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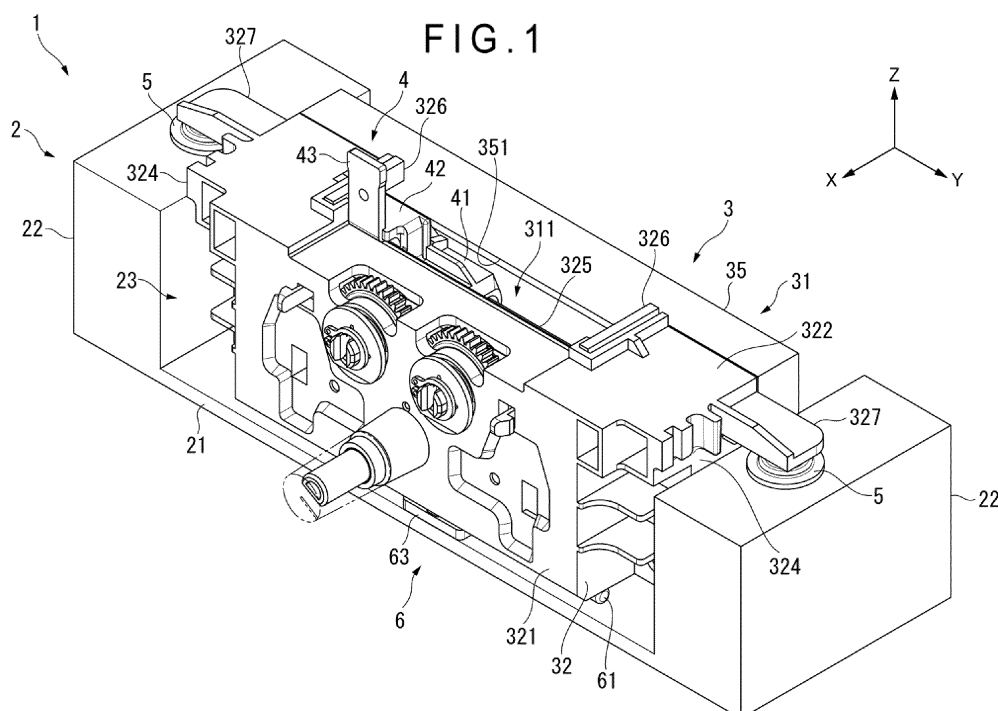
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(54) **OPERATION DEVICE**

(57) An operation device (1) includes: a second base portion (3) including a movable portion (4); a first base portion (2) holding the second base portion (3); and a

damper (5) connecting the first base portion (2) to the second base portion (3), in which the second base portion (3) is capable of oscillating.



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Description

TECHNICAL FIELD

[0001] The present invention relates to an operation device.

BACKGROUND ART

[0002] It has been known that a typical operation device is usable in a fader and the like and is configured to adjust a sound volume and the like by moving a fader knob along a guide rail in a form of a slot (see, for instance, Patent Literature 1).

CITATION LIST

[0003] Patent Literature 1: JP2010-249529A

SUMMARY OF THE INVENTION

PROBLEM(S) TO BE SOLVED BY THE INVENTION

[0004] An operation device (particularly, cross-fader) usable in a DJ device requires a slide operation element to be quickly slidable, unlike, for instance, an operation device (e.g., a fader) in an audio device usable in a mixing console.

[0005] However, in a structure of the operation device disclosed in Patent Literature 1, when a user violently operates the slide operation element and then releases the slide operation element from his hand, the slide operation element may hit an end of a slit, within which the slide operation element is configured to slide, and bounce back, so that an unintentional operation may be made.

[0006] Accordingly, it is conceivable that a shock-absorbent material or the like is provided at the end of the slit to absorb shock generated at the end of the slit, thereby inhibiting the slide operation element from bouncing back. However, in such a structure, when the user does not release the slide operation element from his hand, the user may lose an operational feeling obtained by a contact between the slide operation element and the end of the slit, since the shock caused by the contact between the slide operation element and the end of the slit is absorbed by the end of the slit.

[0007] An object of the invention is to provide an operation device capable of inhibiting a slide operation element from bouncing back without impairing an operational feeling, and a fader including the operation device.

MEANS FOR SOLVING THE PROBLEM(S)

[0008] According to an aspect of the invention, an operation device includes: a second base portion having a slide operation element; a first base portion holding the second base portion; and a damper connecting the first base portion to the second base portion, in which the

second base portion is capable of oscillating.

[0009] According to another aspect of the invention, a cross-fader includes the operation device according to the above aspect of the invention.

BRIEF DESCRIPTION OF DRAWING(S)

[0010]

Fig. 1 is a perspective view of an operation device according an exemplary embodiment of the invention.

Fig. 2 is a partially-cut front elevational view of the operation device.

Fig. 3 is a plan view of the operation device.

Fig. 4 is a cross-sectional view taken along a IV-IV line in Fig. 3.

DESCRIPTION OF EMBODIMENT(S)

[0011] Exemplary embodiment(s) of the invention will be described below with reference to the attached drawings. An operation device according to an exemplary embodiment is exemplarily used in a cross-fader of a DJ device. For describing directions in Figs. 1 to 4, a +X direction refers to a front direction (forward), a -X direction refers to a rear direction (backward), a +Y direction refers to a right direction (rightward), a -Y direction refers to a left direction (leftward), a +Z direction refers to a top direction (upward), and -Z direction refers to a bottom direction (downward).

Structure of Operation Device

[0012] As shown in Figs. 1 to 4, an operation device 1 includes a first base portion 2, a second base portion 3 having a movable portion 4 (a slide operation element), two dampers 5, and a movement restrictor 6.

[0013] The first base portion 2 is formed of a non-deformable material such as plastic and metal. The first base portion 2 includes: a first body portion 21 in a form of a rectangular plate extending in a right-left direction; and a pair of lateral sides 22 extending upward from both ends of the first body portion 21. The second base portion 3 is provided in a space 23 defined by the first body portion 21 and the pair of lateral sides 22.

[0014] Damper attachment holes 221 for attaching the dampers 5 are respectively provided at top ends of the lateral sides 22 as shown in Fig. 2.

[0015] The second base portion 3 includes a box-shaped casing 31 and a guide 36.

[0016] The casing 31 includes a second body portion 32 and a cover 35.

[0017] The second body portion 32 is formed of the same material as, for instance, the first base portion 2. The second body portion 32 includes a front portion 321, a top portion 322, a bottom portion 323, and a pair of lateral portions 324 to form a box whose rear side is

opened.

[0018] The top portion 322 has a rectangular cutout 325 near the front portion 321. The cutout 325 is defined in the front-back direction by a pair of side edges extending in the front-back direction of the casing 31. A stopper 326 is provided at each of the side edges. The stopper 326 (e.g., an elastic body) is in a form of a quadrangular bar extending in the front-back direction. The stopper 326 is preferably made of a low resilient material. A shock-absorbent mechanism and the low resilient material according to the exemplary embodiment can provide a superior advantage in the reduced bouncing of the movable portion 4. Moreover, use of the material having sound absorbency can provide an advantage in reduction of noises generated by a violent operation. On the other hand, when the resilience of the low resilient material is decreased to increase the hardness of the material, the bouncing of the movable portion 4 is reducible by the shock-absorbent mechanism according to the exemplary embodiment while the user can obtain a clear operational feeling due to a contact between the movable portion 4 and inner ends of the second base portion 3 defined by a later-described slit 311.

[0019] A flange 327 projecting outward from the casing 31 is provided to each of the lateral portions 324. A damper attachment pin 328 extending downward is provided to the flange 327 as shown in Fig. 2.

[0020] The cover 35 is formed of a non-deformable material such as plastic and metal into such a shape as being capable of closing the opening of the second body portion 32. A projection 351 capable of being fitted into the cutout 325 of the second body portion 32 is provided at an upper side of the cover 35. The projection 351 is formed in a shape whose length in a projecting direction is shorter than a depth of the cutout 325. This structure defines the slit 311 on an upper surface of the casing 31, the slit 311 extending in a moving direction of the movable portion 4 and penetrating the casing 31 so that an inside of the casing 31 intercommunicates with an outside thereof when the cover 35 is fastened to the second body portion 32 with a screw (not shown). The stoppers 326 are provided on both longitudinal ends of the slit 311.

[0021] The guide 36 includes a first shaft 361 and a second shaft 362 as shown in Fig. 3. The first shaft 361 is fixed at an upper inside of the casing 31. The second shaft 362 is fixed at a lower inside of the casing 31.

[0022] The movable portion 4 is formed of a non-deformable material such as plastic and metal into a cross shape. Specifically, the movable portion 4 includes a central portion (not shown), two sideward projections 41 respectively projecting rightward and leftward from the central portion, a downward projection (not shown) extending downward from the central portion, and an upward projection 42 extending upward from the central portion.

[0023] A bearing hole (not shown) is provided at an end in the projecting direction of each of the two sideward projections 41. The first shaft 361 is inserted into the bearing holes.

[0024] The bearing groove (not shown), which is formed in a C-shape whose bottom is opened, is provided at an end in the projecting direction of the downward projection. The second shaft 362 is disposed inside the bearing groove.

[0025] These structures allow the movable portion 4 held by the second base portion 3 to be reciprocated in an axial direction of the first shaft 361 and the second shaft 362, when the first shaft 361 inserted in the bearing holes and the second shaft 362 disposed inside the bearing groove are fixed to the casing 31.

[0026] The upward projection 42 is formed in such a shape as to project through the slit 311 and configured to be brought into contact with the stopper 326 when the movable portion 4 is fixed to the second base portion 3. The upward projection 42 has an attachment portion 43 extending upward. An operational knob (not shown) is attached to the attachment portion 43.

[0027] The dampers 5 are formed of an elastically deformable material such as rubber substantially into a cylinder. Each of the dampers 5 is fitted in the damper attachment hole 221 of the first base portion 2. The damper attachment pin 328 of the second base portion 3 is fitted in each of the substantially cylindrical dampers 5. With this structure, the first base portion 2 is connected to the second base portion 3 by the dampers 5, whereby the second base portion 3 is swingable with respect to the first base portion 2.

[0028] The movement restrictor 6 includes a first movement restricting shaft 61, a pair of first shaft holders 62, a first slide contact portion 63, a second movement restricting shaft 64, a pair of second shaft holders 65, and a pair of second slide contact portions 66.

[0029] The first movement restricting shaft 61 and the second movement restricting shaft 64 are each in a form of a round bar, for instance, made of metal.

[0030] The pair of first shaft holders 62 are juxtaposed in the right-left direction near a front edge of the first body portion 21 as shown in Figs. 2 and 4. There is a space between the pair of first shaft holders 62. The first slide contact portion 63 can be disposed in the space.

[0031] Each of the first shaft holders 62 includes a first support 621 and a screw 625. The first support 621 is in a form of a quadrangular block. An upper surface of the first support 621 is defined as a first support surface 622 supporting the first movement restricting shaft 61. A rearward positioning portion 623 projecting upward from the first support surface 622 and extending in the right-left direction is provided at a rear edge of the first support 621. A screw hole 624 into which the screw 625 is fastened is provided at a front edge of the first support 621.

[0032] The first movement restricting shaft 61 is mounted on the first support surface 622 while bridging over the first supports 621 in pairs. The screw 625 is fastened into the screw hole 624. Thus, the first movement restricting shaft 61 is held between the first support surface 622, the rearward positioning portion 623 and the screw 625, so that the movement of the first movement restricting

shaft 61 in the front-back and right-left directions is restricted.

[0033] The first slide contact portion 63 is provided to the center in the right-left direction of the bottom portion 323 of the second base portion 3. The first slide contact portion 63 includes: a downward extending portion 631 extending downward from the bottom portion 323; and a forward extending portion 632 extending forward from a lower end of the downward extending portion 631. The first slide contact portion 63 is substantially formed in an L-shape in a lateral view. A first slide contact projection 633 is provided at the center of the forward extending portion 632 in the right-left direction. A second slide contact projection 634 is provided on a part of the bottom portion 323 facing the first slide contact projection 633. The first slide contact projection 633 and the second slide contact projection 634 respectively project in mutually approaching directions.

[0034] Third slide contact projections 635 are provided to right and left sides of the first slide contact portion 63 on the bottom portion 323.

[0035] Thus, while the axial center of the first movement restricting shaft 61 is held between the first slide contact projection 633 and the second slide contact projection 634 of the first slide contact portion 63, both the axial ends of the held first movement restricting shaft 61 are in contact with the third slide contact projections 635.

[0036] The pair of second shaft holders 65 are juxtaposed in the right-left direction near a rear edge of the first body portion 21 as shown in Figs. 3 and 4.

[0037] Each of the second shaft holders 65 includes a second support 651 and a screw 655. The second support 651 is in a form of a quadrangular block. An upper surface of the second support 651 is defined as a second support surface 652 supporting the second movement restricting shaft 64. A forward positioning portion 653 projecting upward from the second support surface 652 and extending in the right-left direction is provided at a front edge of the second support 651. A screw hole 654 into which the screw 655 is fastened is provided at a rear edge of the second support 651.

[0038] The second movement restricting shaft 64 is mounted on the second support surface 652 while bridging over the second supports 651 in pairs. The screw 655 is fastened into the screw hole 654. Thus, the second movement restricting shaft 64 is held between the second support surface 652, the forward positioning portion 653 and the screw 655, so that the movement of the second movement restricting shaft 64 in the front-back and right-left directions is restricted.

[0039] The pair of second slide contact portions 66 are provided to right and left sides on a rear surface of the cover 35 of the second base portion 3. Each of the second slide contact portions 66 includes: a rearward extending portion 661 extending rearward from the cover 35; and a downward extending portion 662 extending downward from a lower end of the rearward extending portion 661. A part of the rear surface of the cover 35, which faces

the downward extending portion 662, is positioned closer to the downward extending portion 662 than the rest of the rear surface of the cover 35 is close to the downward extending portion 662, and functions as a slide contact surface 663 of the second slide contact portions 66.

[0040] At positions outer than the second shaft holders 65, the second movement restricting shaft 64 is held between the downward extending portion 662 and the slide contact surface 663 of each of the second slide contact portions 66.

[0041] Since the first slide contact portion 63 holds the first movement restricting shaft 61 and the second slide contact portions 66 holds the second movement restricting shaft 64 as described above, the first base portion 2 is movable in the axial direction of the first movement restricting shaft 61 and the second movement restricting shaft 64 with respect to the second base portion 3 and is immovable in the other directions.

Advantage(s) of Embodiment(s)

[0042] As described above, the operation device 1 includes the dampers 5 connecting the first base portion 2 to the second base portion 3 on which the movable portion 4 is provided.

[0043] Accordingly, for instance, when an operational knob (not shown) attached to the attachment portion 43 of the movable portion 4 is operated from a position shown in solid lines to a position shown in chain double-dashed lines in Fig. 3 to cause the movable portion 4 to hit an end of the slit 311, the shock caused at this time is absorbed by the dampers 5 since the second base portion 3 is entirely moved with respect to the first base portion 2. Accordingly, when the user releases the operation element from his hand after the movable portion 4 hits the stopper 326, a bouncing amount of the movable portion 4 can be reduced.

[0044] Moreover, since it is not necessary to provide a shock-absorbent material having a low hardness at the ends of the slit 311, it can be inhibited to impair the operational feeling to be felt by the user when the movable portion 4 hits the stopper 326.

[0045] Further, the movement restrictor 6 restricts the second base portion 3 with respect to the first base portion 2 to be movable only in the axial direction of the first movement restricting shaft 61 and the second movement restricting shaft 64, namely, only in the moving direction of the movable portion 4.

[0046] Accordingly, the second base portion 3 can be inhibited from shifting in a direction different from an operation direction of the operational knob (i.e., the moving direction of the movable portion 4) during the operation by the user.

[0047] When the operation device according to the exemplary embodiment is used in a cross-fader of a DJ device, the stopper 326 provided at each end of the slit 311 requires sound absorbency, shock absorbency, durability, and hardness. The sound absorbency is required

for reducing noise caused by hitting sounds. The shock absorbency is required for reducing the bouncing of the movable portion 4. The durability is required for decreasing a replacement frequency of the stopper 326 due to damage and deterioration. The hardness is required for inhibiting a poor positional accuracy at the ends of the slit 311.

[0048] However, it is difficult to choose a material satisfying all the above four properties, so that a compromise on any one of the properties has been inevitable depending on demands of users and manufacturers.

[0049] According to the exemplary embodiment, since the shock absorbency is at least satisfied by the dampers 5 independently of the stopper 326, the material for the stopper 326 can be chosen from materials satisfying at least one of the sound absorbency, durability, and hardness even though having a slightly poor shock absorbency. Thus, the material for the stopper 326 can be chosen from a variety of materials.

[0050] Particularly, since the stopper 326 having the sound absorbency (i.e., the stopper 326 particularly excellent in the sound absorbency) is provided at the ends of the slit 311, sounds made when the movable portion 4 hits the stopper 326 are mostly absorbed by the stopper 326. Consequently, generation of hitting sounds is inhibited even at a violent operation to allow the user to comfortably make a DJ performance.

Modification(s)

[0051] The invention is no means by limited only to the above exemplary embodiment, but may include various improvements and design modifications without deviating from the scope of the invention.

[0052] For instance, although the rubber is used for the dampers 5, a coil spring, a plate spring and a sponge may be used. Alternatively, a hydraulic damper, a pneumatic damper, or a magnetic damper may be used. Moreover, the right and left dampers 5 do not necessarily have the same structure. For instance, the right damper 5 may be made of rubber and the left damper 5 may be in a form of a coil spring.

[0053] Further, although the dampers 5 connecting the first base portion 2 to the second base portion 3 are provided on the top ends of the lateral sides 22 of the first base portion 2, the dampers 5 may be provided to mutually facing surfaces of the lateral sides 22 in pairs (i.e., a left surface of the right lateral side 22 and a right surface of the left lateral side 22). Furthermore, positions of the right and left dampers 5 are not necessarily the same. For instance, one of the dampers 5 may be provided at the left surface of the right lateral side 22 and the other of the dampers 5 may be provided at the top end of the left lateral side 22.

[0054] The movement restrictor 6 is not necessarily provided. Further, a combination of the first movement restricting shaft 61, the first shaft holders 62 and the first slide contact portion 63 provided to the front side of the

operation device 1 or a combination of the second movement restricting shaft 64, the second shaft holders 65 and the second slide contact portions 66 provided to the rear side of the operation device 1 may not be necessarily provided.

[0055] The stopper 326 is not necessarily provided. Although the material preferably having the sound absorbency is chosen for the stopper 326, a material preferably having at least one of the sound absorbency, the shock absorbency or the durability may alternatively be chosen.

[0056] The operation device of the invention may be used in a DJ mixer, a DJ player and an audio effector or may be used in products other than DJ devices, such as a music player, a game device and electric home appliances.

EXPLANATION OF CODE(S)

[0057] 1...operation device, 2...first base portion, 3...second base portion, 4...movable portion (slide operation element), 5...dampers, 6...movement restrictor.

Claims

1. An operation device comprising:

a second base portion having a slide operation element;
a first base portion holding the second base portion; and
a damper connecting the first base portion to the second base portion, wherein
the second base portion is capable of oscillating.

2. The operation device according to claim 1, further comprising:
a movement restrictor configured to restrict a direction in which the second base portion is capable of oscillating with respect to the first base portion only to a moving direction of the slide operation element.

3. The operation device according to claim 1 or 2, further comprising:
a low resilient material provided at both ends of the slide operation element and configured to restrict a movable range of the slide operation element.

4. A cross-fader comprising the operation device according to any one of claims 1 to 3.

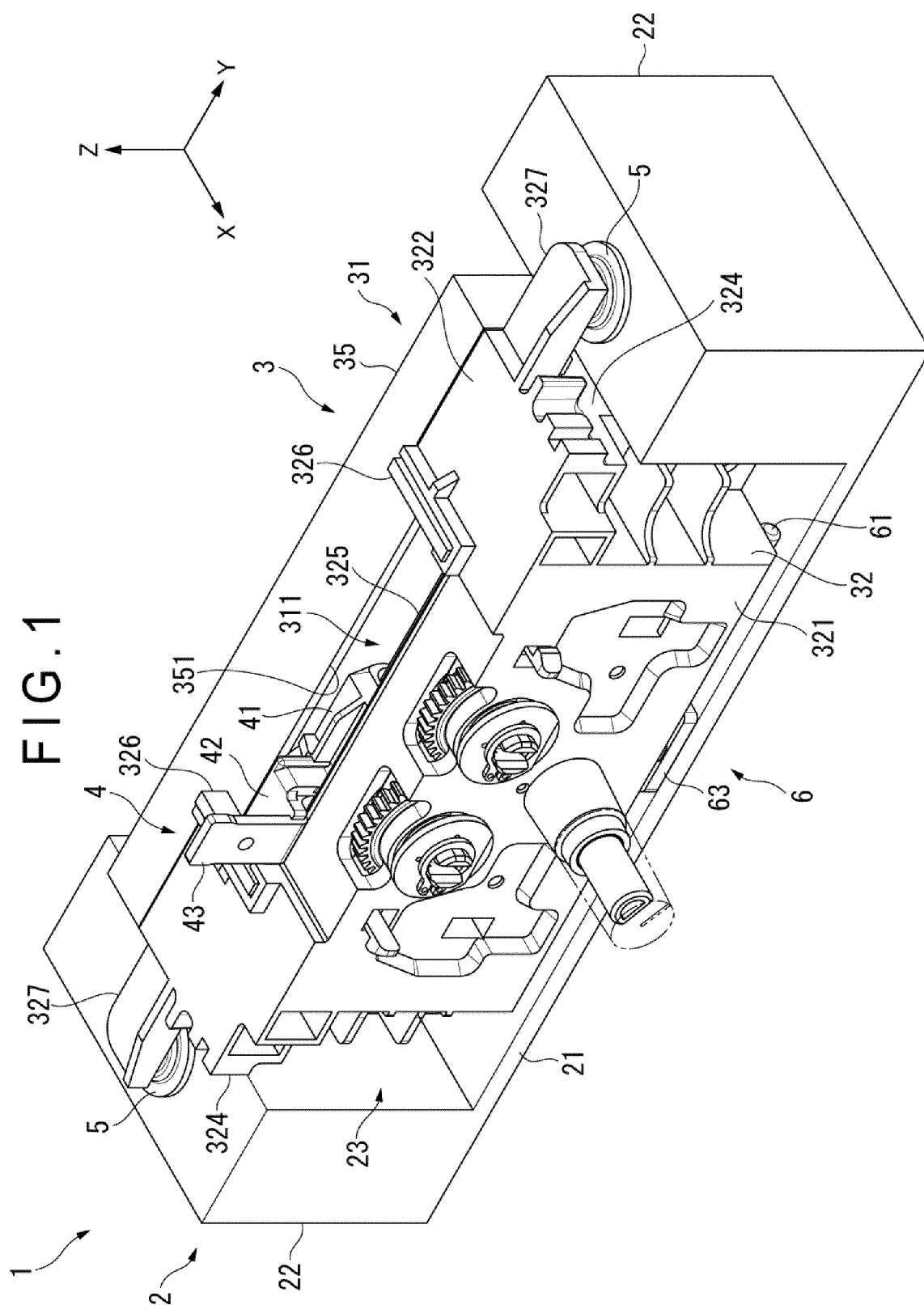
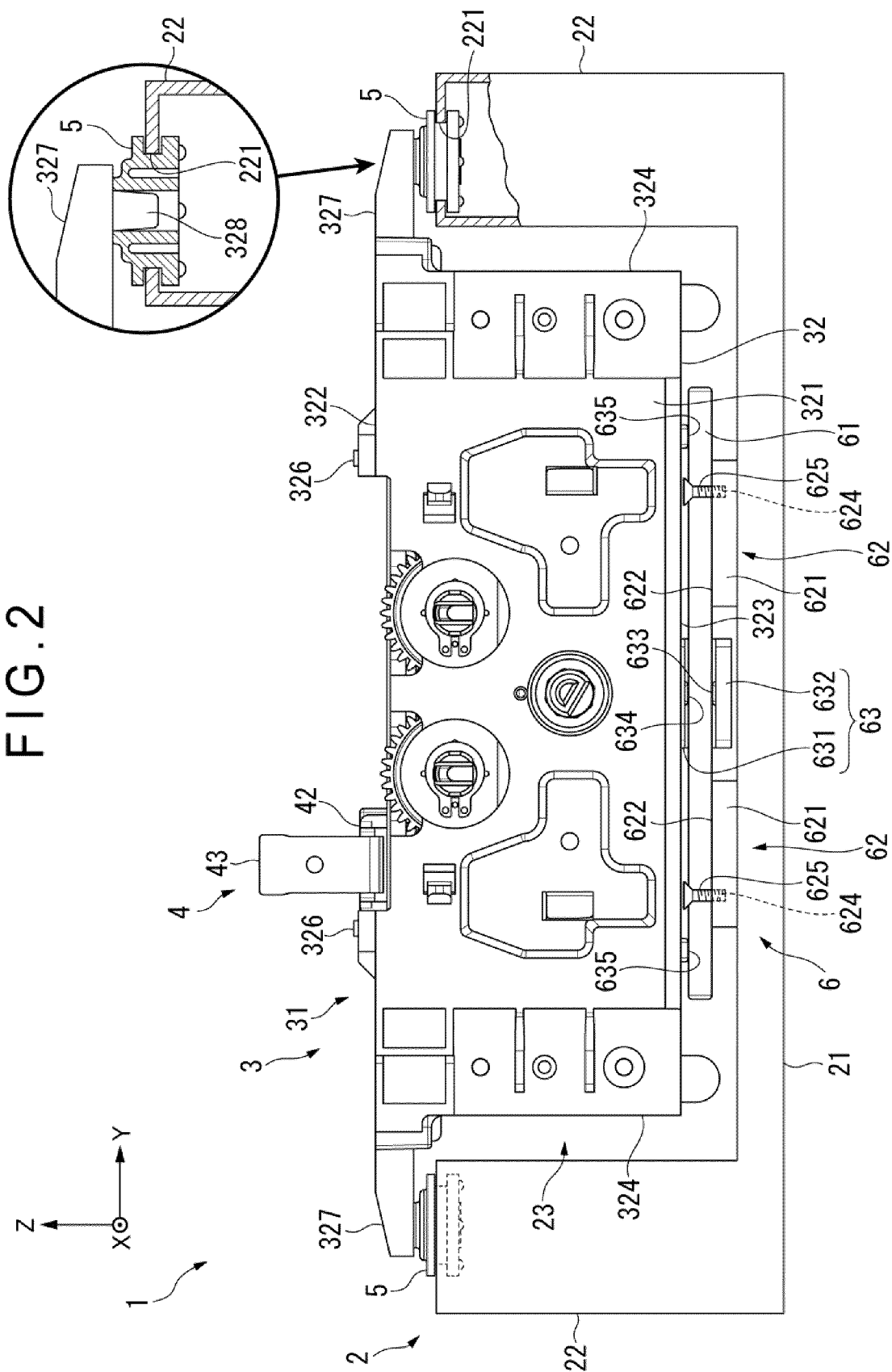


FIG. 2



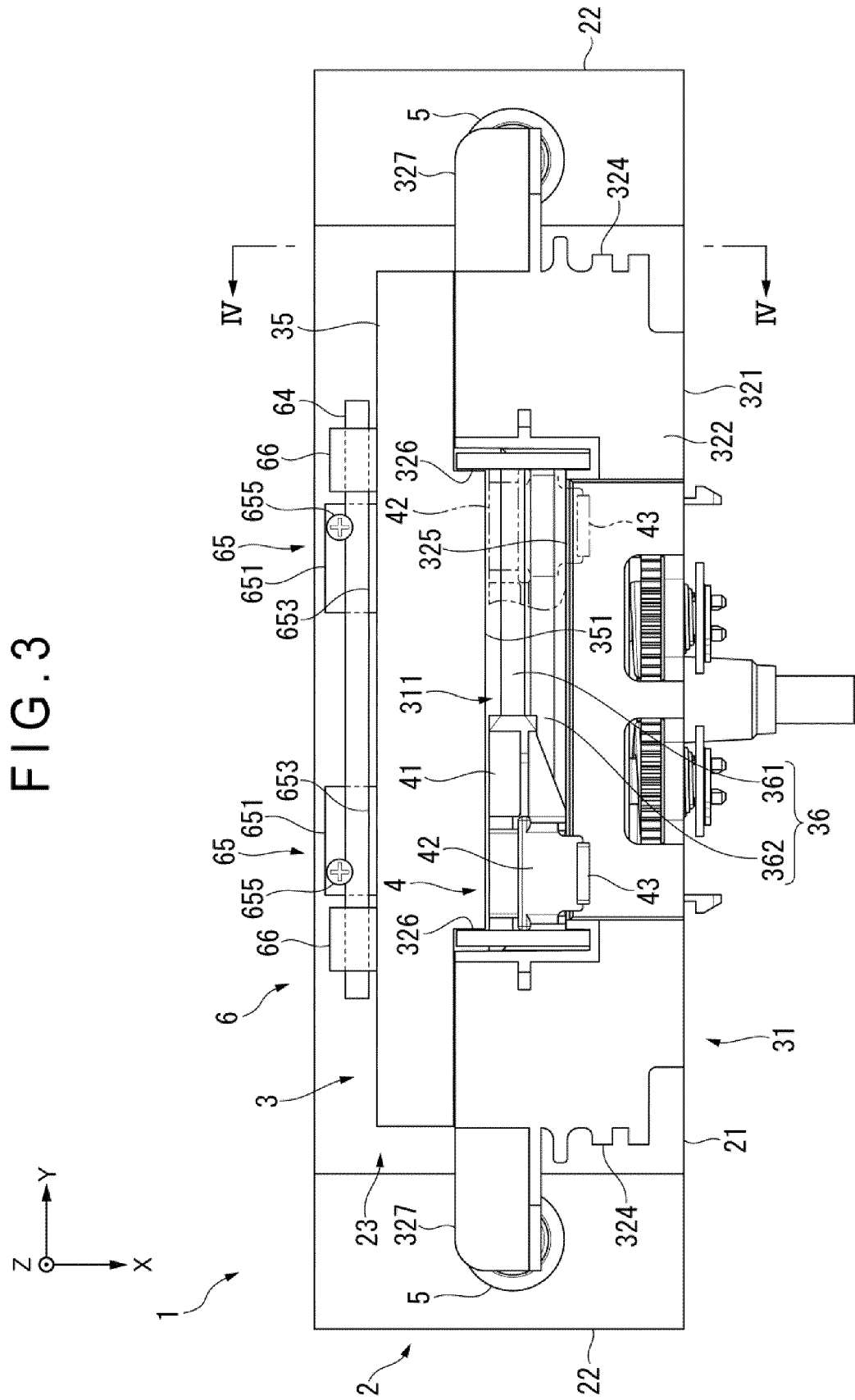
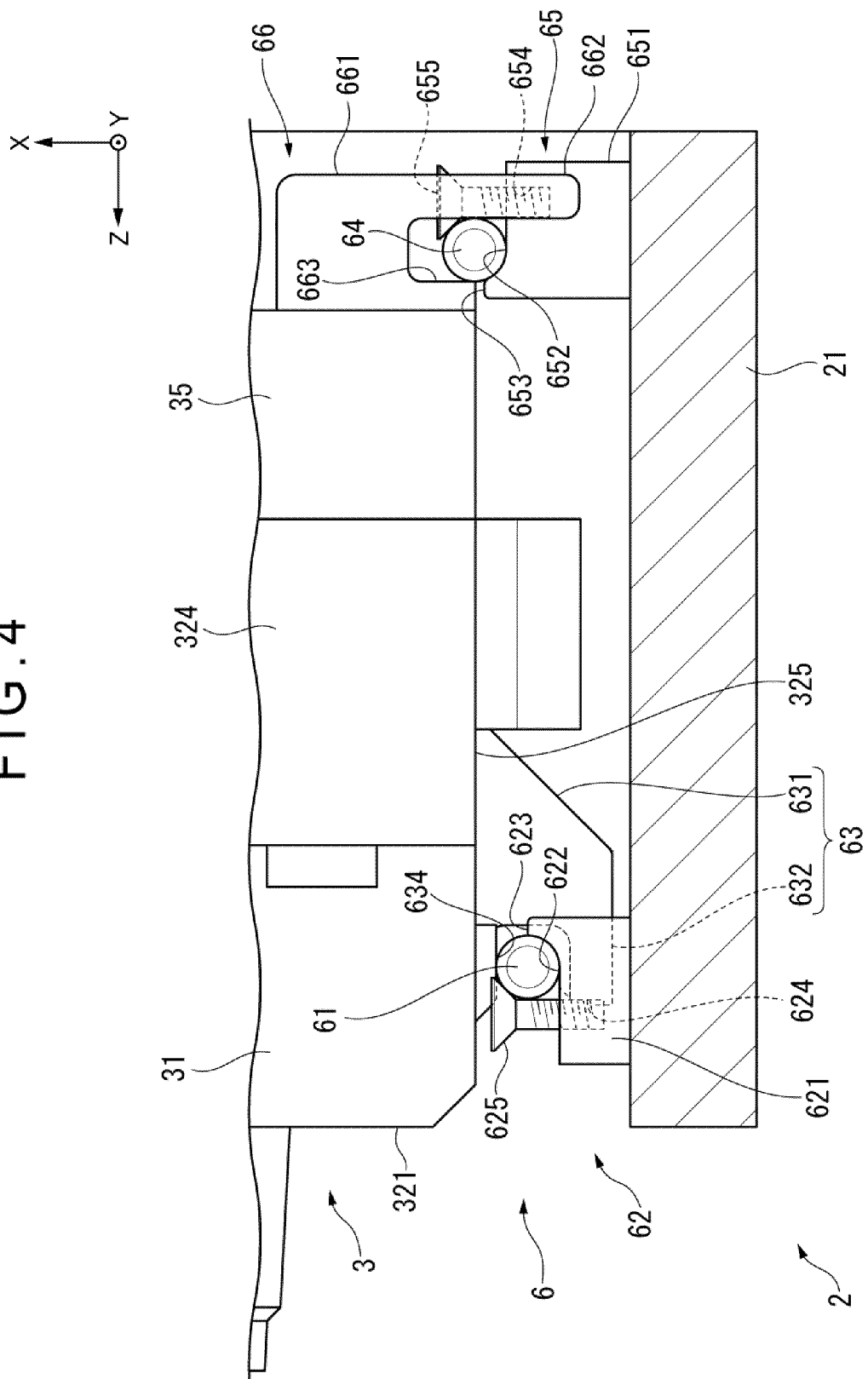


FIG. 4



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2015/070684

A. CLASSIFICATION OF SUBJECT MATTER

G05G5/03(2008.04) i

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

G05G5/03

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

Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2015

Kokai Jitsuyo Shinan Koho 1971-2015 Toroku Jitsuyo Shinan Koho 1994-2015

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2007-228543 A (D & M Holdings Inc.), 06 September 2007 (06.09.2007), entire text; all drawings (Family: none)	1-4
A	JP 2006-332074 A (Yamaha Corp.), 07 December 2006 (07.12.2006), entire text; all drawings & US 2007/0002488 A1 & CN 1892525 A	1-4
A	JP 2006-165144 A (Tokyo Ko-on Denpa Co., Ltd.), 22 June 2006 (22.06.2006), entire text; all drawings (Family: none)	1-4

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

* Special categories of cited documents:

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Date of the actual completion of the international search
05 October 2015 (05.10.15)Date of mailing of the international search report
13 October 2015 (13.10.15)Name and mailing address of the ISA/
Japan Patent Office
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Tokyo 100-8915, Japan

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2010249529 A [0003]