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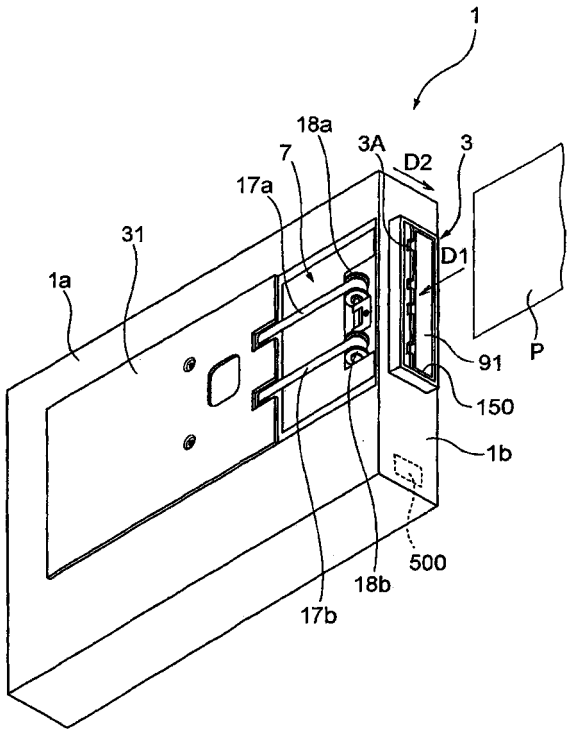
(54) Bill processor

(57) A bill processor includes a housing (1a), a bill insertion slot (3A), a bill transfer mechanism (7), a bill container (60) and a bill pressing mechanism (30). The bill transfer mechanism transfers the bill inserted from the bill insertion slot and discharges the bill toward a bill pushing area (10) positioned downstream. The bill pressing mechanism presses the bill discharged into the bill pushing area toward the bill container. The bill pressing mechanism includes a supporter attached to the housing, a pressing plate movable toward the bill container, a link member joining the supporter and the pressing plate. The link member has an opening and a moving member movable in the opening, and the moving member has a first end portion supported with respect to the supporter and a second end portion engaged with the pressing plate and movable with respect to the supporter.

Fig.1



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Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates to a bill processor which is placed in an arcade where pachinko machines, slot machines, and the like (hereinafter collectively referred to as "game machines") are installed, and is adapted to be arranged between the game machines.

Related Background of the Invention

[0002] In general, for convenience of gamers in arcades such as pachinko parlors, game media lending machines in a tall form (also called "sandwich machines") for lending out pachinko balls and coins (game media) are placed between adjacent game machines in areas where a number of game machines are installed (also called "banks"). Such a game media lending machine is mounted to a frame fixed between the game machines, and actually lends out game media or sends a signal to the game machine in order to lend out the game media when a bill, coin, prepaid card, or the like is inserted through its corresponding insertion slot. For example, a bill processor constructed so as to be able to process bills comprises a bill identifier for identifying bills inserted therein, and a bill container (safe) for accommodating the bills determined valid by the bill identifier.

[0003] The bill processor is also equipped with a mechanism for pushing bills inserted through a bill insertion slot into the bill container. For example, in Japanese Patent Application Laid-Open No. 2002-284368 and Japanese Patent Application Laid-Open No. Hei. 10-21441, a pressing plate for pushing a bill is operated horizontally by way of a pantograph formed by crossing at least one pair of link members.

SUMMARY OF THE INVENTION

[0004] For effectively utilizing the space, arcades are desired to install a lot of game machines efficiently. Accordingly, bill processors placed between the machines as mentioned above are demanded to be made as small as possible. Namely, it is desirable that gaps between adjacent game machines be narrower and that the bill processors be placed efficiently in these gaps.

[0005] However, the above-mentioned Japanese Patent Application Laid-Open No. 2002-284368 and Japanese Patent Application Laid-Open No. Hei. 10-21441 employ a structure in which both sides of a pressing plate are supported with respect to a predetermined supporter by way of a pantograph, whereby a space to be secured for installing and operating the pantograph becomes greater. This causes a problem of increasing the size of the bill processor itself or limiting the space for installing other machines (machines for processing coins and prepaid cards).

[0006] In view of the circumstances mentioned above, it is an object of the present invention to provide a compact bill processor which can accommodate bills in a bill container efficiently and reliably with a tiny space.

[0007] For achieving the above-mentioned object, a bill processor according to the present invention comprises: a housing; a bill insertion slot provided at a front face of the housing and opened for inserting a bill; a bill transfer mechanism for transferring the bill inserted from the bill insertion slot along an inserting direction and discharging the bill toward a bill pushing area positioned downstream; a bill container provided in the housing; and a bill pressing mechanism for pressing the bill discharged into the bill pushing area toward the bill container, wherein the bill pressing mechanism includes: a supporter attached to the housing, a pressing plate movable toward the bill container, a link member joining the supporter and the pressing plate and having an opening and a moving member movable through the opening, the moving member having a first end portion supported with respect to the supporter and a second end portion engaged with the pressing plate and movable with respect to the supporter.

[0008] According to the present invention, the pressing plate for pressing a bill toward the bill container is supported by the link member joining the supporter and the pressing plate and having a moving member movable through the opening, so that the space for installing and operating the bill pressing mechanism including the pressing plate and link member can be reduced, whereby the bill processor itself can be made smaller. Namely, the bill processor according to the present invention can accommodate bills efficiently and reliably in the bill container with a tiny space.

[0009] Moreover, the bill container may include an engaging claw engageable with both longitudinal edge parts of the bill, and the pressing plate may include a flange abuttable against the engaging claw.

[0010] Owing to the above the engaging claw and the flange, the flange causes the pressing plate moved by the moving member to abut against the engaging claw and keeps the pressing plate from being further inserted into the bill container. Even though the pressing plate is supported on only one side by the link member, the pressing plate finally becomes parallel to the supporter (bill) when the flange and the engaging claw abut against each other, whereby a uniform pressure can be exerted on the bill along a longitudinal direction thereof. Namely, bills as a whole can be pressed uniformly, whereby a predetermined number of bills can reliably be accommodated in the bill container even when the bills are folded or when the bills are tenacious (because of an increased number of stacked bills).

[0011] Moreover, the flange of the pressing plate is preferably parallel to the supporter when the flange is abutted against the engaging claw of the bill container.

[0012] Owing to this, in the case where a slight incli-

nation occurs in the front to rear direction in the pressing plate, the inclination is corrected by the abutment of flange and engaging claw mentioned above, whereby bills can reliably be accommodated in the bill container regardless of their conditions (wrinkles, folds, flexures, and the like).

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] Fig. 1 is a perspective view showing the overall structure of a bill processor according to the present invention;

[0014] Fig. 2 is a perspective view showing a state where the lid shown in Fig. 1 is opened and the pressing mechanism is removed;

[0015] Fig. 3 is a plan view showing the inner structure of the bill processor;

[0016] Fig. 4 is an explanatory view showing the structure of a bill pressing mechanism in a state where a pressing plate is opened with respect to the lid;

[0017] Fig. 5 is a view showing a plate driving motor and a deceleration mechanism thereof;

[0018] Fig. 6 is an explanatory view showing the structure of a mechanism for joining the pressing plate to the lid;

[0019] Fig. 7 is views showing operations of the pressing plate, illustrating unpressed state in (a) and pressed state in (b);

[0020] Fig. 8 is a perspective view showing the structure of a mounting tray, wherein (a) and (b) illustrate a state where a bill is discharged into a bill pushing area and a state where bills are stacked, respectively;

[0021] Fig. 9 is a view explaining the pressure plate pushing a bill into the mounting tray, wherein (a), (b), and (c) illustrate the states before pushing the bill, during pushing the bill, and after pushing the bill, respectively;

[0022] Fig. 10 is a view showing the structure of a mounting tray driving mechanism;

[0023] Fig. 11 is a front view showing structures of a shutter mechanism and a lock mechanism;

[0024] Fig. 12 is a perspective view showing the structure of a shutter driving mechanism;

[0025] Fig. 13 is a view explaining the shutter mechanism and the lock mechanism wherein (a) is a side view showing a locked state of the shutter mechanism, and (b) is a side view showing a state when the lock of the shutter mechanism is released;

[0026] Fig. 14 is a block diagram showing a componential example of controller for controlling operations of the bill processor;

[0027] Fig. 15 is a view showing a state where the mounting tray is discharged; and

[0028] Fig. 16 is a view conceptually showing examples of inclinations which may occur in the front to rear direction in the pressing plate.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0029] In the following, an embodiment of the present invention will be explained with reference to the drawings.

[0030] Figs. 1 to 3 are views showing structures of the bill processor in accordance with the embodiment. Fig. 1 is a perspective view showing the overall structure, Fig. 2 is a view showing a state where the lid shown in Fig. 1 is opened and the pressing mechanism is removed. Fig. 3 is a plan view showing the inner structure.

[0031] The bill processor 1 is constructed so as to be mountable to a game media lending machine installed between game machines such as pachinko machines (not depicted), for example. In this case, while the game media lending machine is mounted with other devices (e.g., coin identifier, recording media processor, and power supply) on the upper or lower sides of the bill processor 1, the bill processor 1 may be constructed integrally with or separately from these devices. Alternatively, the bill processor 1 may be placed alone or together with the above-mentioned devices in spaces other than the gap between the game machines. When a bill is inserted in such a bill processing machine and is determined valid, processing for lending game media corresponding to the value of the bill, writing into a recording medium, and the like are performed.

[0032] As shown in Figs. 1 and 2, the bill processor 1 is equipped with a housing 1a formed into a rectangular parallelepiped, whereas the housing 1a is attached to an engaging part of a game media lending machine which is not depicted. The front face (the face to be exposed) 1b of the housing 1a is formed with a bill processing area 3. The bill processing area 3 comprises a bill insertion slot 3A opened like a slit into which a bill P is inserted, and a shutter 91 which can be opened and closed so that a mounting tray (bill container) 60, which is provided in the housing 1a and stacks bills P, can be discharged. In this case, the bill P is inserted into the bill insertion slot 3A along the direction of arrow D1 while in a state where the shorter side of the bill is oriented vertically (in the erect state).

[0033] As clearly shown in Fig. 3, a bill identifier 5 for determining whether the inserted bill P is valid or not and a bill transfer mechanism 7 for transferring the inserted bill P are provided within the housing 1a. The bill identifier 5 is placed at a position near the bill insertion slot 3A in the inserting direction D1, whereas the bill transfer mechanism 7 is provided over a region extending from the bill identifier 5 along the inserting direction D1. In this case, the bill transfer mechanism 7 is equipped with a function of transferring the inserted bill P while holding the same, and has such dimensions as to be contained within a region shorter than the longitudinal length of the bill P, preferably within a half of the length of the bill P at a position near the bill insertion slot 3A in the inserting direction D1.

[0034] Provided on the downstream side of the bill

transfer mechanism 7 is a bill pushing area 10 for sliding the bill P, which is discharged by a downstream roller pair of the bill transfer mechanism 7.

The bill transfer mechanism 7 has substantially the same size as with the bill P so that the bill P discharged from the downstream roller pair can be transferred as it is in the direction of arrow D2 orthogonal to the discharging direction without any restrictions. Thus, the bill pushing area 10 is positioned on the downstream side of the bill transfer mechanism 7, whereas a bill pressing mechanism 30 and the mounting tray 60 are provided on one side and the other side of the housing 1a, respectively, so as to hold the bill pushing area 10 therebetween (see Fig. 2). Namely, as will be explained later, the bill P discharged into the pushing area 10 when the bill transfer mechanism 7 is driven is pressed as it is in the direction of arrow D2 by the pressing plate of the bill pressing mechanism 30, so as to be successively stacked into the mounting tray 60.

[0035] As Fig. 3 clearly shows in particular, the bill transfer mechanism 7 comprises a pair of transfer belts 17a, 17b which extend along the bill inserting direction D1 and are placed with a predetermined gap therebetween. The transfer belts 17a, 17b have respective one ends wound about tension rollers 18a, 18b attached to a shaft 18 which is rotatably supported by an inner frame 1d on the bill insertion slot 3A side, and the respective other ends wound about tension rollers 19a, 19b attached to a shaft 19 which is rotatably supported by the inner frame 1d on the inner side of the bill identifier 5.

[0036] The shaft 19 is driven to rotate by a transfer motor 20 mounted to the inner frame 1d. Namely, the shaft 19 is driven to rotate by way of a gear 20G fixed to a driving shaft of the transfer motor 20 and a gear 19G which is in mesh with the gear 20G and fixed to an end part of the shaft 19. The transfer motor 20 is driven by the controller, which will be explained later, so as to rotate normally/reversely, thereby functioning as a driving source for the bill transfer mechanism 7.

[0037] Pinch rollers 21a, 21b and 22a, 22b abut against the tension rollers 18a, 18b and 19a, 19b, respectively (see Fig. 2). Namely, the bill P inserted into the bill insertion slot 3A is transferred while being held between the transfer belts 17a, 17b and the pinch rollers 21 a, 21 b and 22a, 22b abutting thereagainst, and is finally discharged into the bill pushing area 10 through a nip part between the pinch rollers 22a, 22b and the transfer belts 17a, 17b.

[0038] The bill identifier 5 is equipped with a sensor board 5A, which is provided with a bill insertion sensor 25 positioned nearer to the bill insertion slot 3A than the shaft 18. The bill insertion sensor 25 is constituted by an optical sensor, for example, and detects the insertion of the bill P into the bill insertion slot 3A. When the bill insertion sensor 25 detects the insertion of the bill P, the controller, which will be explained later, drives the transfer motor 20 so as to rotate in the bill feeding direction (rotate normally).

[0039] Between the shafts 18 and 19, the sensor board 5A is provided with bill identification sensors 26. Each bill identification sensor 26 is constituted by an optical sensor so as to emit light to the bill P transferred by the bill transfer mechanism 7. The bill identification sensors 26 are placed at a plurality of positions along a direction orthogonal to the bill inserting direction D1, and sends detection data obtained by light reflected by or transmitted through the bill P to a CPU of the controller to be explained later. The CPU compares the detection data with data concerning a normal bill stored beforehand in a ROM, and determines whether the inserted bill is valid or not.

[0040] As mentioned above, the bill pressing mechanism 30 is provided on one side of the housing 1a with respect to the bill pushing area 10. The bill pressing mechanism 30 comprises a lid 31 as a supporter attached to the housing 1a such as to be openable and closable, a planar pressing plate 32 which is attached to the lid 31 and presses the bill P in the direction of arrow D2 when the bill P is located in the bill pushing area 10 while the lid 31 is closed with respect to the housing 1a, and a plate driving motor 33 for driving the pressing plate 32.

[0041] The structure of the bill pressing mechanism 30 will now be explained with reference to Figs. 4 to 7. In these drawings, Fig. 4 is an explanatory view showing the state where the pressing plate 32 is opened with respect to the lid 31. In Fig. 4, a part of the pressing plate 32 (flanges 32c) is omitted for the purpose of explanation. Fig. 5 is an explanatory view showing structures of the plate driving motor 33 and a deceleration mechanism 37 of the plate driving motor 33. Fig. 6 is an explanatory view showing the structure of a mechanism for joining the pressing plate 32 to the lid 31 (while omitting the control circuit board and the like), and Fig. 7 are views showing operations of the pressing plate 32 in the unpressing state shown in (a) and the pressing state shown in (b).

[0042] The pressing plate 32 has substantially the same size as that of the bill P, and is supported rotatably with respect to the lid 31 so as to be movable in the direction of arrow D2 by a link member 35 joining the rear face on one end side of the pressing plate 32 and the rear face on the other end side of the lid 31 to each other (see Fig. 6). Both end parts of the link member 35 are rotatably supported by shafts 31A, 32A attached to the lid 31 and pressing plate 32, respectively (that is, the pressing plate 32 is supported by only one side of the lid 31 via the link member 35), whereby the pressing plate 32 is supported by the link member 35 so as to move toward/away from the lid 31 as shown in Figs. 6 and 7.

[0043] As shown in Fig. 4, the plate driving motor 33 is placed on the rear face of the lid 31, whereas the pressing plate 32 is driven in a reciprocating fashion in the direction of arrow D2 when the plate driving motor 33 is driven to rotate a depressing arm 38 attached to the center portion of the lid 31.

[0044] Specifically, the rear face of the lid 31 is provided with the deceleration mechanism (gear train) 37 for

decelerating the rotation of the plate driving motor 33 and transmitting the decelerated rotation toward the pressing plate 32, and the depressing arm 38 as a moving member rotatably driven by a final gear 37a of the deceleration mechanism 37 (see Figs. 4 and 5). As apparent from Figs. 4 and 5, the depressing arm 38 is supported at a base end part thereof (a first end portion of the moving member) with respect to the lid 31 and rotatably driven about the base end part since the final gear 37a is attached to the base end part, whereas a leading part (a second end portion of the moving member) is mounted with an engaging protrusion 38a. The engaging protrusion 38a engages with a long groove 32b formed in a protruded member 32a attached to the rear face of the pressing plate 32. When the depressing arm 38 is driven to rotate about the base end part, the engaging protrusion 38a is displaced along the long groove 32b and moves upward and downward with respect to the lid 31. Accordingly, the pressing plate 32 is driven in a reciprocating fashion along the direction of arrow D2 while keeping its parallel state. In addition, the flanges 32c of the pressing plate 32 are parallel to the lid 31 when the flanges 32c are abutted against engaging claws 61c of the mounting tray 60 (See Figs. 7 to 9). For favorably maintaining the parallel reciprocation of the pressing plate 32, the depressing arm 38 pressing the pressing plate 32 at one position is prevented from rotating by 45° or more. As shown in Fig. 4, the protruding member 32a is exposed through the opening 35a formed in the link member 35 and is placed so as not to interfere with the link member 35. The deceleration mechanism 37 is constructed by combining a number of small gears, which reduces the size of the deceleration mechanism 37.

[0045] The pressing plate 32 has such a form as to descend by a predetermined length in the pressing direction (direction D2), whereas flanges (overhangs) 32c are longitudinally formed on both sides thereof. Consequently, when driven downward by the depressing arm 38, the pressing plate 32 enters an opening of the tray 60 which will be explained later. While the pressing plate 32 is on the inside of the opening to a certain extent, the flanges 32c abut against engaging claws 61c of the mounting tray 60 which will be explained later, thereby preventing the pressing plate 32 from further entering the opening of the mounting tray 60 (see Fig. 9). In the case where such flanges 32c are provided, even though the pressing plate 32 is supported on only one side by the link member 35, the pressing plate 32 finally becomes parallel to the bill P when the flanges 32c and the engaging claws 61 c abut against each other, whereby a uniform pressure can be exerted on the bill P along a longitudinal direction thereof. Also, slight inclinations may occur in the front to rear direction even when the pressing plate 32 is held parallel by the depressing arm 38, but such inclinations are corrected, whereby the bill P can reliably be accommodated in the mounting tray 60 regardless of their conditions (wrinkles, folds, flexures, and the like).

[0046] As can be seen from the foregoing, the pressing plate 32 is supported on only one side with respect to the lid 31 by way of the link member 35 in this embodiment. Therefore, slight inclinations may occur in the front to rear direction in the pressing plate 32 even though it is held parallel by the depressing arm 38. Two examples of such a case are conceptually shown in (a) and (b) of Fig. 16. In these examples, the flanges 32c and engaging claws 61c are provided such that the pressing plate 32 finally becomes parallel to the bill P (lid 31) so as to be able to exert a uniform pressure on the bill P even if such a state (where an inclination occurs in the front to rear direction in the pressing plate 32) is caused.

[0047] In this embodiment, a control circuit board 40 (constituting controller; control means) for controlling the driving of various driving mechanisms in the bill processor 1 is attached to the rear face of the lid 31. An optical sensor (rotation detecting sensor) 42 for detecting the amount of rotation of the depressing arm 38 is connected to the control circuit board 40 (see Figs. 4 and 5), and controls the plate driving motor 33 such as to stop driving the plate driving motor 33 when the amount of rotation of the depressing arm 38, i.e., the amount of descent of the pressing plate 32, reaches a predetermined threshold. This prevents unnecessary loads from acting on the plate driving motor 33.

[0048] As shown in Figs. 2 and 3, the mounting tray 60 is provided on the other side of the housing 1a with respect to the bill pushing area 10. The mounting tray 60 is constructed such as to successively stack the bills P pressed by the pressing plate 32. The structure of the mounting tray 60 will now be explained with reference to Figs. 8 and 9.

[0049] The mounting tray 60 has a body 61 comprising a bottom wall 61a and side walls 61b formed on both sides of the bottom wall 61a. A mounting plate 62 for mounting a bundle of bills is provided between the side walls 61b of the body 61, and is pressed by a biasing spring 63 placed between the mounting plate 62 and the bottom wall 61a of the body 61. A pair of engaging claws 61 c extending along the longitudinal direction of the bill P to be accommodated are respectively formed on the side walls 61b so as to project inward at the end parts on the opening side. As shown in Figs. 8(a) and 9(a), the engaging claws 61 c function to sort bills discharged into the bill pushing area 10 by way of the bill transfer mechanism 7 from the bundle of bills contained in the body 61. Namely, when a bill P discharged into the bill pushing area 10 is pressed by the pressing plate 32, the bill P is transferred above the mounting plate 62 while being flexed at the center by the engaging claws 61c as shown in Fig. 9(b). Having ridden over the engaging claws 61c, the bill P is mounted onto the mounting plate 62 against the urging force of the biasing spring 63 as shown in Figs. 8(b) and 9(c). When the pressing plate 32 returns to the initial position, both end parts of the bundle of bills stacked on the mounting plate 62 are pressed against the pair of engaging claws 61c under the urging force of the biasing spring 63. This forms a gap R between the

topmost bill in the bills stacked on the mounting plate 62 and the pressing plate 32 as shown in Fig. 9(a), whereby sorting is done. The gap R is used for receiving the bill P discharged thereafter by way of the bill transfer mechanism 7. As mentioned above, the bill P fed to the gap R is stacked into the mounting tray 60 when the pressing plate 32, located at the initial position, is driven.

[0050] A jam may occur if the bill P has wrinkles and the like when the gap R is too wide, whereas the bill P may not be fed stably when the gap R is too narrow. Specifically, a preferred size of the gap R falls within the range of about 3 to 5 mm. Preferably, the bill pressing mechanism 30 and the mounting tray 60 are arranged so as to form such a gap R in the bill pushing area 10.

[0051] In this embodiment, the bill P stacked in the main body 61 of the mounting tray 60 is held by the urged mounting plate 62 and the engaging claws 61 c, whereas such a structure exposes the front end side of the bundle of bills (see (b) in Fig. 8). Therefore, the leading end part of the bundle of bills stacked on the mounting plate 62 is exposed (see Fig. 15) when the mounting tray 60 is driven such that the front end side thereof projects out of the front face 1b of the housing 1a as will be explained later, whereby an operator can easily pull out the bundle of bills in front thereof, so as to perform a collecting operation.

[0052] Specifically, as shown in Fig. 8(b), it will be preferred if the longitudinal length (i.e., the length of the bill mounting surface) of the body 61 (mounting plate 62) is formed shorter than the length of the bill P to be inserted. When the length of the mounting plate 62 is thus made shorter, the bundle of bills stacked thereon expose the upper and lower faces on the leading end side, whereby the operator can easily pick and pull out the bundle of bills. Such a structure keeps the operator from touching the mounting plate 62 formed from a metal such as SUS with fingers; therefore, the safety during the collecting operation is improved. As shown in Fig. 8, a recession 62a may be formed at the center of the leading edge of the mounting plate 62. Such a configuration also makes it easier to grasp the bundle of bills, whereby the operations and effects mentioned above can be obtained.

[0053] On the leading end side of both side walls 61b of the body 61, cutouts 61d extending in the bill inserting direction are formed over a predetermined range in the portions opposing the housing 1a. When the shutter 91 is opened by a shutter mechanism which will be explained later, while the mounting tray 60 is driven to project, such cutouts 61d can keep the opened shutter 91 and the body 61 from interfering with each other, whereby the space efficiency can effectively be improved. In the mounting tray 60, a bill detecting sensor 128 (see the block diagram of Fig. 14) for detecting the existence of the bill P may be mounted on the mounting plate 62.

[0054] With reference to Figs. 3 and 10, a mounting tray driving mechanism 70 for driving the mounting tray 60 will now be explained.

[0055] The mounting tray driving mechanism 70 comprises a tray driving motor 71 fixed to the inner frame 1d of the housing 1a, and a driving shaft (worm shaft) 72 which is driven by the tray driving motor 71 to rotate. The driving shaft 72 is rotatably supported by the inner frame 1d so as to extend in the bill inserting direction (D1) and has an outer peripheral face formed with a male thread 72a. On one end side, the driving shaft 72 is connected to the output shaft of the tray driving motor 71 by way of a gear train 73.

[0056] A connector 66 is formed at the rear end part of the body 61 of the mounting tray 60, whereas a sliding member 75 arranged so as to surround the driving shaft 72 is joined to the connector 66. The sliding member 75 is formed with a female thread (not depicted) in mesh with the male thread 72a of the driving shaft 72, whereby the sliding member 75, i.e., the mounting tray 60, can be driven to reciprocate axially. For preventing the sliding member 75 from rotating during its reciprocating movement, a guide rod 76 arranged parallel to the driving shaft 72 is inserted through the sliding member 75.

[0057] The mounting tray driving mechanism 70 is provided with moving amount detector 80 which can detect the amount of movement of the mounting tray 60. The moving amount detector 80 can be constructed, for example, by a disk-shaped rotor 81 attached to the opposite side of the output shaft of the tray driving motor 71 and a rotational amount sensor (photosensor) 82 arranged so as to hold the rotor 81 with a predetermined gap. The rotor 81 is formed as an encoder 81 a provided with a plurality of detection openings at predetermined intervals along its circumferential direction. When the encoder 81a (rotor 81) rotates as the tray driving motor 71 revolves, pulses corresponding to the amount of rotation can be obtained by the rotational amount sensor 82. Therefore, the amount of movement of the mounting tray 60 can be grasped from the number of pulses. Providing such moving amount detector 80 makes it possible to accurately control the position at which the mounting tray 60 stops in the projecting direction, and alleviate the load on the tray driving motor 71.

[0058] The mounting tray driving mechanism 70 is further equipped with position detector 85 which can detect an accommodating position of the mounting tray 60 (a position where bills can be contained; containing position). Such position detector 85 can be constructed, for example, by attaching a latch (not depicted) to the sliding member 75 for driving the mounting tray 60 and providing the inner frame 1d with a limit switch 86 which turns ON/OFF when the latch comes into/out of contact therewith. Providing such position detector 85 makes it possible to grasp the state of the mounting tray 60 (whether it is at the accommodating position or a collecting position), and appropriately drive the mounting tray 60 during the bill collecting operation.

[0059] In this embodiment, the bill P stacked in the mounting tray 60 can be collected when a shutter mechanism 90 arranged adjacent to the bill insertion slot 3A in the bill processing area 3 is driven to open. The struc-

ture of the shutter mechanism 90 will now be explained with reference to Figs. 2, 3, and 11 to 13.

[0060] The shutter mechanism 90 comprises the shutter (shielding plate) 91 for closing a rectangular opening formed in the bill processing area 3, and a shutter driving mechanism 92 for driving the shutter 91 to rotate. The shutter 91 is constructed as a substantially rectangular plate, whereas a base end part thereof is fixed to a shaft 91a rotatably supported by the inner frame 1d of the housing 1a.

[0061] The shutter driving mechanism 92 is equipped with a shutter driving motor 95, which is connected to the shaft 91a by way of a gear train 96 constituting a deceleration mechanism connected to a driving shaft 95a of the shutter driving motor 95 and arm-like link members 97a, 97b successively connected to the gear train 96. Therefore, when the shutter driving motor 95 is driven to rotate the driving shaft 95a, its rotational driving force is decelerated by the gear train 96. The shaft of the link member 97a is connected to an output gear 96a of the gear train 96. When the shutter driving motor 95 is driven to rotate normally, the link member 97a is driven to rotate from the state shown in Fig. 13(a) to the state shown in Fig. 13(b). A leading end part of the link member 97b whose base end part is connected to the shaft 91a is joined to the link member 97a. When the link member 97a is driven to rotate as depicted, the shutter 91 is driven to rotate by about 90° by way of the link member 97b from a vertical state toward the inside of the housing.

[0062] The shutter driving mechanism 92 is provided with rotational amount detector 100 which can detect the amount of rotation of the shutter 91. The rotational amount detector 100 can be constructed, for example, by providing the surface of an input gear 96b of the gear train 96 with a plurality of detection openings 101 at predetermined intervals along the circumferential direction thereof, so as to form an encoder, and placing a rotational amount sensor (reflection-type photosensor) 102 for detecting the amount of rotation of the encoder. Such rotational amount detector 100 makes it possible to accurately control a stop position where the shutter 91 attains a rotational angle of about 90° after being rotated, whereby the load on the shutter driving motor 95 can be alleviated.

[0063] In connection with the shutter mechanism 90, a lock mechanism 110 for locking the closed state of the shutter 91 is provided in this embodiment.

[0064] The lock mechanism 110 is constituted by teeth 112 continuously formed at a leading edge of the shutter 91, which is driven to open and close, along its longitudinal direction, a lock plate 113 supported by the inner frame 1d of the housing 1a (so as to get into the groove of the housing 1a, specifically) and movable along the longitudinal axis (direction of arrows) of the shutter 91, and driving mechanism (for example, solenoid 116) for moving the lock plate 113 along its longitudinal axis (the longitudinal axis of the shutter 91).

[0065] The lock plate 113 is formed with teeth 114 corresponding to the teeth 112, and is always pressed by a biasing spring 117 so as to attain such a state that the teeth 112, 114 do not mate (see Fig. 12). When the solenoid 116 is driven in order to collect the bill P, the lock plate 113 moves against the urging force of the biasing spring 117, whereby the teeth 112, 114 mate with each other (see Fig. 11). This releases the shutter 91 from its locked state, so that the shutter 91 can be rotated toward the inside of the housing 1a by the shutter driving mechanism 92, whereby the mounting tray 60 can be set to a dischargeable state.

[0066] Fig. 14 is a block diagram showing a componential example of controller for controlling operations of the bill processor 1.

[0067] As mentioned above, the controller is equipped with the control circuit board 40, attached to the rear face of the lid 31, for controlling operations of various actuators mentioned above. The control circuit board 40 comprises a CPU 130, a ROM 131 and a control RAM 132. The CPU 130 functions to control various driving devices such as the transfer motor 20, plate driving motor 33, tray driving motor 71, shutter driving motor 95, and solenoid 116. The ROM 131 stores operational programs for the above-mentioned various driving devices, detection data concerning valid bills, etc.

[0068] Motor driving circuits 140 to 143 for driving various motors mentioned above are connected to the CPU 130 by way of an I/O port 135, whereas driving operations (normal rotation, reverse rotation, and stop) of the driving motors are controlled according to the operational programs or by control signals from the CPU 130. Fed into the CPU 130 by way of the I/O port 135 are signals from the bill insertion sensor 25 detecting the insertion of bills, detection signals from the bill identification sensors 26 concerning the identification of bills, detection signals from the rotation detecting sensor 42 concerning the pressing position of the pressing plate 32, detection signals from the rotational amount sensor 82 concerning the position of the mounting tray 60, detection signals from the limit switch 86 concerning whether the mounting tray 60 is located at the accommodating position or not, and detection signals from the rotational amount sensor 102 concerning the rotating position of the shutter 91. According to these detection signals, driving operations of the above-mentioned transfer motor 20, plate driving motor 33, tray driving motor 71, shutter driving motor 95, and solenoid 116 are controlled.

[0069] The CPU 130 is connected to a control circuit 200 disposed in a game machine body which is not depicted, whereby game value information corresponding to the value of the inserted bill is transmitted to the game machine.

[0070] Further, a release signal for releasing the locked state in the lock mechanism 110 (for driving the solenoid 116) is fed into the CPU 130 of the control circuit board 40. For example, signal transmitter 3.00 for transmitting the release signal can be constructed as a part of functions of a management server which is connected

to a communication network 400 and manages bank equipments. This makes it possible to collectively release the individual shutters 91 in bill processors present in the bank equipment at the time of a collecting operation, for example.

[0071] Operations of thus constructed bill processor 1 will now be explained.

[0072] First, a procedure of successively stacking bills P into the mounting tray 60 will be explained.

[0073] When a bill P is inserted into the bill insertion slot 3A in a standing state with the shorter sides standing vertically as shown in Figs. 1 to 3, the insertion is detected by the bill insertion sensor 25. When the bill insertion sensor 25 detects the insertion of the bill P, the transfer motor 20 is driven to rotate normally, whereby the bill P is transferred into the housing 1a while being held by the transfer belts 17a, 17b constituting the bill transfer mechanism 7 and the pinch rollers 21 a, 21 b, 22a, 22b abutting against the transfer belts 17a, 17b.

[0074] When the bill P is transferred into the housing 1a, the bill identification sensors 26 detect the bill P, whereby its validity is determined by the controller. When the bill identification sensors 26 fail to determine the validity of the bill P, the transfer motor 20 is driven to rotate in reverse, whereby the bill P in the process of transfer incurs a returning action, so as to be discharged as it is from the bill insertion slot 3A.

[0075] When the bill P is determined valid, the transfer motor 20 is driven to rotate until the rear end of the bill P passes the nip part between the transfer belts 17a, 17b and pinch rollers 22a, 22b. Here, as shown in Figs. 8(a) and 9(a), the bill P is discharged into the gap R between the pressing surface of the pressing plate 32 in the bill pushing area 10, which is positioned on the downstream side of the transfer belts 17a, 17b and pinch rollers 22a, 22b, and the plane including the engaging claws 61 c of the mounting tray 60. As mentioned above, the gap R is set to such a range that jams and the like do not occur.

[0076] When the bill P is located in the pushing area 10 after passing the nip part, the normal rotation of the transfer motor 20 is stopped, and the plate driving motor 33 is driven to rotate. Consequently, the depressing arm 38 drives the pressing plate 32 downward, whereby the lower face of the pressing plate 32 presses the bill P (see Fig. 9(b)). The bill P pressed by the pressing plate 32 moves beyond a pair of engaging claws 61 c of the mounting tray 60 thereafter, and is pressed onto the mounting plate 62 against the urging force of the biasing spring 63. Though the pressure of the pressing plate 32 in the bill direction varies depending on the supporting position of the link member 35, a substantially uniform pressure acts on the bill P along its longitudinal direction since the flanges (overhangs) 32c formed on both sides of the pressing plate 32 abut against the engaging claws 61c. Namely, the bill as a whole can be pressed uniformly, whereby a predetermined number of bills can reliably be accommodated even when the bills are folded or when the bills are tenacious (because of an increased number of stacked bills). The position of the depressing arm 38 is detected by the rotation detecting sensor 42. When the depressing arm 38 is located at an appropriate position (when the flanges 32c of the pressing plate 32 abut against the engaging claws 61c), the plate driving motor 33 is stopped. After the flanges (overhangs) 32c abut against the engaging claws 61c under a predetermined pressure on the pressing plate 32, the plate driving motor 33 is driven to rotate in reverse, whereby the pressing plate 32 returns to the initial position. Here, the urging force of the biasing spring 63 presses the mounting plate 62 toward the engaging claws 61 c, whereby the topmost bill P is pressed against the engaging claws 61 c as shown in Fig. 9(c), so as to be sorted from the next bill to be transferred. As the foregoing action is repeated, the bills P are stably stacked on the mounting plate 62 in the mounting tray 60.

[0077] A procedure of collecting the bills P accommodated in the mounting tray 60 will now be explained.

[0078] When collecting the bills P, for example, a management server (signal transmitter 300) managing an arcade as a whole transmits a signal for releasing the lock mechanism 110 to each bill processor 1 installed in a bank. In this case, for example, the management server may be controlled such as to release the lock mechanisms 110 of all the bill processors 1 in the whole bank or the lock mechanisms 110 in one row of bill processors 1 in the bank. When the bill processor 1 receives the release signal, the solenoid 116 is driven, whereby the lock plate 113 is driven in the longitudinal direction of the shutter 91 against the urging force of the biasing spring 117. Consequently, the teeth 114 of the lock plate 113 and the teeth 112 formed in the shutter 91 mate with each other. When the shutter driving motor 95 is driven to rotate in this state, the shutter 91 attains an open state (see Fig. 13(b)). The shutter driving motor 95, whose amount of rotation is detected by the rotational amount sensor 102, is stopped at an appropriate position (a position tilted at about 90°).

[0079] When the shutter driving motor 95 is stopped, the tray driving motor 71 is driven to rotate, whereby the front end side of the mounting tray 60 is discharged from the front face of the housing 1a. Since both side walls 61b are formed with the cutouts 6 1 d as mentioned above, the body 61 of the mounting tray 60 does not interfere with the tilted shutter 91, and is discharged from its front end side. The amount of rotation of the tray driving motor 71 is detected by the rotational amount sensor 82, whereby the mounting tray 60 is stopped at an appropriate position.

[0080] In the state where the mounting tray 60 is stopped, the bundle of bills mounted on the mounting plate 62 are held such as to expose the front end side as shown in Fig. 15, whereby the operator can pick the exposed bundle of bills and pull them out as they are, and thus can efficiently perform an operation of collecting bills. In particular, as shown in Fig. 8, the length of the mounting plate 62 mounting the bill P is shorter than the length of the bill P, while the recession 62a is formed at

the center of the leading edge of the mounting plate 62, so that the bundle of bills in the stacked state can easily be picked by the leading end part when the mounting tray 60 projects, which facilitates the operation of collecting the bills P in this embodiment.

[0081] After the lapse of a predetermined time from when the bill detecting sensor 128 detects the absence of the bill P on the mounting plate 62 (when the collecting operation is completed) during the operation of collecting the bill P, a process which is the reverse of the foregoing is performed. Namely, the tray driving motor 71 is driven to rotate in reverse, so as to return the mounting tray 60 to the accommodating position. At the time when the limit switch 86 detects the existence of the mounting tray 60, the shutter driving motor 95 is driven in reverse, so as to rotate the shutter 91 to the closed state. Thereafter, the solenoid 116 is deactivated, so as to return the lock plate 113 to the initial position, and the lock mechanism 110 is actuated.

[0082] Since the lock mechanism 110 is thus automatically actuated when the absence of bills on the mounting plate 62 is detected, it is sufficient for the operator to perform only the bill collecting operation, which makes it unnecessary to perform other operations, whereby the bill collecting operation can efficiently be performed. Also, such a structure reliably prevents the shutter 91 from being unlocked (by human errors) during the bill collecting operation, whereby security can be improved.

[0083] The above-mentioned controller may be configured such that the lock mechanism 110 is not released if there is no bill P on the mounting plate 62 when the signal for releasing the lock mechanism 110 is received. Namely, when there is no bill P, the lock mechanism 110 is maintained as it is without driving the mounting tray 60, whereby unintentional unlocking and the like can reliably be prevented from happening.

[0084] The lock mechanism 110 may be released by a dedicated portable terminal owned by the operator. For example, each bill processor 1 may be provided with an infrared receiver 500 (see Figs. 1 and 14), and the lock mechanism 110 may be released when a predetermined lock release signal is received from the portable terminal. Such a structure makes it possible to release lock mechanisms of a number of bill processors individually, so as to perform the collecting operation. Alternatively, such releasing operations may be performed collectively by the portable terminal via a management server. Namely, lock mechanisms may be released collectively in the whole bank or each row of the bank by an operation of the portable terminal.

[0085] In the bill processor 1 in accordance with this embodiment, since the pressing plate 32 for pressing the bill P toward the mounting tray 60 is supported by only one side of the lid 31 by way of the link member 35 as explained in the foregoing, a space to be secured for installing and operating the bill pressing mechanism 30 including the pressing plate 32 and link member 35 can be reduced, whereby the bill processor 1 itself can be made smaller. Since the depressing arm 38 for moving the pressing plate 32 toward the mounting tray 60 while keeping the pressing plate 32 substantially parallel to the lid 31 is provided, the bill processor 1 in accordance with this embodiment can eliminate the unstableness of the pressing plate 32, which is supported by the lid 31 only in one side of the pressing plate 32, whereby a uniform pressure can be exerted on the bill P along the longitudinal direction thereof. Namely, the bill P can be accommodated in the mounting tray 60 efficiently and reliably with a tiny space.

[0086] When the pressing plate 32 is moved by the depressing arm 38, the flanges 32c cause the pressing plate 32 to abut against the engaging claws 61c of the mounting tray 60 and prevent the pressing plate 32 from further entering the mounting tray 60. In the case where such flanges 32c are provided, when a slight inclination occurs in the front to rear direction in spite of the presence of the depressing arm 38 for the parallel hold, the pressing plate 32 finally becomes parallel to the lid 31 (bill P) when the flanges 32c abut against the engaging claws 61c, even though the pressing plate 32 is supported by the link member 35 only in one side of the pressing plate 32. Accordingly, a uniform pressure can be exerted on the bill P along the longitudinal direction thereof. Namely, bills as a whole can be pressed uniformly, whereby a predetermined number of bills can reliably be accommodated in the mounting tray 60 even when the bills are folded or when the bills are tenacious (because of an increased number of stacked bills).

[0087] Also, in the case where a slight inclination occurs in the front to rear direction in the pressing plate 32 even when the pressing plate 32 is held parallel by the depressing arm 38, the inclination is corrected by the abutment of flanges 32c and engaging claws 6 1 c in the bill processor 1 in accordance with this embodiment, whereby bills P can reliably be accommodated in the mounting tray 60 regardless of their conditions (wrinkles, folds, flexures, and the like).

[0088] Without being restricted to the above-mentioned embodiment, the present invention can be carried out while being modified in various ways within the scope not deviating from the gist thereof as a matter of course. For instance, constituent members such as various driving mechanisms and sensors arranged within the housing mentioned above are only examples thereof, and their specific structures may be modified as appropriate as long as they can perform the same processes and operations. The mounting tray 60 may be anything as long as it can expose and hold a bundle of bills such that their leading end can be picked out when projected out of the housing, whereby the structure can be modified as appropriate. The lock mechanism may be released for each bill processor without the aid of external management servers and the like. Namely, the collecting operation may individually be performed for each bill processor.

[0089] As described above, the present invention can provide a compact bill processor which can accommo-

date bills efficiently and reliably in the bill container with a tiny space.

[0090] The bill processor of the present invention can be installed not only between various game machines, but also in various apparatus which handle bills, e.g., external apparatus such as various vending machines.

Claims

1. A bill processor comprising:

a housing;
a bill insertion slot provided at a front face of the housing and opened for inserting a bill;
a bill transfer mechanism for transferring the bill inserted from the bill insertion slot along an inserting direction and discharging the bill toward a bill pushing area positioned downstream;
a bill container provided in the housing; and
a bill pressing mechanism for pressing the bill discharged into the bill pushing area toward the bill container,

wherein the bill pressing mechanism includes:

a supporter attached to the housing,
a pressing plate movable toward the bill container,
a link member joining the supporter and the pressing plate and having an opening and a moving member movable through the opening, the moving member having a first end portion supported with respect to the supporter and a second end portion engaged with the pressing plate and movable with respect to the supporter.

2. The bill processor according to claim 1,
wherein the bill container includes an engaging claw engageable with both longitudinal edge parts of the bill, and the pressing plate includes a flange abuttable against the engaging claw.

3. The bill processor according to claim 2,
wherein the flange of the pressing plate is parallel to the supporter when the flange is abutted against the engaging claw of the bill container.

4. The bill processor according to any of claims 1 to 3,
wherein the pressing plate is supported by one side of the lid via the link member.

5. The bill processor according to any of claims 1 to 4,
wherein the moving member of the link member is attached to the center portion of the supporter.

6. The bill processor according to any of claims 1 to 5,
wherein the pressing plate includes a protruded member attached to a face thereof and having a long groove, and
wherein the second end portion of the moving member has an engaging protrusion engaging with the long groove of the protruded member.

Fig.1

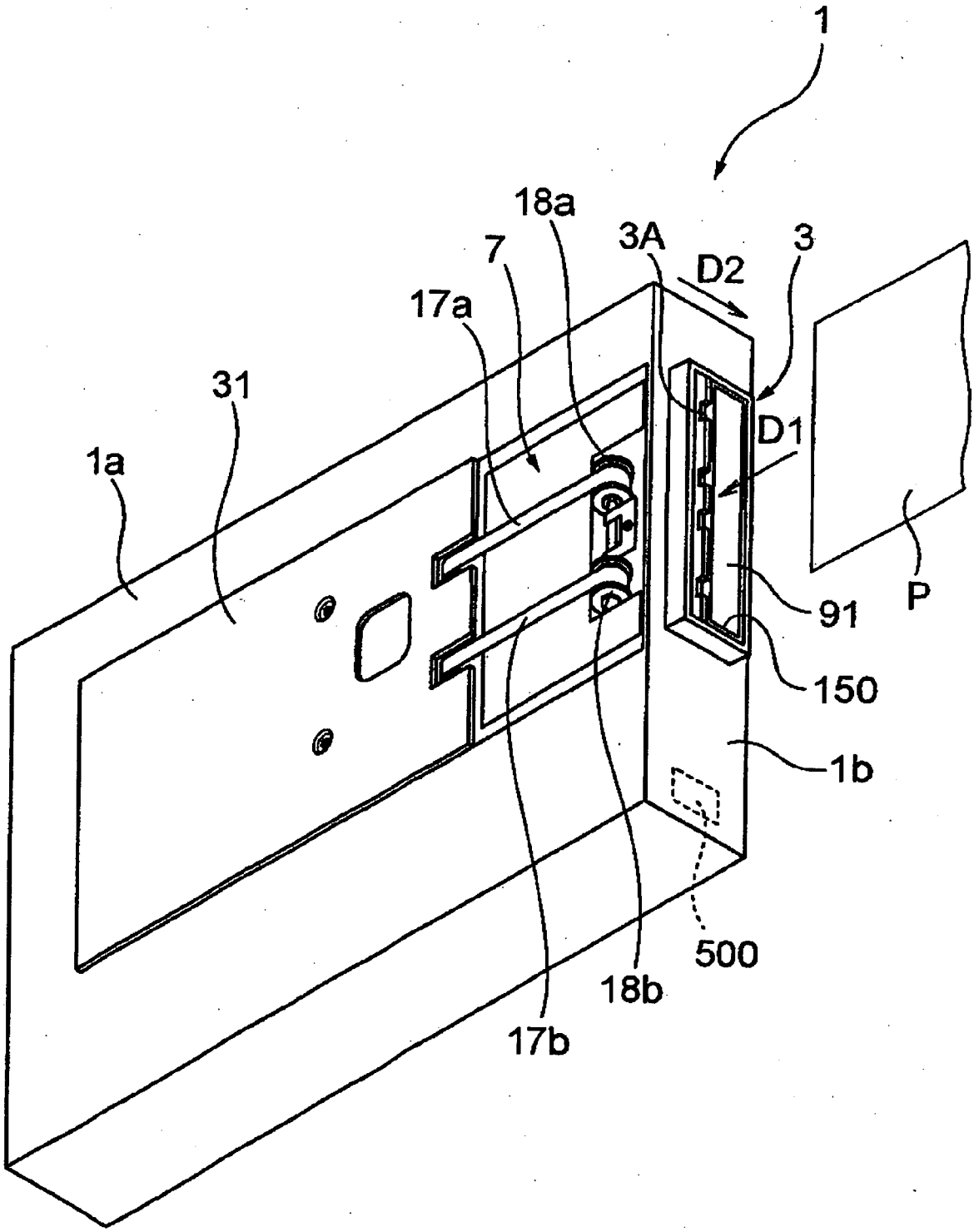
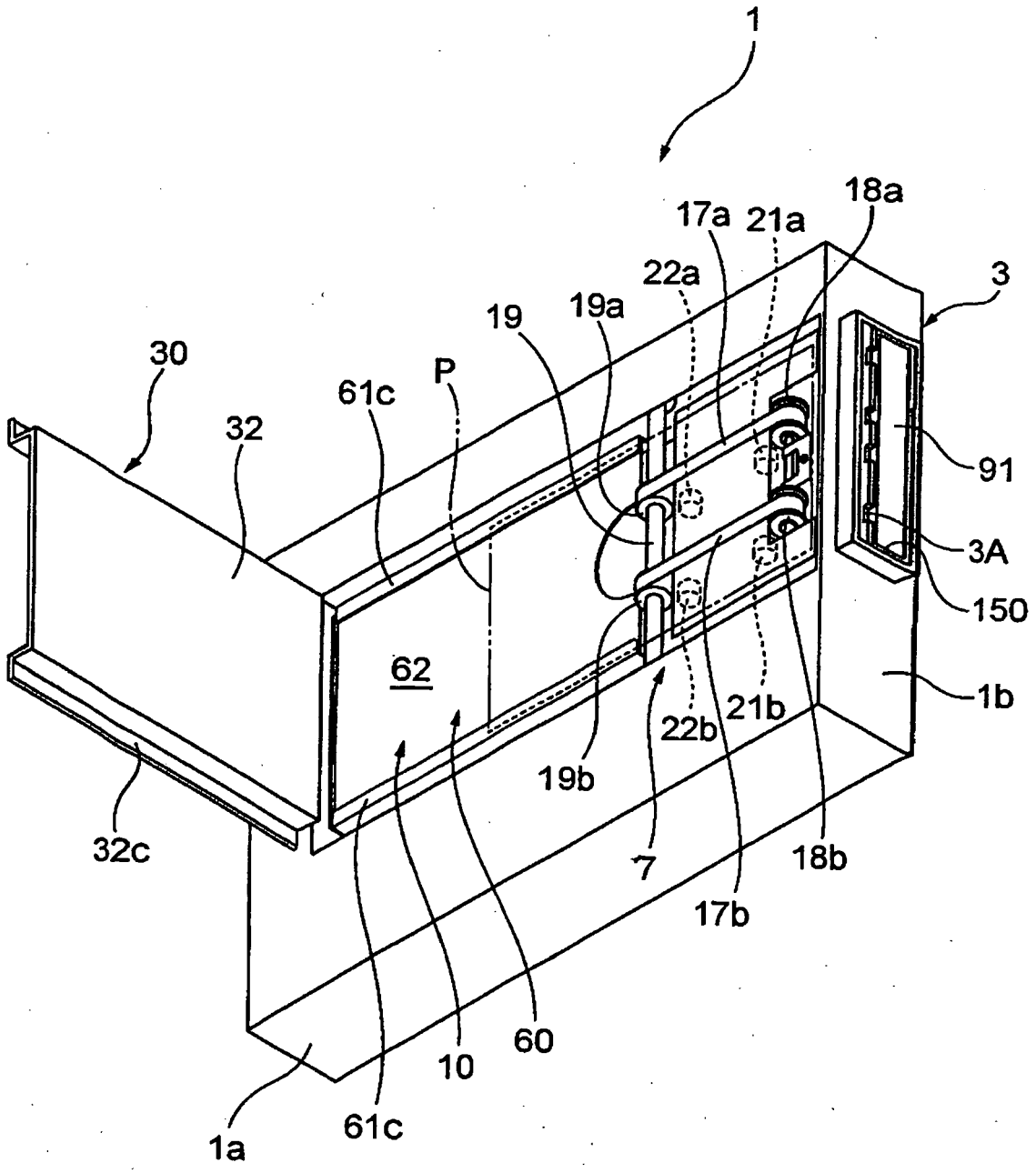


Fig.2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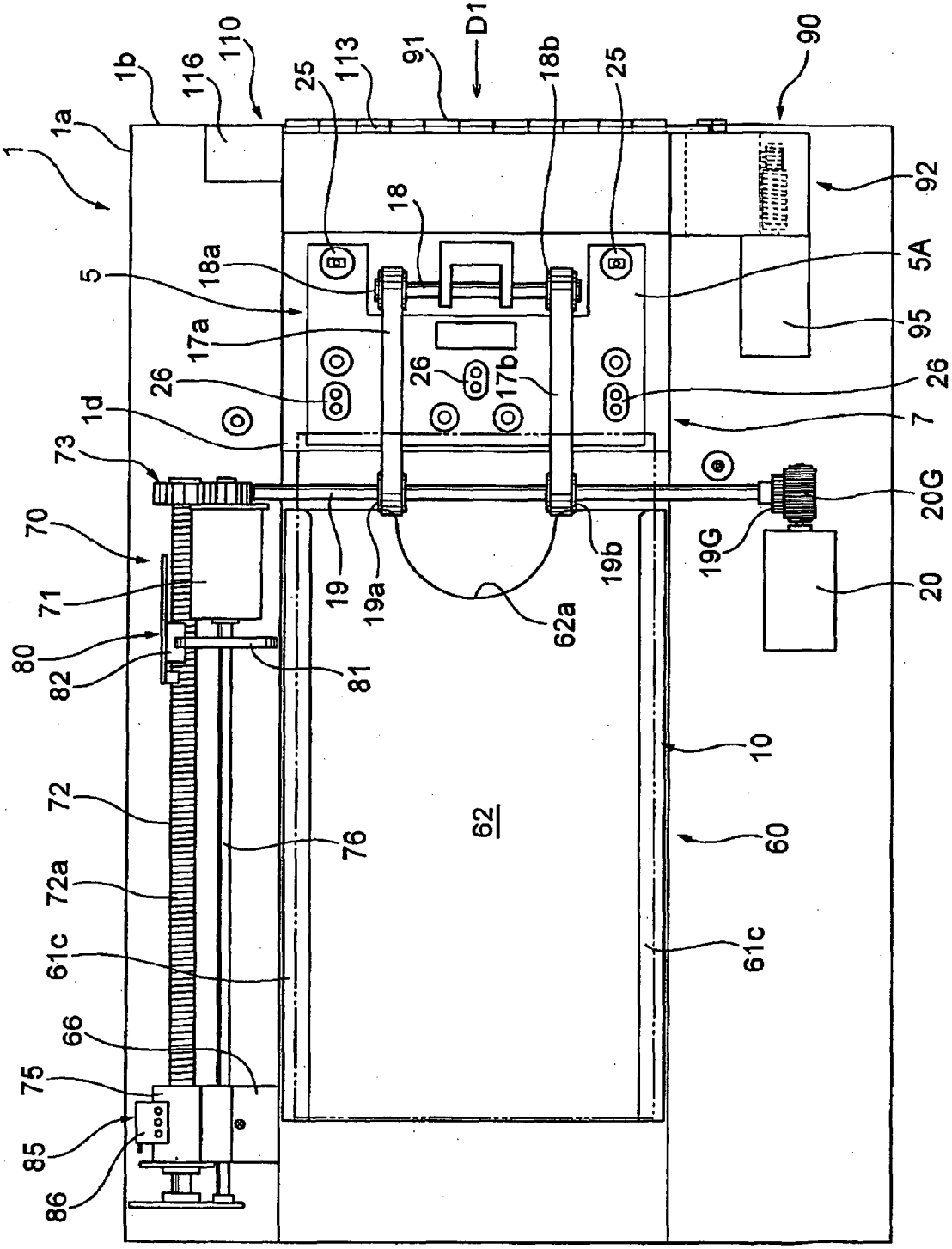
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Fig.3

Fig.4

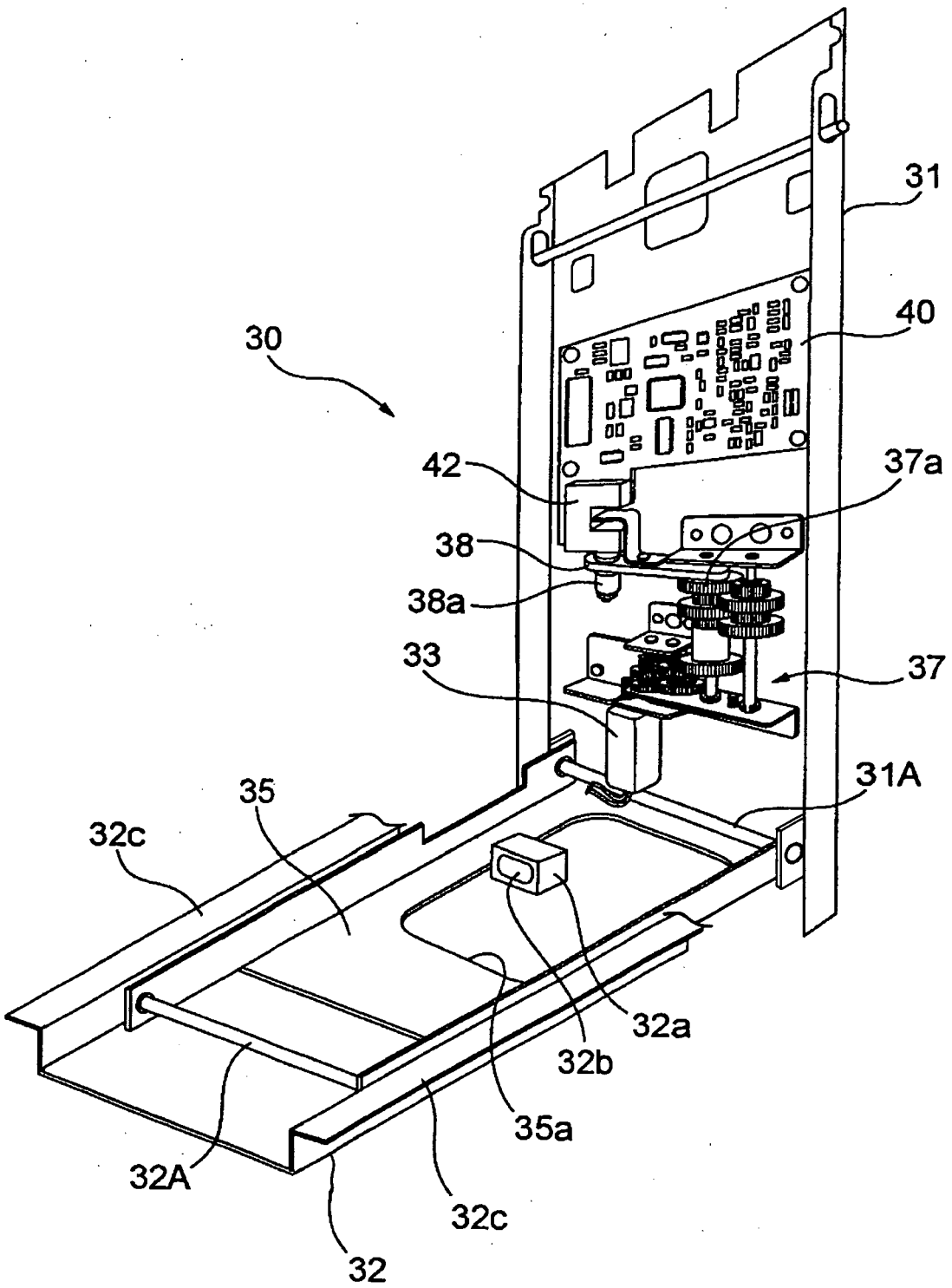


Fig.5

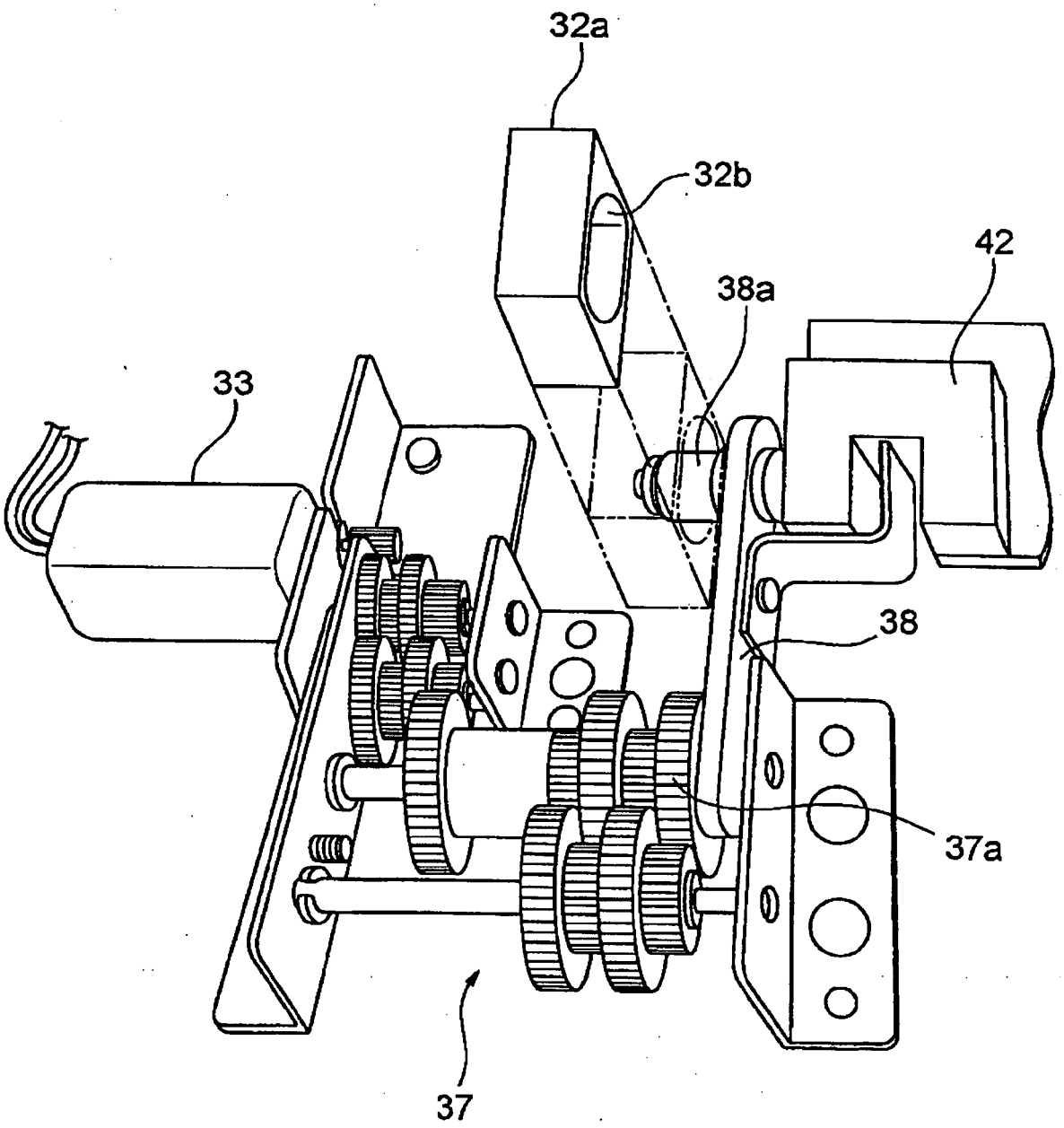


Fig.6

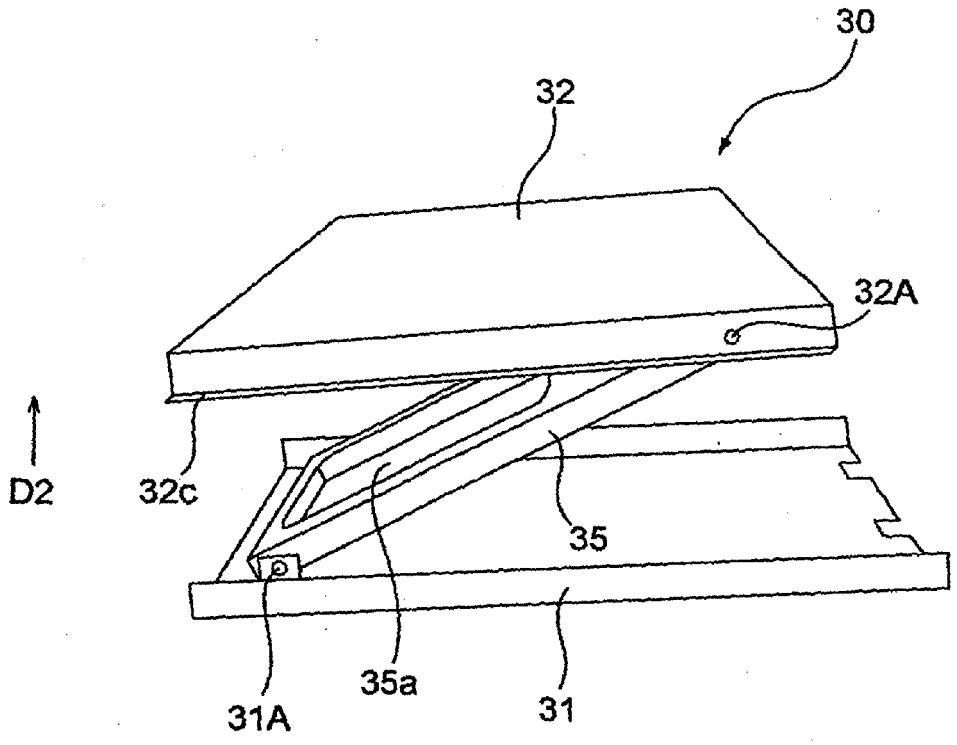


Fig.7

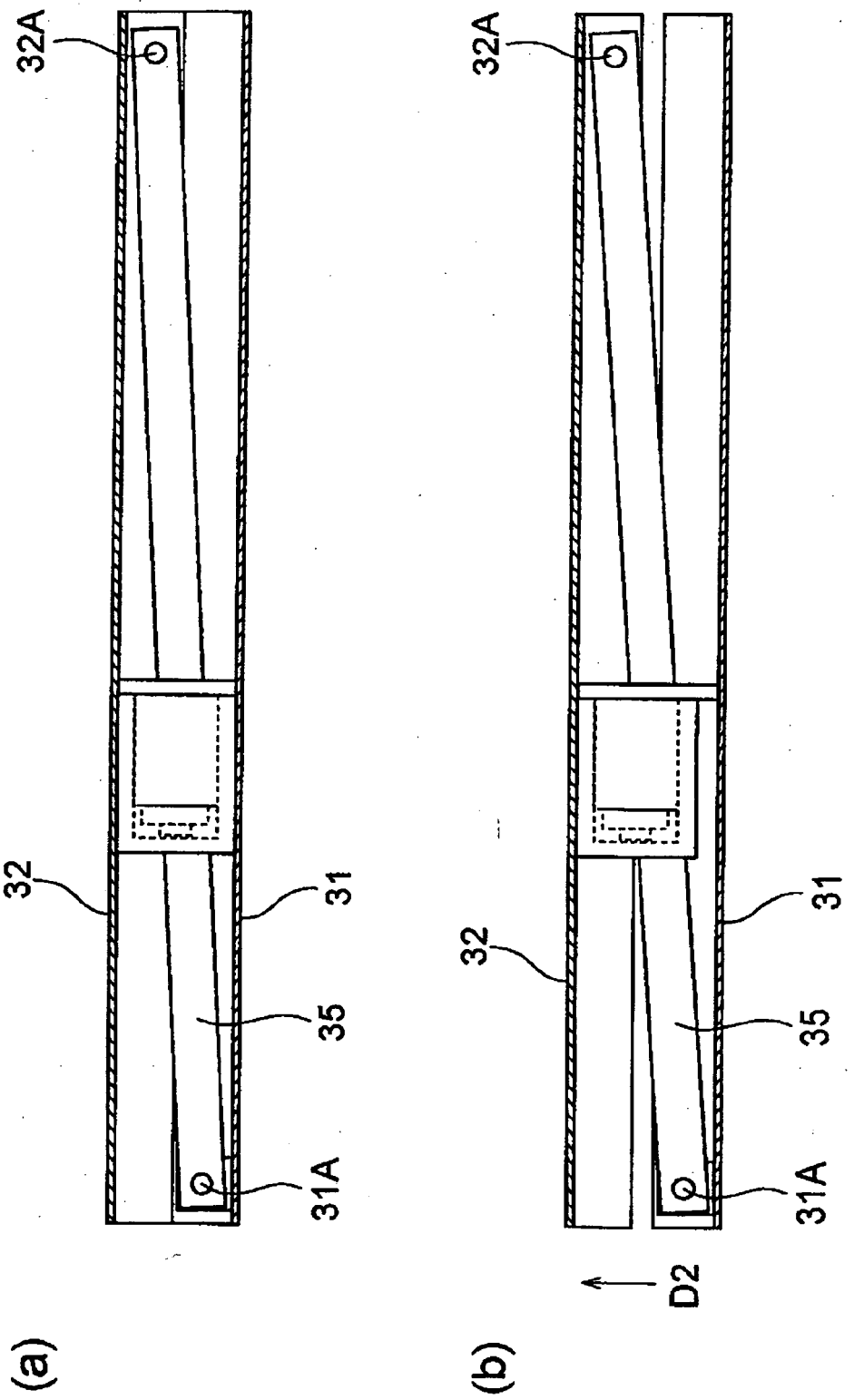


Fig.8

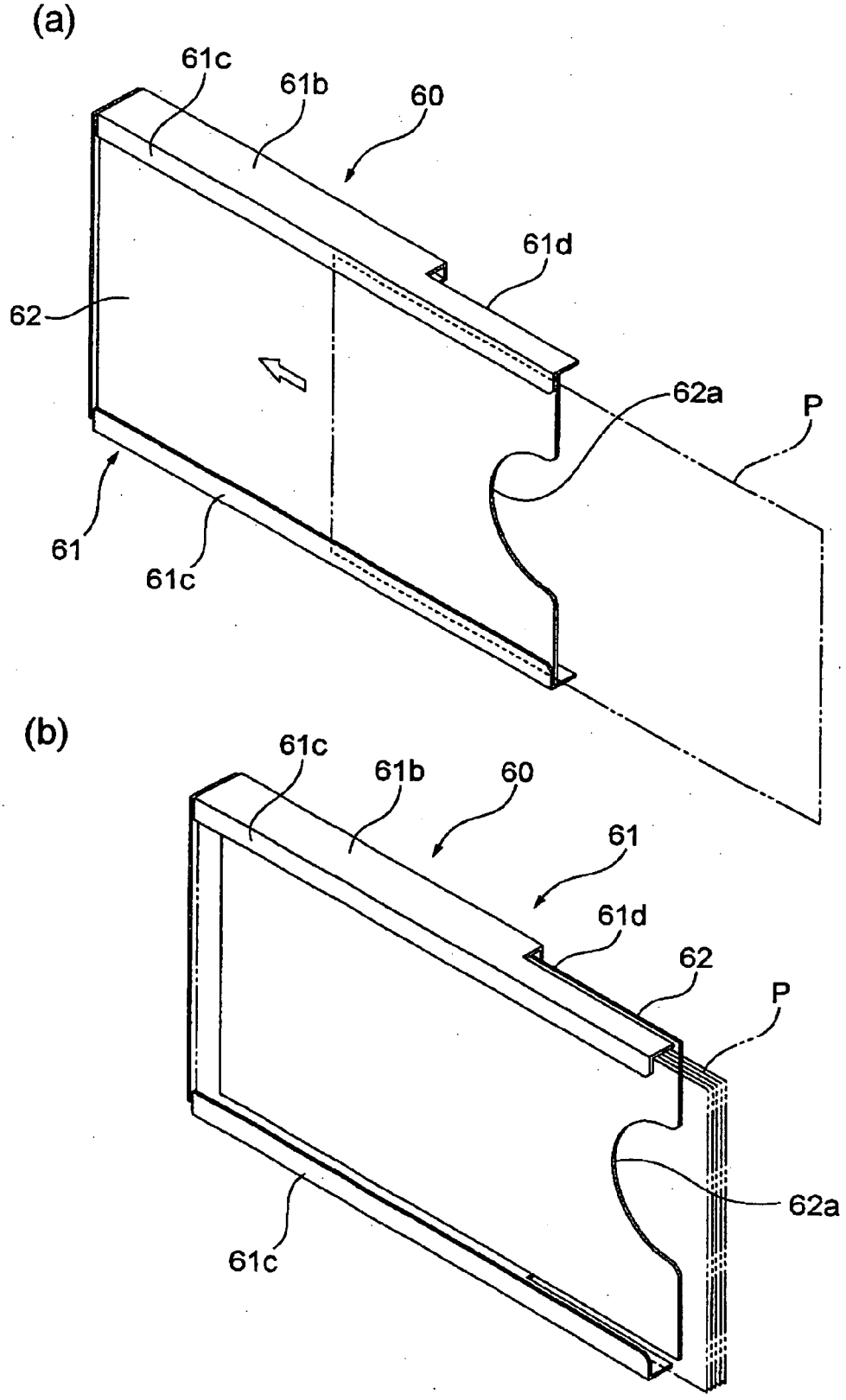
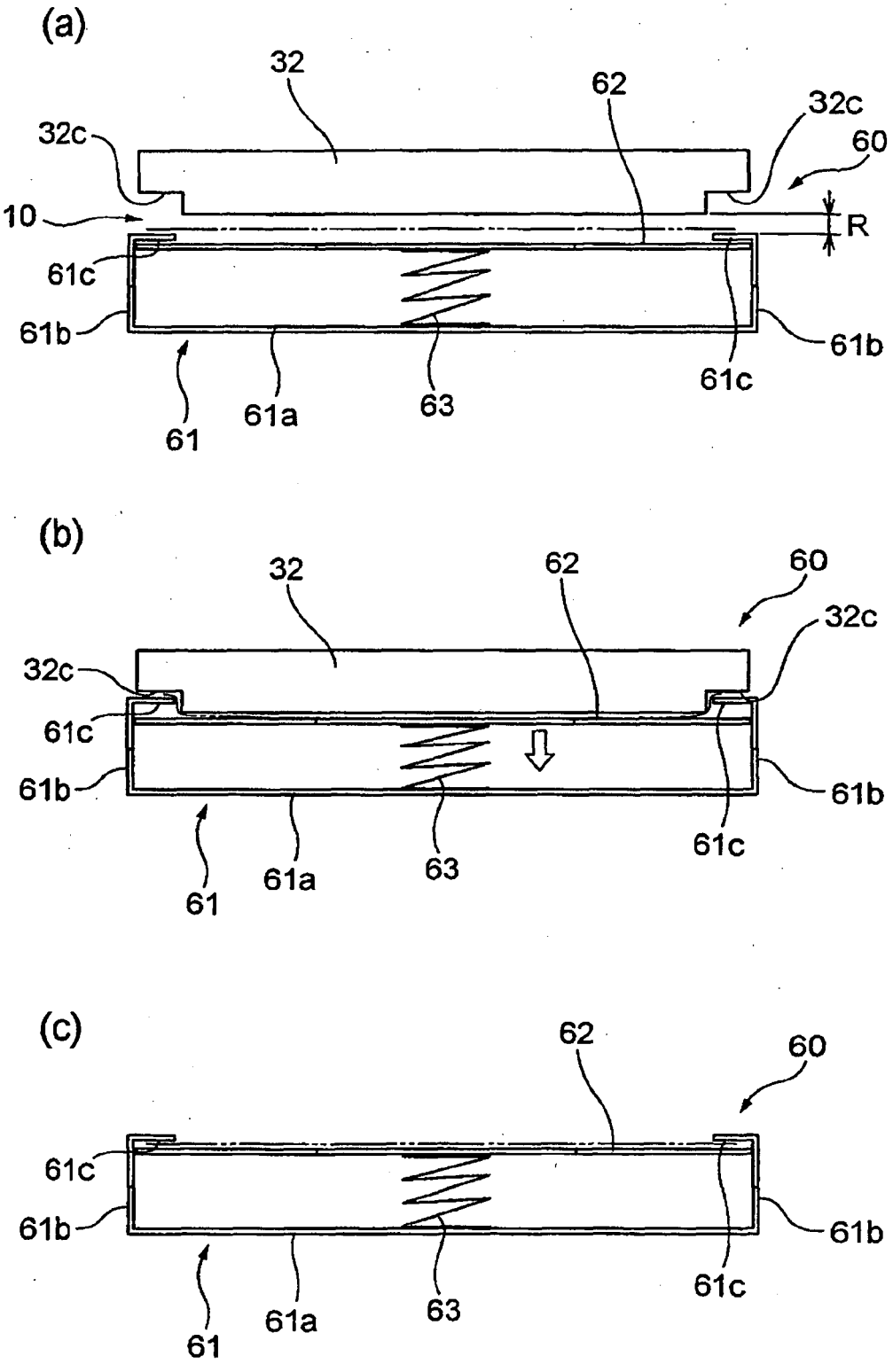


Fig.9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32c
32c
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10
R
61c
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61b
61c
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61a
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(b)
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60
32c
32c
61c
61b
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Fig.10

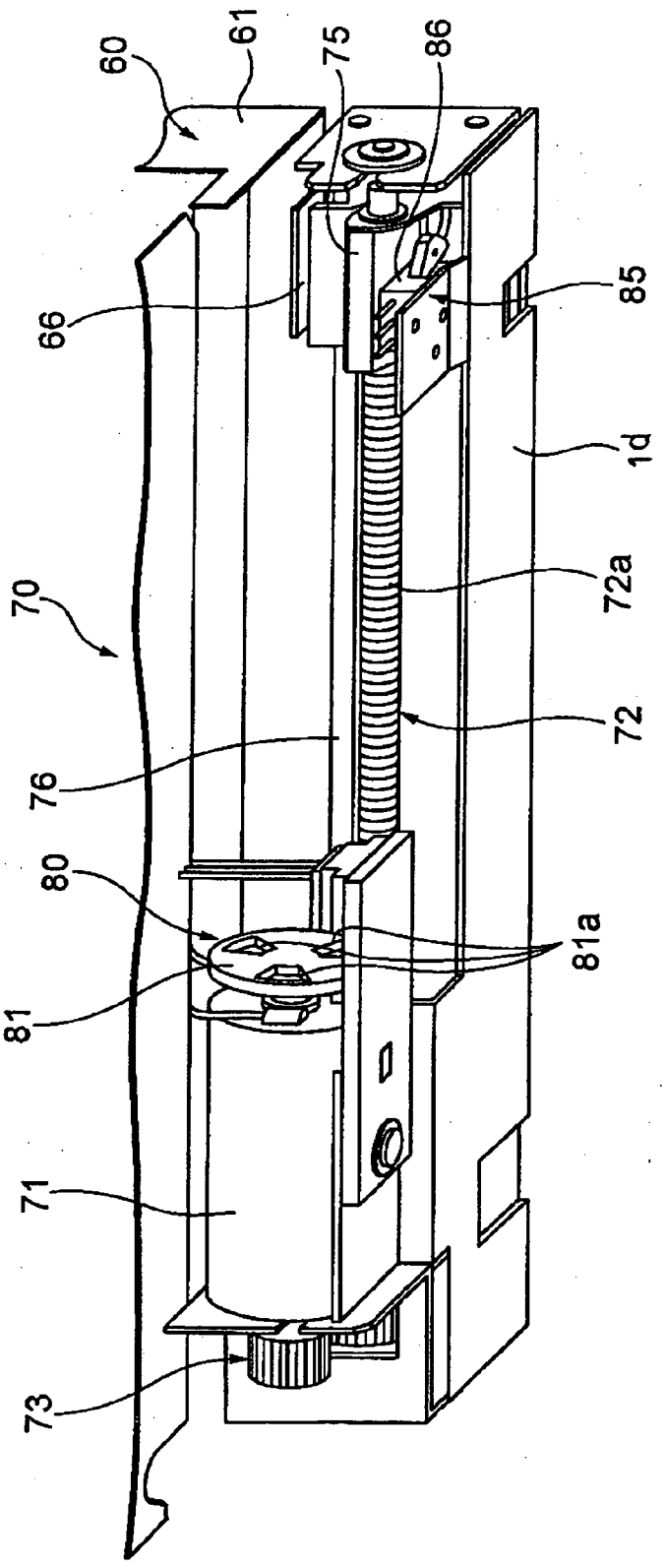
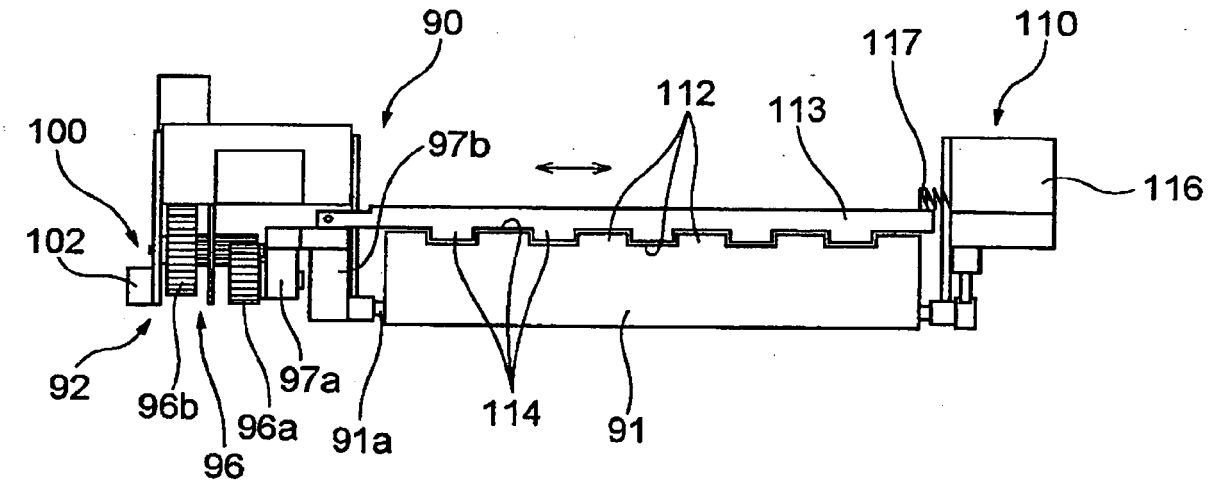


Fig.11



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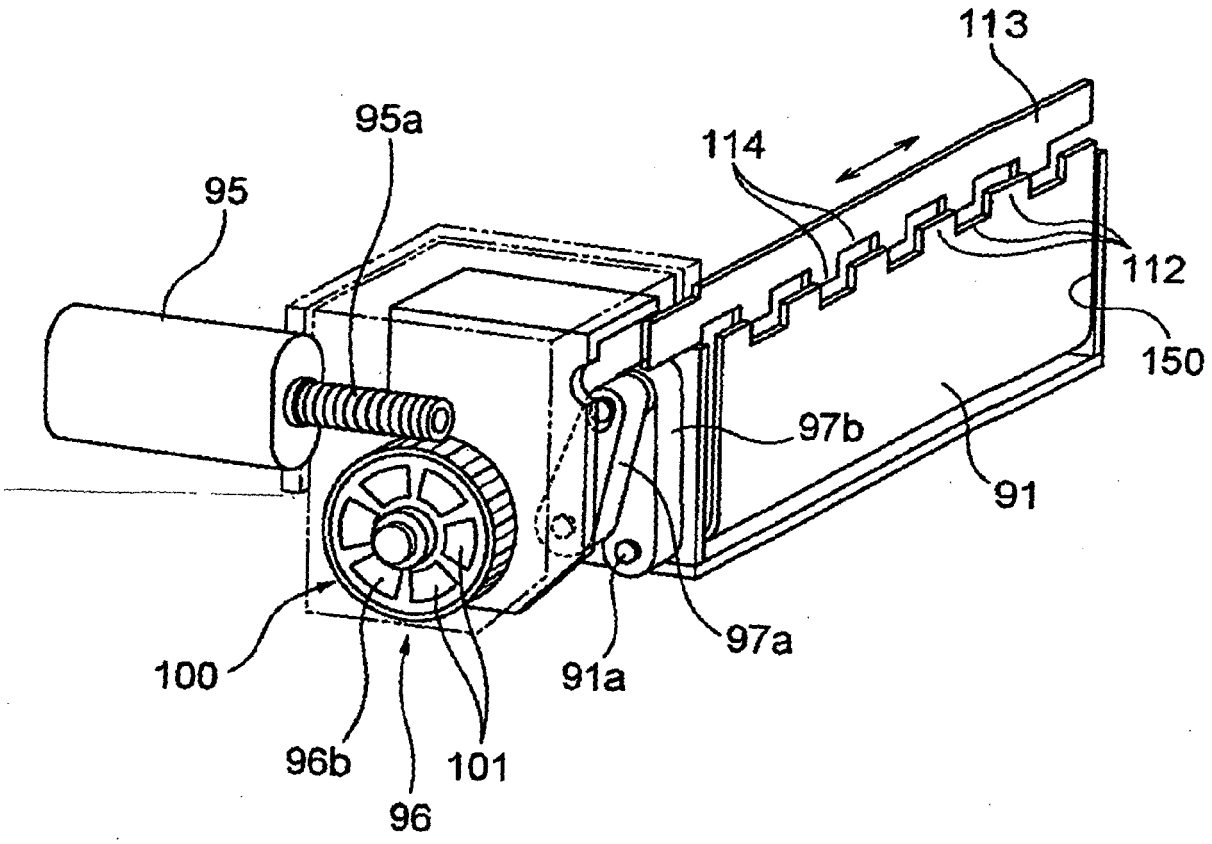


Fig.13

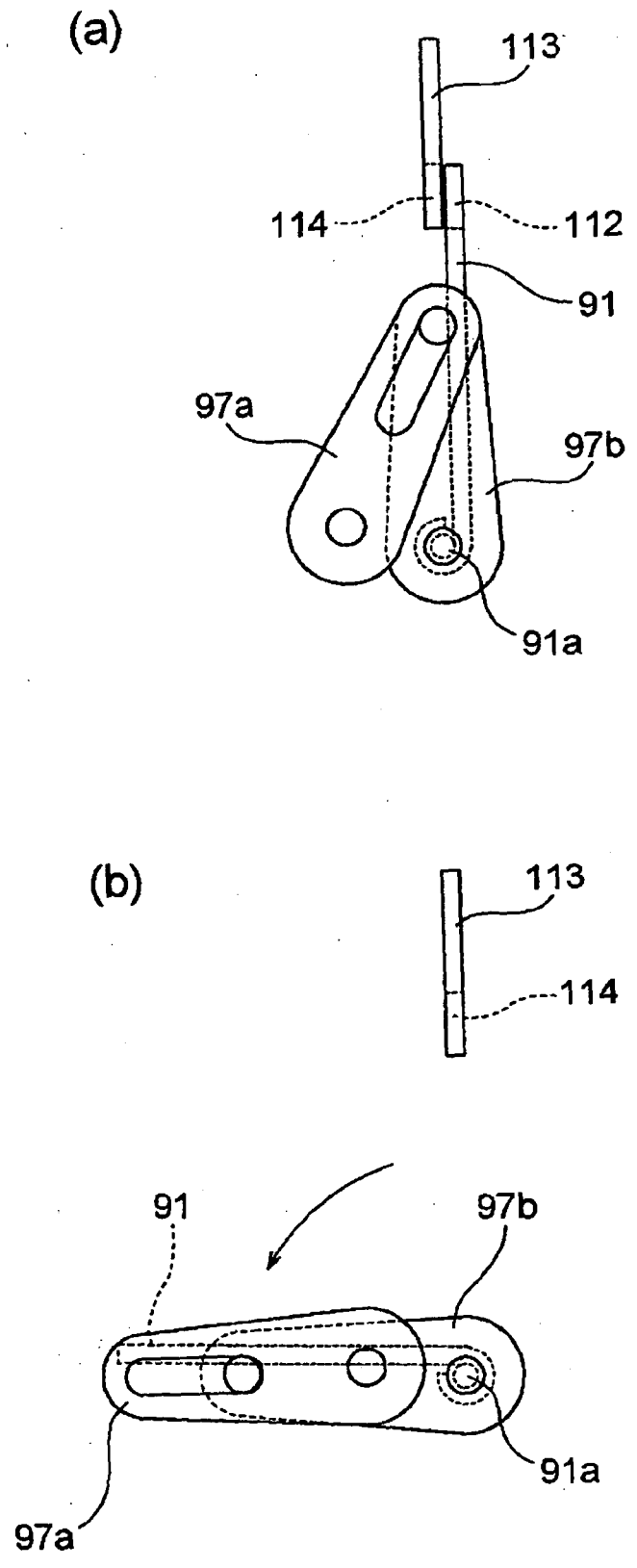
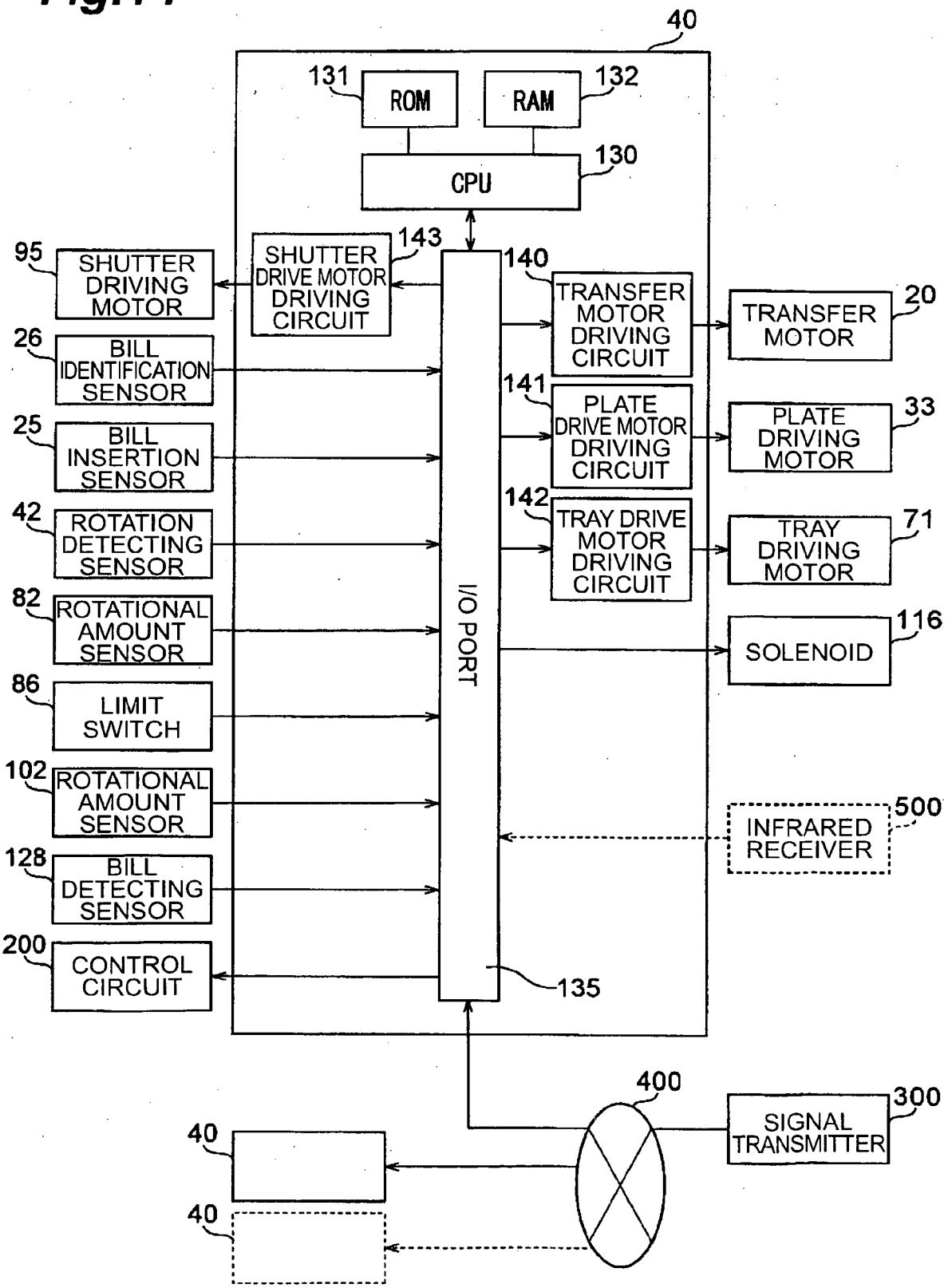


Fig.14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RAM
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CPU
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SHUTTER DRIVE MOTOR DRIVING CIRCUIT
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TRANSFER MOTOR DRIVING CIRCUIT
TRANSFER MOTOR
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PLATE DRIVE MOTOR DRIVING CIRCUIT
PLATE DRIVING MOTOR
33
142
TRAY DRIVE MOTOR DRIVING CIRCUIT
TRAY DRIVING MOTOR
71
SOLENOID
116
I/O PORT
95
SHUTTER DRIVING MOTOR
26
BILL IDENTIFICATION SENSOR
25
BILL INSERTION SENSOR
42
ROTATION DETECTING SENSOR
82
ROTATIONAL AMOUNT SENSOR
86
LIMIT SWITCH
102
ROTATIONAL AMOUNT SENSOR
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CONTROL CIRCUIT
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INFRARED RECEIVER
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SIGNAL TRANSMITTER
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40

Fig.15

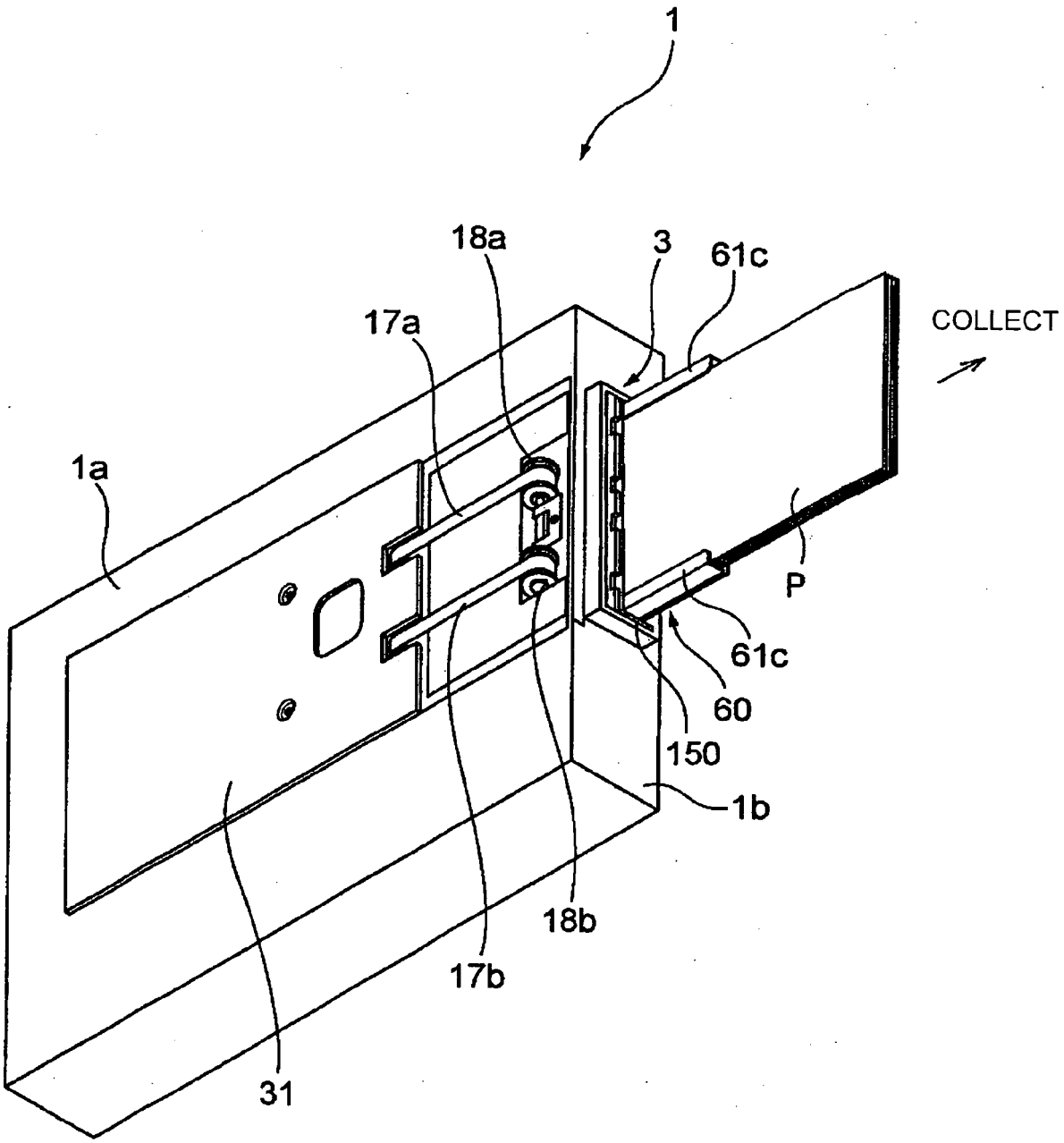
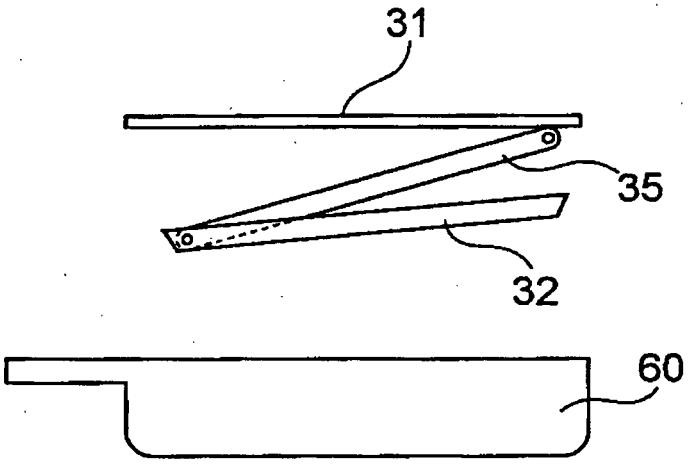


Fig.16



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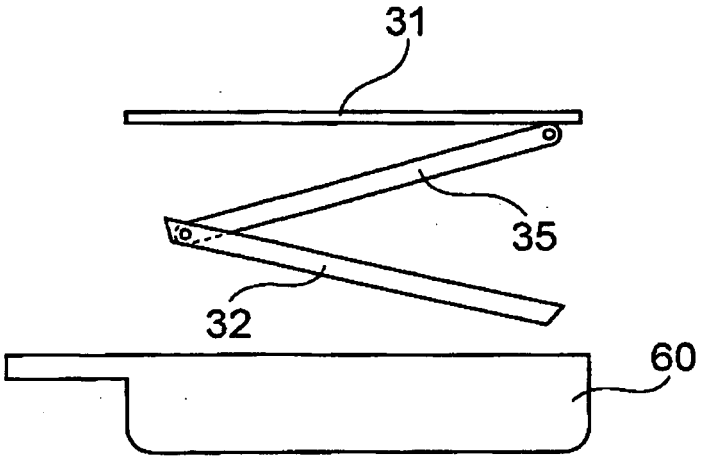

(b)

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- JP 10021441 A **[0003] [0005]**