US 20100108844A1

(19) United States

(12) Patent Application Publication

(10) Pub. No.: US 2010/0108844 A1

(43) Pub. Date: May 6, 2010

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(54) PANEL ATTITUDE CHANGING SYSTEM AND ELECTRONIC EQUIPMENT WITH PANEL ATTITUDE CHANGING SYSTEM

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(21) Appl. No.: **12/588,793**

(22) Filed: **Oct. 28, 2009**

(30) **Foreign Application Priority Data**

Oct. 30, 2008 (JP) P2008-280108

Publication Classification

(51) **Int. Cl.**
A47B 96/06 (2006.01)

(52) **U.S. Cl.** **248/274.1**

(57) **ABSTRACT**

A movable base is adapted to pivot about first pivotal shafts, a panel holder configured to hold a panel is pivotally connected to the movable base through second pivotal shafts perpendicular to the first pivotal shafts, and a holder drive mechanism arranged on the movable base is configured for the panel holder to pivot about the second pivotal shafts.

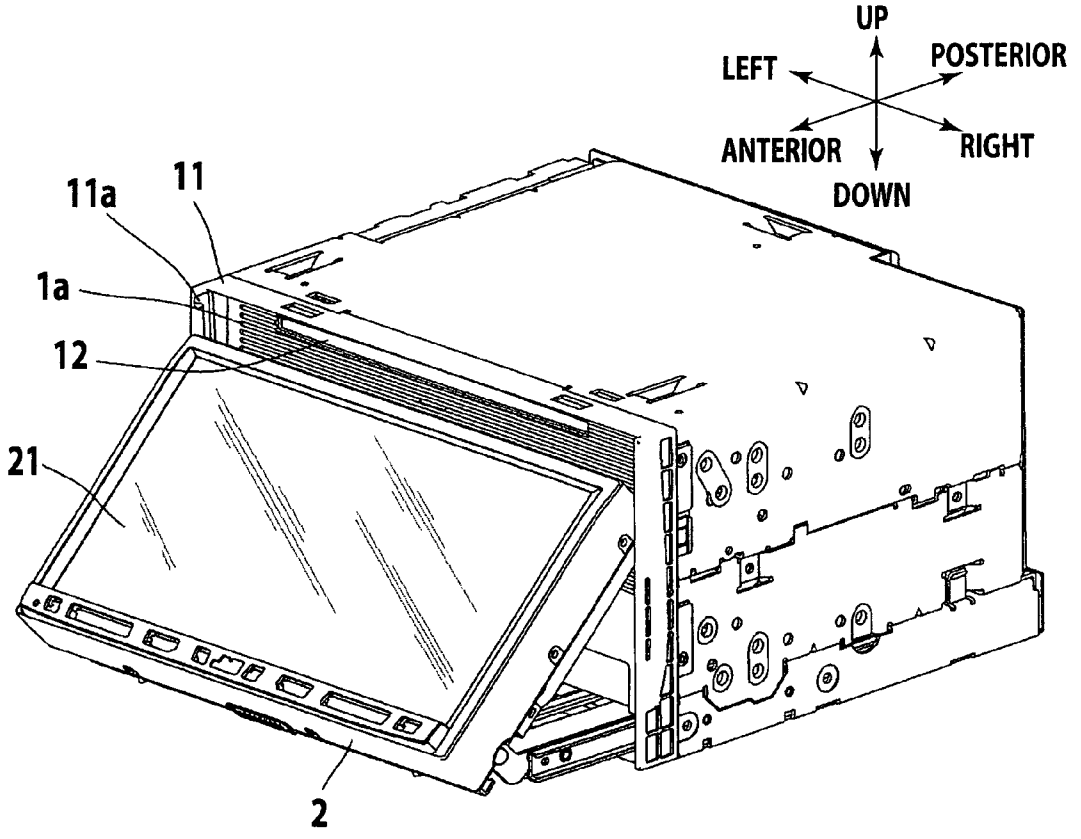


FIG. 1

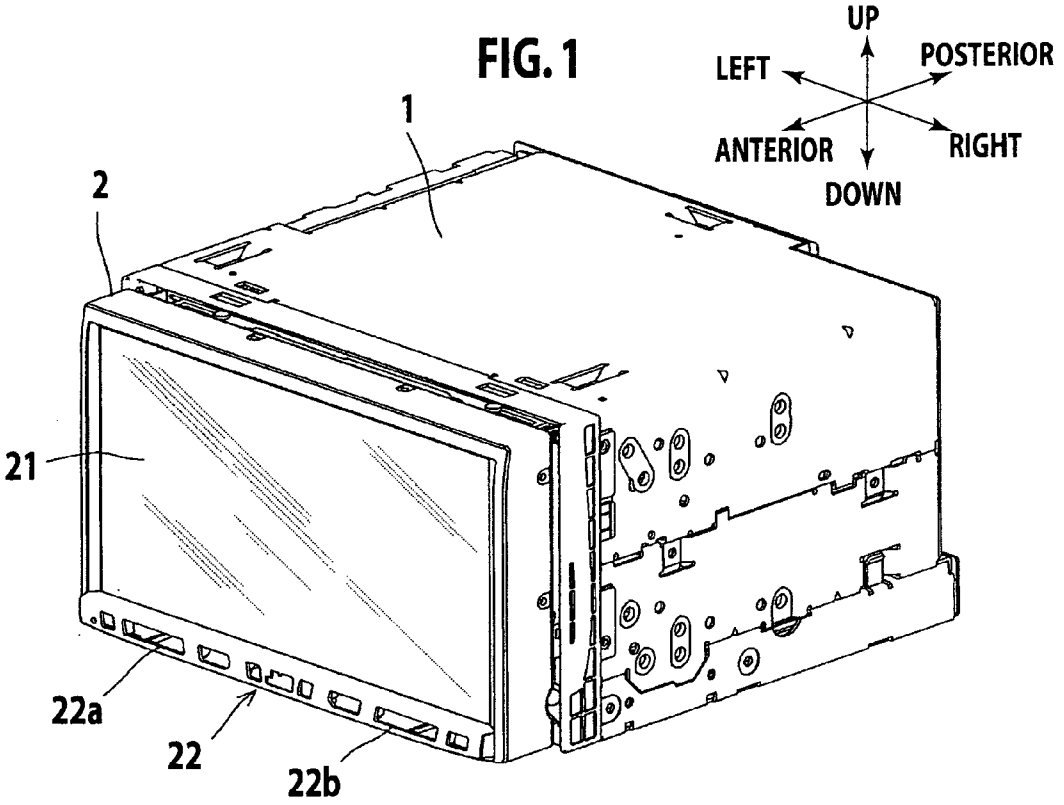

UP
LEFT
POSTERIOR
ANTERIOR
RIGHT
DOWN
1
2
21
22a
22
22b

FIG. 2

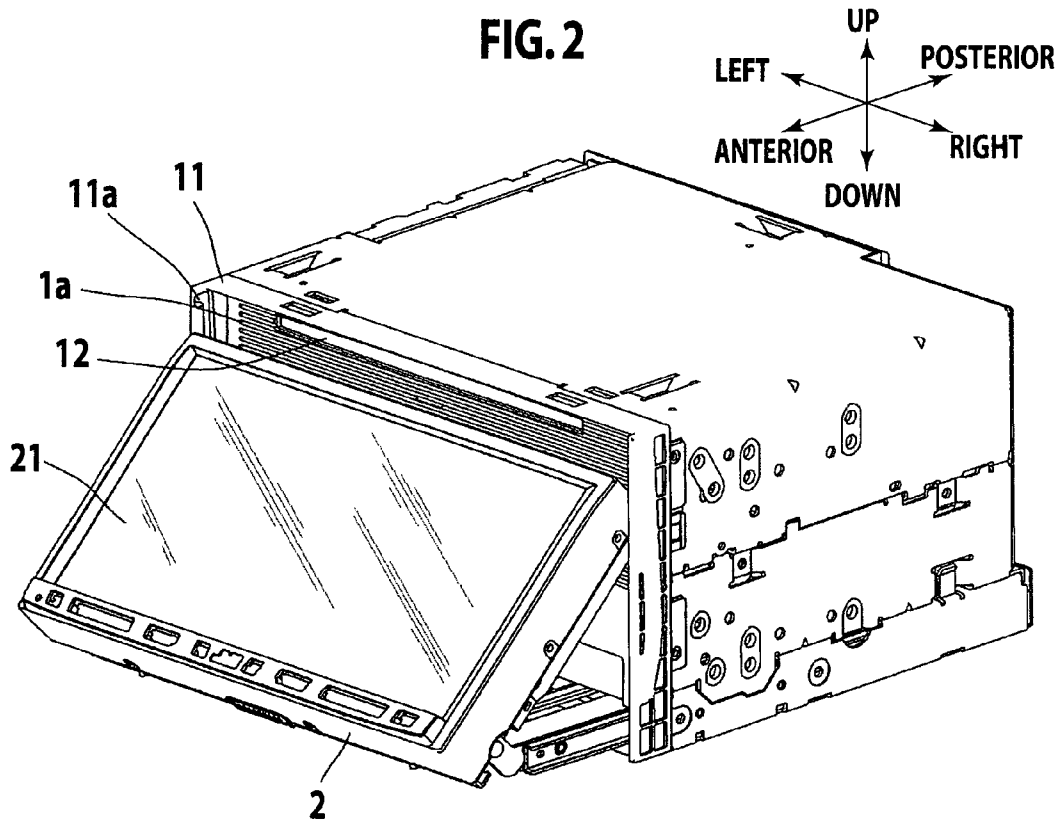

UP
LEFT
POSTERIOR
ANTERIOR
RIGHT
DOWN
11a
11
1a
12
21
2

FIG. 3

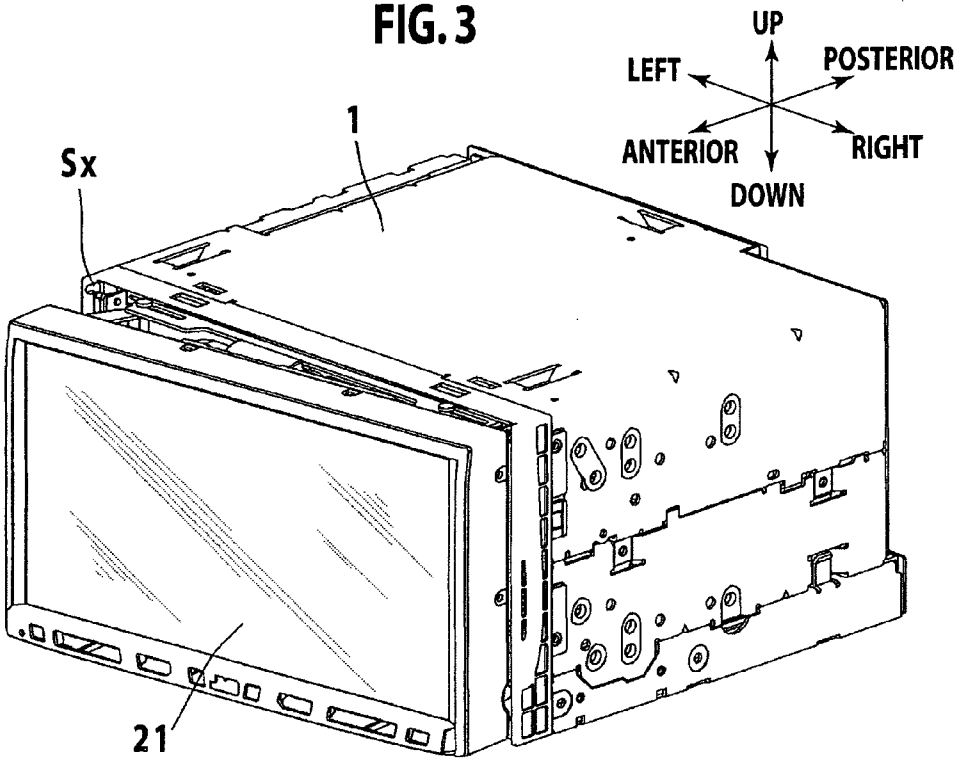

UP
LEFT
POSTERIOR
ANTERIOR
RIGHT
DOWN
1
Sx
21

FIG. 4

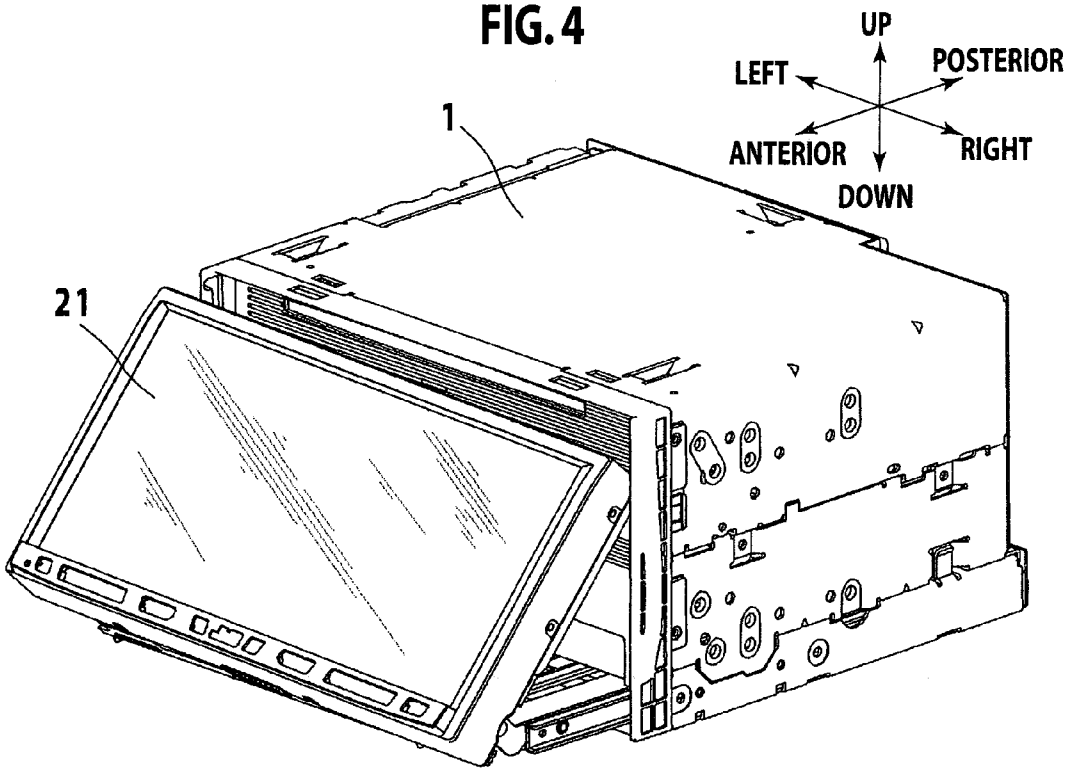

UP
LEFT
POSTERIOR
ANTERIOR
RIGHT
DOWN
1
21

FIG. 5

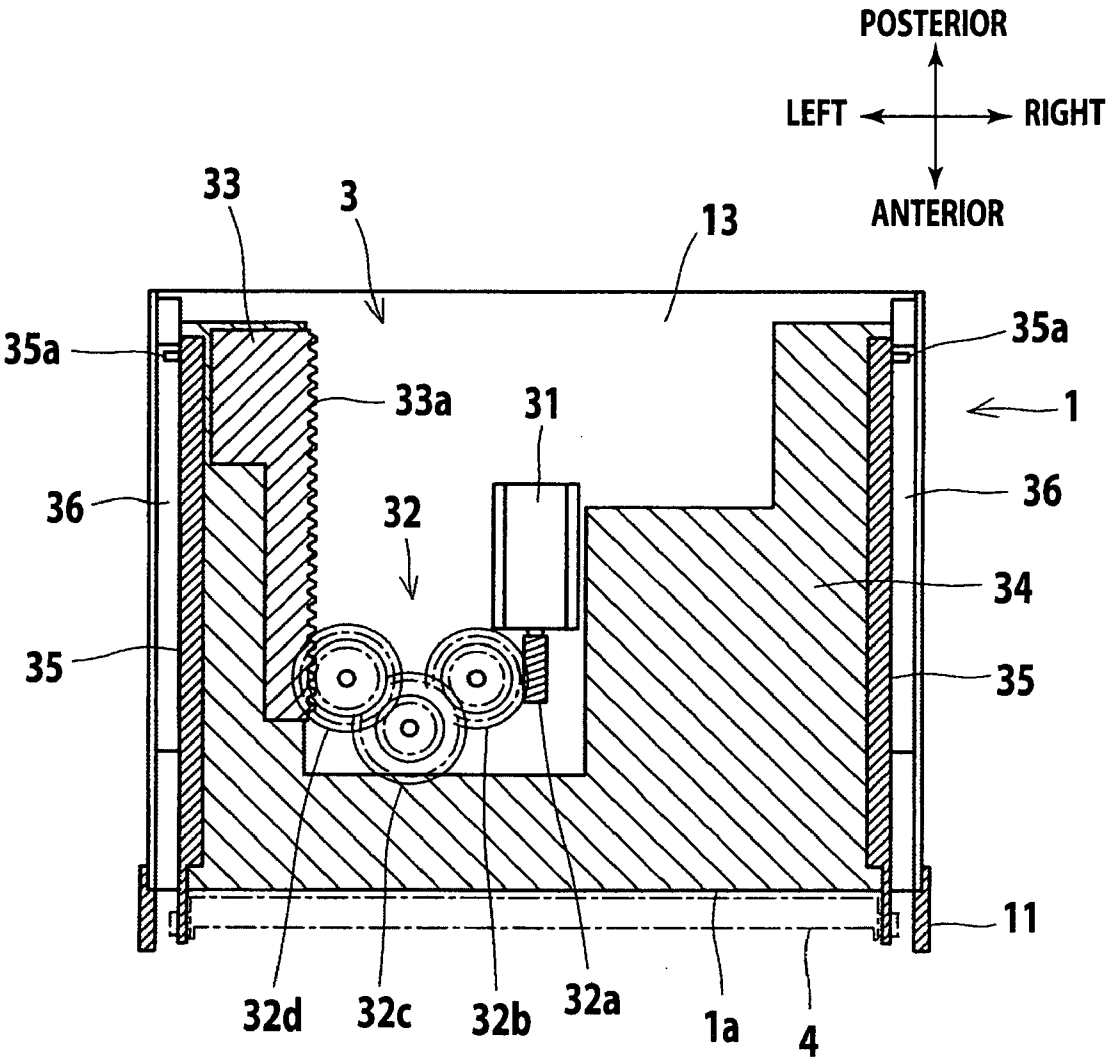

POSTERIOR
LEFT
RIGHT
ANTERIOR
33
3
13
35a
35a
33a
31
1
36
36
32
34
35
35
11
32d
32c
32b
32a
1a
4

FIG. 6

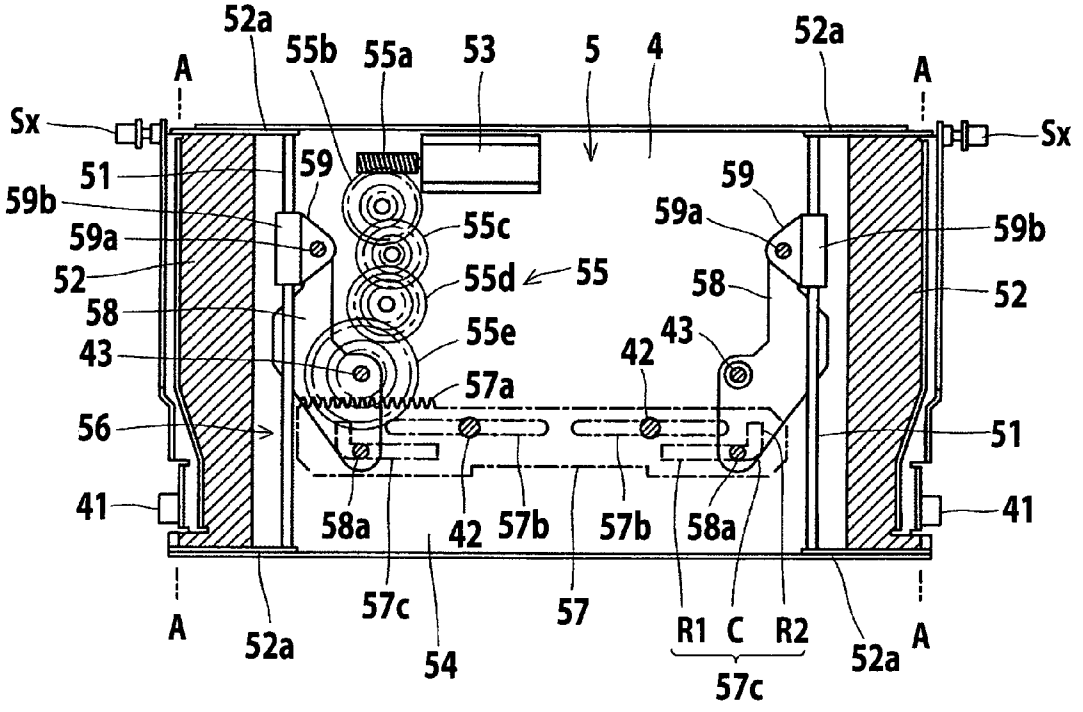

52a
55b
55a
53
5
4
52a
A
A
Sx
Sx
51
59
59
59b
59a
59a
59b
55c
52
55d
55
58
52
58
55e
43
42
43
57a
56
51
41
41
58a
42
57b
57b
58a
A
A
52a
57c
57
54
R1
C
R2
52a
57c

FIG. 7A

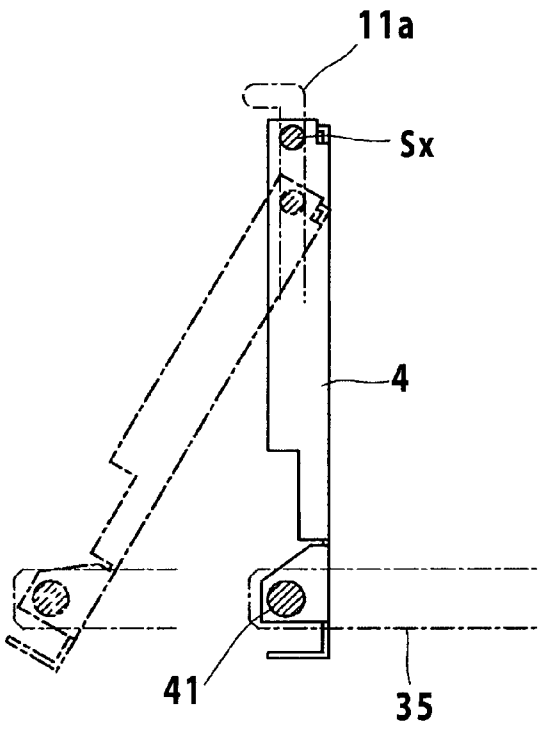


FIG. 7B

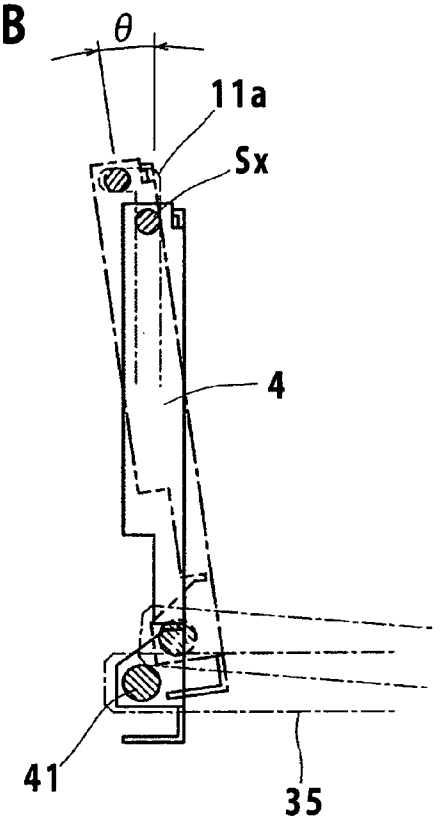


FIG. 8

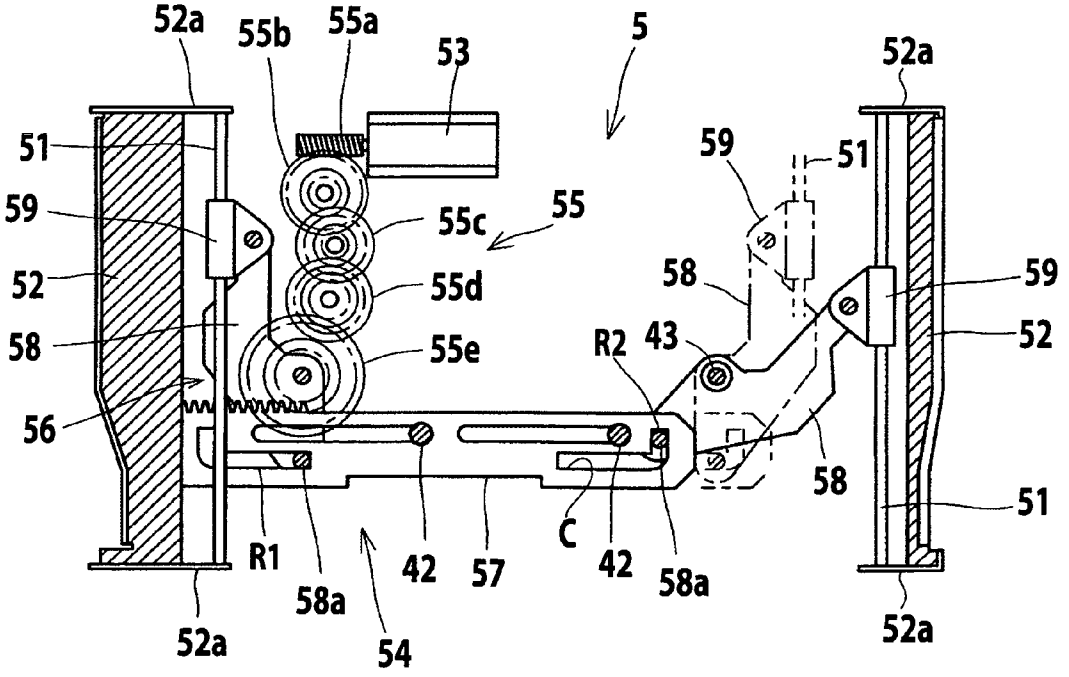


FIG. 9

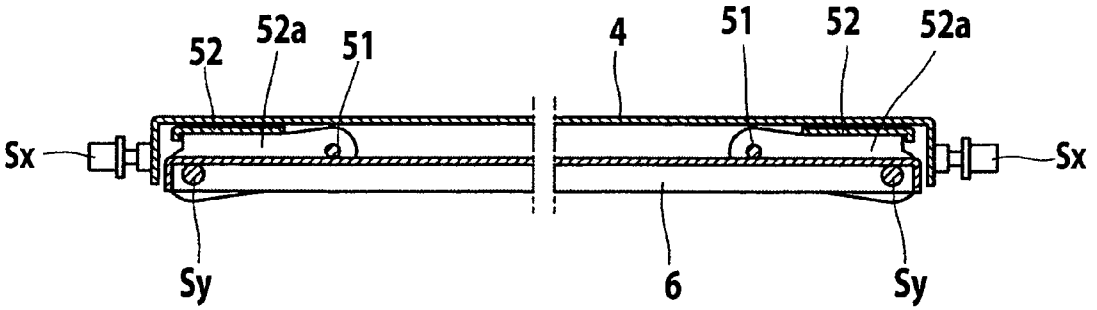


FIG. 10

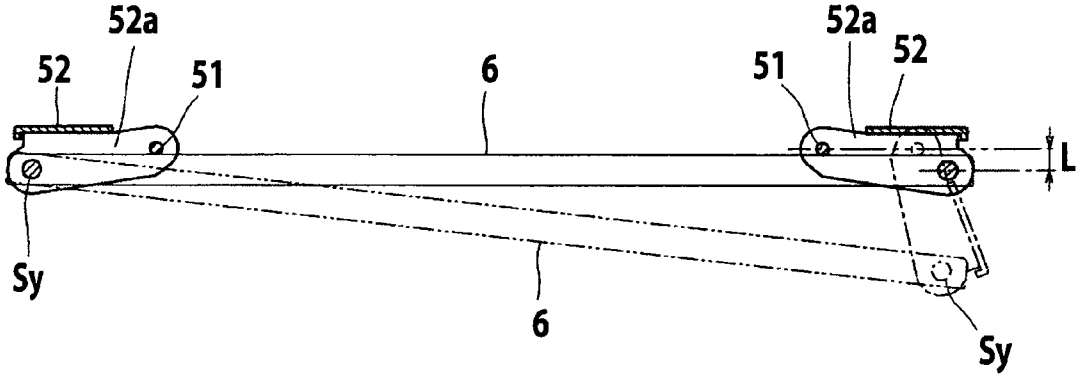


FIG. 11

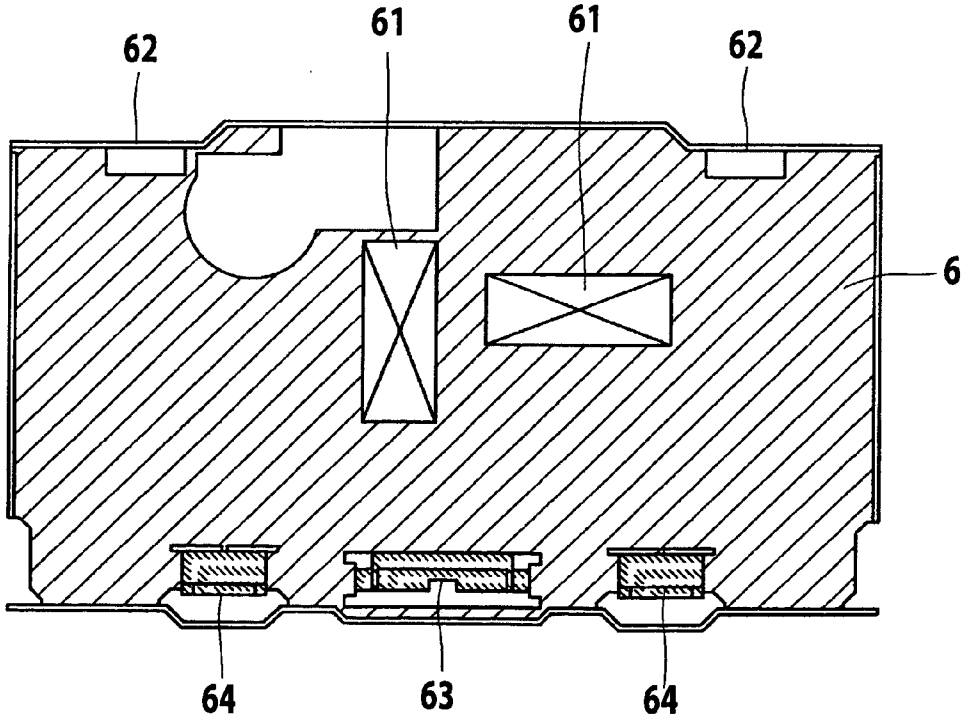


FIG. 12

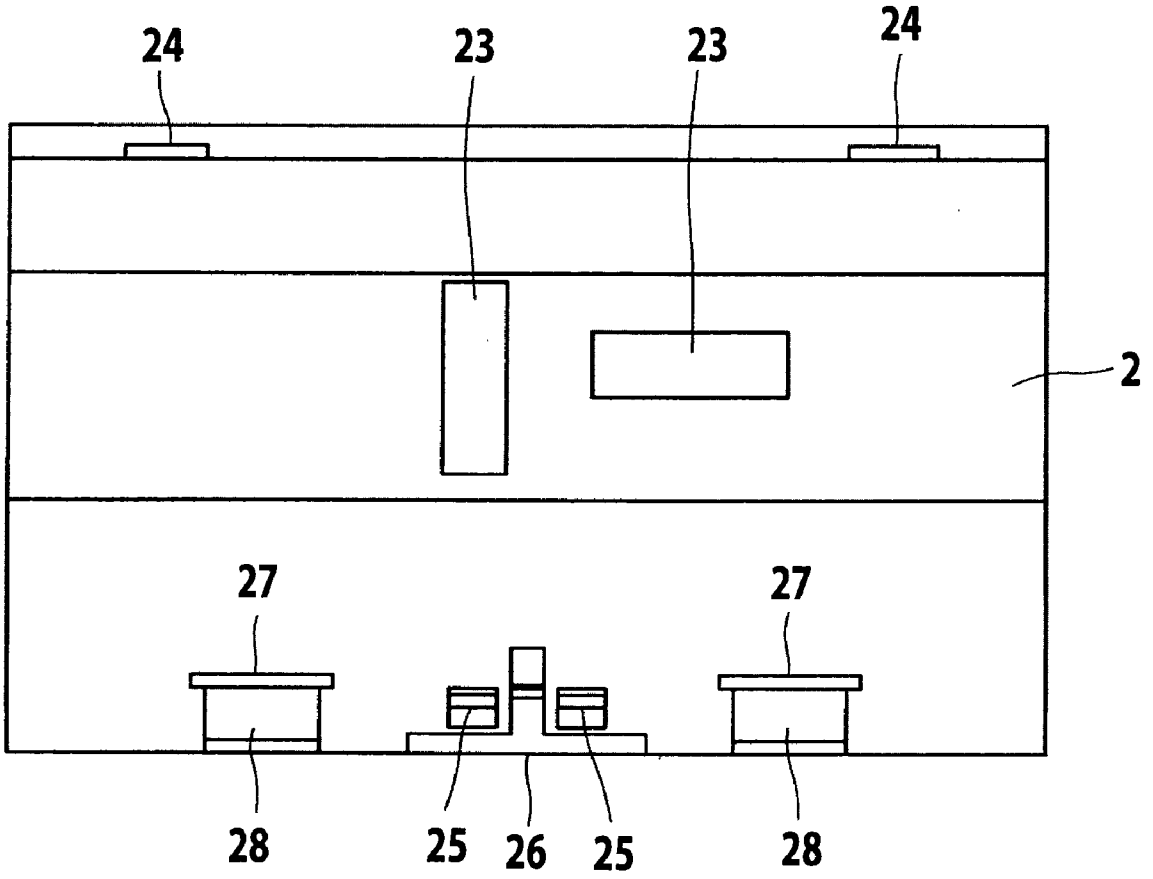


FIG. 13

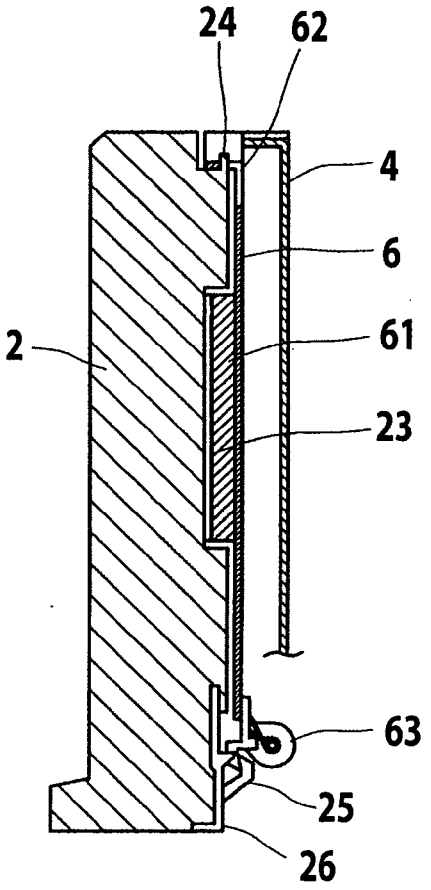


FIG. 14

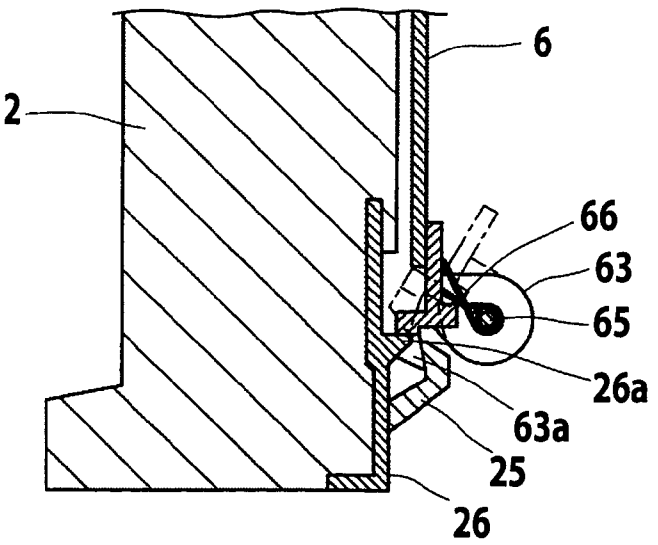


FIG. 15

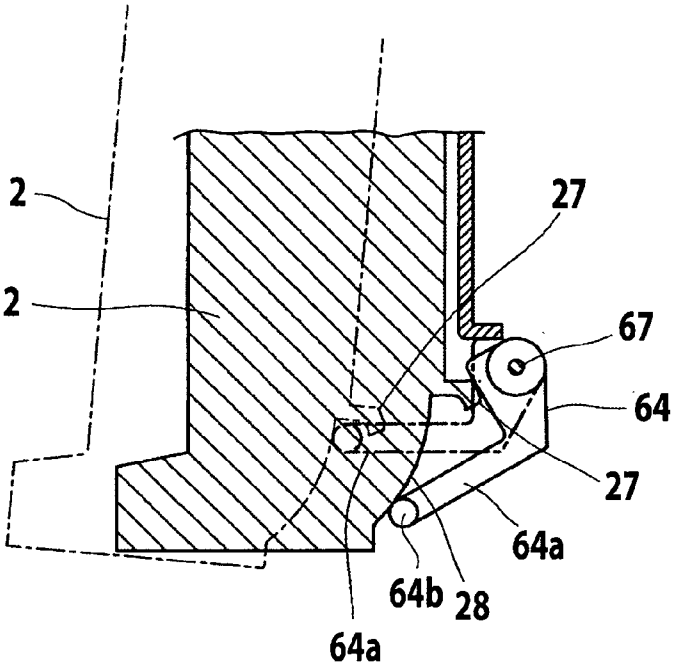
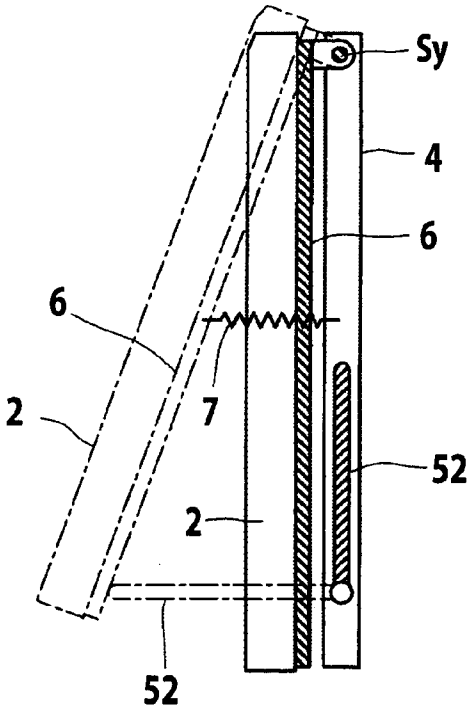


FIG. 16



PANEL ATTITUDE CHANGING SYSTEM AND ELECTRONIC EQUIPMENT WITH PANEL ATTITUDE CHANGING SYSTEM

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The present invention addresses a technique to implement a desirable orientation of a panel, such as a liquid crystal display panel (referred herein to an LCD panel), a panel-form speaker, or an operational panel, and relates to a panel attitude changing system, in particular to that suitable for vehicular electronic equipments provided with such a type of panel at a front of an equipment casing main body.

[0003] 2. Description of the Related Art

[0004] As well-known conventional vehicular electronic equipments such as a car audio or car navigation system, there are those provided with an operational panel having a display screen or a display panel such as an LCD panel, at a front of an equipment casing main body to be fixed in a vehicle interior. Most of electronic equipments of such a type are arranged to a center console in a vehicle interior, and adapted for a user sitting in a driver's seat or front passenger's seat to look a front face of the panel (such as a display screen) from an angle, not from an anterior. To this point, there have been studies to provide a display screen with an enlarged visual angle. However, even though given an enlarged visual angle of display screen, some panels have an operational portion operable from an angle such as from a driver's seat, leaving a room of improvement for the operability to be enhanced.

[0005] In this respect, there are known configurations adapted to change a normal direction (referred herein to an "orientation") of a panel vertically and sideways, for enhancement of operability of an operational portion as well as visibility of a display screen of the panel.

[0006] Japanese Patent Application Laid-Open Publication No. 2007-245930 discloses a vehicular equipment, in which a holder for supporting a panel and an equipment casing main body are interconnected by drive mechanisms, which are operative to change the orientation of the holder as well as the panel supported by the holder vertically and sideways.

SUMMARY OF THE INVENTION

[0007] In the vehicular equipment disclosed in the patent document-1, the drive mechanisms operative to change the orientation of the panel are each configured with a complex cam mechanism including a pair of arms as following nodes connected to the holder, and a cam plate adapted for a forward rotation and a reverse rotation to bring the pair of arms in defined motions, and they are arranged at both right and left of the equipment casing main body, needing a large number of component parts and a space for their arrangement, constituting difficulties to equipment down-sizing and cost reduction.

[0008] Further, for the drive mechanism, the cam plate has curvilinear cam grooves that are continuously formed therein to bring the pair of arms in defined motions, and may be difficult in design, consuming much time for assembly of the component parts, as well.

[0009] Further, according to the patent document-1, assuming a state of the panel inclined in an anteroposterior direction, for instance, in order for the panel face to be oriented sideways, the panel is unable to directly turn sideways with a maintained anteroposterior inclination, but instead it is to go through an upright attitude to turn sideways. That is, the configuration in the patent document-1 is inadaptable for any action to simultaneously change the orientation of the panel face vertically and sideways, and the orientation of the panel face is restricted simply to a selective one of horizontal and vertical directions. Therefore, for a point of view positioned obliquely upwardly off from the panel face, the panel face is unable to provide an anterior view to the viewpoint, so it has a deteriorated visibility to the viewpoint, as an issue.

[0010] The present invention has been devised in view of such problems, and an object thereof is to provide a panel attitude changing system with a simplified structure that allows, even in application to an electronic equipment provided with a panel and arranged to a center console in a vehicle interior, for instance, for a favorable acquisition of an output (such as an audio or video) from the panel irrespective of the user's position, as well as favorable operations as necessary thereto.

[0011] To achieve the object described, according to an aspect of the present invention, a panel attitude changing system comprises a movable base adapted to pivot about first pivotal shafts, a panel holder configured to hold a panel and pivotally connected to the movable base through second pivotal shafts perpendicular to the first pivotal shafts, and a holder drive mechanism arranged on the movable base and configured for the panel holder to pivot about the second pivotal shafts.

[0012] According to another aspect of the present invention, in the above-noted panel attitude changing system, the holder drive mechanism comprises operational plates adapted to lie and stand between the movable base and the panel holder, a rotary drive source configured to generate power for the operational plates to lie and stand, and a power train configured for transmission of power with conversion of rotary motions of the rotary drive source to lying and standing motions of the operational plates, and is adapted, as an operational plate stands with power transmitted by the power train, for the panel holder to pivot about the second pivotal shafts to come out anteriorly at an end thereof the operational plate is standing.

[0013] To achieve the object described, according to another aspect of the present invention, a panel attitude changing system comprises a stationary base, a panel holder configured to hold a panel and pivotally connected to the stationary base through pivotal shafts, and a holder drive mechanism arranged on the stationary base and configured for the panel holder to pivot about the pivotal shafts, the holder drive mechanism comprising operational plates adapted to lie and stand between the stationary base and the panel holder, a rotary drive source configured to generate power for the operational plates to lie and stand, and a power train configured for transmission of power with conversion of rotary motions of the rotary drive source to lying and standing motions of the operational plates, the holder drive mechanism being adapted, as an operational plate stands with power transmitted by the power train, for the panel holder to pivot about the pivotal shafts to come out anteriorly at an end thereof the operational plate is standing.

[0014] According to another aspect of the present invention, in the above-noted panel attitude changing system, the panel has a display adapted to display a frame of image, and is detachably attached to the panel holder.

[0015] According to another aspect of the present invention, an electronic equipment comprises the above-noted

panel attitude changing system, with the panel positioned at an end of an equipment casing main body.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] FIG. **1** is a perspective view of an electronic equipment with a panel including a panel attitude changing system according to an embodiment of the present invention.

[0017] FIG. **2** is a perspective view of the electronic equipment with the panel oriented upward.

[0018] FIG. **3** is a perspective view of the electronic equipment with the panel oriented rightward.

[0019] FIG. **4** is a perspective view of the electronic equipment with the panel oriented upwardly rightward.

[0020] FIG. **5** is a schematic plan view of an internal structure of an equipment casing main body.

[0021] FIG. **6** is a front view of a movable base with a holder drive mechanism mounted thereon.

[0022] FIG. **7**A and FIG. **7**B are side views of the movable base in pivotal motions.

[0023] FIG. **8** is a front view of the holder drive mechanism in operation.

[0024] FIG. **9** is a sectional top view of the movable base connected with the panel holder.

[0025] FIG. **10** is a sectional top view of the panel holder in pivotal motion.

[0026] FIG. **11** is a front view of the panel holder.

[0027] FIG. **12** is a rear view of the panel.

[0028] FIG. **13** is a sectional side view of the panel held by panel holder.

[0029] FIG. **14** is a fractional sectional side view of the panel held by panel holder.

[0030] FIG. **15** is a fractional sectional side view of the panel in the course of removal from the panel holder.

[0031] FIG. **16** is a sectional side view of a panel attitude changing system according to another embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0032] There will be described below into details the preferred embodiments of the present invention, with reference to the accompanying drawings. FIG. **1** is a perspective view of an electronic equipment with a panel including a panel attitude changing system according to an embodiment of the present invention.

[0033] In the embodiment of FIG. **1**, the electronic equipment is a vehicular AV (audio and visual) device. Designated at reference character **1** is an equipment casing main body, and **2** is a panel unit (referred herein simply to a panel) provided at an end (the front end) of the casing main body **1**.

[0034] The panel **2** is a display panel (an LCD panel in this embodiment) that has a display portion **21** configured to display a frame of image, and an operational portion **22** extending along a lower edge of an outside of the display portion **21**. The operational portion **22** is configured for signal inputs to an unshown controller in the casing main body **1**, and has operational switches such as a main power switch and a volume control switch, including select switches **22***a* and **22***b* operable to change the orientation of a front face of the panel (i.e., of the display portion **21**). It is noted that the operational portion **22** may be configured as a touch panel to incorporate into the display portion **21**.

[0035] According to the present embodiment, assuming an initial position of the panel **2** as an attitude standing upright alongside a front end of the casing main body **1** as illustrated in FIG. **1**, the orientation of the panel face is changeable about later-described mutually orthogonal two axes Sx and Sy (upwardly and downwardly, and rightwardly and leftwardly, for instance), by pressing operations to the select switches **22***a* and **22***b*. It is noted that, in this embodiment, the panel face is described as changeable upwardly and downwardly, and rightwardly and leftwardly, while the changeable direction is variable in dependence on how the electronic equipment is arranged.

[0036] FIG. **2** illustrates a state of the panel declined rearwards with the panel face turned upward (in an up-oriented position), where the panel **2** has come out at a lower end thereof anteriorly from the initial position, as it has pivoted about a pair of first pivotal shafts Sx shown in FIG. **3** that are horizontal shafts oriented rightward and leftward. The first pivotal shafts Sx are movable fulcrums for the panel **2** to pivot thereabout, which are slidably supported by guide grooves **11***a* formed in insides of right and left walls of a main body frame **11** that encloses a front face **1***a* of the casing main body **1**.

[0037] As illustrated in FIG. **2**, the front face **1***a* of the casing main body **1** has a slit-shape opening **12** formed therein, which appears when the panel **2** is oriented upward, allowing for a recording medium (a disc such as CD or DVD) to be inserted and taken out therethrough. The casing main body **1** has an unshown drive unit installed therein for reproducing information recorded in the recording medium, whereby for instance an audio signal is read from the recording medium to output to a speaker in the vehicle interior, or a video signal such as of map information read therefrom is input to the display portion **21** of the panel **2** to display thereon.

[0038] FIG. **3** illustrates a state of the panel having the panel face turned rightward (in a right-oriented position), where the panel **2** has come out at a left end thereof anteriorly from the initial position, as it has pivoted about an associate pair of second pivotal shafts Sy that are vertical shafts oriented upward and downward perpendicularly to the first pivotal shafts Sx. In the present embodiment, this panel **2** is movable for an upward pivot to have such an attitude as illustrated in FIG. **4**, with an orientation of the panel face maintained rightward as in FIG. **3**, while it also is possible to have a maintained leftward orientation. From this state where the panel face is in an upper right-oriented position as in FIG. **4**, the panel **2** is still movable for a left-handed pivot in order to set the panel face in an up-oriented position or an upper left-oriented position.

[0039] Description is now made of a specific configuration of the panel attitude changing system that permits various attitude-changing actions (face-orienting motions) of the panel **2**. FIG. **5** is a schematic plan view of an internal structure of the casing main body **1**. As illustrated in FIG. **5**, the casing main body **1** has a base drive mechanism **3** arranged therein as a driving system for causing the orientation of the panel face to change vertically. In FIG. **5**, the base drive mechanism **3** includes a reversible motor **31** as a drive power source, a speed-reducing gear train **32** to be driven by the reversible motor **31**, and a rack **33** to be driven by the gear train **32** to reciprocate in a longitudinal direction along a bottom of the casing main body **1**.

[0040] The speed-reducing gear train **32** is made up by a worm gear **32***a* fixed on a rotor shaft of the reversible motor **31**, a first gear **32***b* meshing at a worm wheel portion thereof with the worm gear **32***a*, a second gear **32***c* meshing at a large-diameter gear portion thereof with a small-diameter gear portion of the first gear **32***b*, and a third gear **32***d* meshing at a large-diameter gear portion thereof with a small-diameter gear portion of the second gear **32***c*, the third gear **32***d* having a small-diameter gear portion thereof meshing with a gear portion **33***a* of the rack **33**.

[0041] The rack **33** is fixed to a base plate **34**, which has right and left arm members **35** attached to both sides thereof. The base plate **34** is longitudinally slidably supported by right and left guide rails **36** fixed to a bottom member of a chassis **13** as an armoring of the casing main body **1**. Both arm members **35** have distal ends thereof protruded outside through the front face **1***a* of the casing main body **1** in which the opening **12** is formed. The arm members **35** are connected at the distal ends by a movable base **4**.

[0042] As illustrated in FIG. **6**, the movable base **4** is formed as a rectangular planer metallic member, on which a holder drive mechanism **5** is mounted for driving a panel holder **6** shown in FIG. **11** to pivot about the second pivotal shafts Sy (lying on right and left vertical lines A-A in FIG. **6**), thereby causing the panel face to turn sideways. The movable base **4** has, at both right and left edges thereof, the pivotal shafts Sx rightwardly and leftwardly protruding from upper ends thereof, and link pins **41** rightwardly and leftwardly protruding from lower ends thereof, respectively.

[0043] For the movable base **4**, as illustrated in FIG. **7**A and FIG. **7**B, the first pivotal shafts Sx at the upper ends are fit in the guide grooves **11***a* (refer to FIG. **2**) of the casing main body **1**, whereby the movable base **4** is supported to be pivotal about the pivotal shafts Sx, while the link pins **41** at the lower ends are linked for articulation with distal ends of the arm members **35**. As the arm members **35** go forward as illustrated in FIG. **7**A, the link pins **41** are pushed and come out anteriorly, causing the movable base **4** to pivot about the first pivotal shafts Sx sliding downward along the guide grooves **11***a*, so the movable base **4** is declined to give the panel face an up-oriented position.

[0044] On the other hand, as the arm members **35** go backward as illustrated in FIG. **7**B, the link pins **41** are pulled and get back posteriorly, causing the movable base **4** to pivot about the first pivotal shafts Sx sliding upward along the guide grooves **11***a*, so the movable base **4** is inclined from an upright posture for instance to an anteverted posture, whereto an angle θ of anteversion is set to approximately 8 degrees in this embodiment.

[0045] In order to enable the movable base **4** to take such an anteverted posture as illustrated in FIG. **7**B without interferences with the casing main body **1**, the guide grooves **11***a* are bent anteriorly at their upper ends, thereby permitting the arm members **35** to swing upward at the distal ends as illustrated in FIG. **7**B. In order to enable the arm members **35** to swing upward, the arm members **35** are provided at their rear ends with pins **35***a* (refer to FIG. **5**) to be guided inside unshown recesses formed in the guide rails **36**.

[0046] Description is now made of a configuration of the holder drive mechanism **5**. As illustrated in FIG. **6** and FIG. **8**, the holder drive mechanism **5** includes right and left movable shafts **51** as pivotal rod members extending close to a planer base portion (as a principal plane) of the movable base **4**, right and left operational plates **52** adapted for lying and standing motions (illustrated in FIG. **9** and FIG. **10**) about those movable shafts **51**, respectively, a reversible motor **53** fixed to the planer base portion of the movable base **4** as a rotary drive source for generating power for the operational plates **52** to be thereby driven to lie and stand, and a power train **54** configured for transmission of power from the reversible motor **53** to the operational plates **52**.

[0047] Each operational plate **52** is formed as a strip-shaped metallic plate that is bent at right angles at both upper and lower ends thereof to inwardly extend as upper and lower link pieces **52***a*, which cooperatively support a corresponding one of the movable shafts **51** extending therebetween.

[0048] The power train **54** includes a speed-reducing gear train **55** to be driven by the reversible motor **53**, and a power transmission selector **56** for separately transmitting power of the speed-reducing gear train **55** to the right and left operational plates **52**.

[0049] The speed-reducing gear train **55** is made up by a worm gear **55***a* fixed on a rotor shaft of the reversible motor **53**, a first gear **55***b* meshing at a worm wheel portion thereof with the worm gear **32***a*, a second gear **55***c* meshing at a large-diameter gear portion thereof with a small-diameter gear portion of the first gear **55***b*, a third gear **55***d* meshing at a large-diameter gear portion thereof with a small-diameter gear portion of the second gear **55***c*, and a fourth gear **55***e* meshing at a large-diameter gear portion thereof with a small-diameter gear portion of the third gear **55***d*, the fourth gear **55***e* having a small-diameter gear portion thereof operatively connected for power transmission to the power transmission selector **56**. The first to fourth gears **55***b*-**55***e* are rotatively mounted on a principal plane portion of the movable base **4**.

[0050] The power transmission selector **56** includes a rack **57** adapted to move sideways along a principal plane of the movable base **4**, and right and left swingable levers **58** operatively engaged with the rack **57**.

[0051] The rack **57** is a strip-shape planer member that has a gear portion **57***a* extending along a side edge at one end thereof to mesh with a small-diameter gear portion of the fourth gear **55***e*. The rack **57** is formed with right and left straight-linear elongate holes **57***b* extending in a longitudinal direction thereof, and right and left L-shape cam grooves **57***c* that are each respectively provided as a connected combination of a first path R**1** in parallel with a corresponding elongate hole **57***b*, a second path R**2** non-parallel with the elongate hole **57***b*, and a corner C in between. There are right and left guide pins **42** protruded from the movable base **4** and slidably fit in the right and left elongate holes **57***b*, respectively. The right and left swingable levers **58** have convex portions **58***a* projecting therefrom as cam followers slidably engaged with the right and left cam grooves **57***c*, respectively.

[0052] The right and left swingable levers **58** are pivotal, for swing motions in parallel with the principal plane of the movable base **4**, about right and left pivots provided as fixed nodes **43** for articulation on the movable base **4**, respectively, while one node **43** concurrently serves as a support shaft for the fourth gear **55***e* to revolve therearound. In this embodiment, the right and left swingable levers **58** have the convex portions **58***a* at locations thereon lower than the right and left nodes **43**, respectively, and right and left slide heads **59** vertically pivotally attached thereto at locations thereon higher than the right and left nodes **43**, respectively. Those locations may be reversed vice versa, subject to a secured sufficient spacing in between for later-described motions to be effective.

[0053] The right and left slide heads **59** are small-piece elements that are pivotal at proximal ends thereof, for swing motions in parallel with the right and left swingable levers **58**, about pivots provided as fixed nodes **59***a* for articulation on the swingable levers **58**, respectively. The right and left slide heads **59** have tubular bearing portions **59***b* formed, for the right and left movable shafts **51** to be provided therethrough, at distal ends thereof offset ahead of the proximal ends to avoid interferences between the movable shafts **51** and the swingable levers **58**, respectively. The bearing portions **59***b* are slidably fit along the lengths on the right and left movable shafts **51**.

[0054] The right and left operational plates **52** are pivotally supported on the panel holder **6** by means of right and left pairs of upper and lower second pivotal shafts Sy interposed in between, respectively (refer to FIG. **9** and FIG. **10**). In this embodiment, the second pivotal shafts Sy are all projected from corresponding parts of the panel holder **6**, while they may be projected from operational plates **52**, as necessary.

[0055] In the holder drive mechanism **5** described, as the reversible motor **53** rotates in a direction, the rack **57** is driven to move straight-linearly in a corresponding sense with drive power transmitted through the speed-reducing gear train **55**.

[0056] Assuming the sense of movement to be leftward, as illustrated in FIG. **8**, the left swingable lever **58** located on that side where the rack **57** is coming up is put out in an immobile state with the convex portion **58***a* abutting on a right end of the first path R**1** in the left cam groove **57***c*. Instead, the convex portion **58***a* of the right swingable lever **58** is guided through the corner C to the second path R**2** in the right cam groove **57***c*, whereby the right swingable lever **58** is forced to pivot about the right node **43** on the movable base **4**, for instance from a position of broken lines to a position of solid lines in FIG. **8**, causing the slide head **59** to push the right movable shaft **51** rightwardly outward.

[0057] As the movable shaft **51** is pushed outward, the right operational plate **52** is forced to pivot about the movable shaft **51** and the right pair of upper and lower second pivotal shafts Sy, so its outer edge is spaced from the movable base **4**, for instance from a position illustrated by solid lines in FIG. **10** where it is lying along the principal plane of the movable base **4** to a position illustrated by chain lines in FIG. **10** where it is forwardly standing on the movable base **4**.

[0058] In other words, the power train **54** constituting the holder drive mechanism **5** is configured for conversion of rotary motions in the speed-reducing gear train **55** to lying and standing motions of the operational plates **52** to oppositely drive the right and left operational plates **52** into lying and standing motions. Under a condition that both right and left operational plates **52** are lying, if the reversible motor **53** is operated in a reverse direction to the above-noted direction, then the operational plate **52** on the opposite side being the left in FIG. **8** is driven to stand, and if the reversible motor **53** is operated in an opposite direction under this condition, then the standing operational plate **52** is driven to lie.

[0059] Such the holder drive mechanism **5** is mounted on the movable base **4**, where as illustrated in FIG. **9**, the panel holder **6** for holding the panel **2** is linked in a manner of covering the principal plane and the holder drive mechanism **5** (represented simply by the right and left operational plates **52** in FIG. **9**). The panel holder **6** is pivoted at right and left upper and lower ends thereof on associated link pieces **52***a* of the operational plates **52** through right and left pairs of upper and lower second pivotal shafts Sy (as short round pins in this embodiment) perpendicular to the first pivotal shafts Sx. The right and left operational plates **52** are driven to alternately lie and stand within a space defined by and between the movable base **4** and the panel holder **6**.

[0060] The first and second pivotal shafts Sx and Sy are all arranged parallel with the panel face or the principal plane of the movable base **4** or the panel holder **6**. As described, the upper and lower link pieces **52***a* of each operational plate **52** have a movable shaft **51** pivotally supported by and between inner ends thereof, the movable shaft **51** being slidably engaged with a slide head **59** linked with one end of a swingable lever **58** pivoted on a pin **43** fixed to the movable base **4**. That is, according to the present embodiment, the panel holder **6** is not directly coupled by left and right pivotal shafts Sy with the movable base **4**, but instead it is linked to the movable base **4** through left and right pivotal shafts Sy, operational plates **52**, movable shafts **51**, slide heads **59**, and swingable levers **58**.

[0061] As either right or left operational plate **52** is driven to stand as illustrated in FIG. **10**, the panel holder **6** comes out anteriorly at corresponding one of right and left ends thereof (the right end in FIG. **10**), pivoting about pivotal shafts Sy at the opposite end. Each swingable lever **58** has outward pressing forces acting through a slide head **59** on a movable shaft **51** in a panel-transverse direction, whereto associated upper and lower pivotal shafts Sy working as nodes for articulation between an associated operational panel **52** and the panel holder **6** have their locations offset in a panel-longitudinal direction at a prescribed center-to-center distance L, thereby allowing for a smooth standing motion of the operational panel **52**.

[0062] FIG. **11** is a front view of the panel holder **6**, and FIG. **12**, a rear view of the panel **2** to be held by the panel holder **6**. The panel holder **6** is a metallic planer member substantially identical in size to the movable base **4**, and has connectors **61** attached to a central portion thereof for interfacing signals to be input to the panel **2**, as illustrated in FIG. **11**. The panel holder **6** is cut at an upper edge portion thereof to provide right and left locking holes **62**, and has in a lower portion thereof a lock lever **63**, and right and left auxiliary levers **64** with the lock lever **64** in between.

[0063] As illustrated in FIG. **12**, the panel **2** has a back face (as an opposite face to the before-mentioned display portion **21**) for provision of connectors **23** to be connected for electric conduction to the connectors **61** on the panel holder **6**. The panel **2** has a back face, which is formed at an upper portion thereof with projections **24** engageable with the locking holes **62** of the panel holder **62**, and has in a lower portion thereof a pair of hooks **25** lockingly engageable with the lock lever **63**, and a release lever **26** for releasing a locking engagement between lock lever **63** and hooks **25**. It further has a pair of projections **27** for drop-off prevention at locations corresponding to the auxiliary levers **64**, with the release lever **26** in between.

[0064] As illustrated in FIG. **13**, the panel **2** is fit to the panel holder **6** in a conforming manner with the projections **24** of the panel **2** inserted in the locking holes **62** of the panel holder **6**. As the panel **2** is applied to the panel holder **6**, their connectors **23** and **61** are fit together for electric conduction, with the lock lever **63** working to prevent the panel **2** from being dropped off.

[0065] FIG. **14** is an enlarged fractional sectional view of the panel **2** locked on the panel holder **6** by the lock lever **63**. As illustrated in FIG. **14**, the lock lever **63** is rotatively sup-

ported by an axle **65** fixed to the panel holder **6**, and the axle **65** has a spring **66** applied thereto for pressing an upper portion of the lock lever **63** against a backside of the panel holder **6**. The lock lever **63** has a pair of locking clicks **63***a* formed thereon for a locking engagement with the pair of hooks **25** projecting from the back face of the panel **2**.

[0066] The release lever **26** is vertically slidable along the back face of the panel **2**, and spring-biased downwards, and has at a transversely intermediate portion thereof a lock releasing projection **26***a* engageable for abutment with a recess between locking clicks **63***a* of the lock lever **63**.

[0067] For operation, a lower end face of the release lever **26** can be pressed to move the release lever **26** upward, causing the lock releasing projection **26***a* to push the above-noted recess of the lock lever **63** upward, whereby the lock lever **63** is rotated against repulsive forces of the spring **66**, up to an angular position illustrated by chain lines in FIG. **14**, where the locking clicks **63***a* are released from the hooks **25**.

[0068] As illustrated in FIG. **15**, also the right and left auxiliary levers **64** are each respectively rotatively supported by an axle **67** fixed to the panel holder **6**, and clockwise biased in FIG. **15** by an unshown spring. Each auxiliary lever **64** is bent forward to provide an arm portion **64***a* with a hooking tip **64***b* to be brought into engagement with a corresponding projection **27** of the panel **2** when the lock lever **63** is unlocked.

[0069] That is, to prevent the panel **2** from being dropped off, the projection **27** is supported on the hooking tip **64***b* of the arm portion Ma abutting on and pushing forward a lower portion of the panel **2**. On the back face of the panel **2**, there is a region for the hooking tip **64***b* of the arm portion Ma to be brought into slidable contact therewith under each projection **27**, where the surface describes an arcuate convex plane **28**, allowing for a smooth engagement of the hooking tip **64***b* with the projection **27**.

[0070] The foregoing description is made of a specific example of the embodiment, and in no way restrictive. For instance, the movable base **4** may well be configured as a stationary base fixed to a front side of the equipment casing main body **1**, with a holder drive mechanism **5** mounted thereon, including a pair of operational plates **52** adapted to lie and stand, thereby causing a panel **2** held by a panel holder **6** to pivot about pivotal shafts Sy, allowing for the orientation of a panel face to be changed vertically or sideways.

[0071] Further, the holder drive mechanism **5** is not always required to have a pair of operational plates **52**. For instance, as illustrated in FIG. **16**, there may well be a single operational plate **52** adapted to lie and stand and disposed at a side of one edge of a movable base (or stationary base) **4**, subject to provision of a pair of pivotal shafts Sy at the side of other edge, and arrangement of a panel holder **6** linked for pivotal motions about the pivotal shafts Sy, permitting the panel holder **6** to pivot about the pivotal shafts Sy in accordance with lying and standing motions of the operational plate **52**.

[0072] According to the embodiment illustrated in FIG. **16**, the pivotal shafts Sy may extend in a transverse direction, allowing for the orientation of panel face of the panel **2** held by the panel holder **6** to be changed in a vertical direction, or the pivotal shafts Sy may extend in a vertical direction, allowing for the orientation of panel face to be changed in a transverse direction. For the embodiment illustrated in FIG. **16**, the base **4** and the panel holder **6** may preferably be connected by a pulling spring **7**, affording to restore the panel holder **6** to an original position as the operational plate **52** lies.

[0073] The panel **2** is assumed as an LCD panel in the foregoing embodiments, but it is not limited thereto according to the present invention, and may be a planer speaker (a panel-shape speaker), or an operation panel such as that having switch knobs or buttons.

[0074] As will be seen from the foregoing embodiments, according to the present invention, a panel holder configured to hold a panel is pivotally connected to a movable base adapted to pivot about first pivotal shafts, through second pivotal shafts perpendicular to the first pivotal shafts, and a holder drive mechanism arranged on the movable base is configured for the panel holder to pivot about the second pivotal shafts, allowing for a panel face once oriented either vertically or sideways to be oriented, with that orientation left as it is, in another direction. Accordingly, even for an electronic equipment with panel having an equipment casing main body fixed to a center console in an automobile for instance, the panel face can be oriented upwardly rightward or upwardly leftward with ease for a favorable acquisition of panel output (a visual contact of picture or hearing of audio) such as from a driver's seat or front passenger's seat, simultaneously permitting favorable operations as necessary.

[0075] Moreover, possible simultaneous pivots of the movable base and the panel holder permit a swift change of panel face orientation to a desirable direction.

[0076] Further, provision of a holder drive mechanism mounted on a movable base or a stationary base permits a facilitated assembly of a unit as a combination of the holder drive mechanism and the movable or stationary base to electronic equipment, while the holder drive mechanism includes operational plates adapted to lie and stand between a panel holder and the movable or stationary base, affording for the panel holder holding a panel to pivot in accordance with the lying and standing motions, thus allowing for a thin and compact structure of an entirety of a panel attitude changing system.

[0077] In addition, as the panel has a display portion for image display, even in application to those of which a display portion has a narrow visible angle, the display portion can provide a favorable vision of display image at a quite opposite direction, and as the panel is detachably attachable to the panel holder, the panel can be post-assembled to prevent the panel from being injured in a course of equipment production or assemblage.

[0078] While preferred embodiments of the present invention have been described using specific terms, such description is for illustrative purposes, and it is to be understood that changes and variations may be made without departing from the spirit or scope of the following claims.

What is claimed is:

1. A panel attitude changing system comprising:

a movable base adapted to pivot about first pivotal shafts;

a panel holder configured to hold a panel and pivotally connected to the movable base through second pivotal shafts perpendicular to the first pivotal shafts; and

a holder drive mechanism arranged on the movable base and configured for the panel holder to pivot about the second pivotal shafts.

2. The panel attitude changing system according to claim **1**, wherein the holder drive mechanism comprises operational plates adapted to lie and stand between the movable base and the panel holder, a rotary drive source configured to generate power for the operational plates to lie and stand, and a power train configured for transmission of power with conversion of

rotary motions of the rotary drive source to lying and standing motions of the operational plates, and is adapted, as an operational plate stands with power transmitted by the power train, for the panel holder to pivot about the second pivotal shafts to come out anteriorly at an end thereof the operational plate is standing.

3. The panel attitude changing system according to claim **1**, wherein the panel has a display adapted to display a frame of image, and is detachably attached to the panel holder.

4. An electronic equipment comprising the panel attitude changing system according to claim **1**, with the panel positioned at an end of an equipment casing main body.

5. A panel attitude changing system comprising:

a stationary base;

a panel holder configured to hold a panel and pivotally connected to the stationary base through pivotal shafts; and

a holder drive mechanism arranged on the stationary base and configured for the panel holder to pivot about the pivotal shafts,

the holder drive mechanism comprising operational plates adapted to lie and stand between the stationary base and the panel holder, a rotary drive source configured to generate power for the operational plates to lie and stand, and a power train configured for transmission of power with conversion of rotary motions of the rotary drive source to lying and standing motions of the operational plates,

the holder drive mechanism being adapted, as an operational plate stands with power transmitted by the power train, for the panel holder to pivot about the pivotal shafts to come out anteriorly at an end thereof the operational plate is standing.

6. The panel attitude changing system according to claim **5**, wherein the panel has a display adapted to display a frame of image, and is detachably attached to the panel holder.

7. An electronic equipment comprising the panel attitude changing system according to claim **5**, with the panel positioned at an end of an equipment casing main body.

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