) zum Unterscheiden der Papierblätter, die eingeführt oder ausgezahlt werden;
eine Papierblattaufbewahrungseinheit (30), die unter der Papierblattverarbeitungseinheit (10) angeordnet ist und mehrere Papierblattaufbewahrungsabschnitte (32) zum Sortieren und Aufbewahren der unterschiedenen Papierblätter und einen Aufbewahrungskörper (31) zum Aufbewahren der Papierblattaufbewahrungsabschnitte (32) enthält; und
einen Transportmechanismus (27) zum Befördern der Papierblätter in beiden Richtungen zwischen der Papierblattverarbeitungseinheit (10) und der Papierblattaufbewahrungseinheit (30) über einen Transportweg (28), der die Papierblattverarbeitungseinheit (10) und die Papierblattaufbewahrungseinheit (30) miteinander verbindet; und
wobei der Einheitsführungsmechanismus (50) einen ersten Gleitmechanismus (151), der in dem Zwischenraum angeordnet ist, der das Gleiten der Umschließung (102) und der Papiergelderarbeitungseinheit (10) ermöglicht, und
einen zweiten Gleitmechanismus (171), der in dem Zwischenraum angeordnet ist, der das Gleiten der Umschließung (102) und der Papierblattaufbewahrungseinheit (30) ermöglicht,
aufweist.

3. Papierblattverarbeitungsvorrichtung nach Anspruch 2,
wobei der zweite Gleitmechanismus (171) derart konfiguriert ist, dass der Aufbewahrungskörper (31) dadurch auf gleitfähige Weise getragen wird;
wobei der Einheitsführungsmechanismus (50) einen Hängemechanismus (54) aufweist, der Aufnahmeführungsschienen (54R, 54L), die in einem unteren Abschnitt der Papiergeldverarbeitungseinheit (10) angeordnet sind und in der Bewegungsrichtung angeordnet sind, und erste Rollen (56), die auf oder in dem Papiergeldaufbewahrungsabschnitt (32) angebracht sind und durch die Aufnahmeführungsschienen (54R, 54L) geführt werden, enthält, wobei der Hängemechanismus (54) derart konfiguriert ist, dass sich die ersten Rollen (56) auf den Aufnahmeführungsschienen (54R, 54L) bewegen, während der Papierblattaufnahmeabschnitt durch die Papiergeldverarbeitungseinheit (10) aufgehängt ist; und
wobei der Hängemechanismus derart konfiguriert ist, dass die Aufnahmeführungsschienen (54R, 54L) und die ersten Rollen (56) auf der Breite nach gegenüberliegenden Seiten der Papiergeldverarbeitungseinheit (10) angeordnet sind, eine erste Rolle (56) in einer Breitenrichtung in Position angeordnet ist und sich auf den Aufnahmeführungsschienen (54R, 54L) bewegt und die andere erste Rolle (56) sich mit freiem Spiel in der Breitenrichtung auf den Aufnahmeführungsschienen (54R, 54L) bewegt.

Revendications

1. Dispositif de traitement de feuilles de papier ayant
une unité à monnaie en papier pour discriminer des feuilles de papier introduites ou sorties, pour trier les feuilles de papier discriminées et pour les stocker,
une enceinte (102) ayant un espace de stockage (102S) qui stocke l'unité à monnaie en papier, et un mécanisme de guidage d'unité (50) disposé dans des intervalles permettant le coulissement horizontal de l'enceinte (102) et de l'unité à monnaie en papier, et fonctionnant pour guider l'unité à monnaie en papier afin de tirer l'unité à monnaie en papier vers l'intérieur et vers l'extérieur de l'espace de stockage (102S) ;
caractérisé en ce que
ledit mécanisme de guidage d'unité (50) comprend

- une portion de guidage (152, 172) disposée dans une direction horizontale le long d'une paroi intérieure de l'enceinte (102),
- une portion guidée (162, 182) disposée sur un côté d'une paroi extérieure de l'unité à monnaie en papier en déplacement le long de la portion de guidage (152, 172), et
- un mécanisme de connexion (168, 188) pour connecter ensemble l'unité à monnaie en papier et la portion guidée (162, 182) ; et

dans lequel ledit mécanisme de connexion (166, 188) comprend des portions d'ajustement de distance afin de faire varier la distance entre la portion guidée (162, 182) et l'unité à monnaie papier lorsqu'il reçoit une force horizontale par un mouvement de l'unité à monnaie en papier ;
dans lequel ledit mécanisme de connexion comprend un élément de connexion (165) qui connecte ensemble ladite portion guidée (162) et une paroi extérieure de ladite unité à monnaie en papier ;
dans lequel lesdites portions d'ajustement de distance comprennent un élément de sécurisation (169n) qui est une vis, laquelle est fixée sur l'élément de connexion (165) via un trou de serrage (166h) formé dans une portion horizontale (166) de l'élément de connexion (165), et une fente (10h) qui est formée dans une portion horizontale d'une plaque de support (10c) supportant l'unité à monnaie en papier et dans laquelle l'élément de sécurisation (169n) est inséré, et un élément d'espacement (169s, 189s) pour former un espace (Sp3) depuis l'unité à monnaie en papier, et dans lequel la fente (10n) a un diamètre plus grand qu'un diamètre extérieur de l'élément d'espacement (169s, 189s) dans une direction perpendiculaire à la direction dans laquelle se déplace l'unité à monnaie en papier, et
dans lequel l'élément de sécurisation (169n) se déplace ensuite à travers la fente (10h) dans une direction perpendiculaire à la direction de mouvement de l'unité à monnaie en papier, pour rendre ainsi variable les intervalles de coulissement.

2. Dispositif de traitement de feuille de papier selon la revendication précédente 1,
dans lequel ladite unité à monnaie en papier comprend :

une unité de traitement de monnaie en papier (10) pour discriminer des feuilles de papier insérées ou distribuées ;
une unité de stockage de feuilles de papier (30) disposée au-dessous de l'unité de traitement de feuilles de papier (10) et incluant une pluralité de portions de stockage de feuilles de papier (32) afin de stocker et de trier

les feuilles de papier discriminées, et un corps de stockage (31) afin de stocker les portions de stockage de feuilles de papier (32) ; et

un mécanisme de transport (27) pour convoyer les feuilles de papier de façon bidirectionnelle entre l'unité de traitement de feuilles de papier (10) et l'unité de stockage de feuilles de papier (30) via un trajet de transport (28) qui connecte ensemble l'unité de traitement de feuilles de papier (10) et l'unité de stockage de feuilles de papier (30) ; et

dans lequel ledit mécanisme de guidage d'unité (50) comprend un premier mécanisme coulissant (151) disposé dans ledit intervalle et permettant un glissement de ladite enceinte (102) et de l'unité de traitement de monnaie en papier (10), et

un second mécanisme coulissant (171) disposé dans ledit intervalle et permettant un coulissement de ladite enceinte (102) et de l'unité de stockage de feuilles de papier (30).

3. Dispositif de traitement de feuilles de papier selon la revendication 2, dans lequel ledit second mécanisme coulissant (171) est configuré de telle façon que ledit corps de stockage (31) et supporté en coulissement par celui-ci ;

dans lequel ledit mécanisme de guidage d'unité (50) comprend un mécanisme suspendu (54) incluant des rails de guidage et de réception (54R, 54L) situés dans une partie inférieure de ladite unité de traitement de monnaie en papier (10) et disposés dans la direction de mouvement, et des premiers rouleaux (56) montés sur ou dans la portion de stockage de monnaie en papier (32) et étant guidés par les rails de guidage et de réception (54R, 54L), ledit mécanisme de suspension (54) étant ainsi configuré que les premiers rouleaux (56) se déplacent sur les rails de guidage et de réception (54R, 54L) alors que la portion de stockage de feuilles de papier est suspendue par l'unité de traitement de monnaie en papier (10) ; et

dans lequel ledit mécanisme de suspension est ainsi configuré que les rails de guidage et de réception (54R, 54L) et les premiers rouleaux (56) sont disposés sur des côtés opposés dans le sens de la largeur de l'unité de traitement de monnaie en papier (10), un premier rouleau (56) est placé dans une position dans une direction dans le sens de la largeur et se déplace sur lesdits rails de guidage et de réception (54R, 54L), et l'autre premier rouleau (56) se déplace sur les rails de guidage et de réception (54R, 54L), avec un jeu libre dans la direction de la largeur sur les rails de guidage et de réception (54R, 54L).

FIG.1

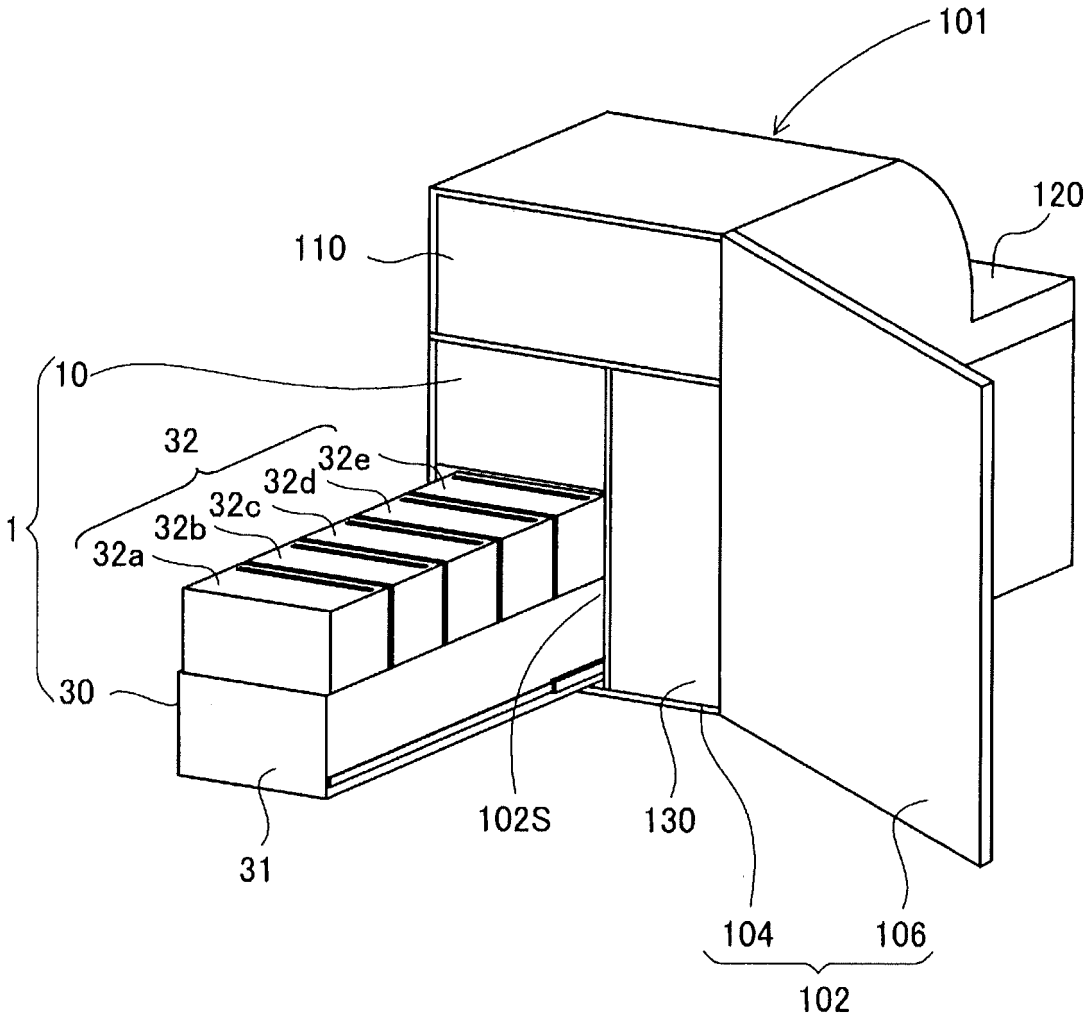


FIG.2

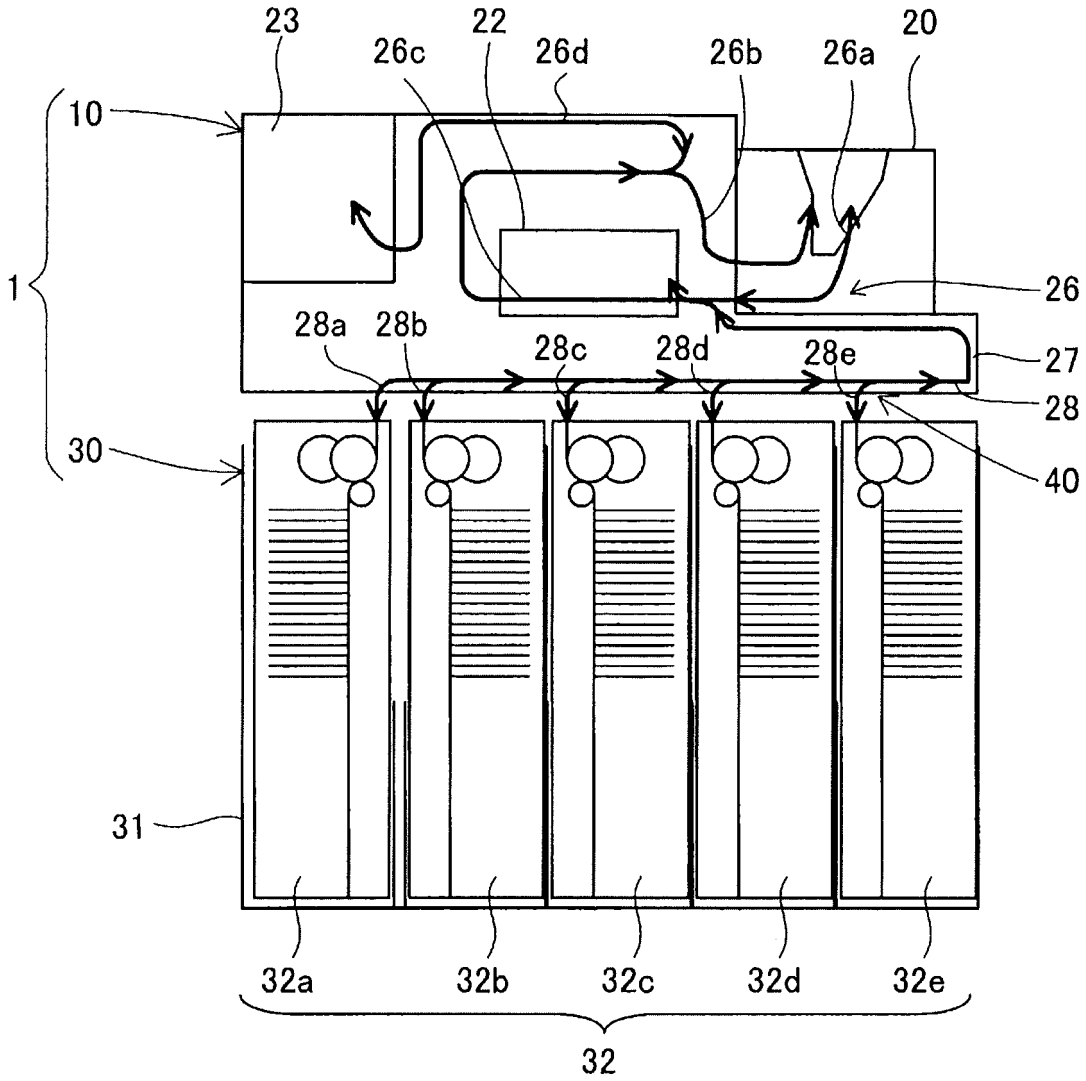

23
22
20
26c
26d
26b
26a
10
1
26
28a
28b
28c
28d
28e
27
28
30
40
31
32a
32b
32c
32d
32e
32

FIG.3

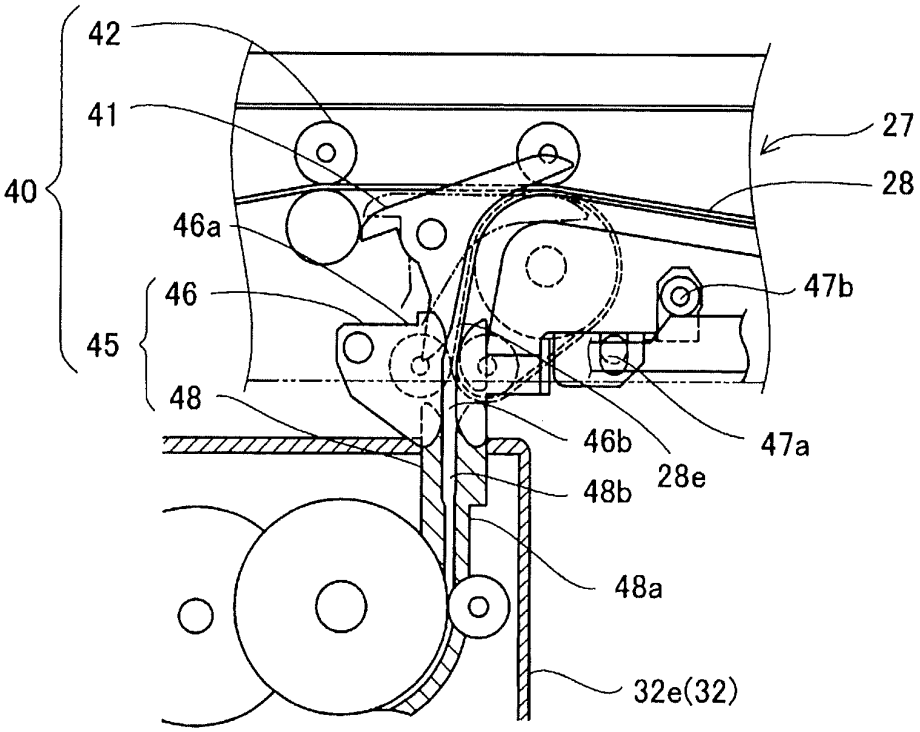

42
41
40
46a
46
45
48
27
28
47b
47a
46b
28e
48b
48a
32e(32)

FIG.4

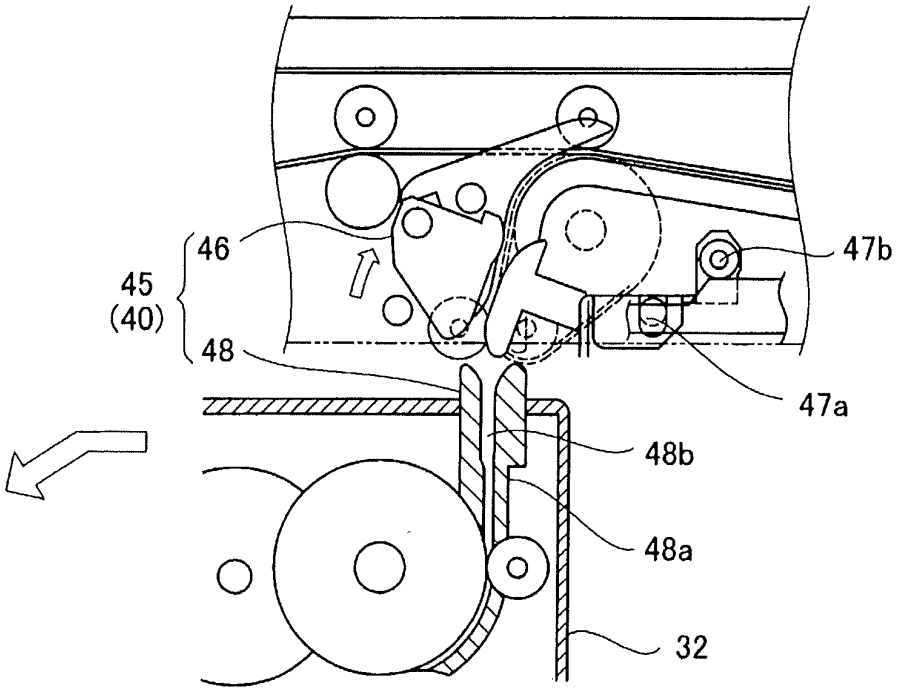

46
45
(40)
48
47b
47a
48b
48a
32

FIG.5

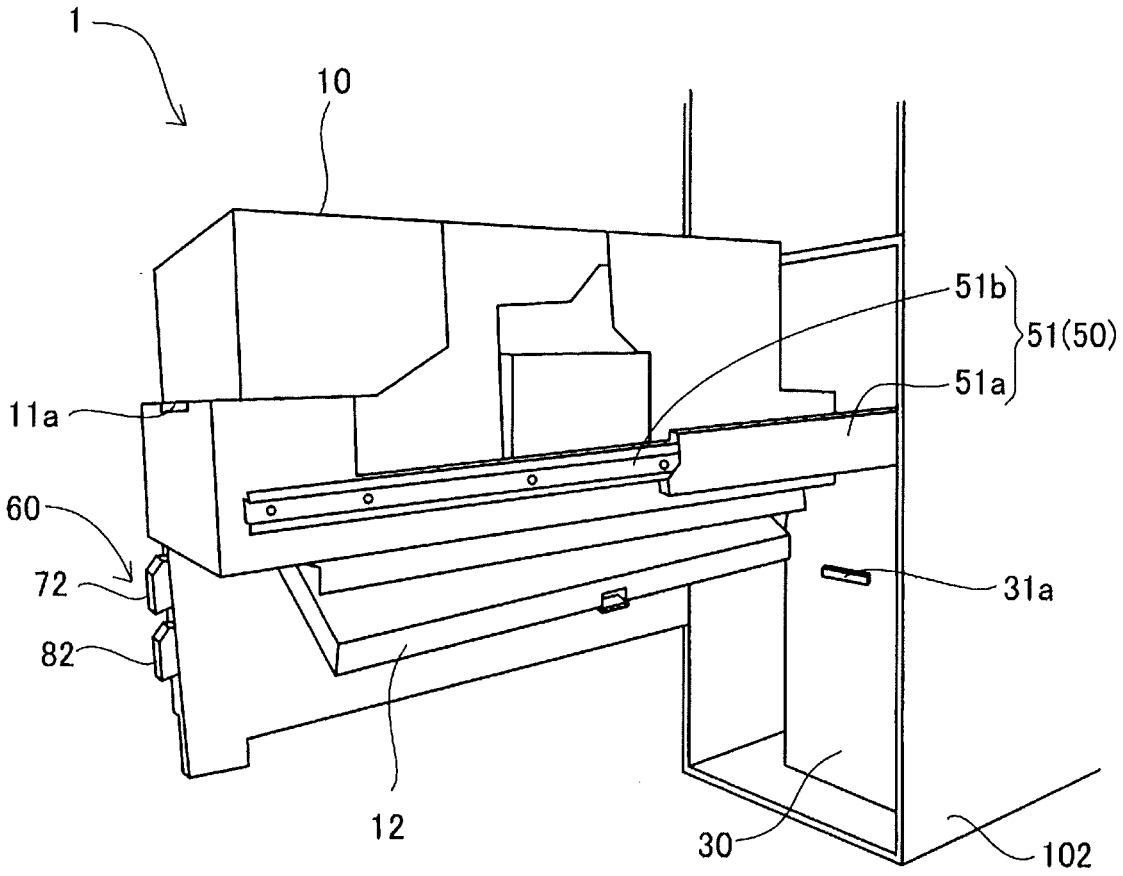


FIG.6

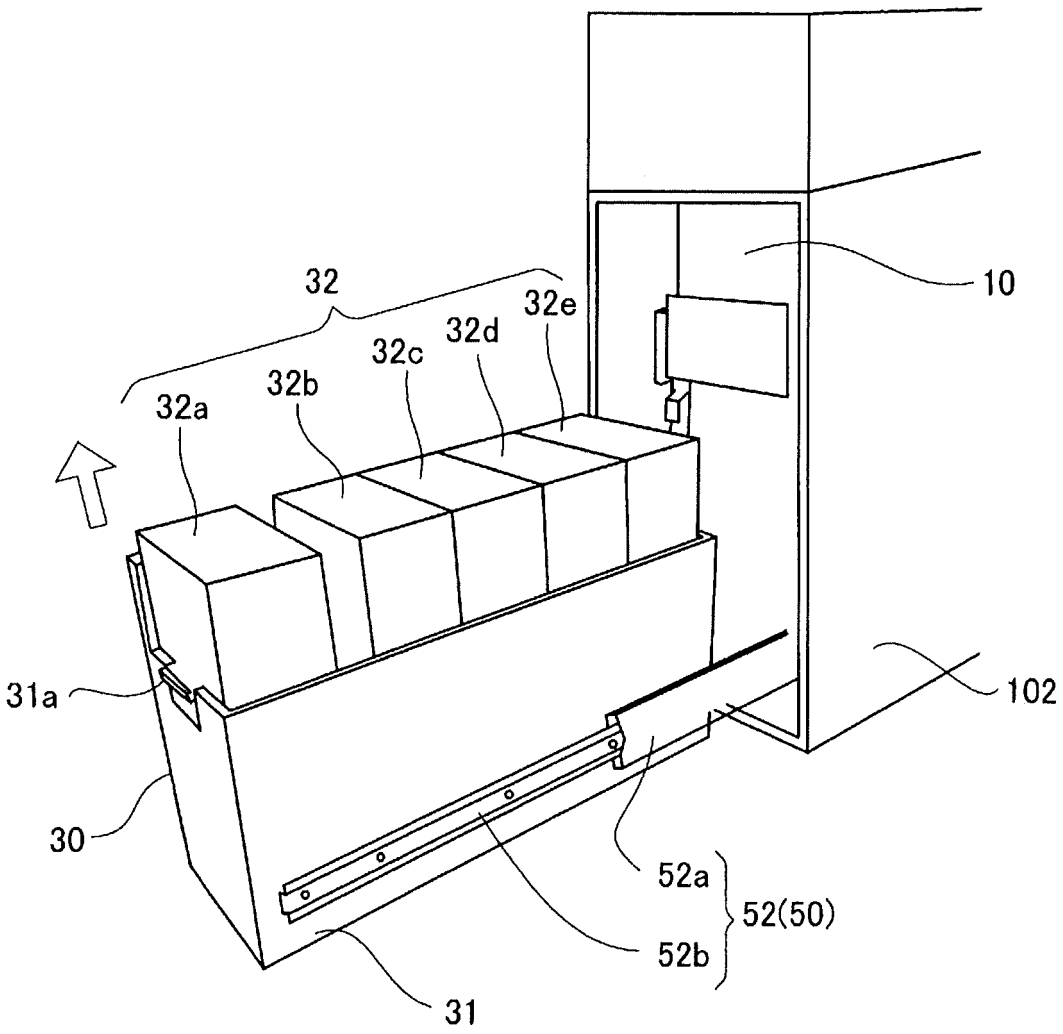


FIG.7A

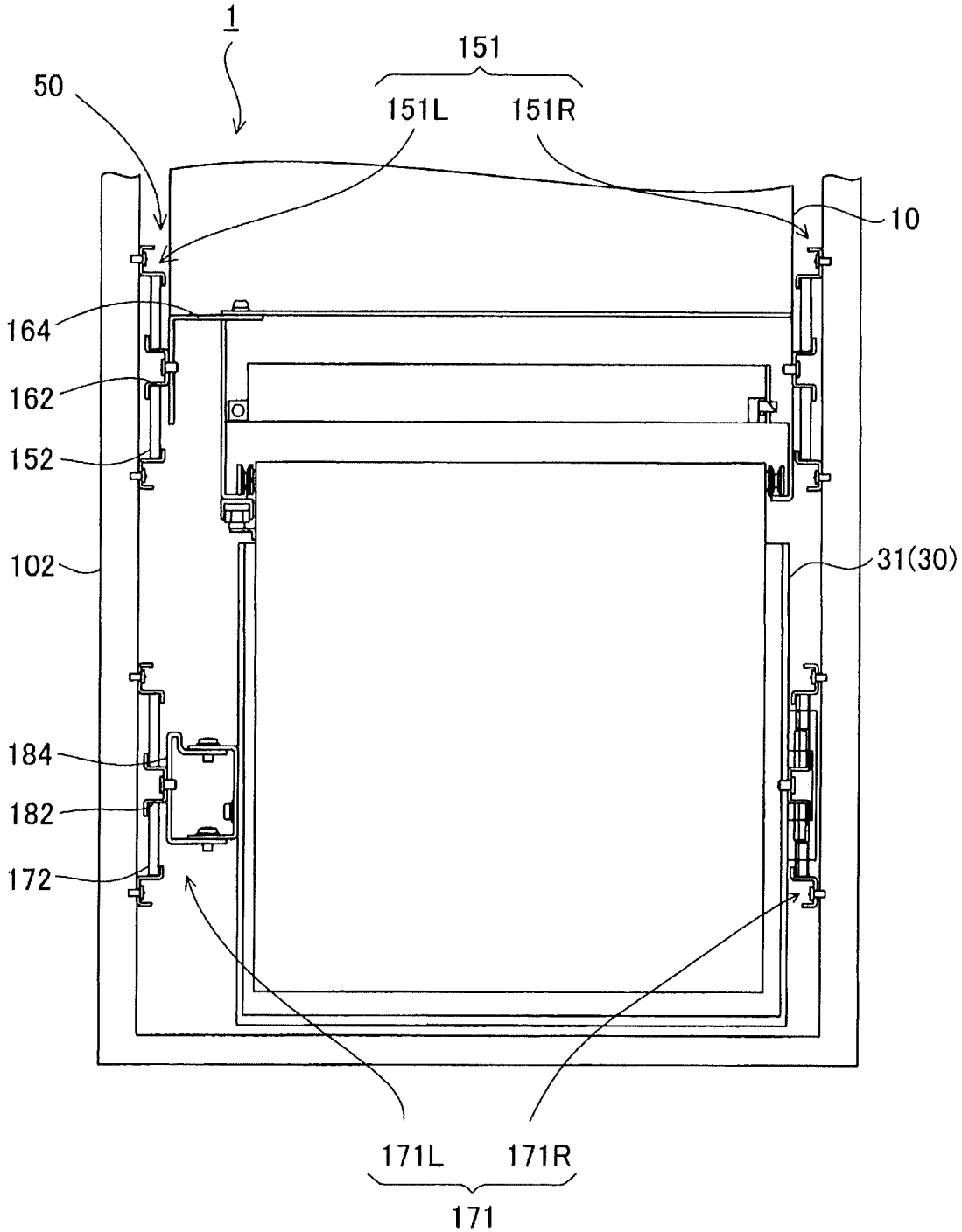

1
151
50
151L
151R
10
164
162
152
102
31(30)
184
182
172
171L
171R
171

FIG.7B

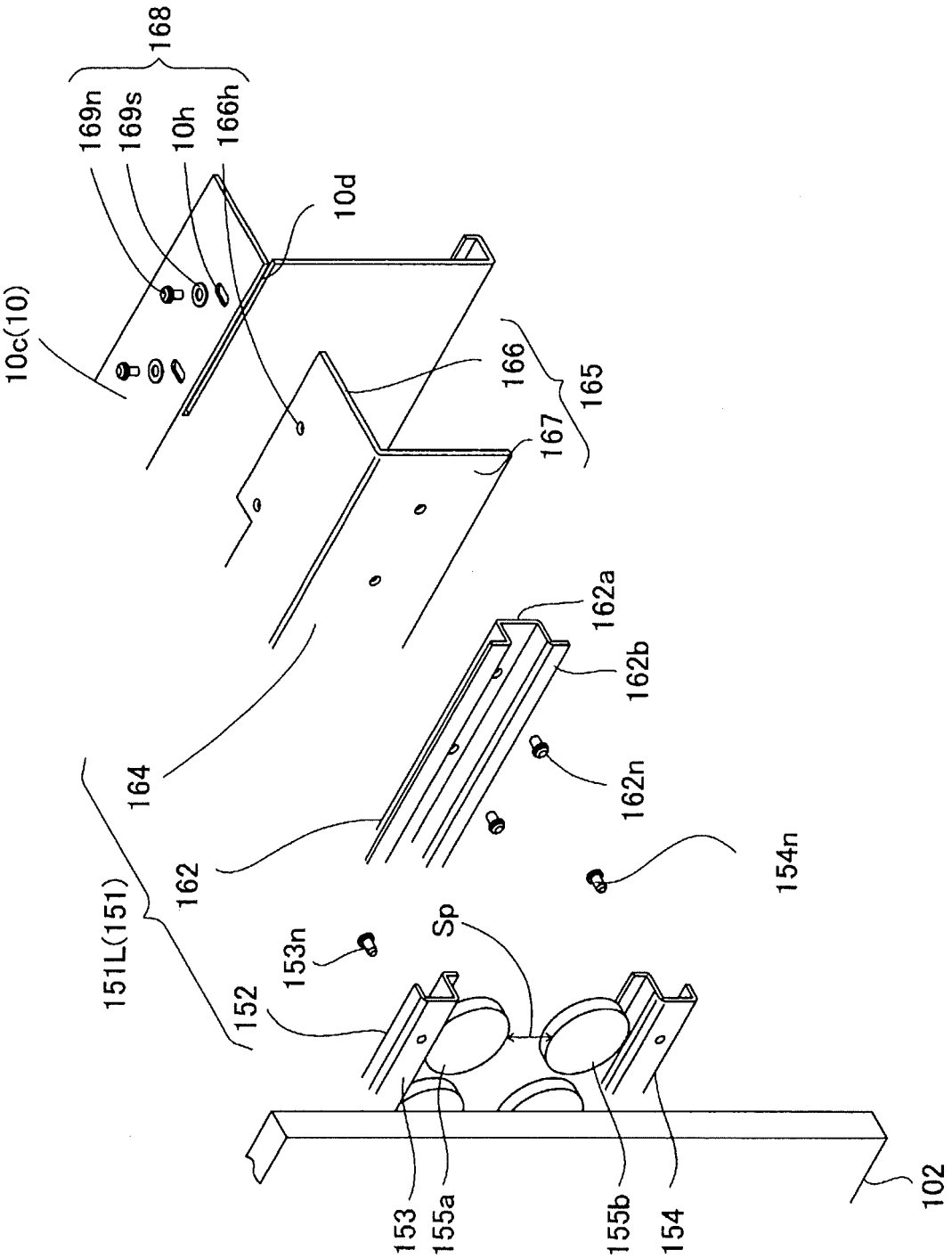

168
169n
169s
10h
166h
10d
10c(10)
166
165
167
164
162a
162b
162n
162
154n
151L(151)
153n
Sp
152
153
155a
155b
154
102

FIG.7C

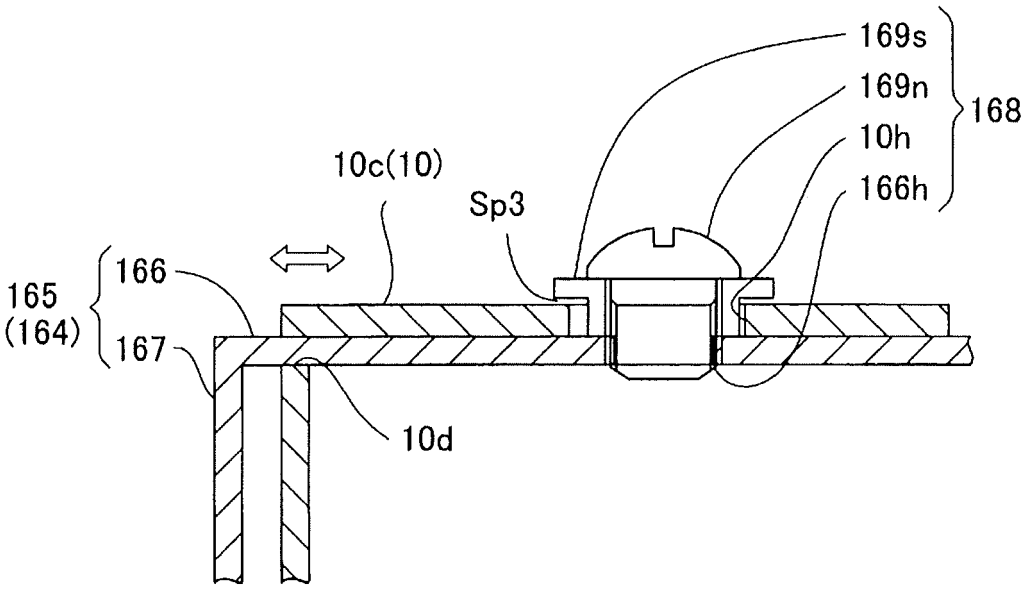


FIG.7D

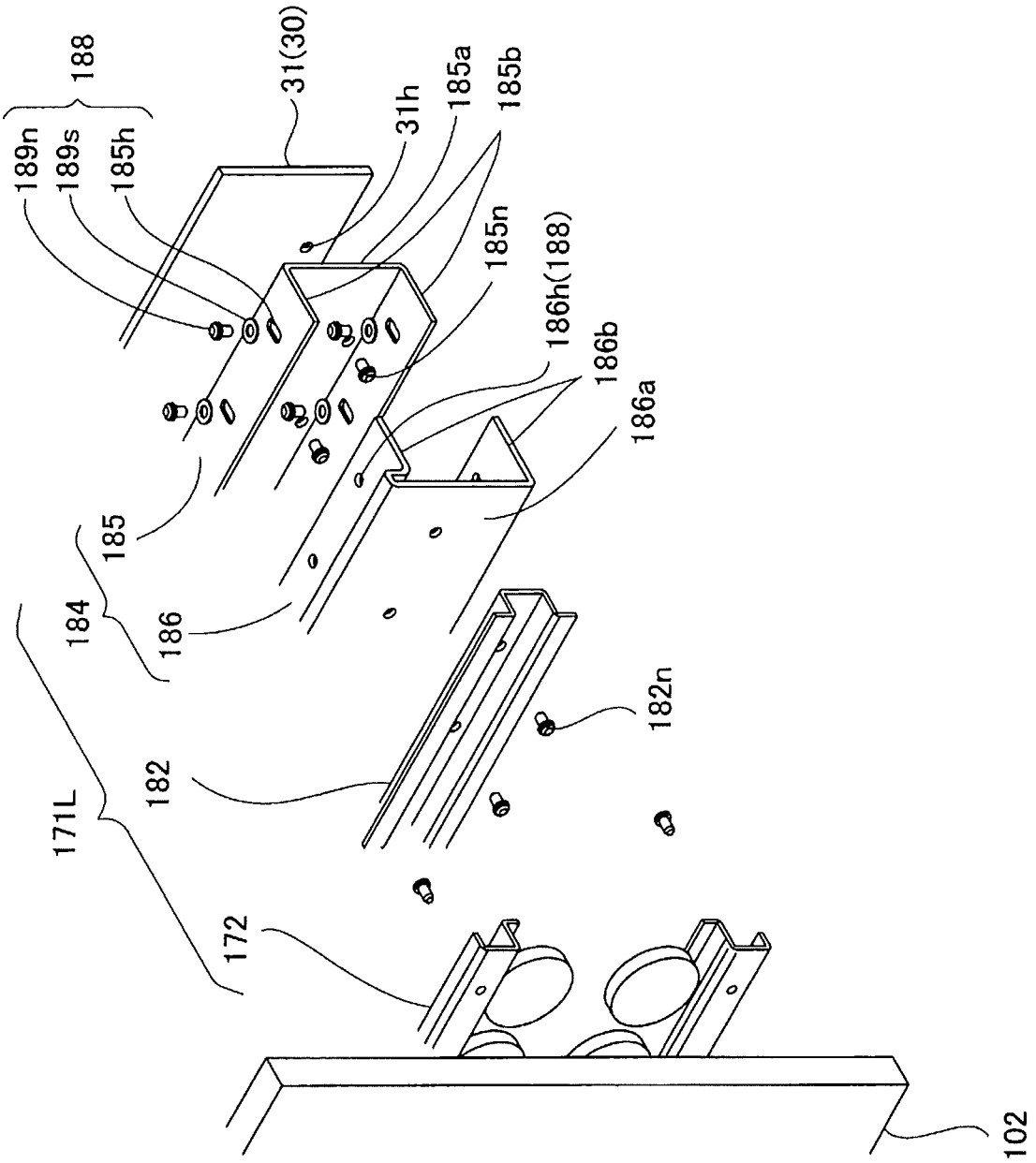

188
189n
189s
185h
31(30)
31h
185a
185b
185n
186h(188)
186b
186a
185
184
186
182n
182
171L
172
102

FIG.7E

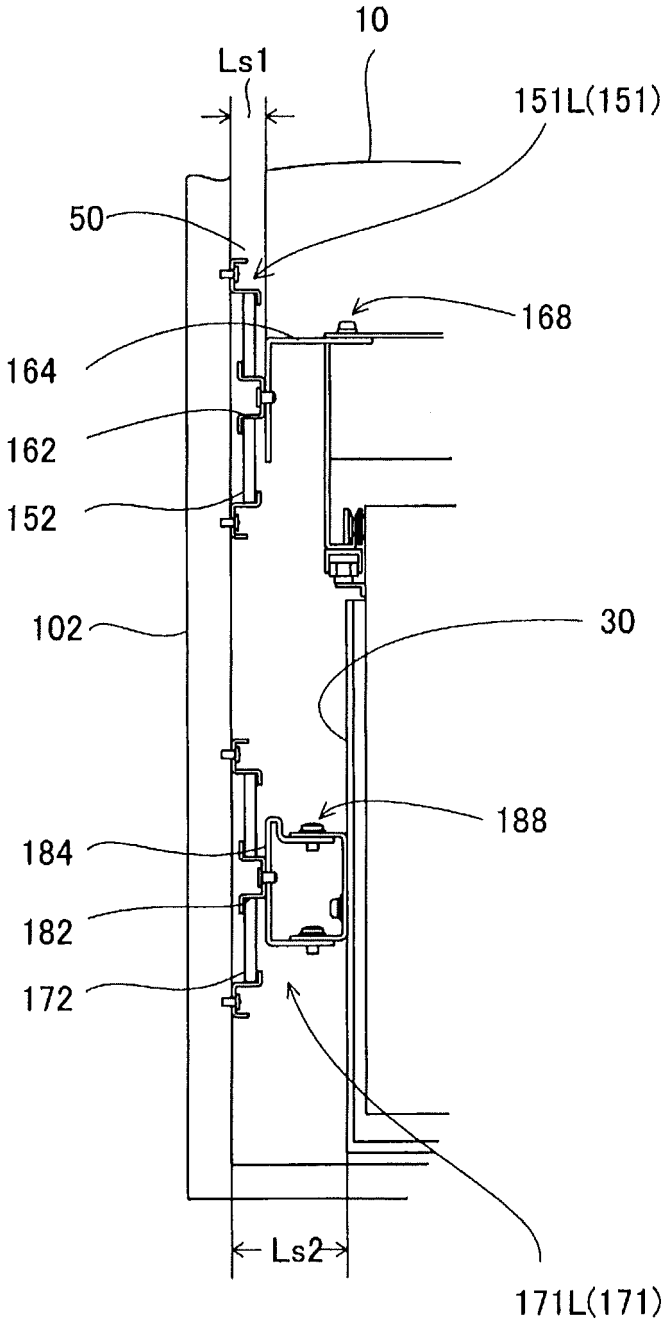

10
Ls1
151L(151)
50
168
164
162
152
102
30
188
184
182
172
Ls2
171L(171)

FIG.7F

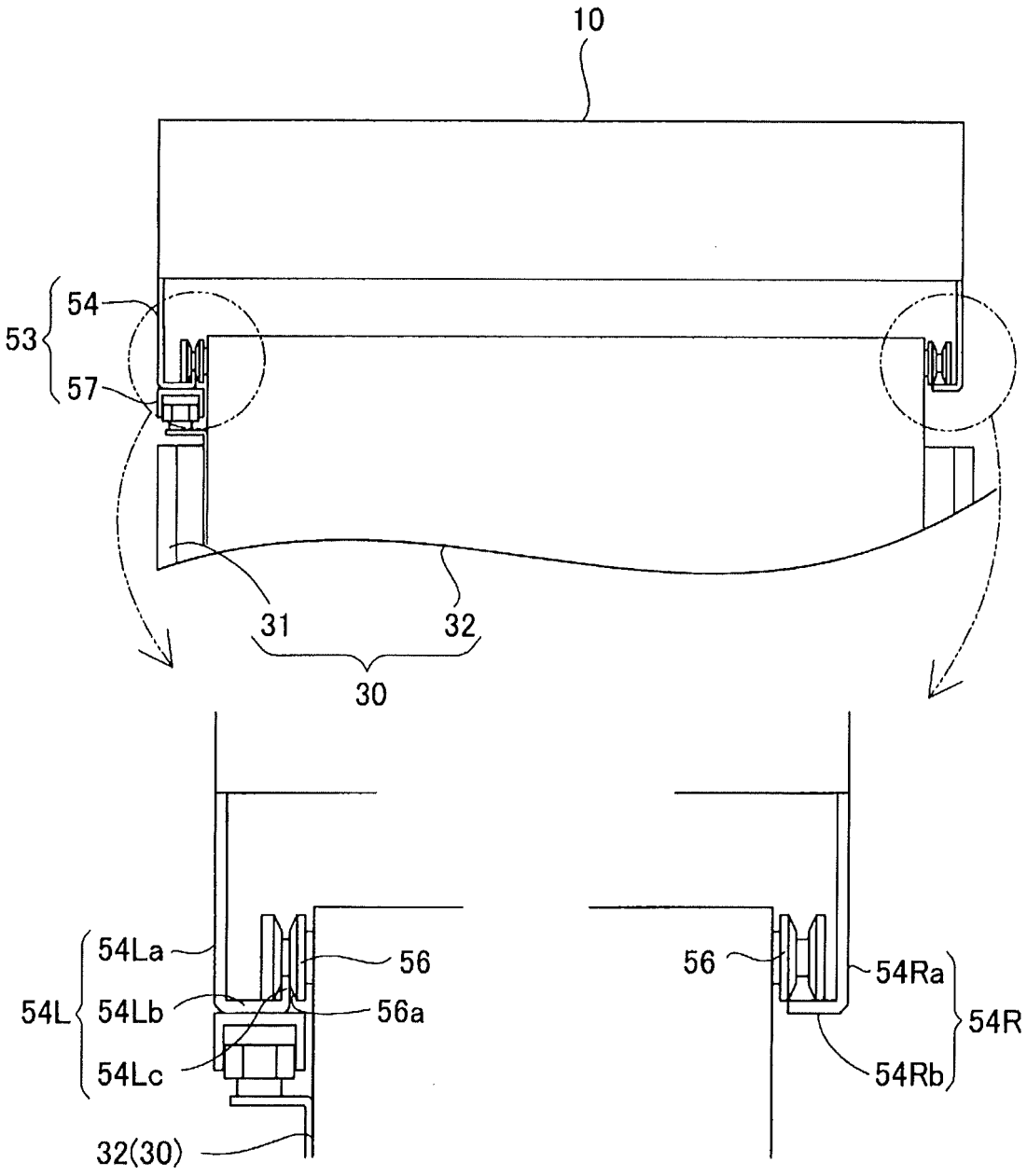

10
53
54
57
31
32
30
54L
54La
54Lb
54Lc
56
56a
32(30)
56
54R
54Ra
54Rb

FIG.8

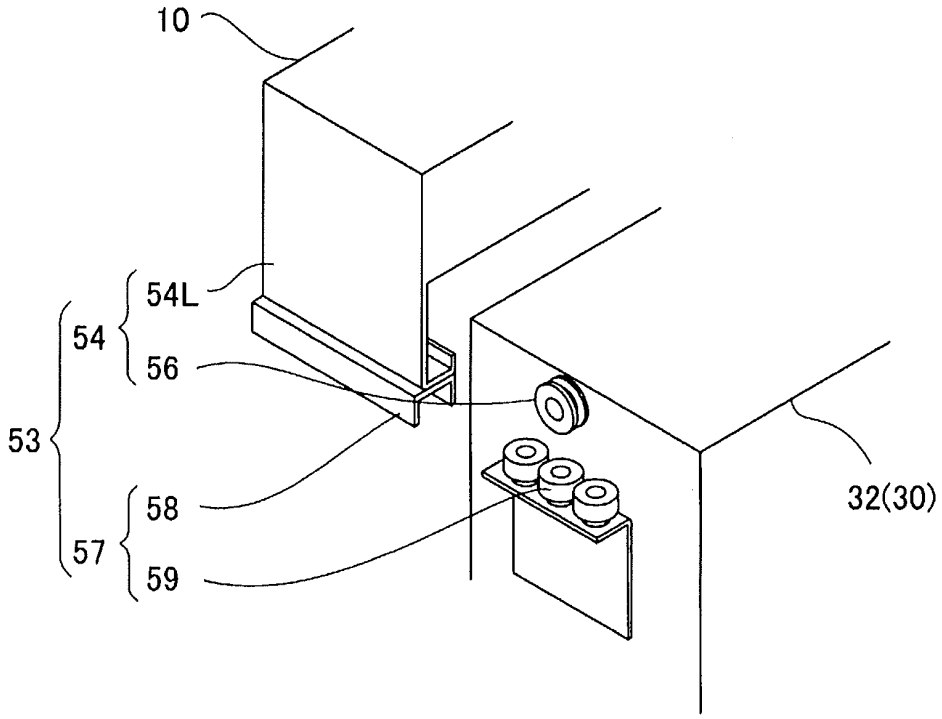

10
54L
54
56
53
58
57
59
32(30)

FIG.9

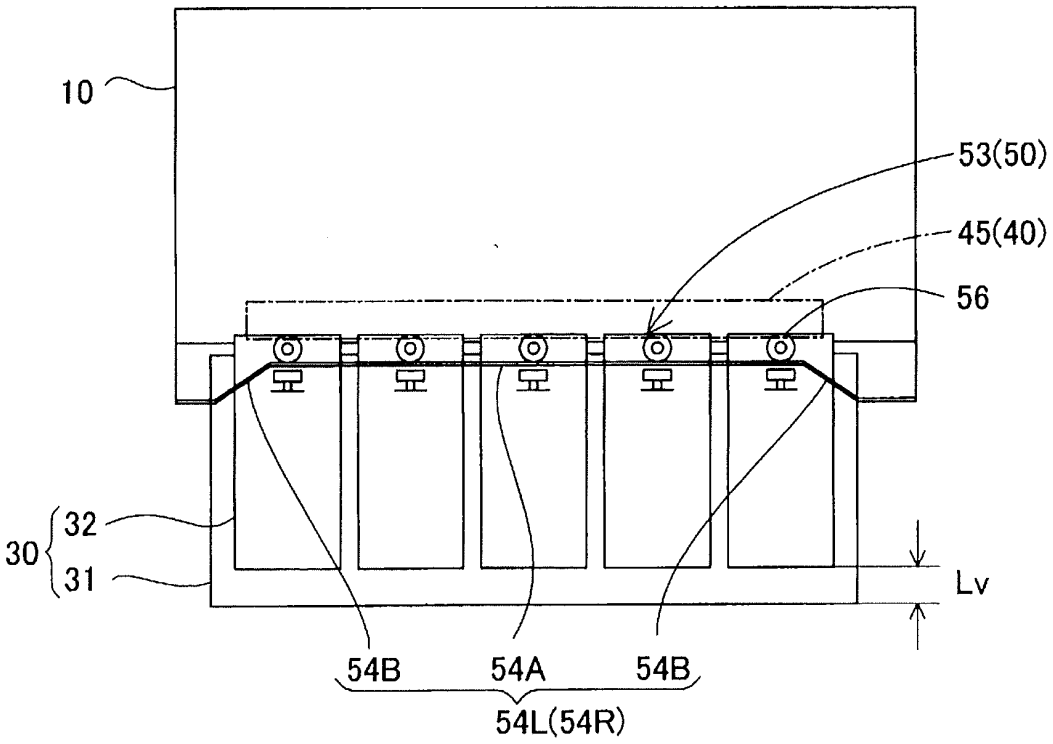

10
53(50)
45(40)
56
32
30
31
Lv
54B
54A
54B
54L(54R)

FIG.10

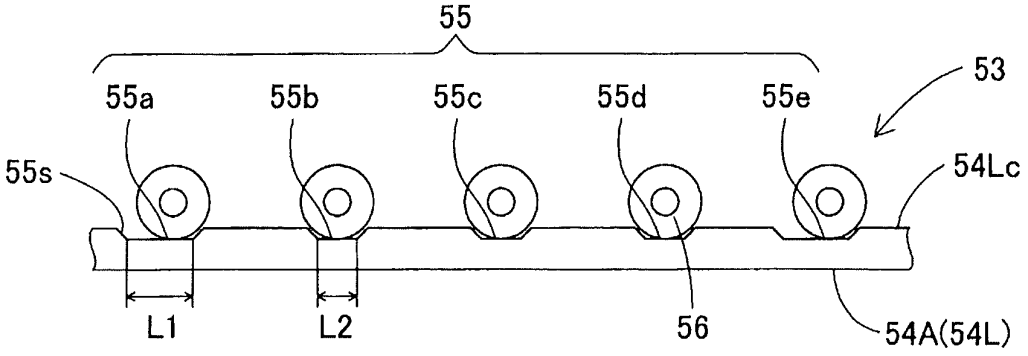


FIG.11

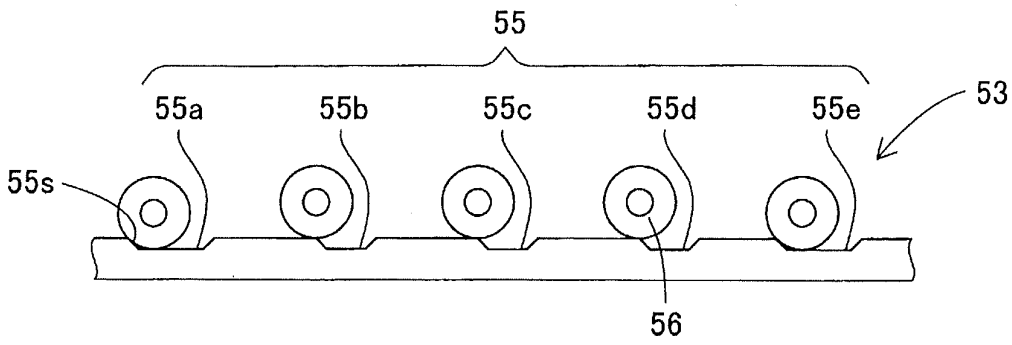


FIG.12

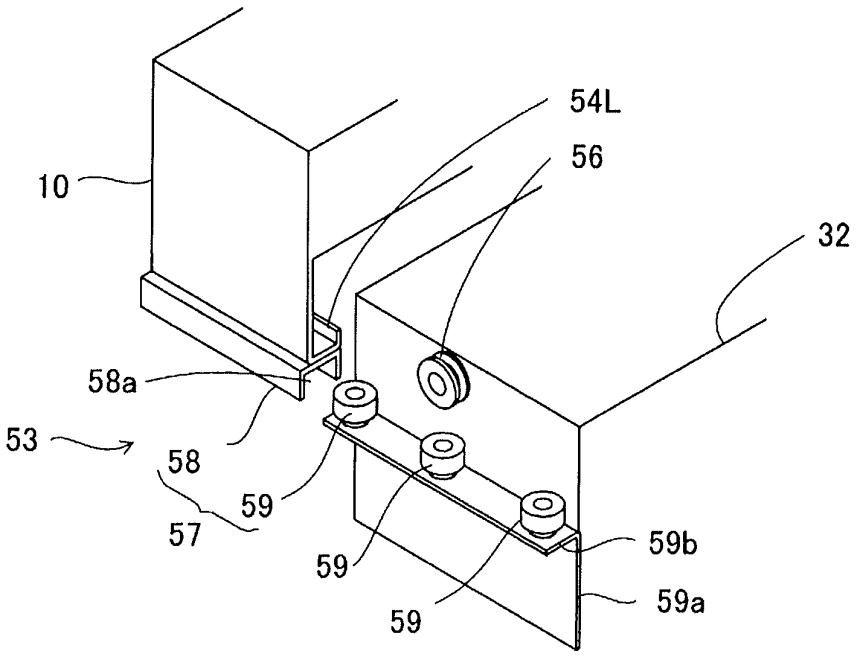


FIG.13

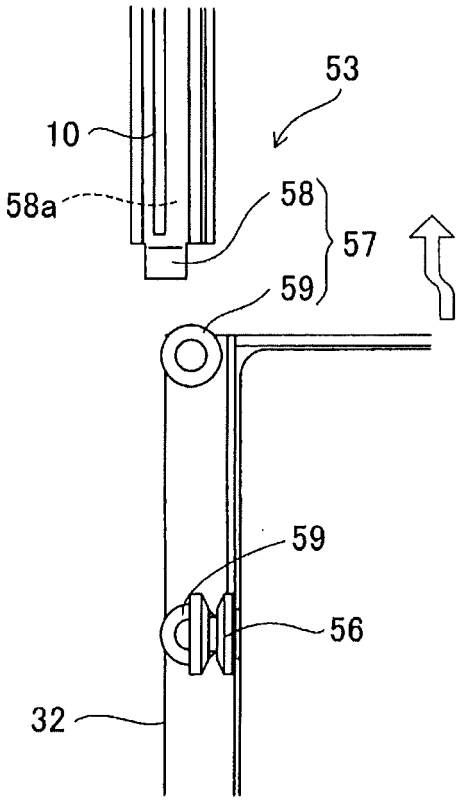

53
10
58a
58
57
59
59
56
32

FIG.14

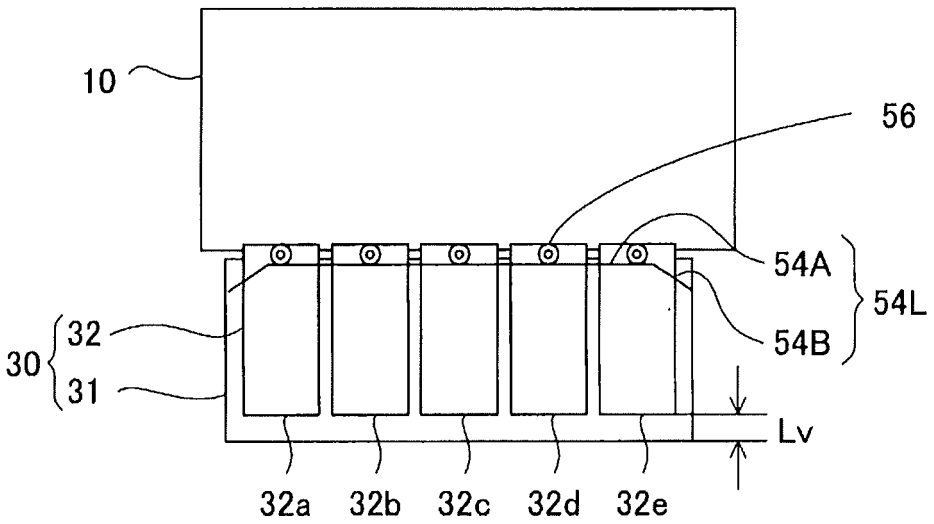

10
56
54A
54L
54B
32
30
31
Lv
32a
32b
32c
32d
32e

FIG.15

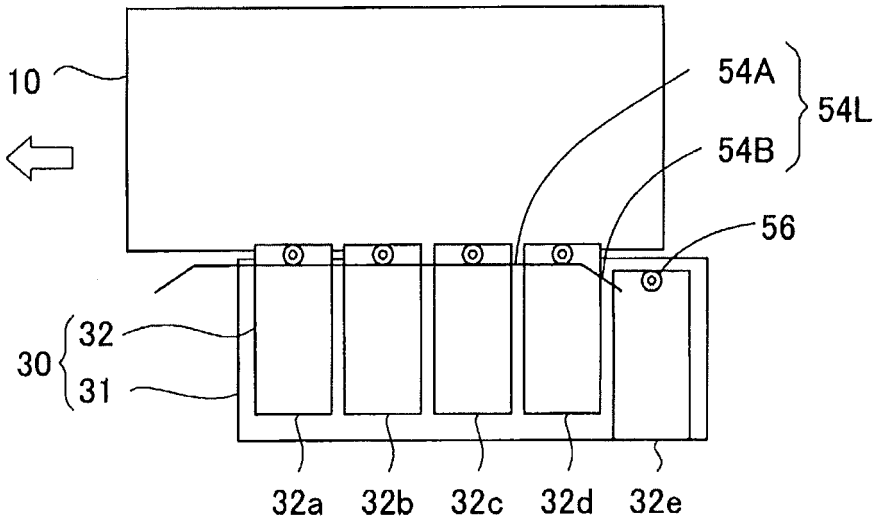

10
54A
54B
54L
56
30
32
31
32a
32b
32c
32d
32e

FIG.16

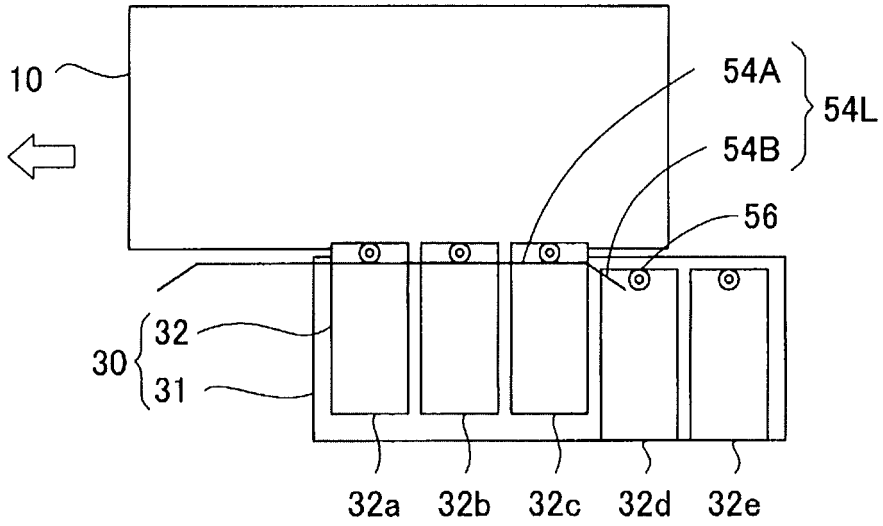

10
54A
54B
54L
56
30
32
31
32a
32b
32c
32d
32e

FIG.17

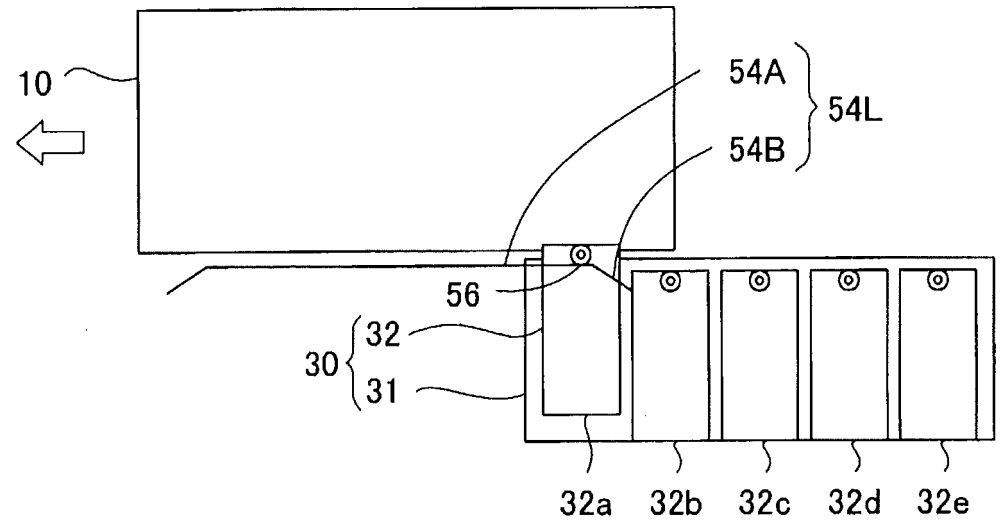

10
54A
54B
54L
56
30
32
31
32a
32b
32c
32d
32e

FIG.18

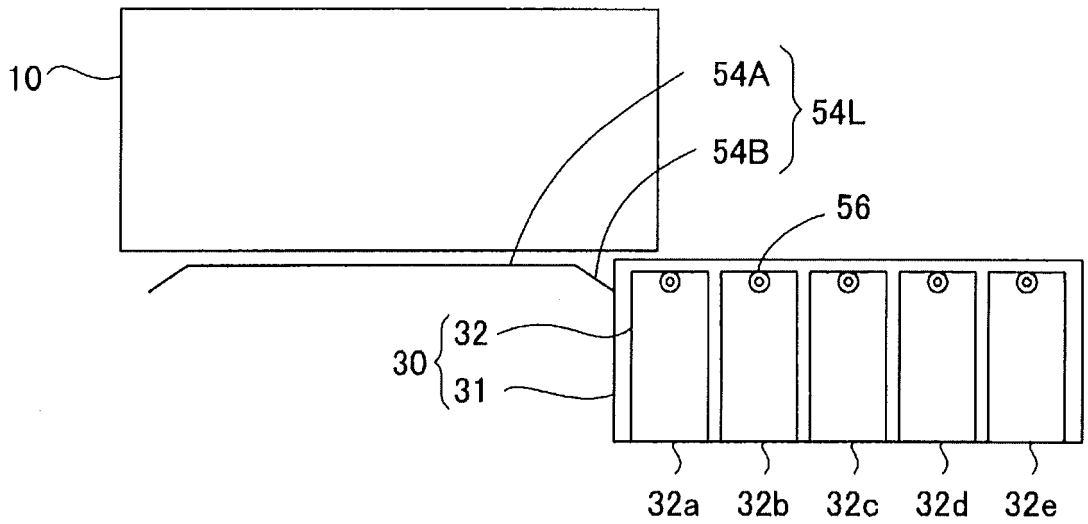

10
54A
54B
54L
56
30
32
31
32a
32b
32c
32d
32e

FIG.19

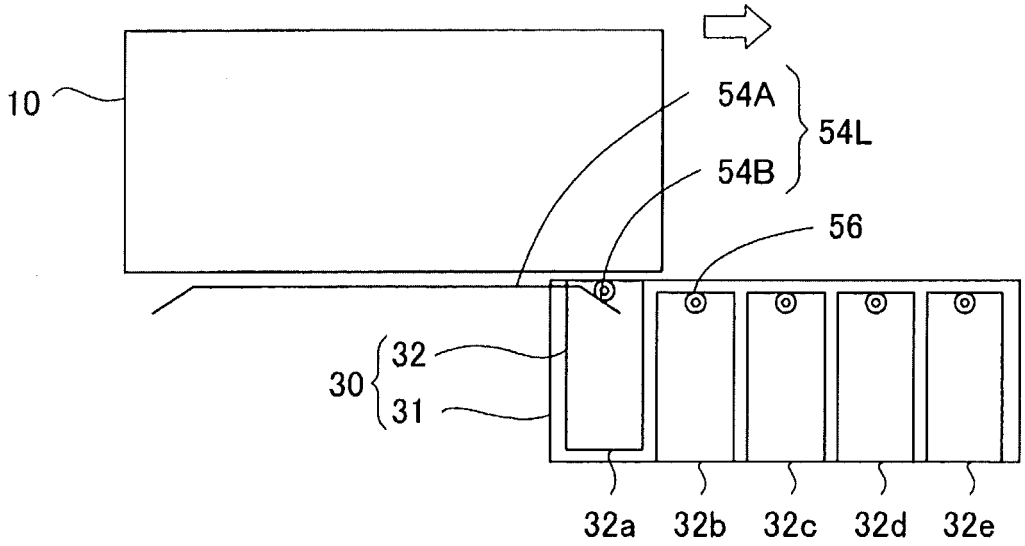

10
54A
54B
54L
56
30
32
31
32a
32b
32c
32d
32e

FIG.20

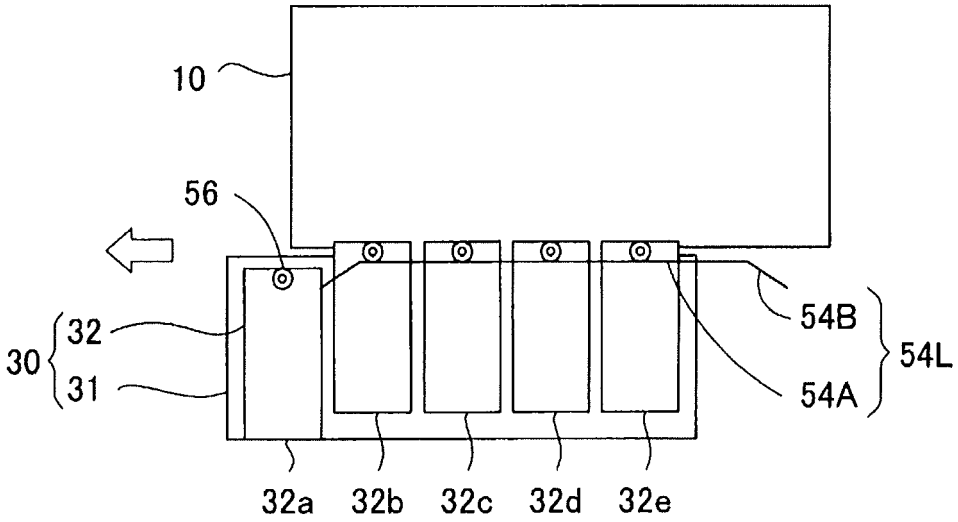

10
56
30
32
31
54B
54A
54L
32a
32b
32c
32d
32e

FIG.21

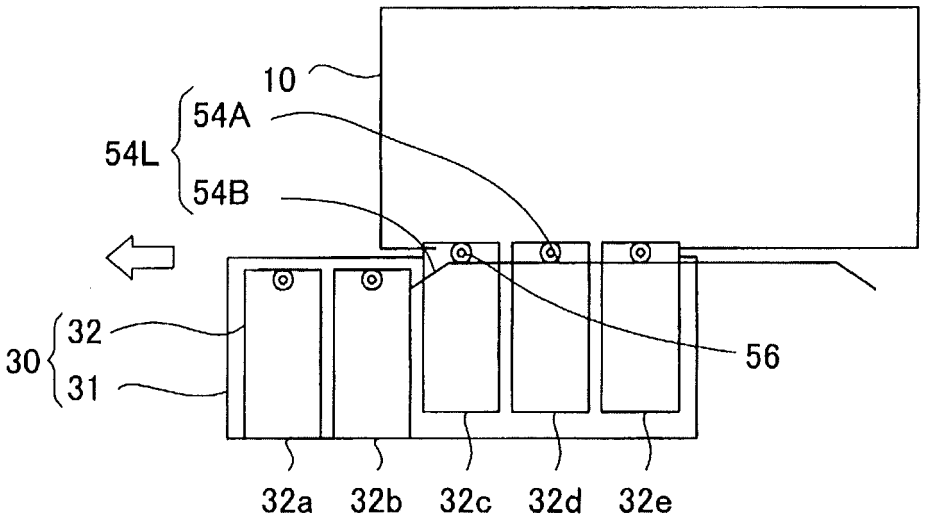

10
54A
54L
54B
56
30
32
31
32a
32b
32c
32d
32e

FIG.22

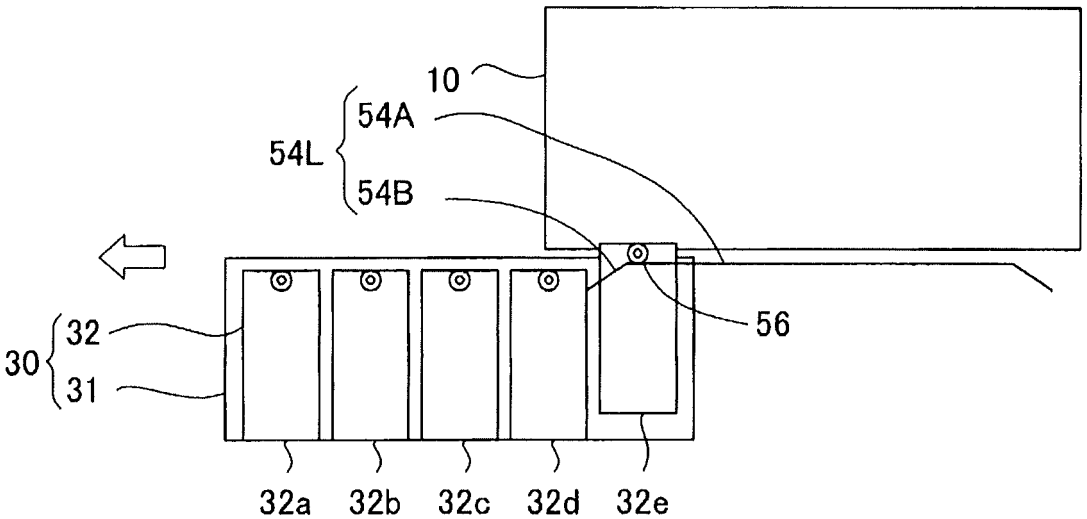

10
54A
54L
54B
56
30
32
31
32a
32b
32c
32d
32e

FIG.23

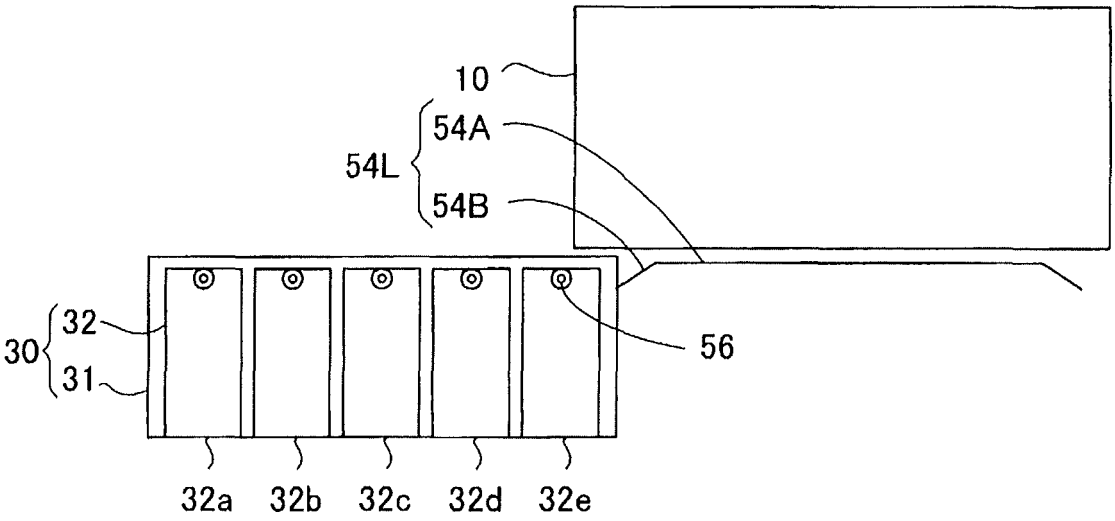


FIG.24

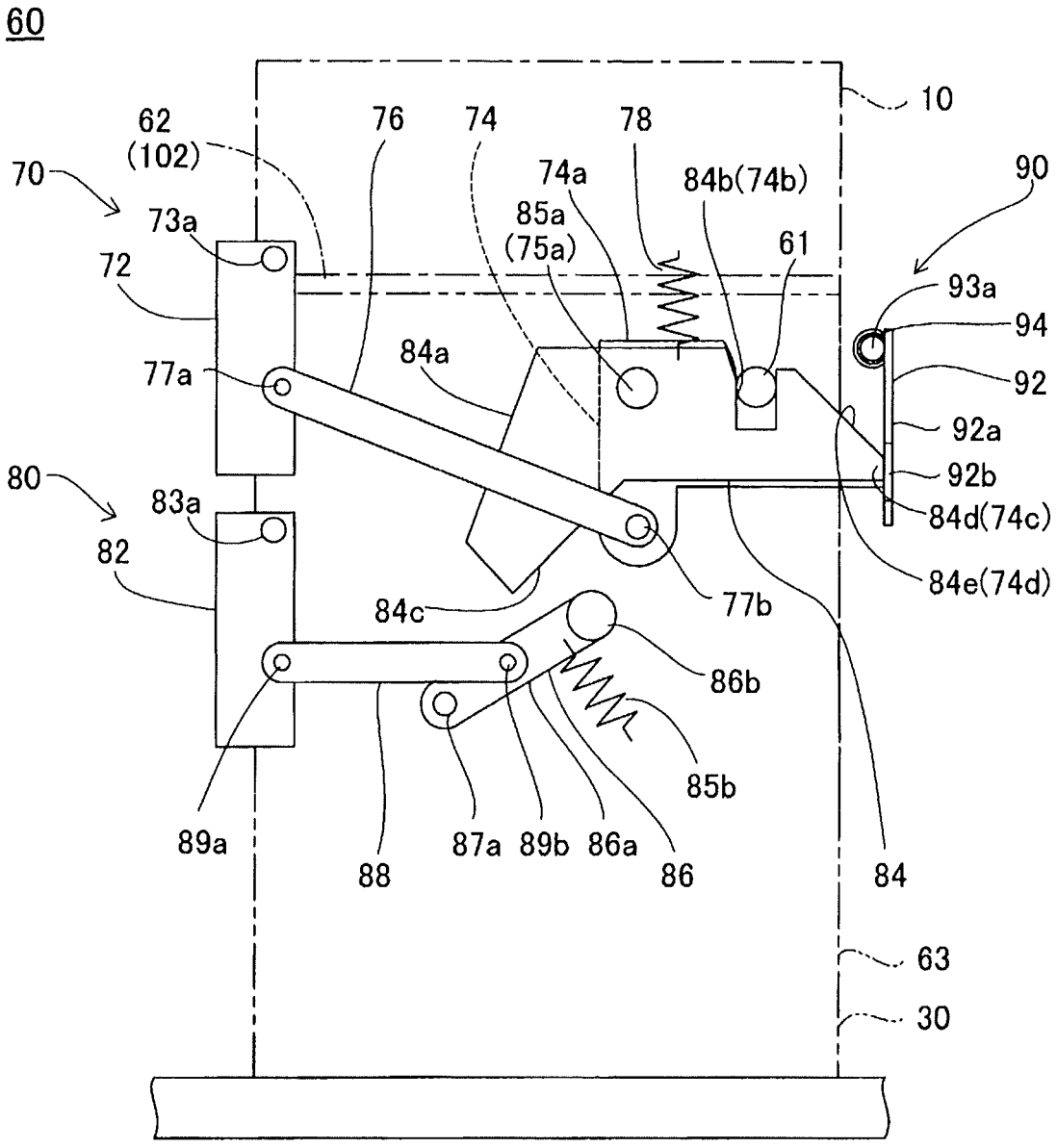

60
10
62
(102)
76
74
78
70
74a
84b(74b)
90
73a
85a
(75a)
61
72
93a
94
84a
77a
92
92a
80
83a
92b
84d(74c)
82
84e(74d)
77b
84c
86b
85b
89a
88
87a
89b
86a
86
84
63
30

FIG.25

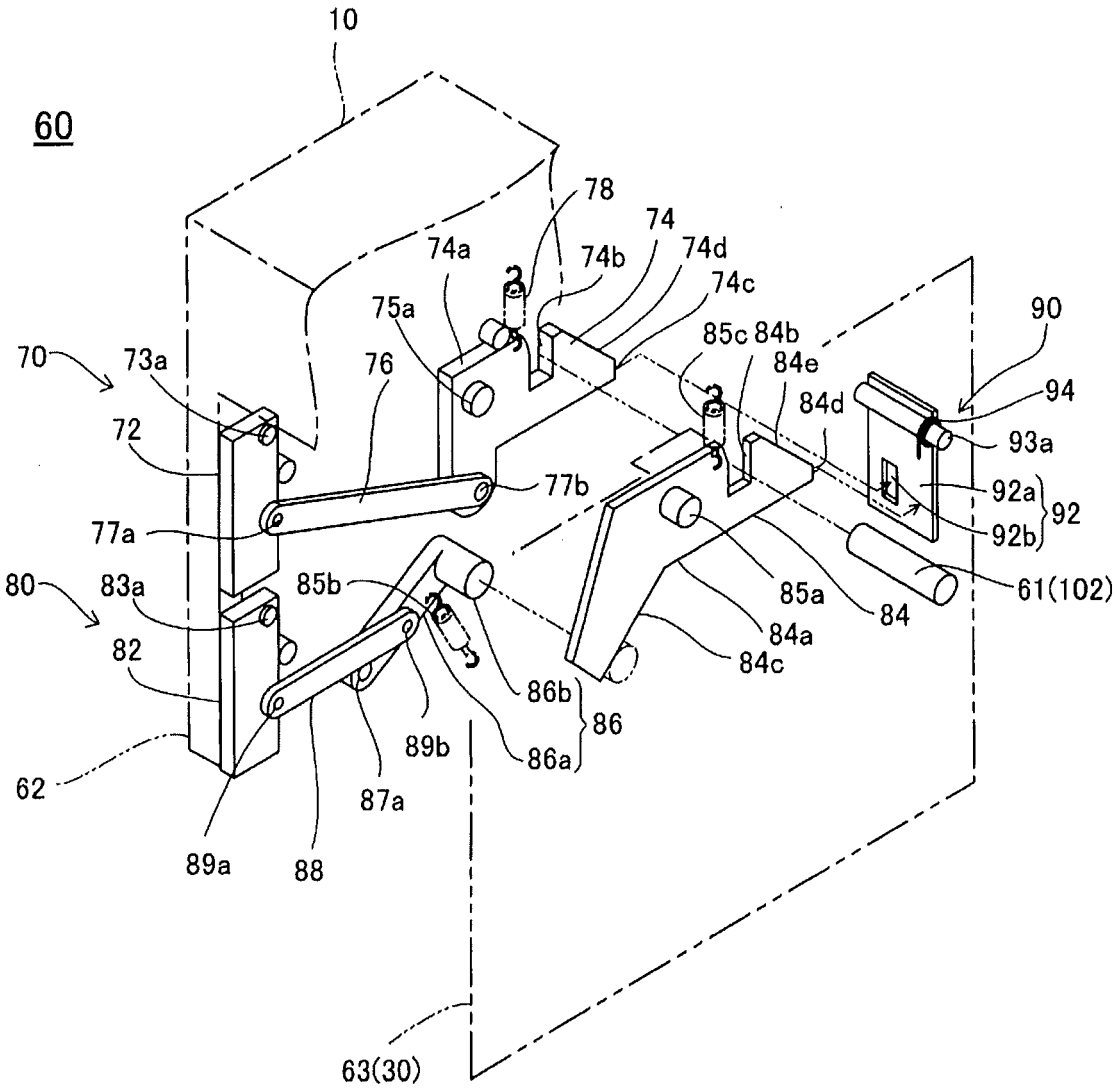

10
60
78
74
74a
74b
74d
74c
75a
90
70
73a
76
85c
84b
84e
94
72
84d
93a
77b
92a
92
77a
92b
80
83a
85b
85a
61(102)
84
84a
82
84c
86b
86
89b
86a
62
87a
89a
88
63(30)

FIG.26

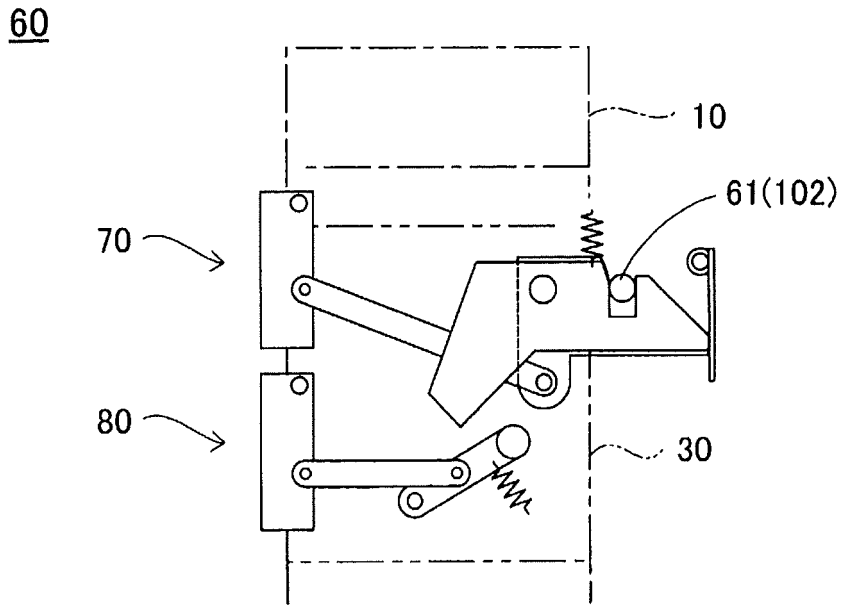

60
10
61(102)
70
80
30

FIG.27

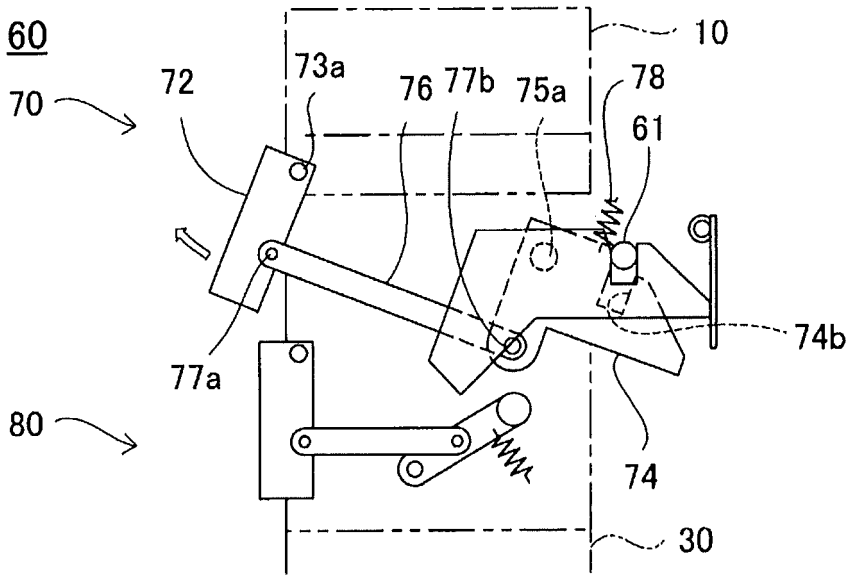

60
10
72
73a
76
77b
75a
78
61
70
74b
77a
80
74
30

FIG.28

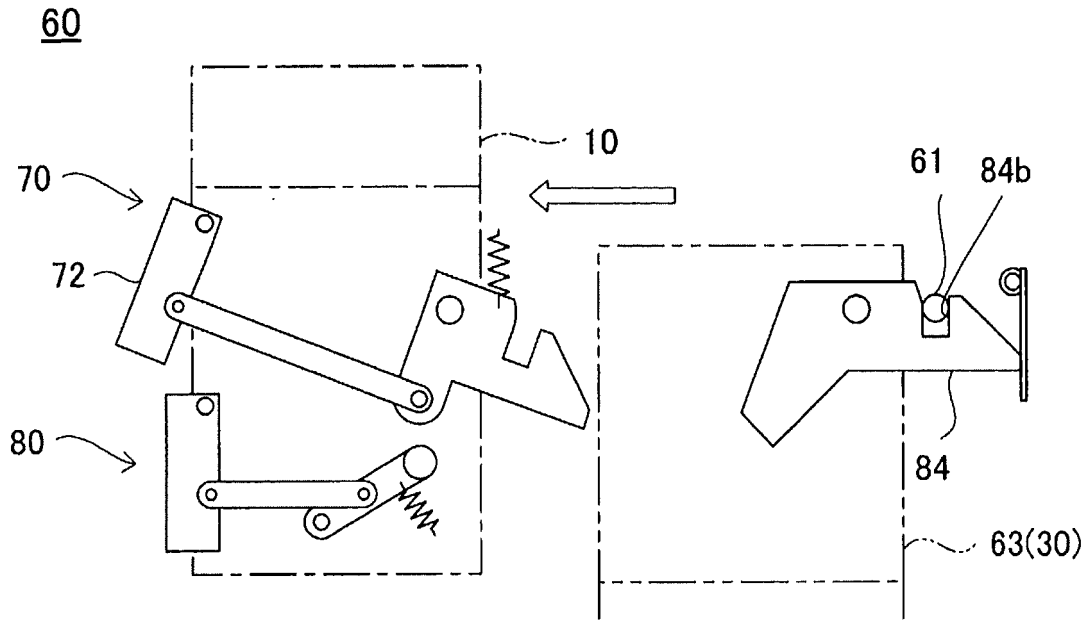


FIG.29

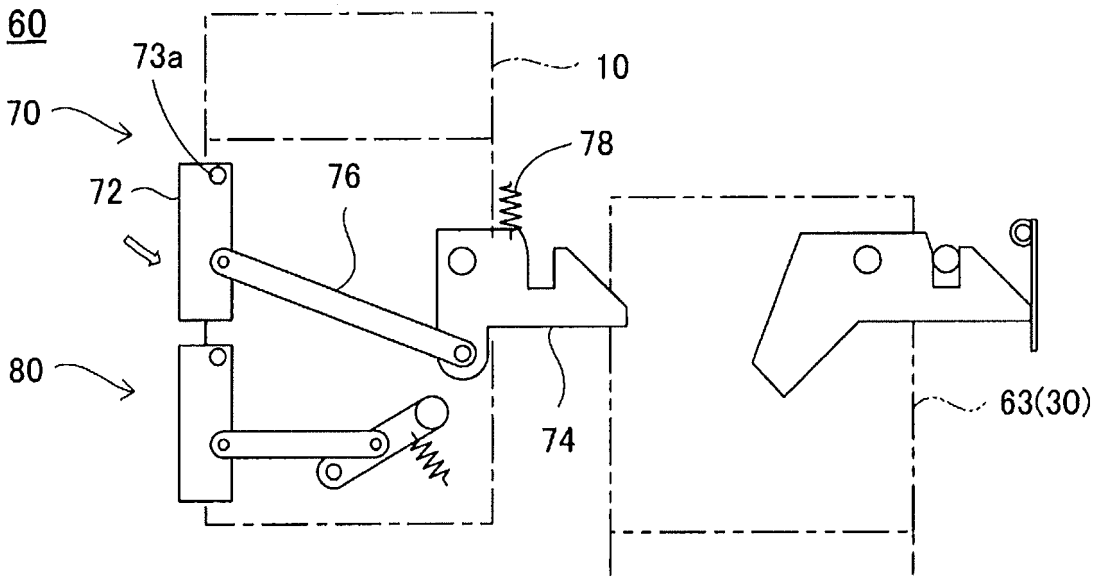


FIG.30

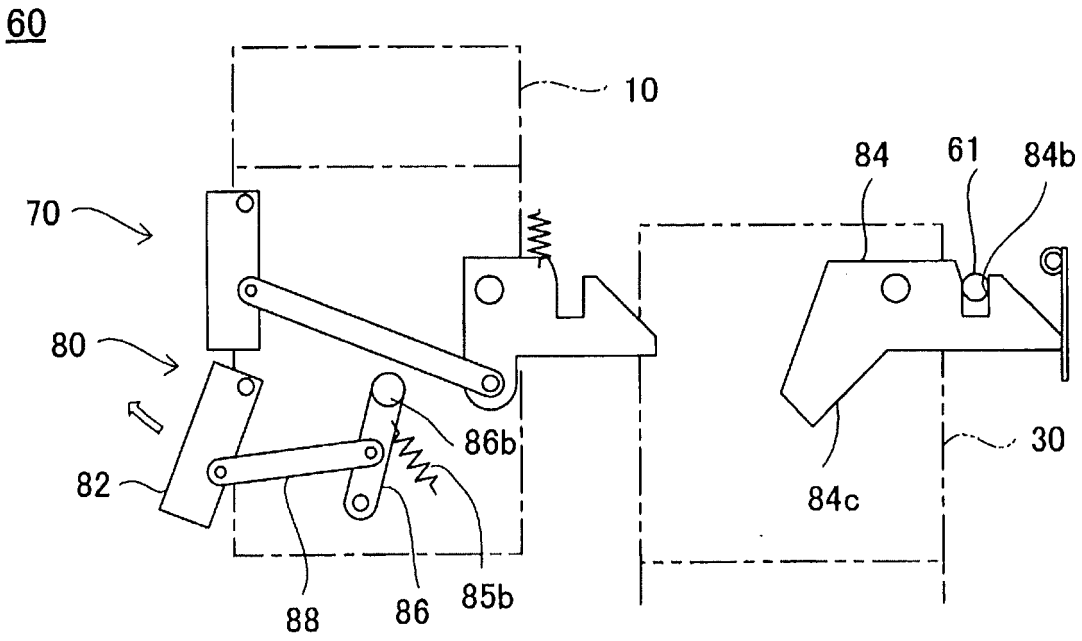

60
10
70
80
82
86b
88
86
85b
84
61
84b
84c
30

FIG.31

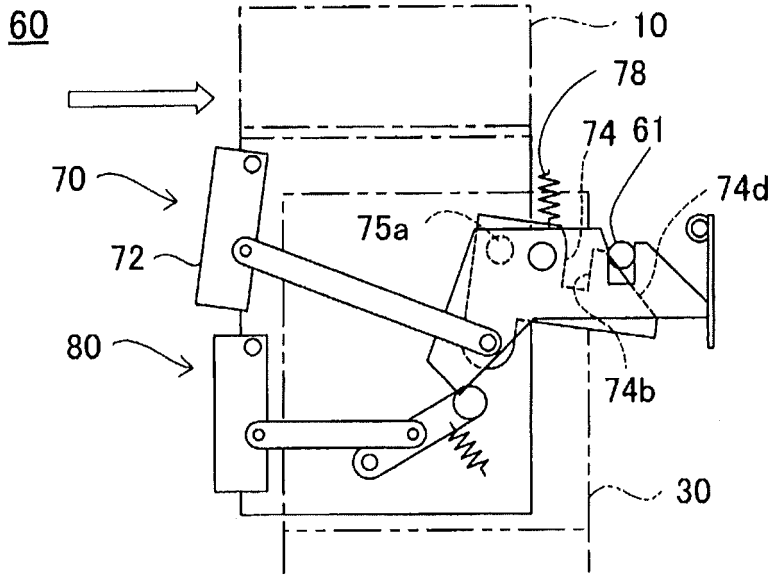

60
10
78
74
61
74d
70
75a
72
80
74b
30

FIG.32

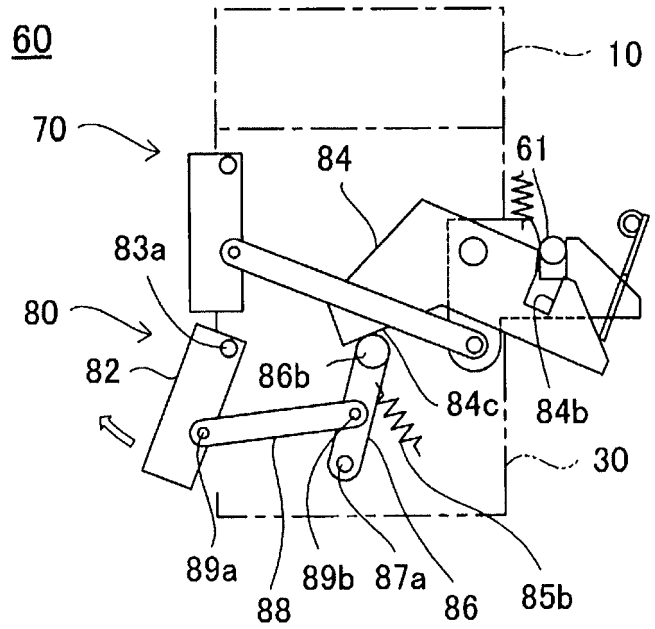

60
10
70
84
61
83a
80
82
86b
84c
84b
30
89a
88
89b
87a
86
85b

FIG.33

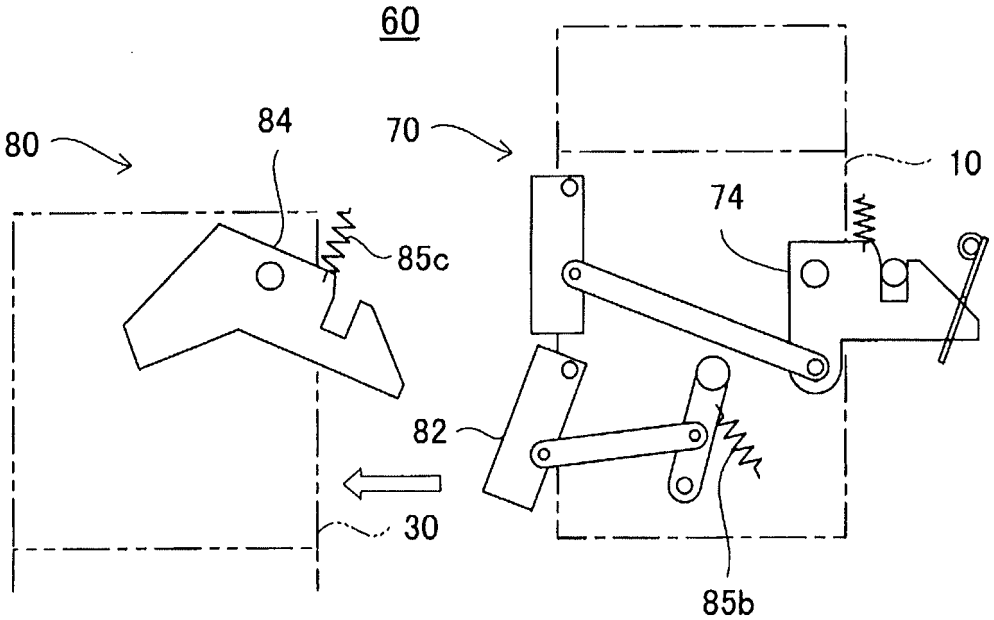

60
80
84
70
10
74
85c
82
30
85b

FIG.34

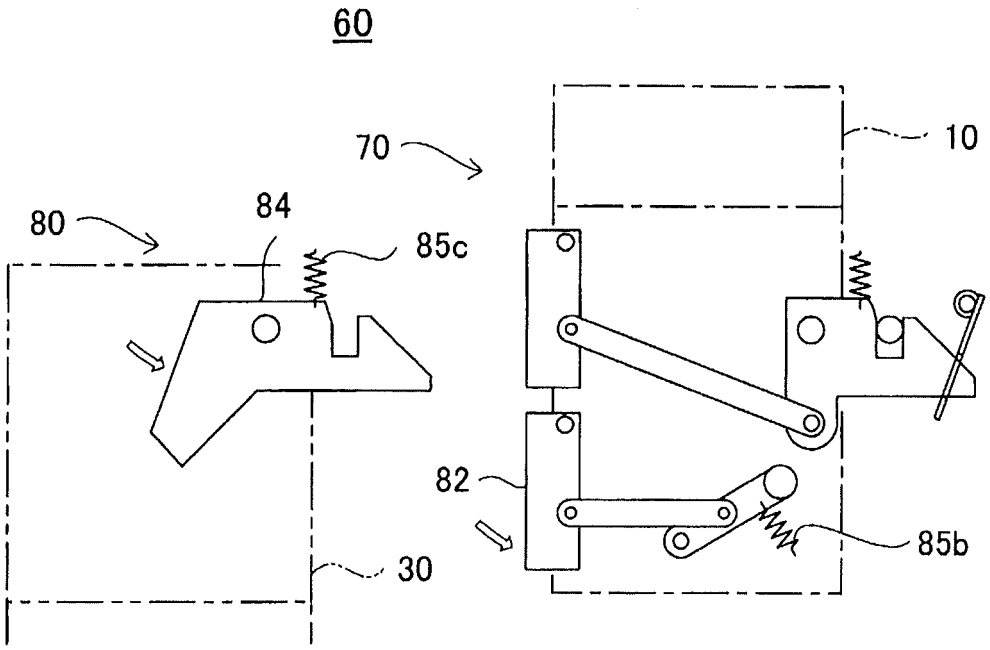

60
70
10
80
84
85c
82
85b
30

FIG.35

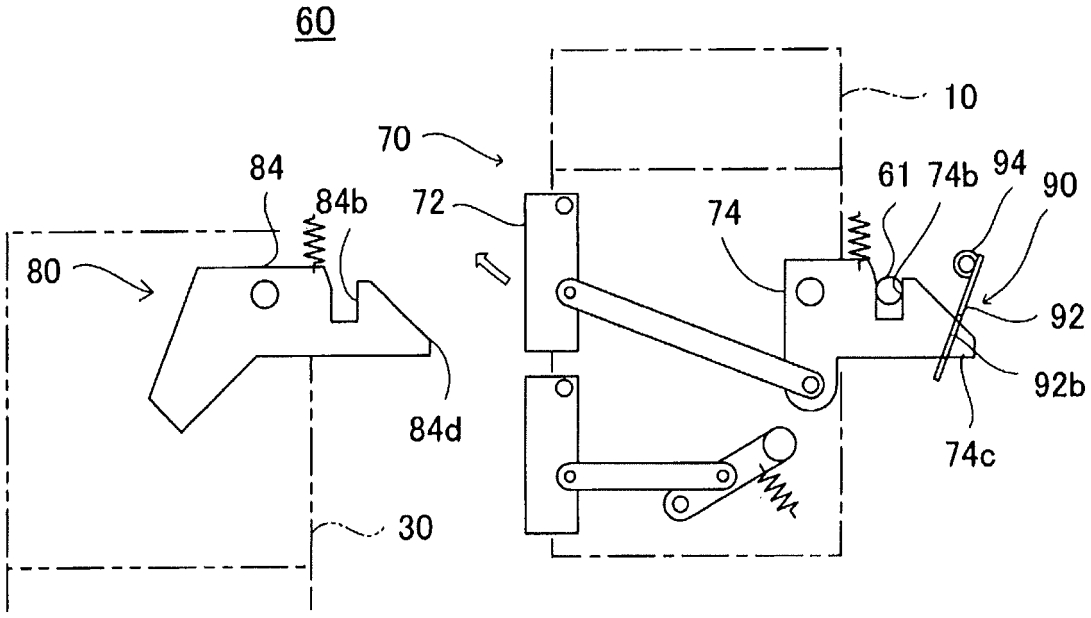
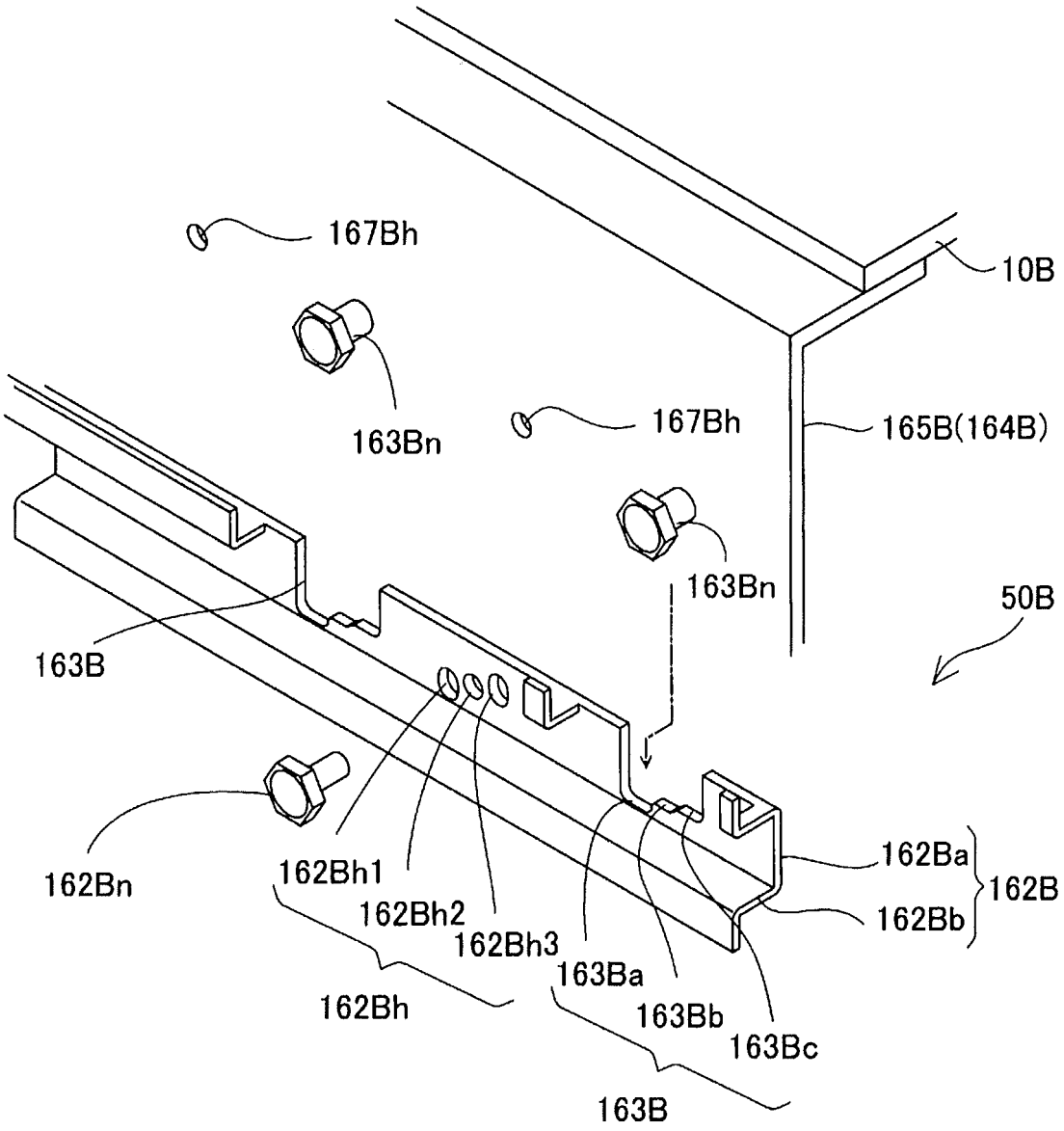

60
10
70
84
84b
72
61
74b
94
90
74
80
92
92b
84d
74c
30

FIG.36


167Bh
10B
163Bn
167Bh
165B(164B)
163Bn
50B
163B
162Bn
162Bh1
162Bh2
162Bh3
162Ba
162Bb
162B
163Ba
163Bb
163Bc
162Bh
163B

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