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AOKI(10) **Pub. No.: US 2007/0131574 A1**(43) **Pub. Date: Jun. 14, 2007**(54) **PLATE MATERIAL PACKING BOX, PLATE
MATERIAL TRANSPORTING METHOD, AND
PLATE MATERIAL LOADING OR
UNLOADING METHOD****Publication Classification**(51) **Int. Cl.**
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filed on Jul. 21, 2005.**(30) **Foreign Application Priority Data**Jul. 23, 2004 (JP) 2004-216475
Feb. 23, 2005 (JP) 2005-047131(57) **ABSTRACT**

A plate material packing box capable of preventing dirt from entering thereinto, easily storable in a storage room with a low ceiling by reducing the height dimension during transportation, and capable of transporting plate materials efficiently and constantly; a plate material transporting method using such a plate material packing box; and a plate material loading or unloading method. The packing box comprises a pedestal 3 having an upper lining, a plate material storage box 14 put on the pedestal 3, and an upper cover 2 enclosing the plate material storage box 14 on the pedestal 3 and being detachable from the pedestal 3, wherein the plate material storage box 14 is an upwardly open support having a bottom plate 15 to have a plurality of plate materials G put thereon in a substantially horizontally stacked state, and side plate 16a to 16d along four sides of its periphery, the upper cover 2 is a downwardly open box having a top plate 6 covering the upper surface of the plate material storage box 14 and side frames 5 along four sides of its periphery; a vibration damper 17 is interposed between the pedestal 3 and the bottom plate 15; and a cushion material 20 is installed between the top plate 6 and the plate materials G put on the bottom plate 15.

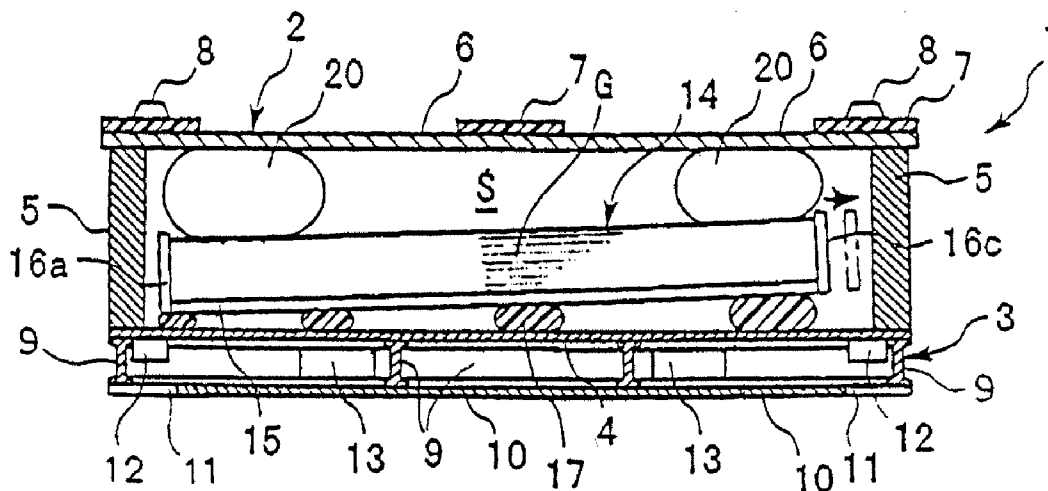


Fig. 1

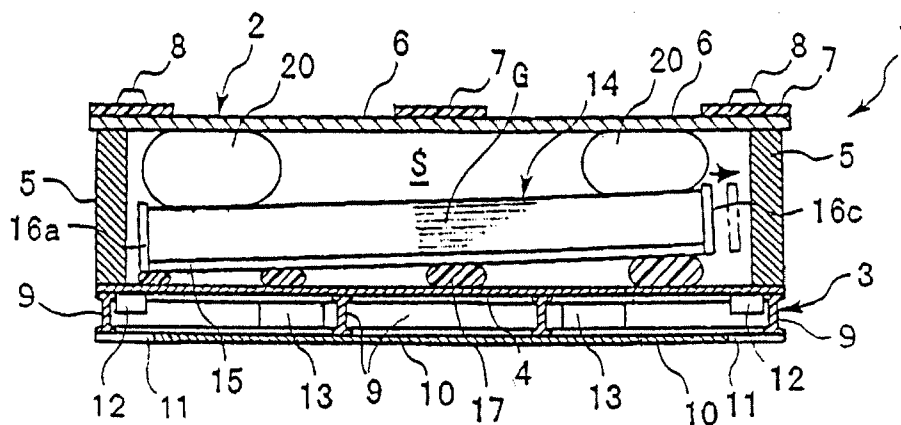
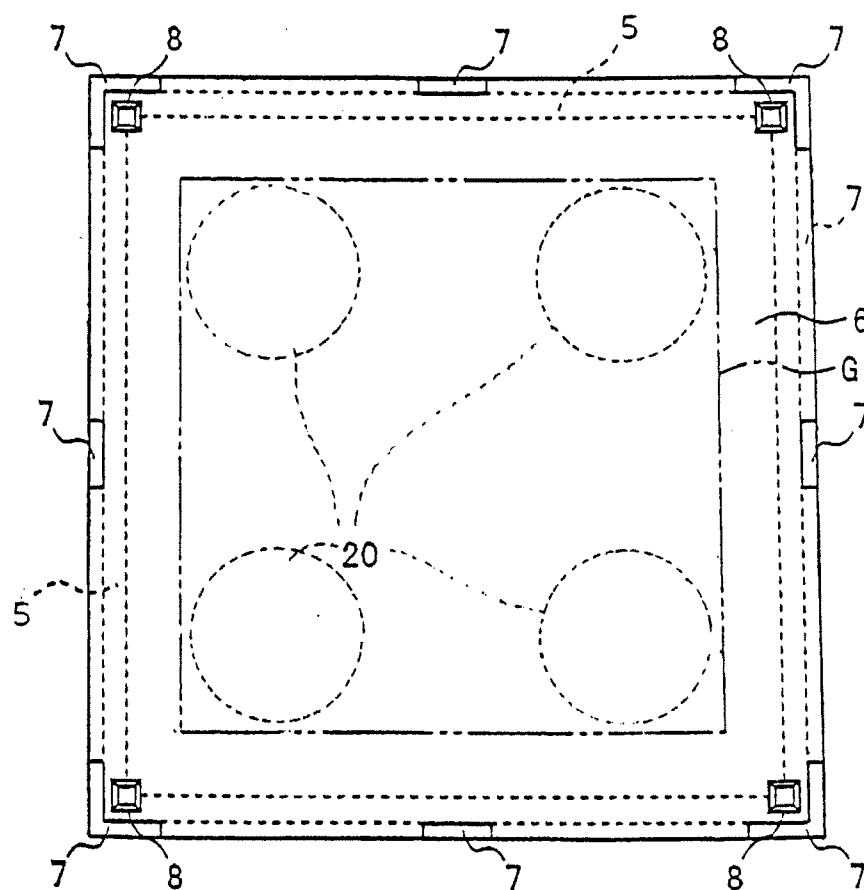


Fig. 2



F i g. 3

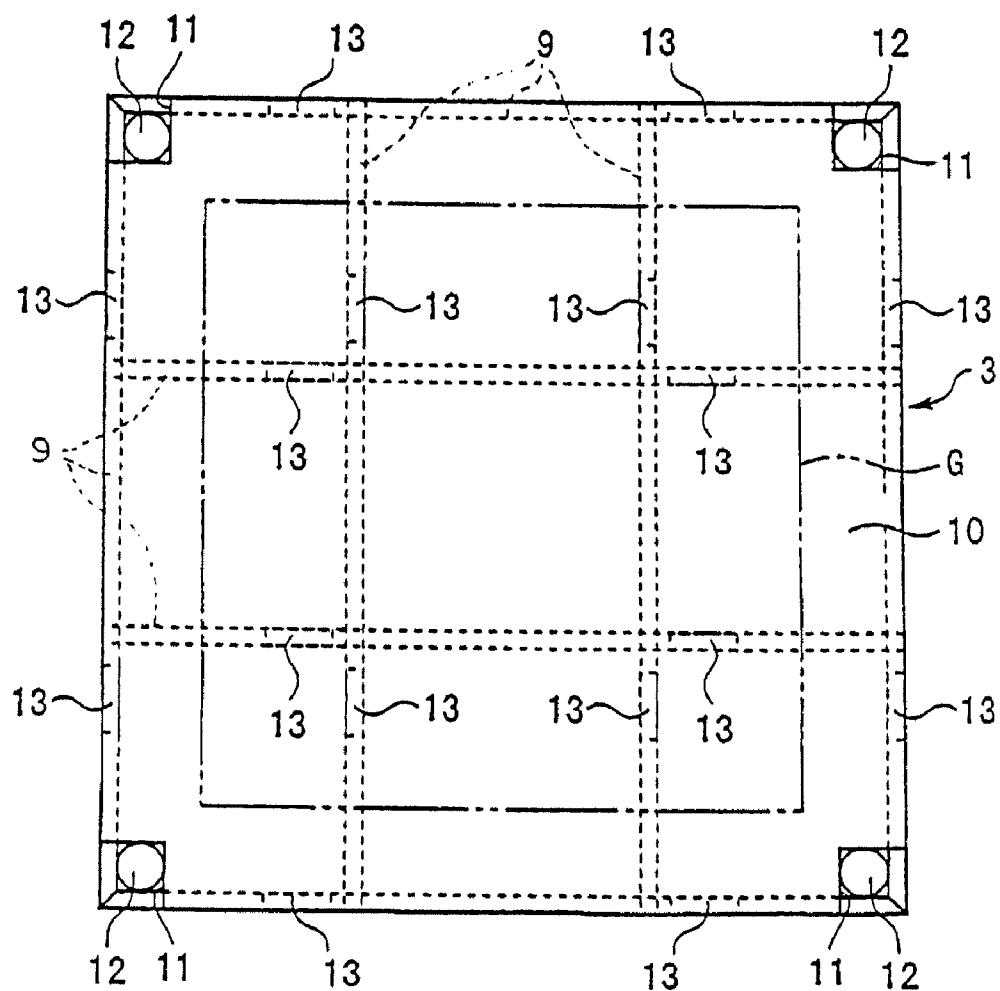
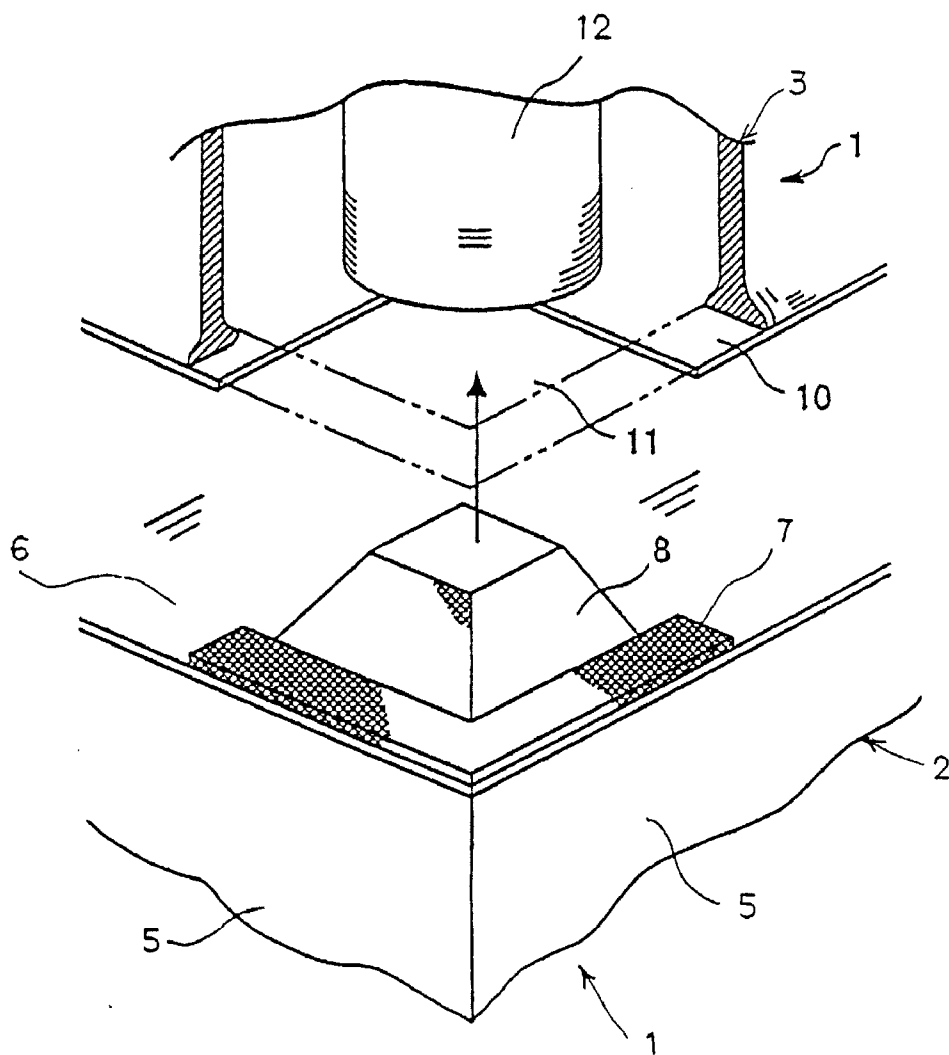
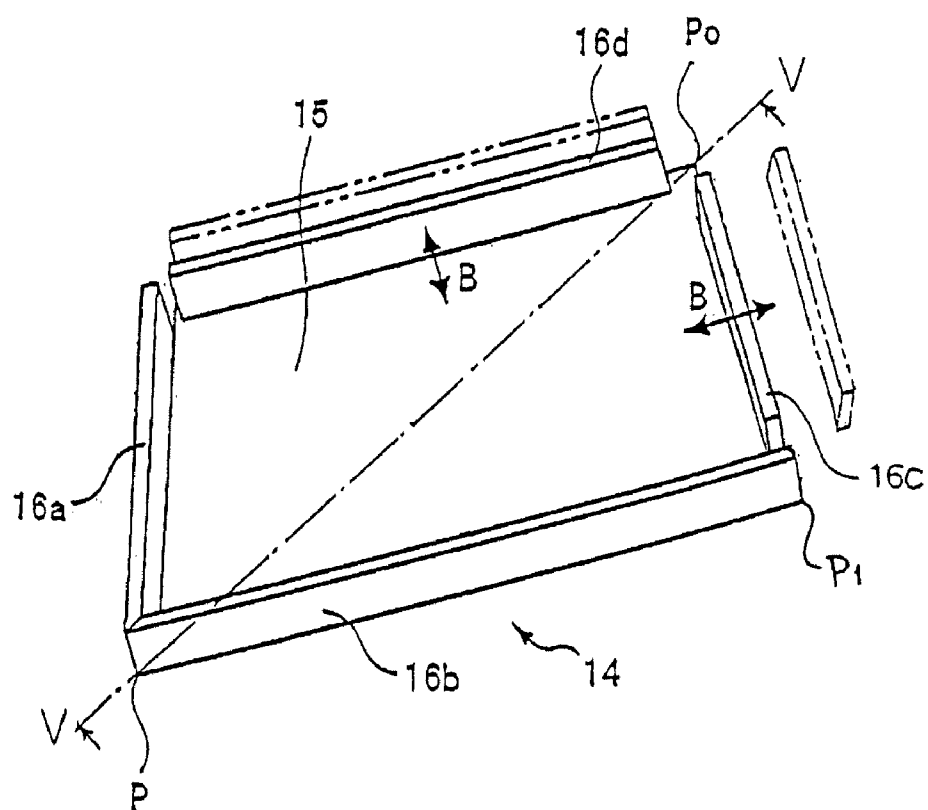


Fig. 4



F i g . 5



F i g . 6

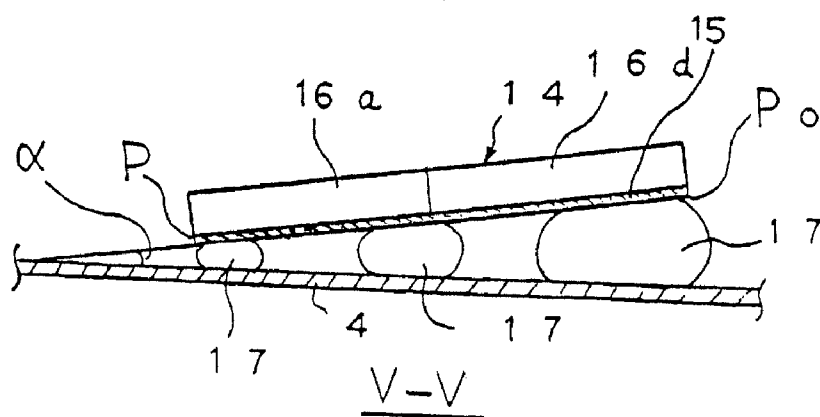


Fig. 7

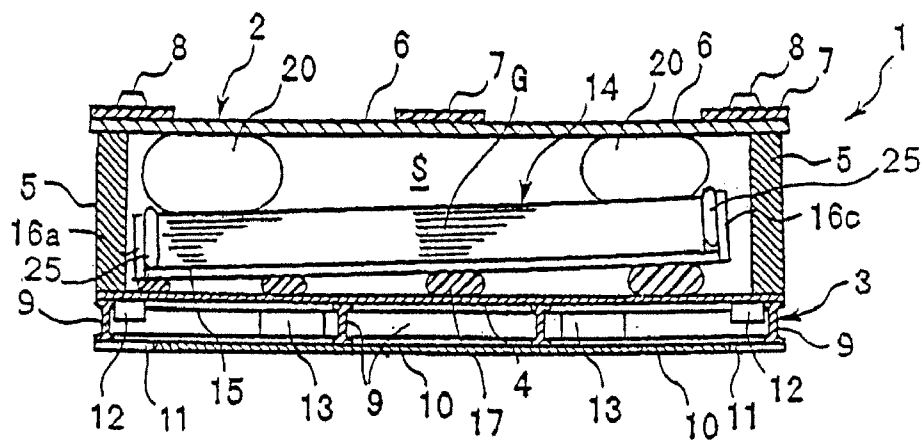
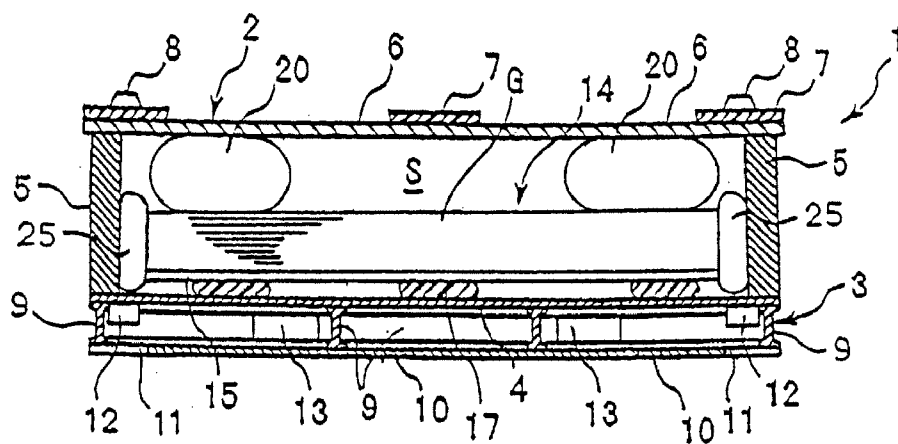
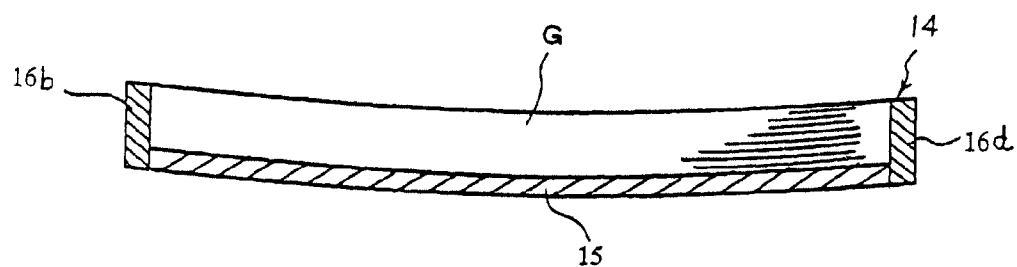


Fig. 8



F i g. 9(A)



F i g. 9(B)

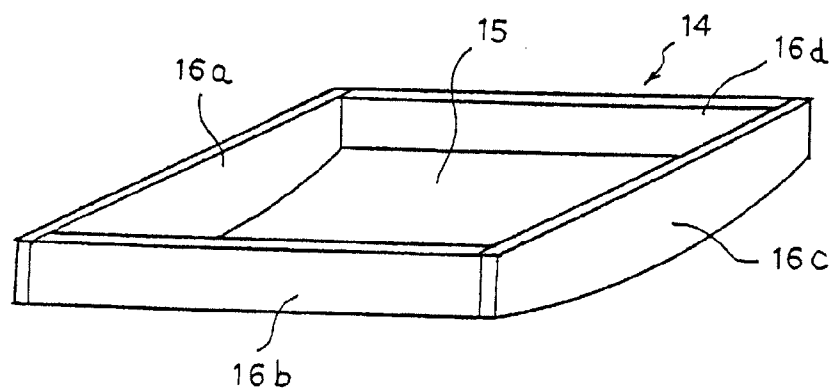


Fig. 12

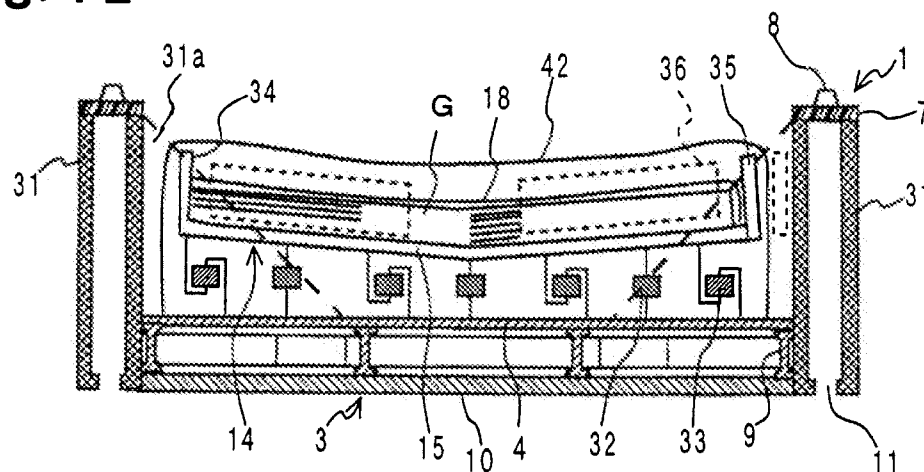
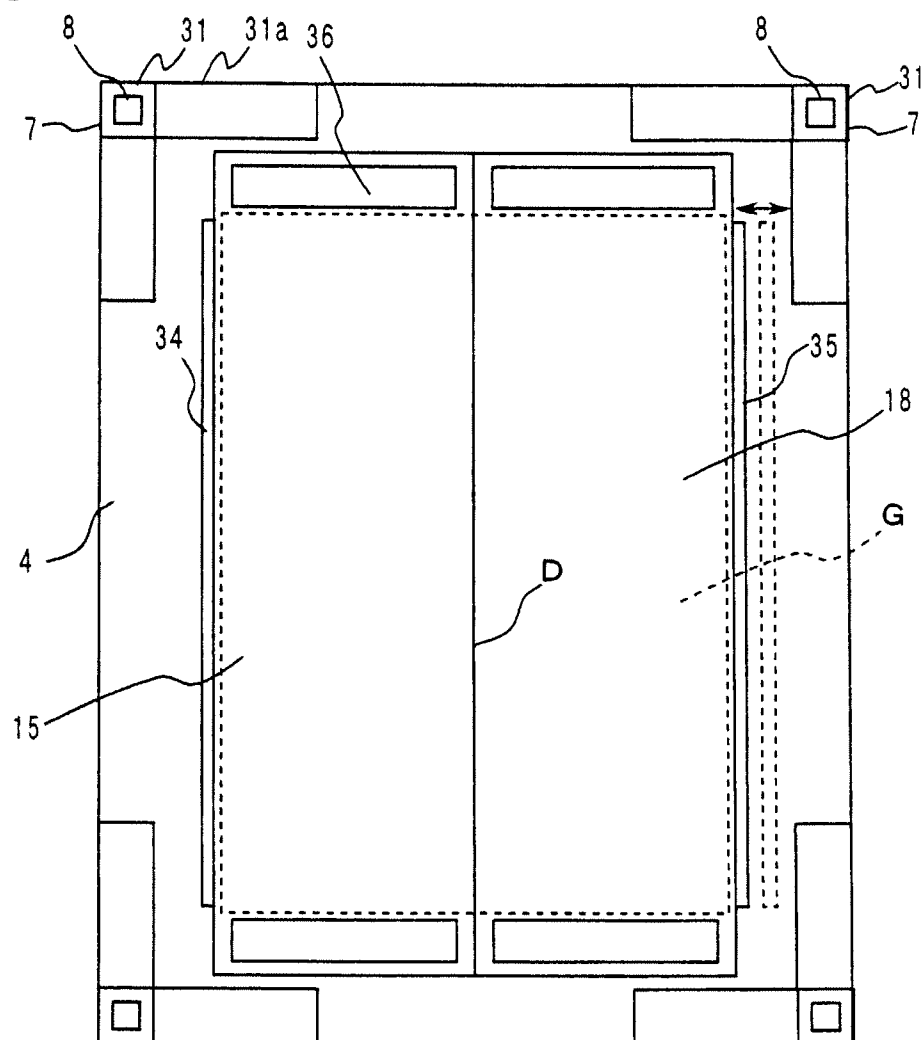
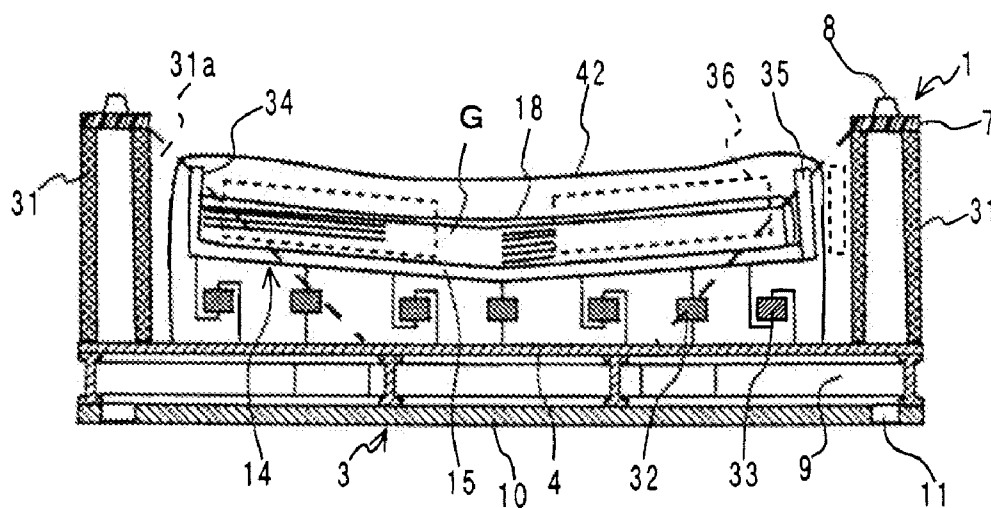


Fig. 13



F i g. 14



F i g. 15

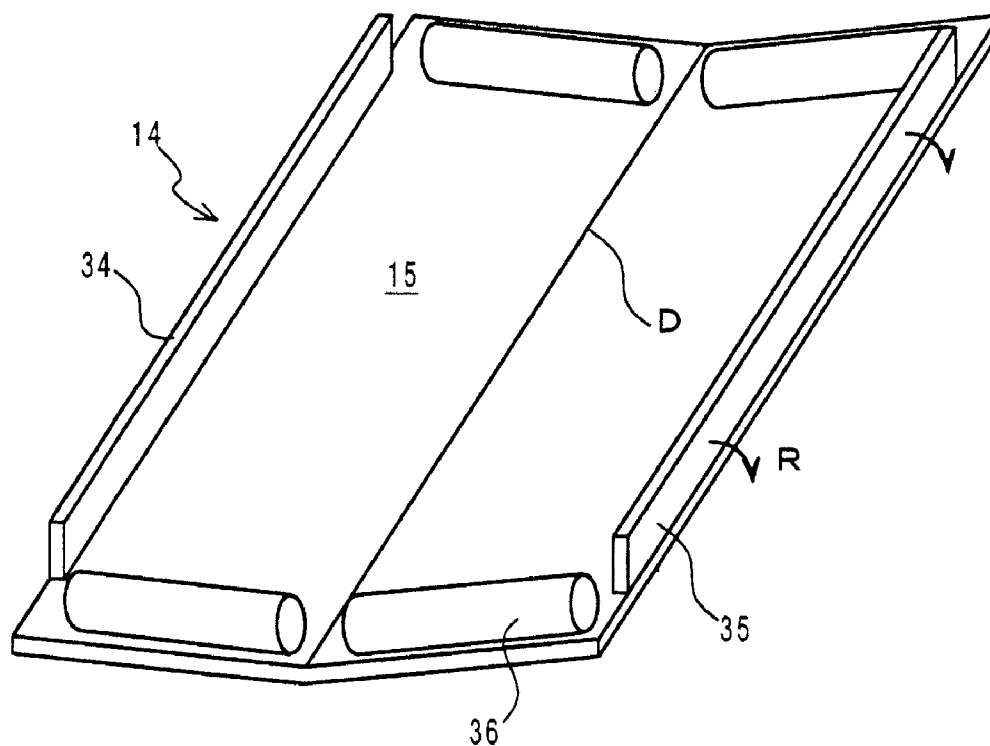


Fig. 16

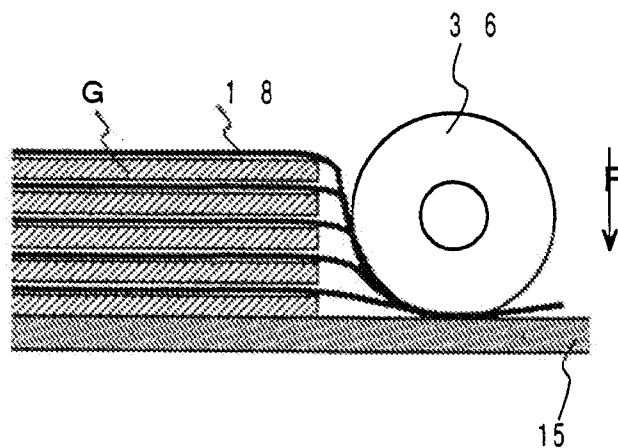


Fig. 1(7) A

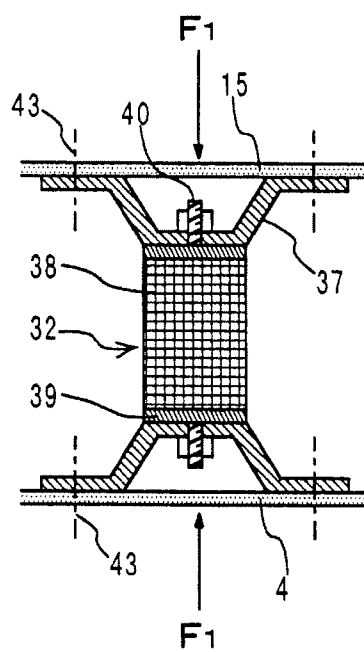
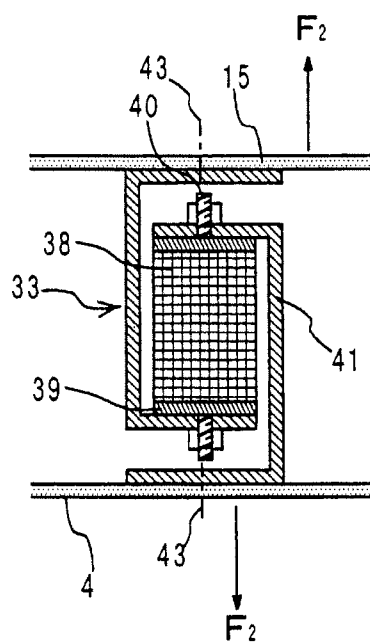


Fig. 1(7) B



F i g. 18

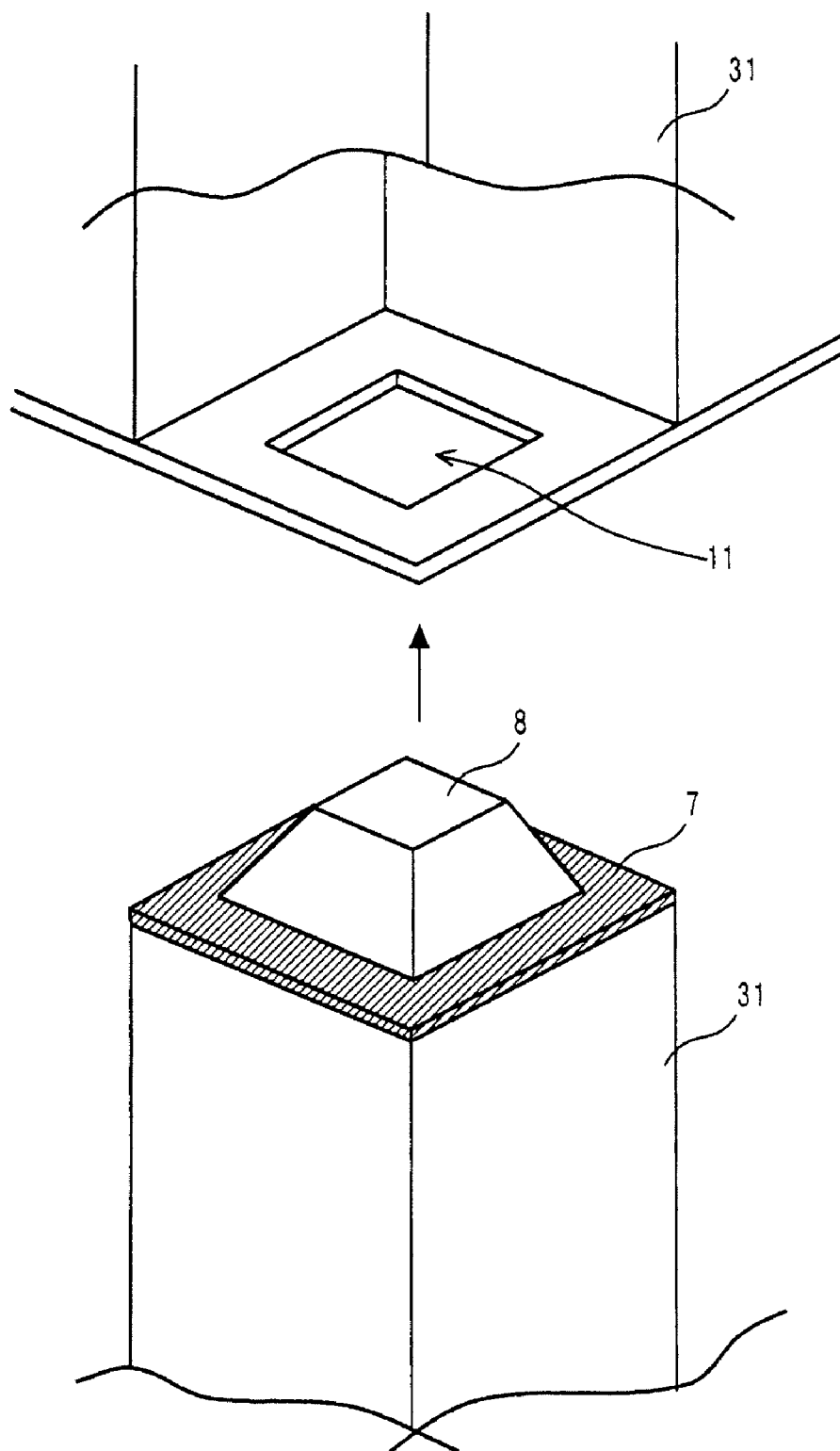
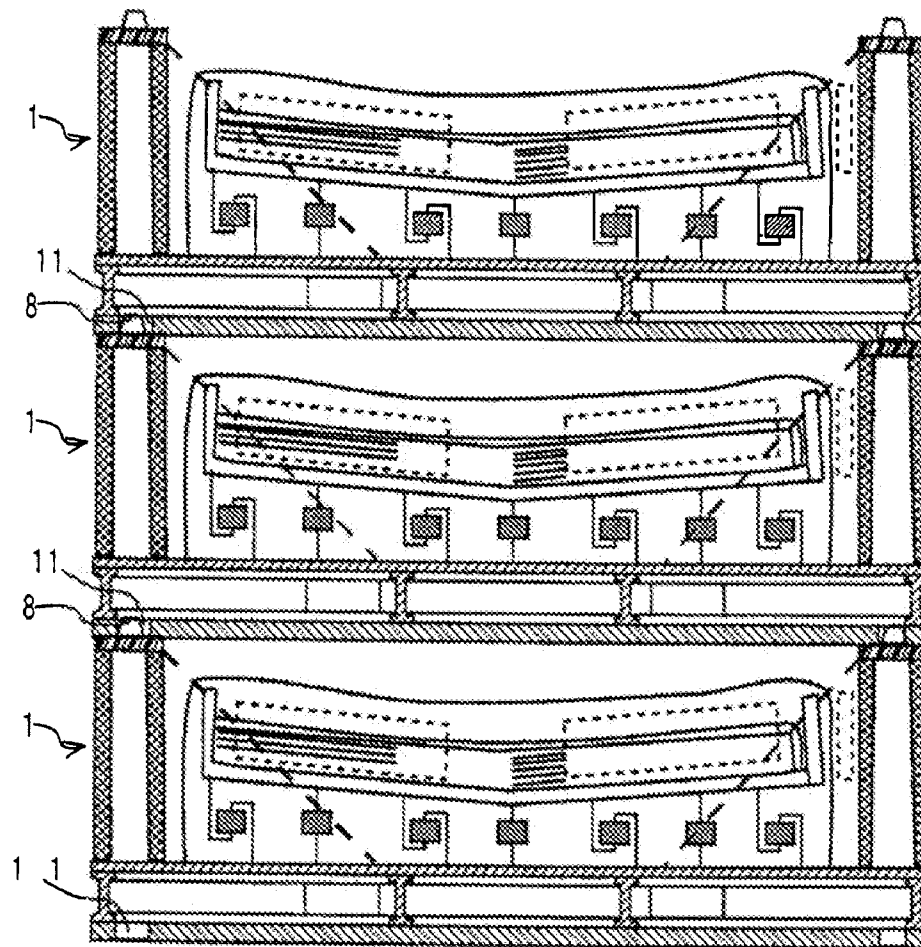


Fig. 19



F i g. 20

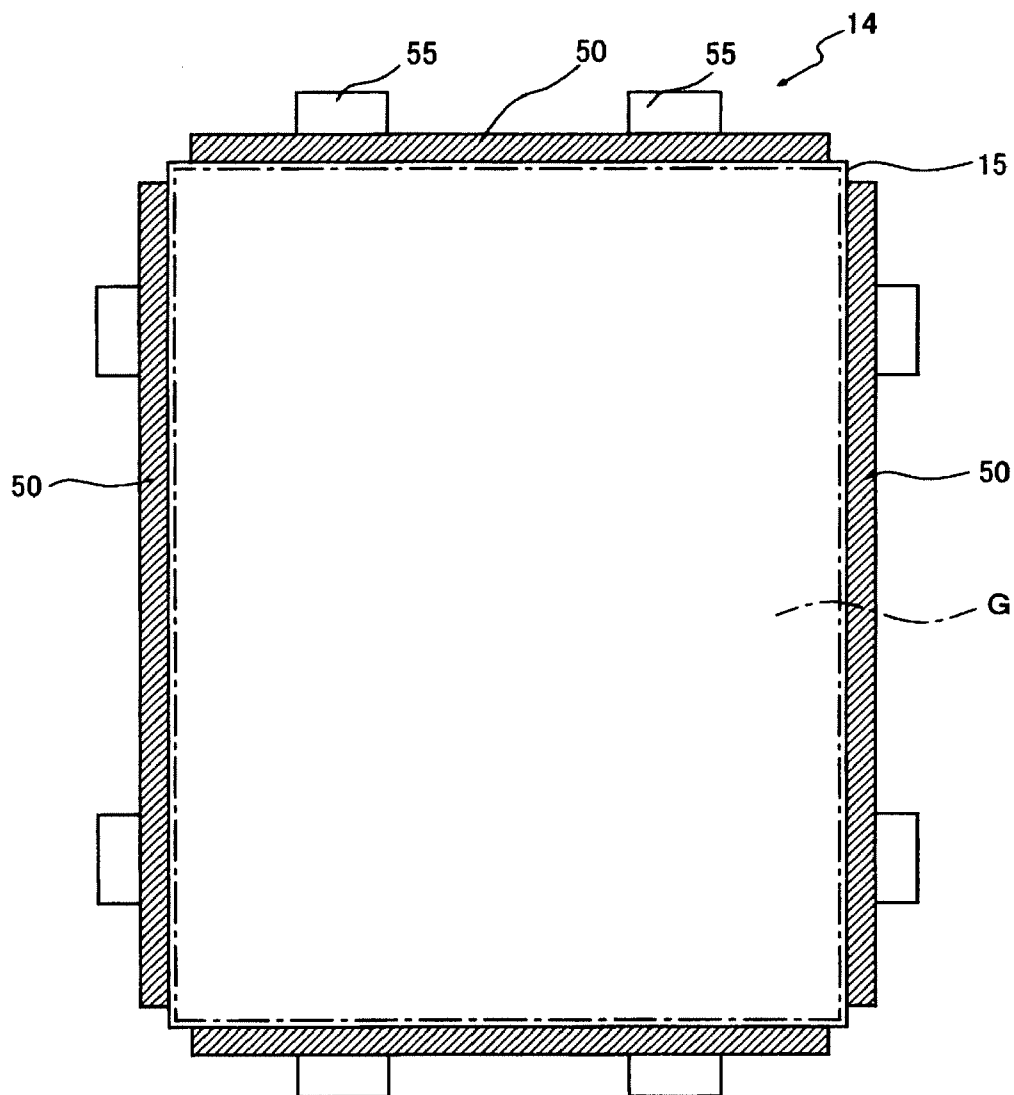


Fig. 21(A)

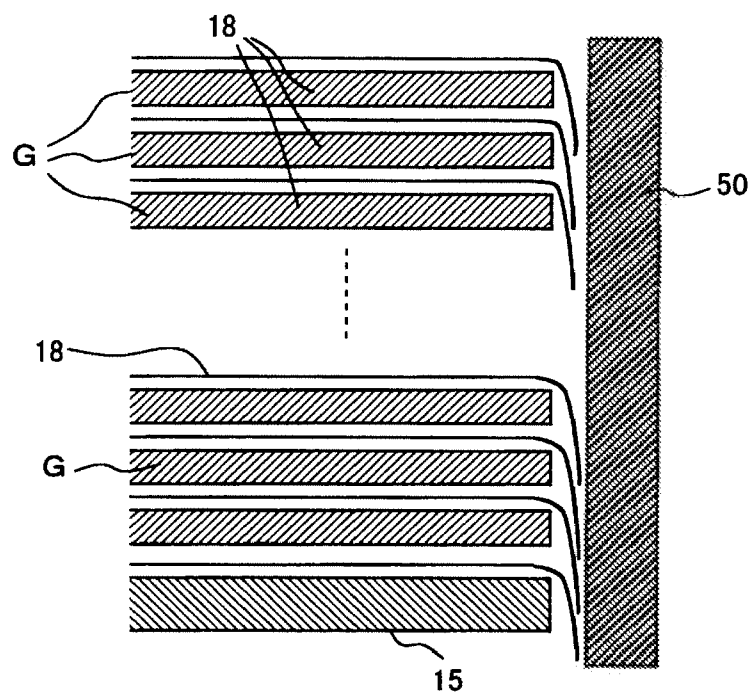


Fig. 21(B)

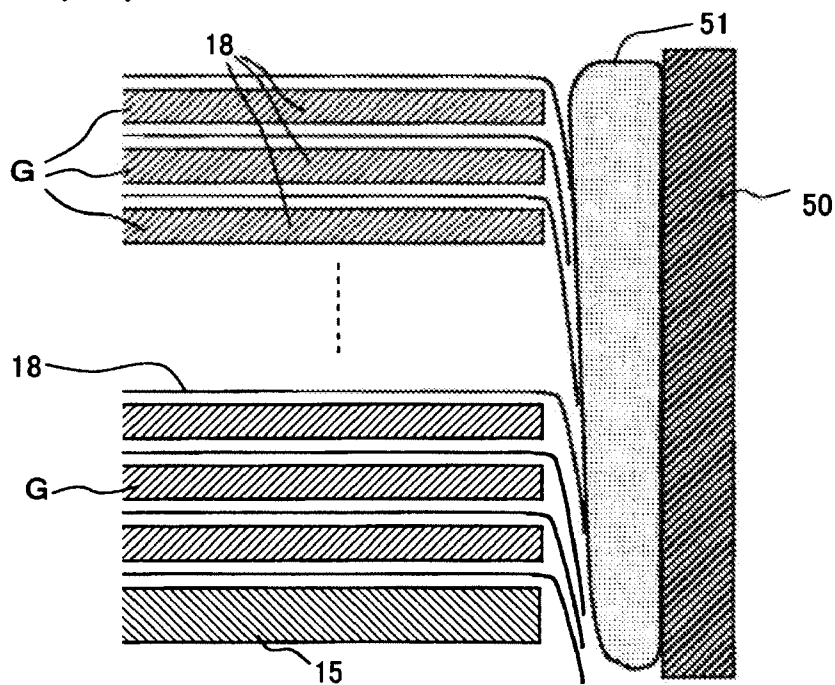
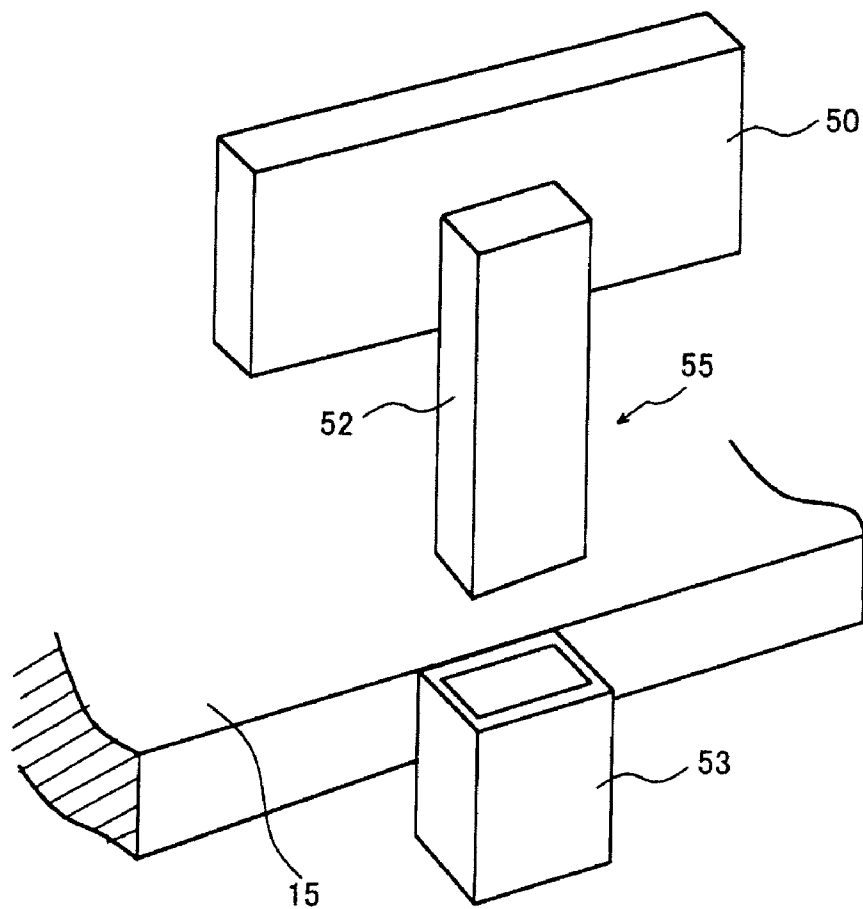


Fig. 22



F i g. 23

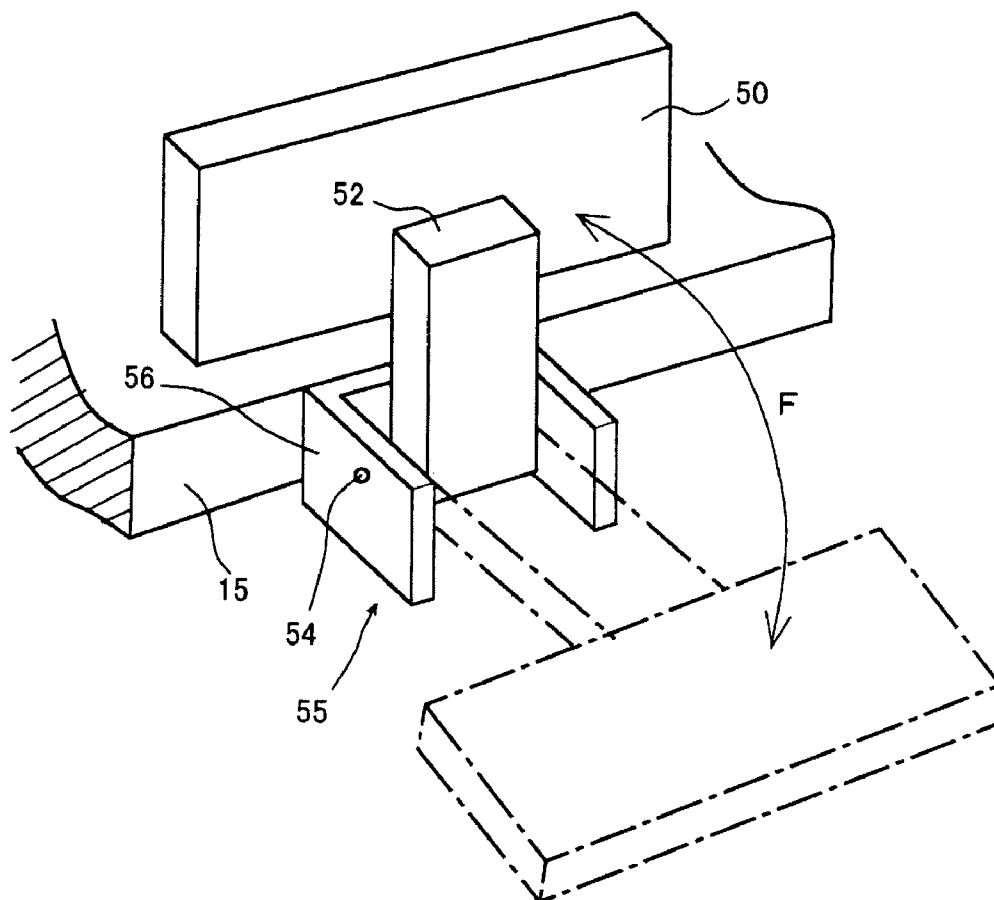


PLATE MATERIAL PACKING BOX, PLATE MATERIAL TRANSPORTING METHOD, AND PLATE MATERIAL LOADING OR UNLOADING METHOD

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The present invention relates to a plate material packing box designed to pack plate materials, particularly large size plate materials for e.g. flat panel display (FPD) i.e. liquid crystal display or plasma display, or large size plate materials as intermediate products in the process for their production, and to be unpacked after the transportation; a plate material transporting method using such a plate material packing box; a plate material loading method; and a plate material unloading method.

[0003] 2. Discussion of Background

[0004] In recent years, there has been an increasing need for large size plate glass to be used for e.g. FPD glass. As a means to transport such large size plate glass, a packing rack is known wherein a plurality of plate glass are secured in a vertically standing state (e.g. Patent Document 1).

[0005] However, with this packing rack, the plate glass is transported in a standing state, and it sometimes happens that in the case of air transportation, the height dimension is so large (e.g. at least 2 m) that it cannot be smoothly stored in a storage room in an airplane.

[0006] Further, in a case where plate glass is transported in a standing state, in order to secure the stability of the packing box, the dimension of one side of bottom surface is made large (for example, 0.5 time the height of the packing box). However, in a clean room in which a production of display panels is carried out, the weight to be transportable by a forklift, is restricted. Therefore, the number of plate glass to be put on one packing box is restricted. Therefore, the volume and weight of the packing box increases against the number of plate glass which can be put thereon, whereby the transportation efficiency decreases.

[0007] Further, heretofore, it has been common to transport plate glass in a bare state or in a state covered with a plastic bag. Therefore, due to penetration of dust, etc. the plate glass surface tends to get dirty or is likely to be scratched. Further, in a case where plastic bags, etc. are used, it is necessary to separately prepare such plastic bags, thus increasing the number of components required for packing and making the preparation operation for transportation or the operation for taking out the plate glass after transportation cumbersome.

[0008] The foregoing description has been made with respect to plate glass but the same applies also to plate materials such as resin plates or metal plates.

[0009] Patent Document: JP-A-2000-272684

SUMMARY OF THE INVENTION

[0010] The present invention has been made in view of the above-described situation, and it is an object of the present invention to provide a plate material packing box capable of preventing dust from entering into the packing box, easily storable in a storage room with a low ceiling by reducing the

height dimension during transportation, and capable of carrying out transportation of plate materials efficiently and constantly, a plate material transporting method using such a plate material packing box, and a plate material loading or unloading method.

[0011] To accomplish the above object, the present invention provides the following plate material packing box, plate material transporting method using such a plate material packing box, and plate material loading or unloading method.

[0012] (1) A plate material packing box comprising a pedestal having an upper lining, a plate material storage box put on the pedestal, and an upper cover enclosing the plate material storage box on the pedestal and being detachable from the pedestal, wherein the plate material storage box is an upwardly open support having a bottom plate to have a plurality of plate materials put thereon in a substantially horizontally stacked state, and side plates along four sides of its periphery; the upper cover is a downwardly open box having a top plate covering the upper surface of the plate material storage box and side frames along four sides of its periphery; a vibration damper is interposed between the pedestal and the bottom plate; and a cushion material is installed between the top plate and the plate materials put on the bottom plate.

[0013] According to the above plate material packing box, a vibration damper is provided between the pedestal and the bottom plate, and a cushion material is further provided between the top plate and the plate materials, whereby the plate materials can be transported in a stabilized state where a vibration from the exterior is scarcely transmitted to the plate materials. Further, this plate material packing box is based on the premise that plate materials are transported in a horizontally flatly stacked state, and as compared with the conventional vertical type transportation mode, sufficient loading efficiency can be provided to a conveying means, and even in a case where the ceiling of the storage section of the conveying means is low, an interference with the ceiling is less likely to occur.

[0014] Further, the plate material storage box will be covered from above and below by the upper lining of the pedestal, and the side frames and the top plate of the upper cover, whereby deposition of foreign matters such as dust on the plate materials can be prevented.

[0015] (2) A plate material packing box comprising a pedestal having an upper lining, a plate material storage box put on the pedestal, side frames fixed along the periphery of the plate material storage box on the pedestal, and an upper cover detachable from the side frames, wherein the plate material storage box is an upwardly open support having a bottom plate to have a plurality of plate materials put thereon in a substantially horizontally stacked state, and a side plate provided along one side of its periphery; the upper cover is a top plate covering the upper surface of the plate material storage box; a vibration damper is interposed between the pedestal and the bottom plate; and a cushion material is installed between the top plate and the plate materials put on the bottom plate.

[0016] According to the above plate material packing box, the side frames are fixed to the pedestal side, and the top plate being the upper cover is detachable from the side

frames and is openable or closable at the time of loading or unloading the plate materials, whereby three side plates of the plate material storage box are omitted to make the construction simple, and at the same time, a cushion material may be provided between the above-mentioned side frames and the plate materials corresponding to the omitted side plates along three sides, whereby the plate materials can be held stably on the bottom plate.

[0017] (3) The plate material packing box according to the above (1) or (2), wherein the bottom plate is formed to have a rectangular shape and inclined at a prescribed angle to the upper surface of the pedestal with one or two corners thereof being at the lowest point.

[0018] According to the above construction, the bottom plate is inclined at a prescribed angle to the upper surface of the pedestal with one or two corners thereof being at the lowest point, whereby the positions of individual plate materials on the bottom plate can be settled on the lowest point side, and displacement among the plate materials can be prevented. Here, the number of corners to be the lowest point is preferably one from such a viewpoint that the positions of a plurality of plate glass can be thereby readily aligned.

[0019] (4) The plate material packing box according to any one of the above (1) to (3), wherein the bottom plate has a surface curved in a concave shape to have the plate materials put thereon.

[0020] When the surface of the bottom plate on which the plate materials are to be put, is formed as curved in a concave shape in this manner, the plate materials sagged in a concave shape by flat stacking, will be held stably on the concave surface of the bottom plate, and displacement can be prevented against vibration in a transverse direction, and a stabilized packing state can be maintained.

[0021] (5) The plate material packing box according to any one of the above (1) to (3), wherein the bottom plate is downwardly curved or bent in a convex shape.

[0022] When the surface of the bottom plate on which the plate materials are to be put, is formed as downwardly curved or bent in a convex shape in this manner, the plate materials sagged in a concave shape by flat stacking, will be held stably along the bottom plate, and displacement can be prevented even against vibration in a transverse direction, and a stabilized packing state can be maintained.

[0023] (6) The plate material packing box according to any one of the above (1) to (5), which has a positioning means to set the position of another plate material packing box to be put on the top plate, wherein the positioning means comprises a plurality of guide members projecting upwardly from the top plate and fixed to the top plate, and a plurality of openings formed at the pedestal to engage with such guide members.

[0024] The plate material packing box is thus provided with the positioning means between the packing boxes, whereby displacement among a plurality of plate material packing boxes in a flatly stacked state will be eliminated. Further, as the positioning means, a plurality of guide members projecting upwardly from the top plate and fixed to the top plate, and a plurality of openings formed on the pedestal to engage with the guide members, are provided,

whereby in a state where a plurality of flat material packing boxes are flatly stacked, the openings of each plate material packing box (except for the packing box at the lowest position) are engaged with guide members of a plate material packing box located beneath, whereby the packing boxes will be supported in a stabilized state.

[0025] (7) A plate material transporting method which comprises stacking a plurality of plate materials in the plate material storage box of the plate material packing box as defined in any one of the above (1) to (6) and transporting the plate materials.

[0026] The plate materials are thus transported in such a state that a plurality of plate materials are stacked in the plate material storage box of the plate material packing box, whereby many large size plate materials can be transported all at once in a package low in height in a stabilized state.

[0027] (8) A plate material loading or unloading method which comprises, in such a state that the upper cover of the plate material packing box as defined in any one of the above (1) to (6) is removed, lifting the plate material packing box so that the bottom plate be at a prescribed angle to the horizontal plane, and loading a plurality of plate materials in the plate material storage box or unloading such plate materials from the plate material storage box.

[0028] Thus, in such a state that the upper cover of the plate material packing box is removed, the plate material packing box is lifted so that the bottom plate be at a prescribed angle to the horizontal plane, and plate materials are then loaded, whereby the plate materials can be easily loaded. Likewise, by lifting the plate material packing box so that the bottom plate be at a prescribed angle to the horizontal plane and unloading the plate materials from the plate material storage box, it is possible to easily take out the plate materials.

[0029] (9) A plate material packing box comprising a pedestal having an upper lining, a plate material storage box put on the pedestal, and a vibration damper interposed between the pedestal and the plate material storage box, wherein

[0030] the plate material storage box comprises a rectangular bottom plate to have a plurality of plate materials put thereon in a horizontally stacked state, side plates provided along mutually opposing two sides of the bottom plate and inserting paper hold-down rolls provided along other mutually opposing two sides of the bottom plate;

[0031] the bottom plate is downwardly curved or bent in a convex shape, and the bending line at the apex of the bent surface or the generating line of the curved surface is in parallel with the side plates;

[0032] the pedestal is provided with a positioning means for stacking plate material packing boxes.

[0033] According to the above plate material packing box, the portions protruding from the edges of the plate materials, of the protective inserting paper sheets covering the respective upper surfaces of the stacked plate materials, are held down to the bottom plate and secured by the inserting paper hold-down rolls, whereby the plate materials are certainly secured on the bottom plate via the inserting paper sheets, and vibration on the bottom plate will be suppressed. Accordingly, a cushion material or an upper cover to cover

the top surface of the stacked plate materials will be unnecessary, and the number of components can be reduced, whereby the construction will be simplified, and at the same time, the size and weight reduction can be attained.

[0034] Further, the bottom plate is downwardly curved or bent in a convex shape or in a V-shape, whereby the plate materials put on the bottom plate will be prevented from displacement in an oblique direction to the bottom plate by vibration, and the plate materials can further certainly be secured.

[0035] Further, the pedestal is provided with a positioning means, whereby it is possible to certainly position the stacked boxes and to prevent displacement even without the upper cover.

[0036] (10) The plate material packing box according to the above (9), wherein the side plates are provided along the long sides of the bottom plate; one side plate is fixed to the bottom plate; and the other side plate is rotatably or separably hinged to the bottom plate so that the side provided with this side plate is openable and closable.

[0037] Thus, the side plates are provided along the long sides, whereby the bottom plate will be curved or bent along the short sides of the bottom plate. Accordingly, the displacement in the height direction of the bottom plate due to the bending or curvature will be small, and the shape of the storage box will be compact.

[0038] Further, by rotating or separating one side plate to open the side plate surface, the plate materials on the bottom plate can efficiently and smoothly be withdrawn from the opened side surface, whereby the operation efficiency for loading or unloading the plate materials will be improved.

[0039] (11) The plate material packing box according to the above (9), wherein stacking members consisting of pillars or walls are installed on the pedestal around the plate material storage box, and the positioning means comprises guide members provided at upper ends of the stacking members and openings provided on the bottom surface side of the pedestal to engage with the guide members.

[0040] According to such a plate material packing box, when such packing boxes are stacked, the upper packing box will be supported on the lower packing box by the stacking members consisting of pillars or walls installed on the peripheral portion of the pedestal. At that time, the guide members provided at the upper ends of the stacking members of the lower packing box will fit in the openings provided on the lower surface of the pedestal of the upper packing box, whereby positioning can simply and certainly be carried out by such a simple structure, and displacement can be prevented.

[0041] (12) The plate material packing box according to the above (9), wherein the vibration damper comprises a stretch absorber and a shrink absorber, and the stretch absorber and the shrink absorber are provided as regularly distributed over the entire lower surface of the bottom plate.

[0042] By such a construction, when the bottom plate on the pedestal is vibrated up and down to the pedestal, it is possible to separate the tensile side and the compression side respectively so that the vibration can be absorbed by the stretch absorber and the shrink absorber, respectively. Accordingly, the attachment structure for the vibration

damper made of a spring or an elastic body may be made to be a structure wherein only either the tensile force or the compression force will act. The vibration damper can thereby be certainly secured to the pedestal and bottom plate, and it is thereby possible to prevent peeling or falling which is likely to occur with the attaching structure where both the tensile force and compression will act.

[0043] (13) A plate material transporting method which comprises stacking a plurality of plate materials in the plate material storage box of the plate material packing box as defined in any one of the above (9) to (12) and transporting the plate materials.

[0044] Thus, the plurality of plate materials on the bottom plate of the plate material storage box are transported in a state where they are horizontally stacked, whereby many plate materials can be transported all at once in a package low in height. A remarkable effect can be obtained particularly when such a construction is applied to large size plate materials.

[0045] (14) A plate material packing box comprising a pedestal having an upper lining, a plate material storage box put on the pedestal, and a vibration damper interposed between the pedestal and the plate material storage box, wherein

[0046] the plate material storage box comprises a rectangular bottom plate to have a plurality of plate materials put thereon in a horizontally stacked state via inserting paper sheets, and hold-down plates are provided along the respective four sides of the bottom plate to press the plate materials from their side surfaces via inserting paper sheets protruding from the plate materials.

[0047] According to the above plate material packing box, the plate materials put horizontally on the bottom plate are pressed by the hold-down plates provided along the respective four sides of the bottom plate, via the inserting paper sheets protruding from the respective side surfaces, whereby the plate materials can certainly be held down and secured without direct contact with the plate materials, while the side surfaces of the plate materials are protected by the inserting paper sheets.

[0048] (15) The plate material packing box according to the above (14), wherein each hold-down plate is detachable from the bottom plate or openable as it falls down outside of the bottom plate.

[0049] According to the above plate material packing box, each hold-down plate is detachable from the bottom plate or hinged to be openable and closable, whereby the side surfaces of the plate materials will be open to facilitate the operation for loading or unloading.

[0050] (16) The plate material packing box according to the above (14), wherein a cushion material is provided between the inserting paper sheets and the hold-down plates.

[0051] According to the above plate material packing box, the hold-down plates will hold down the inserting paper sheets via the cushion material, whereby the side surfaces of the plate materials can be uniformly and constantly pressed and secured along the shape of the inserting paper sheets protruding from the side surfaces of the plate materials and being overlapped one on another.

BRIEF DESCRIPTION OF THE DRAWINGS

[0052] FIG. 1 is a vertical cross-sectional view of a plate material packing box according to an embodiment of the present invention.

[0053] FIG. 2 is a top view of the plate material packing box according to the embodiment of the present invention.

[0054] FIG. 3 is a bottom view of the plate material packing box according to the embodiment of the present invention.

[0055] FIG. 4 is a perspective view illustrating a process of engagement of packing boxes with each other when plate material packing boxes according to the embodiment of the present invention are to be stacked.

[0056] FIG. 5 is a schematic view of a plate material storage box according to an embodiment of the present invention.

[0057] FIG. 6 is a cross-sectional view along V-V in FIG. 5.

[0058] FIG. 7 is a view illustrating the construction of another embodiment of the present invention.

[0059] FIG. 8 is a view illustrating the construction of still another embodiment of the present invention.

[0060] FIGS. 9(A) and (B) are views illustrating the shape of a plate material storage box having a recessed bottom plate.

[0061] FIG. 10 is a perspective view of an erection table to let the plate material packing box according to the embodiment of the present invention stand erect.

[0062] FIGS. 11(a) and (b) illustrate the use of the erection table in FIG. 6, i.e. FIG. 11(a) shows the posture of the erection table before the plate material packing box is made to stand erect, and FIG. 11(b) shows the posture of the erection table at the time of loading a plate material to a plate material packing box or at the time of unloading a plate material from a packing box.

[0063] FIG. 12 shows another plate material packing box of the present invention.

[0064] FIG. 13 is a top view of FIG. 12.

[0065] FIG. 14 is a schematic view illustrating another embodiment of the plate material packing box.

[0066] FIG. 15 is a schematic view of a plate material storage box.

[0067] FIG. 16 is a cross-sectional view of the vicinity of a hold-down roll in a state where plate materials are stored.

[0068] FIGS. 17(A) and (B) illustrate an embodiment of the vibration damper, i.e. FIG. 17(A) is a cross-sectional view of a shrink absorber, and FIG. 17(B) is a cross-sectional view of a stretch absorber.

[0069] FIG. 18 is a schematic view illustrating the fitting of a guide member and an opening.

[0070] FIG. 19 is a schematic view wherein plate material packing boxes are stacked.

[0071] FIG. 20 is a plan view of another embodiment of the plate material storage box.

[0072] FIGS. 21(A) and (B) are cross-sectional views illustrating the attachment of a hold-down plate.

[0073] FIG. 22 is a perspective view illustrating the attachment of a hold-down plate.

[0074] FIG. 23 is a perspective view of another embodiment of the attachment of a hold-down plate.

MEANING OF SYMBOLS

[0075] 1: plate material packing box, 2: upper cover, 3: pedestal, 4: upper lining, 5: side frame, 6: top plate, 7: shock-absorbing pad, 8: guide member, 9: I-beam frame, 10: lower lining, 11: opening, 12: vibration absorbing device, 13: hole for forklift, 14: plate material storage box, 15: bottom plate, 16a, 16b, 16c, 16d: side plates, 17: vibration damper, 18: inserting paper sheet, 20: cushion material, 21: erection table, 22: large table portion, 23: small table portion, 24: parallel grooves, 25: cushion material, 31: pillar member, 32: shrink absorber, 33: stretch absorber, 34, fixed side plate, 35: movable side plate, 36: hold-down roll, 37: bracket, 38: jell material, 39: metal plate, 40: bolt, 41: bracket, 42: cover, 43: screw, C: chain, D: plate material, S: internal space, 50: hold-down plate, 51: cushion material, 52: pillar, 53: pillar bearing, 54: spindle, 55: attaching portion, 56: bracket

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0076] FIG. 1 is a vertical cross-sectional view of the plate material packing box of the present invention. This embodiment is one applied to large size plate glass as the plate material G. The plate material packing box (hereinafter referred to as the packing box) 1 is designed to store a plurality (for example, 50 sheets) of plate materials G in a substantially horizontally stacked state. The packing box 1 comprises a pedestal 3, an upper cover 2 put on the pedestal 3, and a plate material storage box 14 put on the pedestal 3 within this upper cover 2.

[0077] The pedestal 3 is one prepared in such a manner that a plurality of I-beam frame materials 9 formed by an extruded material made of e.g. an aluminum alloy are assembled lengthwise and crosswise in a lattice-like arrangement to form a frame, and on an upper side of this frame, an upper lining 4 is fixed, and on the lower side, a lower lining 10 is fixed.

[0078] A plate material storage box (hereinafter referred to as a storage box) 14 is put on the upper lining 4 of the pedestal 3 via a vibration damper 17. This storage box 14 is an upwardly opened box and comprises a rectangular bottom plate 15 and four side plates 16a to 16d provided along the four sides thereof (FIGS. 5 and 6). In this storage box 14, a plurality of plate materials G will be flatly stacked, as will be described hereinafter.

[0079] The vibration damper 17 is preferably made of a material capable of efficiently absorbing a vibration frequency of e.g. from 8 to 20 Hz taking into consideration the vibration frequency resulting in a vehicle (or an airplane) itself during the ground transportation or air transportation. As such a material, a rubber, a resin or a silicone material may, for example, be used.

[0080] The upper cover 2 is downwardly opened to enclose the exterior of the storage box 14 from above and

comprises four side frames **5** and a top plate **6**. Inside, an internal space **s** is formed to accommodate plate materials. The side frames **5** may be iron plates or the like, or I-beam frame materials **9** similar to the pedestal **3** may also be used. On the lower side of the top plate **6**, a vibration absorbing means such as a cushion material (an air bag or an air cylinder) **20** is provided, whereby plate materials **G** stacked in the storage box **14** are resiliently secured.

[0081] Here, the cushion material **20** may run out of the side plates **16a** to **16d** of the storage box **14** so long as it is located between the top plate **6** and the plate materials **G** to resiliently push the plate materials **G** to secure them.

[0082] FIG. 2 a top view of this packing box **1**. The packing box **1** is preferably rectangular so that it corresponds to the shape of the plate materials **G** to be stored. At the time of loading the plate materials into the interior space **S** and at the time of unloading the plate materials from the internal space **S**, the upper cover **2** is removed from the pedestal **3** by a suitable means such as a manpower or a robot.

[0083] When transported to the intended place by e.g. a truck or airplane (hereinafter referred to as a transportation means), packing boxes **1** will be stored in a storage room or on a loading platform of the transportation means in a stacked state. Accordingly, on the top plate **6** of the upper cover **2**, a plurality of shock absorbing pads (cushioning material) **7** to protect the plate materials are attached at the periphery of the upper surface thereof in such an assumption that another packing box will be flatly stacked thereon. Such shock absorbing pads **7** are made of an elastic material such as a rubber.

[0084] At each corner of the top plate **6**, a truncated pyramid guide member **8** is fixed on the top plate **6** so that it projects upwards from the shock absorbing pad **7**, for positioning with the upper packing box to be put thereon. Here, the shape of this guide member **8** is not limited to the truncated pyramid shape, and it may, for example, be a truncated cone shape. The portion of the packing box which engages with the guide member **8** will be described hereinafter.

[0085] FIG. 3 is a bottom view of the packing box **1**. The I-beam frame materials **9** are assembled lengthwise and crosswise in plurality in a lattice-like arrangement to support the storage box **14** stably. Intersections of the I-beam frame materials **9** are integrated by a means such as welding.

[0086] The pedestal **3** is constituted by a lattice-like frame composed of the I-beam frame materials **9**. The lower lining **10** fixed to the lower surface of this pedestal **3** is provided with rectangular openings (guide holes) **11** to receive guide members **8** of a packing box **1** stacked below, at the respective corners thereof. On the lower surface of the upper lining **4** above the openings **11**, shock absorbing devices (shock absorbers) **12** may be attached to reduce the shock with the guide members **8**. Such shock absorbing devices **12** may, for example, be constituted by air cylinders, rubber dampers or the like, and in a state where the packing boxes are stacked one another, they are provided at such positions that the lower portions of the shock absorbing devices **12** will abut against the guide members **8** of another packing box **1** stacked beneath, entering from below via openings **11**.

[0087] The upper lining **4** is made of e.g. an iron plate and is required in order to put the storage box **14** stably on the

pedestal **3** and to prevent dust from entering into the internal space **S** (FIG. 1) storing the plate materials. The lower lining **10** is likewise made of e.g. an iron plate and is required in order to smoothly transport the packed box **1** by a conveyer such as a roller conveyer. However, if the transportation can be carried out by e.g. a conveyer without any problem, the lower lining **10** may be omitted.

[0088] In the lengthwise and crosswise I-beam frame materials **9**, holes for a forklift **13** to receive forks of a forklift (not shown) are formed, for example, two holes per one I-beam frame material **9**. It is thereby possible that the packing box **1** may receive forks of a forklift from either lengthwise or crosswise direction of the rectangular pedestal.

[0089] FIG. 4 is a perspective view illustrating the state before engagement of the guide members **8** with openings **11** and with shock absorbing devices **12**, when a plurality of packing boxes **1** are to be stacked. In a case where another packing box **1** is put on a packing box **1**, the upper packing box **1** is positioned so that the guide members **8** of the lower packing box **1** will enter into the openings **11** formed on the lower lining **10**, and it is gradually lowered towards the packing box **1** located below. At that time, the guide members **8** of the lower side packing box **1** will enter the openings **11** of the upper side packing box **1**. As mentioned above, the guide members **8** are formed to have a truncated pyramid shape, and the openings **11** to receive the guide members are likewise rectangular. Accordingly, even if the guide members **8** and the openings **11** are not accurately positioned, in the stacking process, side walls of the guide members **8** will interfere with the openings **11**, so that any displacement in the horizontal direction between the upper side packing box **1** and the lower side packing box **1** will automatically be corrected, whereby accurate positioning of the packing boxes to each other can be accomplished during the stacking (positioning means).

[0090] The upper end surfaces of such guide members **8** will abut against the lower end surfaces of the vibration absorbing devices **12** of the above packing box **1**, whereby a vibration absorbing action in an up-and-down direction is obtainable in the stacked state.

[0091] FIG. 5 is a perspective view of the storage box **14**, and FIG. 6 is a cross-sectional view as viewed from the direction of arrow **V** in FIG. 5.

[0092] This storage box **14** comprises a bottom plate **15** and four side plates **16a** to **16d** along its periphery. Plate materials **G** will be stored in a flatly stacked state in an upwardly opened box comprising this bottom plate **15** and the four side plates **16a** to **16d**. A plurality of vibration dampers **17** are disposed between the bottom plate **15** and the upper lining **4** of the pedestal **3** (FIG. 1) to protect the plate materials **G** against a shock from the exterior of the packing box.

[0093] As shown in FIGS. 1 and 6, the bottom plate **15** of the storage box **14** is disposed on the upper lining **4** so that the entire bottom plate is inclined at a prescribed angle α within a range of e.g. from 0° to 5° (preferably about 2°) to the upper lining **4** with one apex (corner) **P** among four corners being the lowest point. Accordingly, in this embodiment, the respective vibration dampers **17** are interposed between the bottom plate **15** and the upper lining **4** so that

their respective thicknesses are different as shown in FIG. 1. Here, the inclination of the bottom plate 15 may be 0° (i.e. no inclination), if positional displacement of the plate materials in a transverse direction can be prevented by making the bottom plate 15 to have a convex shape, as described hereinafter.

[0094] Thus, by having the bottom plate 15 inclined at a prescribed angle α to the upper lining 4, in the stacked state of the plate materials, the individual plate materials G will abut against two side plates 16a and 16b constituting the apex P, whereby the plate materials G will be stably held against a vibration in a transverse direction, and displacement among the plate materials will be corrected.

[0095] In this connection, as shown in FIG. 5, among four side plates 16a to 16d surrounding the bottom plate 15 from four directions, the two side plates 16a and 16b constituting the apex P as the lowest point will be fixed to the bottom plate 15 as they are, while the side plates 16c and 16d located at both sides of the apex P located on the opposite side on the diagonal line of the apex P will be attached to the bottom plate 15 or another member (such as the forward end of a rod of an air cylinder, not shown) so that they are slidable on the bottom plate 15. Namely, the side plates 16a and 16b are fixed side plates, and the side plates 16c and 16d are movable side plates. Therefore, the widths of the side plates 16c and 16d are smaller than the side plates 16a and 16b, respectively.

[0096] It is thereby possible to enlarge the area to receive plate materials on the bottom plate 15 by temporarily separating the side plates 16c and 16d from the opposing side plates 16b and 16a, for example, when plate materials G are loaded on the bottom plate 15 or when plate materials G are unloaded from the bottom plate 15, whereby the glass loading operation or the glass unloading operation can be facilitated. Further, in a state where the loading of plate materials has been completed, the movable side plates 16c and 16d will be maintained in such a state as abutted against the side surfaces of plate materials G, so that the individual plate materials G will not move in the storage box 14 during the transportation.

[0097] Here, when the bottom plate 15 is inclined, the apex P is made to be the lowest point in the above embodiment. However, two points of P and P₁ may, for example, be made to be the lowest points. However, with a view to facilitating alignment of the position of plate materials G, it is preferred that the apex at the lowest point is only one.

[0098] FIG. 7 illustrates another embodiment of the invention.

[0099] This embodiment is one wherein cushion materials 25 are disposed between the side plates 16a, 16c and 16d and the plate materials G stored in the storage box 14. In this case, for example, when a bottom plate 15 is inclined with an apex P being the lowest point as in the above-described FIG. 5, plate materials G are loaded as abutted against the side plate 16b, and cushion materials 25 are disposed along the rest of three sides.

[0100] Otherwise, as mentioned above, two points of apexes P and P₁ are made to be the lowest points (i.e. the side plate 16b is made to be the side plate at the lowest position), and plate materials G are loaded as abutted against this side

plate 16b, and cushion materials 25 will be provided at the side plates 16a, 16c and 16d along the rest of three sides.

[0101] FIG. 8 illustrates still another embodiment of the present invention.

[0102] This embodiment is one wherein side frames 5 along four sides of an upper cover 2 are fixed on a pedestal 3, and a top plate 6 is made separable from the side frames 5, so that at the time of packing or unpacking, only the top plate 6 is removed from the pedestal 3 to make the upper side of the pedestal 3 open, so that the plate materials G may be loaded or unloaded. In such a case, among side plates 16a to 16d of the storage box 14, only the side plate 16b is provided, and side plates 16a, 16c and 16d along other three sides are omitted. And, the bottom plate 15 is inclined with the above-described two apexes P and P₁ (FIG. 5) being the lowest point. Here, plate materials G are abutted against the side plate 16b located at the lowest position to attain the positioning on the bottom plate 15, and cushion materials 25 are provided between the remaining three sides and the side frames 5 fixed to the pedestal 3 thereby to resiliently secure the plate materials G. By such a construction, the construction of the storage box 14 can be simplified.

[0103] FIGS. 9(A) and (B) are views illustrating the shape of a plate material storage box having a bottom plate recessed. The bottom plate 15 may be formed as curved slightly in a concave shape in the short side direction or in the long side direction, or in the short side and long side directions, of the plate glass, with a curvature of e.g. a radius being from 10 m to 25 m, taking into consideration the deflection of the entire plate materials to be loaded (by their own weight). It is thereby possible to prevent the plate materials G put on the bottom plate 15 from displacement by a vibration in a transverse direction and to hold them stably. The direction in which the curvature is formed, is particularly preferably the short side direction.

[0104] Plate materials G to be stored are large size plate materials having e.g. a thickness of from 0.5 mm to 1.3 mm and a size of from about 1,400 mm×1,700 mm to 2,400 mm×2,800 mm. Further, at the time of flatly stacking them in the storage box 14, they are preferably stacked in such a state that inserting paper sheets 18 are interposed between the plate materials in order to avoid direct contact of the plate materials G with one another. The inserting paper sheets 18 preferably have a roughened surface having a smoothness of at most 18 seconds (JIS P-8119, 1976) to minimize the contact area and preferably have a paper quality to avoid transfer of a resin content in the inserting paper sheets 18 to the plate materials G to form paper skin pattern, burn marks or soiling on the glass surface. Namely, the resin content of the inserting paper sheets 18 is preferably at most 0.05% (JIS P-8205, 1976), and the paper quality is such that by the composite effects with the above-mentioned paper surface roughness, no adverse effects will be given to the quality of the plate materials G themselves.

[0105] The plate materials G stacked on the bottom plate 15 in such a manner, are resiliently held down by cushion materials 20 such as air bags provided on the lower surface side of the top plate, so that they will not vibrate up and down on the bottom plate 15 during the transportation. As a result, the storage box 14 containing plate materials G will be supported in a floating state by cushion materials 20 from above and by vibration dampers 17 from below, whereby the

plate materials G will be held in a stabilized state even if a shock is exerted from the exterior during the transportation of the packing boxes or even if the packing boxes themselves undergo vibration up and down during the transportation.

[0106] As described in the foregoing, in the packing box 1 of this embodiment, a plurality of large size plate materials G can be stored stably in a flatly stacked state. Further, their transportation is carried out in such a state that such packing boxes 1 are stacked one on another as the plate materials G are flatly loaded in the respective boxes. By transporting large size plate materials in a flatly stacked state in this manner, they can be easily and efficiently stored in e.g. a storage room having a low ceiling, and a number of plate materials can be transported stably by various transportation means.

[0107] At the time of loading plate materials G on such a packing box 1 or at the time of unloading plate materials G from the packing box 1 after the transportation, the packing box 1 may be lifted so that the storage box 14 of the packing box 1 will have a prescribed angle of from 0° to 90°, preferably from 75° to 85°, to the horizontal plane.

[0108] FIG. 10 is a perspective view of an erection table to have the packing box 1 put thereon and to lift it at a prescribed angle, and FIGS. 11(a) and (b) are views illustrating the state of use of such an erection table.

[0109] The erection table 21 is a L-shape member constituted by a large table portion 22 and a small table portion 23 vertically standing from one end of the large table portion 22. Such an erection table 21 is provided at a position to load or unload prescribed plate materials G on the path of a chain conveyer comprising chains C. The large table portion 22 and the small table portion 23 are provided with two parallel grooves 24 to let chains C of the conveyer pass therethrough along the direction for transportation of the packing box.

[0110] During the transportation by the chain conveyer, when the packing box 1 reached the erection table 21 with the large table portion 22 being in a horizontal state, it abuts against the small table portion 23 as shown in FIG. 11(a) and it is maintained. Thereafter, the erection table 21 is lifted as shown in FIG. 11(b) (by arrow D). This lifted angle is optionally adjustable within a range of from horizontal to substantially right angle. This lifted angle is adjusted to the optimum angle so that the operation by a robot for loading or unloading of the plate materials can be smoothly carried out.

[0111] When such an erection table is used for the operation of loading or unloading plate materials in a state where the packing box 1 is erected from the horizontal state, handling of the plate materials G themselves is simple as compared with a case where the plate materials G are taken out from the packing box 1 in a horizontal state or as compared with a case where plate materials G are overlaid afresh on the plate materials G in the storage box 14, and it is possible to easily unload plate materials G from the storage box 14 or to easily load plate materials G to the storage box 14 even by a robot or manpower. Further, the plate material loading or unloading method to load or unload plate materials is such a state that the packing box is lifted to stand erect, presents a less load to the plate materials G and thus reduces the possibility of damages to glass.

[0112] As described in the foregoing, the plate material packing box of the present invention comprises a plate material storage box capable of having a plurality of large size plate materials put thereon in a flatly stacked state, and vibration dampers to absorb vibrations with frequencies within a prescribed range beneath the plate material storage box, whereby a plurality of large size plate materials can be transported in a stabilized state where vibrations from the exterior are scarcely transmitted to the plate materials. Further, such plate material packing boxes are presupposed to be transported in a substantially horizontally flatly stacked state. Accordingly, as compared with the conventional vertically stacked transportation mode, a sufficient loading efficiency can be presented to a transporting vehicle, and at the same time, they can be stored without trouble even in a storage room narrow in the height direction such as in an airplane.

[0113] The packing box of the present invention can be used in such a manner that plate materials are packed and transported, and after the transportation, unpacked to take out the plate materials, whereupon the empty packing box may be re-used as it is. Such re-use may be repeated many times.

[0114] FIG. 12 illustrates another packing box according to the present invention, and FIG. 13 is a top view thereof. As illustrated, the packing box 1 comprises a pedestal 3 and a storage box 14. The pedestal 3 is one wherein a plurality of I-beam frame materials 9 formed by an extruded material made of e.g. an aluminum alloy, are assembled lengthwise and crosswise in a lattice-like arrangement to form a frame, and on an upper side of this frame, an upper lining 4 is fixed and on a lower side, a lower lining 10 is fixed. Here, the pedestal 3 may be formed by assembling materials such as angular pipes other than the I-beam frame materials 9 to form a frame.

[0115] At four corners of the pedestal 3, pillar members 31 (stacking members in Claims) are provided as projecting upwardly. On the top surfaces of the pillar members 31, shock absorbing pads 7 are bonded, and guide members 8 are attached thereon. Such guide members 8 are inserted and fit in openings 11 provided at lower surfaces of the pillar members 31, whereby a plurality of packing boxes 1 can be stacked (FIG. 19). Here, fixing of the pillar members 31 to the pedestal 3 may be reinforced by means of e.g. angle members (not shown), etc. Further, the pillar member 31 may not necessarily be a pillar-shaped member, but may be a wall-shaped member formed along one side on the pedestal 3.

[0116] The storage box 14 is put on an upper lining 4 of the pedestal 3 via vibration dampers. The vibration dampers consist of shrink absorbers 32 and stretch absorbers 33, and it is thereby possible to reduce the up-and-down vibration of the plate materials G during the transportation. The plate materials G are put on the bottom plate 15 of the storage box 14. The side walls of the storage box 14 are constituted by a fixed side plate 34, a movable side plate 35 and hold-down rolls 36, and the hold-down rolls 36 and the bottom plate 15 are designed to pinch inserting paper sheets 18 to be interposed between the plate materials G. After storage of the plate materials G, the storage box 14 will be covered by a cover 42, whereby deposition of dust on the plate materials G can be prevented. In FIG. 13, the cover 42 is omitted.

[0117] As shown in FIG. 13, the side plates 34 and 35 are provided along the opposing long sides of the rectangular bottom plate 15 of the storage box 14. Two hold-down rolls 36 are provided on each of the opposing short sides. The bottom plate 15 is bent in a V-shape as shown in FIG. 12, and the bending line D (FIGS. 13 and 15) along the apex of the V-shape is in parallel with the long sides of the bottom plate 15.

[0118] The pillar members 31 at the four corners of the pedestal 3 are provided with triangular or rectangular reinforcing walls 31a (triangular in this embodiment) along the sides of the pedestal.

[0119] FIG. 14 illustrates another embodiment of the plate material packing box.

[0120] In this embodiment, pillar members 31 are provided on the upper surface of the upper lining 4 of the pedestal 3, and openings 11 are formed at four corners of the lower lining 10. The rest of the construction is the same as in the embodiment of FIG. 12.

[0121] FIG. 15 is a schematic view of a plate material storage box, and FIG. 16 is a cross-sectional view of the vicinity of the hold-down roll in a state where the plate materials are stored.

[0122] As described above, the storage box 14 comprises a bottom plate 15, a fixed side plate 34, a movable side plate 35 and hold-down rolls 36. The movable side plate 35 can be turned in the direction of arrow R to the bottom plate 15 with the lower side of the side plate being the axis. The hold-down rolls 36 are movable in an up-and-down direction to the bottom plate 15. When plate materials G are to be stored in the plate material storage box 14, a plate material G is put on the bottom plate 15 by abutting one side of the plate material G against the fixed side plate 34 in a state where the movable side plate 35 is moved down. Then, an inserting paper sheet 18 is put on the plate material G, and another plate material G is put thereon. After a predetermined number of plate materials G are flatly stacked, the movable side plate 35 is moved back to stand erect. Then, the hold-down rolls 36 are lowered (arrow F), the inserting paper sheets 18 protruding from the plate materials G are pinched by the hold-down rolls 36 and the bottom plate 15, whereby the plate materials G are secured by the hold-down rolls 36 via the inserting paper sheets 18. It is thereby possible to prevent by the hold-down rolls 36 the up-and-down movement of the plate materials G by vibration. Further, it is possible to prevent the plate materials G from displacement in a transverse direction. Here, the hold-down rolls 36 may have any shape such as a column shape, so long as it is a shape capable of holding-down the inserting paper sheets.

[0123] When hold-down rolls having a roll diameter larger than the height of the stacked plate materials G, are used, it is possible to certainly prevent the plate materials G from displacement in a transverse direction.

[0124] Instead of the turning type movable side plate 35, the movable side plate may be made to be slidable in the direction of arrow B as shown in the above-described FIG. 5. By providing such a movable side plate 35, the opening area of the bottom plate 15 will be broadened, whereby the operation for loading the plate materials G will be facilitated. Further, after loading the plate materials G, when the

movable side plate 35 is returned to the initial position, it is preferred to have such a dimensional shape so that it pushes the plate materials G towards the fixed side plate 34 via the inserting paper sheets protruding from the plate materials G. Accordingly, also the size of the inserting paper sheets is preferably such a size that they protrude to the directions of three sides i.e. the opposing two short sides and the long side provided with the movable side plate 35, against the plate materials G.

[0125] The bottom plate 15 is bent in a V-shape, and its bending line D is parallel with the longitudinal direction of the bottom plate 15. Instead of the bottom plate bent in a V-shape, a downwardly convex curved bottom plate may be employed. Also in such a case, the curvature surface is preferably formed along short sides (i.e. the generating line of the curvature is in parallel with the long sides). As the bottom plate 15 is made to have a recessed shape in such a manner, it is possible to mount plate materials G stably and to prevent the plate materials G from displacing obliquely to the actual direction during the transportation. The angle of such a V-shape is preferably at least 160° and less than 180°, more preferably at least 170° and at most 176°. The bottom plate 15 is disposed preferably so that it is generally horizontal to the pedestal 3, but it may be inclined so that one side will be lower as described above (FIG. 6).

[0126] FIGS. 17(A) and (B) illustrate an embodiment of the vibration absorber. FIG. 17(A) is a cross-sectional view of a shrink absorber, and FIG. 17(B) is a cross-sectional view of a stretch absorber.

[0127] The shrink absorber 32 is constructed in such a manner that a resilient jell material 38 is attached via metal plates 39 to brackets 37 processed by bending and fixed to the bottom plate 15 and the upper lining 4 by screws 43. The jell material 38 and the metal plates 39 are bonded by e.g. an adhesive, and the brackets 37 are bonded or fixed by integrally formed bolts 40 to the metal plates 39.

[0128] The stretch absorber 33 is constructed in such a manner that a resilient jell material 38 is attached via metal plates 39 between two brackets 41 having a roughly $\sqcap$ -shaped cross-section and fixed to the bottom plate 15 and the upper lining 4 by screws 43. The jell material 38 and the metal plates 39 are bonded by e.g. an adhesive, and the brackets 37 are bonded or fixed by integrally formed bolts 40 to the metal plates 39.

[0129] Such shrink absorbers 32 and stretch absorbers 33 are regularly disposed substantially over the entire lower surface of the bottom plate 15. It is thereby possible to suppress the up-and-down vibration of the storage box 14 caused by swinging of the pedestal 3 due to a vibration during the transportation. Namely, in the case of FIG. 17(A), when compression is exerted between the bottom plate 15 and the upper lining 4 (arrows F_1), the jell material 38 is compressed to provide an effective cushion effect. In the case of FIG. 17(B), when extension is exerted between the bottom plate 15 and the upper lining 4 (arrows F_2), the jell material 38 is compressed to provide an effective cushion effect. In either case, the jell material 38 itself is compressed to provide a cushion effect. Instead of such a jell material 38, an elastic material such as a compression rubber or a compression spring material made of e.g. metal may be employed. Otherwise, an elastic body having an elasticity against a tensile force may also be employed.

[0130] FIG. 18 is a schematic view illustrating the junction between a guide member and an opening, and FIG. 19 is a schematic view when packing boxes are stacked.

[0131] As shown, the guide member 8 provided with a shock absorbing pad 7 on a pillar member 31 is inserted and fit in the opening 11 formed on the lower surface of the pillar member 31 of a packing box put thereon. As the guide member 8 is fit in the opening 11 in such a manner, a plurality of packing boxes 1 may be stacked (three layers in FIG. 19). Even if the packing boxes 1 are swayed by e.g. a vibration during the transportation, the shock absorbing pads 7 provided between the respective packing boxes 1 will ease such swaying and will further ease the vibration of plate materials G.

[0132] FIG. 20 illustrates another embodiment of the plate material storage box according to the present invention. This storage box 14 is one wherein hold-down plates 50 pressing plate materials G from their side surfaces, are provided along the respective four sides of a rectangular bottom plate 15. The size of the plate materials G is substantially the same size as the bottom plate 15.

[0133] Each hold-down plate 50 is mounted on the bottom plate 15 detachably or openable as it falls down outside, via one or more attaching portions 55.

[0134] The hold-down plates 50 may be provided in such a manner that one hold-down plate corresponding to the length of each side of the rectangular bottom plate 15 may be provided, or two or more short hold-down plates may be provided along each side.

[0135] FIGS. 21(A) and (B) are cross-sectional views of the hold-down plate portion of the plate material storage box of FIG. 20.

[0136] A plurality of plate materials G are put on the bottom plate 15 as horizontally stacked. Inserting paper sheets 18 are interposed between the respective plate materials G.

[0137] FIG. 21(A) illustrates an embodiment wherein inserting paper sheets 18 protruding from the side surfaces of the plate materials G are directly held down by the hold-down plate 50. The hold-down plate 50 presses the plate materials G having substantially the same size as the bottom plate 15, from their side surfaces, via the protruded end portions of the inserting paper sheets 18, in combination with the bottom plate 15. The overlap portions at the protruded end portions of the inserting paper sheets 18 are held-down by the hold-down plate 50, whereby the hold-down plate 50 will not directly contact the side surfaces of the plate materials G, and due to the flexibility of the inserting paper sheets, the stacked assembly of plate materials G can certainly be secured by pressing it from the four side surfaces, while the plate materials G are protected.

[0138] FIG. 21(B) illustrates an embodiment wherein the inserting paper sheets 18 protruding from the side surfaces of the plate materials G are held-down by the hold-down plate 50 via a cushion material 51. The hold-down plate 50 presses the plate materials G having substantially the same size as the bottom plate 15, from their side surfaces via a cushion material 51 and the protruded end portions of the inserting paper sheets 18. By the interposition of the cushion material 51, the stacked assembly of plate materials can

certainly be secured by pressing the side surfaces of the plate materials uniformly and stably in accordance with the shape of the side surfaces by absorbing non-uniformity in the shape of the overlapped portions of the end portions of the inserting paper sheets or by absorbing non-uniformity of the end portions of the plate materials G.

[0139] FIG. 22 is a perspective view of an embodiment of the construction of the hold-down plate-attaching portion. This embodiment of the attaching portion 55 has a construction wherein the hold-down plate 50 is made detachable from the bottom plate 15. On the rear surface of the hold-down plate 50, a pillar 52 is fixed. This pillar 52 is inserted into a pillar bearing 53 provided at the side edge of the bottom plate 15, so that the press-down plate 50 is attached to the bottom plate 15. It is thereby possible that when a plate material is loaded on or unloaded from the bottom plate 15, the hold-down plate 50 may be separated from the bottom plate 15, so that the side surface of the plate material is released, whereby the operation for loading or unloading can smoothly be carried out. Here, the pillar bearings 53 are provided with a proper distance from the side surface of the end portion of the bottom plate 15.

[0140] FIG. 23 is a perspective view of another embodiment of the construction of the hold-down plate-attaching portion. This embodiment of the attaching portion 55 has a construction wherein the hold-down plate 50 is made openable (arrow F) as it falls down outside to the bottom plate 15. On the rear surface of the hold-down plate 50, a pillar 52 is fixed. This pillar 52 is attached pivotally about the spindle 54 to the bracket 56 formed on the side edge of the bottom plate 15. It is thereby possible that at the time of loading a plate material on the bottom plate 15 or unloading it therefrom, the hold-down plate 50 is permitted to fall-down outside of the bottom plate 15 to release the side surface of the plate material, whereby the operation for loading or unloading can be smoothly carried out. Here, the bracket 56 is provided with a proper distance from the side surface of the end portion of the bottom plate 15.

INDUSTRIAL APPLICABILITY

[0141] As an application example of the present invention, not only plate glass, but all products may be stored in the packing box of the present invention so long as they are plate materials which can be flatly stacked, and yet, vibration absorbers are disposed below the plate material storage box, whereby the products can be protected from vibration or shock during their transportation. However, the present invention is particularly effective for plate glass, taking into consideration that large size thin plate materials can thereby be transported stably and efficiently.

[0142] The entire disclosures of Japanese Patent Application No. 2004-216475 filed on Jul. 23, 2004 and Japanese Patent Application No. 2005-047131 filed on Feb. 23, 2005 including specifications, claims, drawings and summaries are incorporated herein by reference in their entireties.

What is claimed is:

1. A plate material packing box comprising a pedestal having an upper lining, a plate material storage box put on the pedestal, and an upper cover enclosing the plate material storage box on the pedestal and being detachable from the pedestal, wherein the plate material storage box is an upwardly open support having a bottom plate to have a

plurality of plate materials put thereon in a substantially horizontally stacked state, and side plates along four sides of its periphery; the upper cover is a downwardly open box having a top plate covering the upper surface of the plate material storage box and side frames along four sides of its periphery; a vibration damper is interposed between the pedestal and the bottom plate; and is a cushion material is installed between the top plate and the plate materials put on the bottom plate.

2. A plate material packing box comprising a pedestal having an upper lining, a plate material storage box put on the pedestal, side frames fixed along the periphery of the plate material storage box on the pedestal, and an upper cover detachable from the side frames, wherein the plate material storage box is an upwardly open support having a bottom plate to have a plurality of plate materials put thereon in a substantially horizontally stacked state, and a side plate provided along one side of its periphery; the upper cover is a top plate covering the upper surface of the plate material storage box; a vibration damper is interposed between the pedestal and the bottom plate; and a cushion material is installed between the top plate and the plate materials put on the bottom plate.

3. The plate material packing box according to claim 1, wherein the bottom plate is formed to have a rectangular shape and inclined at a prescribed angle to the upper surface of the pedestal with one or two corners thereof being at the lowest point.

4. The plate material packing box according to claim 2, wherein the bottom plate is formed to have a rectangular shape and inclined at a prescribed angle to the upper surface of the pedestal with one or two corners thereof being at the lowest point.

5. The plate material packing box according to claim 1, wherein the bottom plate has a surface curved in a concave shape to have the plate materials put thereon.

6. The plate material packing box according to claim 2, wherein the bottom plate has a surface curved in a concave shape to have the plate materials put thereon.

7. The plate material packing box according to claim 1, wherein the bottom plate is downwardly curved or bent in a convex shape.

8. The plate material packing box according to claim 2, wherein the bottom plate is downwardly curved or bent in a convex shape.

9. The plate material packing box according to claim 1, which has a positioning means to set the position of another plate material packing box to be put on the top plate, wherein the positioning means comprises a plurality of guide members projecting upwardly from the top plate and fixed to the top plate, and a plurality of openings formed at the pedestal to engage with such guide members.

10. The plate material packing box according to claim 2, which has a positioning means to set the position of another plate material packing box to be put on the top plate, wherein the positioning means comprises a plurality of guide members projecting upwardly from the top plate and fixed to the top plate, and a plurality of openings formed at the pedestal to engage with such guide members.

11. A plate material transporting method which comprises stacking a plurality of plate materials in the plate material storage box of the plate material packing box as defined in claim 1 and transporting the plate materials.

12. A plate material transporting method which comprises stacking a plurality of plate materials in the plate material storage box of the plate material packing box as defined in claim 2 and transporting the plate materials.

13. A plate material loading or unloading method which comprises, in such a state that the upper cover of the plate material packing box as defined in claim 1 is removed, lifting the plate material packing box so that the bottom plate be at a prescribed angle to the horizontal plane, and loading a plurality of plate materials in the plate material storage box or unloading such plate materials from the plate material storage box.

14. A plate material loading or unloading method which comprises, in such a state that the upper cover of the plate material packing box as defined in claim 2 is removed, lifting the plate material packing box so that the bottom plate be at a prescribed angle to the horizontal plane, and loading a plurality of plate materials in the plate material storage box or unloading such plate materials from the plate material storage box.

15. A plate material packing box comprising a pedestal having an upper lining, a plate material storage box put on the pedestal, and a vibration damper interposed between the pedestal and the plate material storage box, wherein

the plate material storage box comprises a rectangular bottom plate to have a plurality of plate materials put thereon in a horizontally stacked state, side plates provided along mutually opposing two sides of the bottom plate and inserting paper hold-down rolls provided along other mutually opposing two sides of the bottom plate;

the bottom plate is downwardly curved or bent in a convex shape, and the bending line at the apex of the bent surface or the generating line of the curved surface is in parallel with the side plates;

the pedestal is provided with a positioning means for stacking plate material packing boxes.

16. The plate material packing box according to claim 15, wherein the side plates are provided along the long sides of the bottom plate; one side plate is fixed to the bottom plate; and the other side plate is rotatably or separably hinged to the bottom plate so that the side provided with this side plate is openable and closable.

17. The plate material packing box according to claim 15, wherein stacking members consisting of pillars or walls are installed on the pedestal around the plate material storage box, and the positioning means comprises guide members provided at upper ends of the stacking members and openings provided on the bottom surface side of the pedestal to engage with the guide members.

18. The plate material packing box according to claim 15, wherein the vibration damper comprises a stretch absorber and a shrink absorber, and the stretch absorber and the shrink absorber are provided as regularly distributed over the entire lower surface of the bottom plate.

19. A plate material transporting method which comprises stacking a plurality of plate materials in the plate material storage box of the plate material packing box as defined in claim 15 and transporting the plate materials.

20. A plate material packing box comprising a pedestal having an upper lining, a plate material storage box put on the pedestal, and a vibration damper interposed between the pedestal and the plate material storage box, wherein

the plate material storage box comprises a rectangular bottom plate to have a plurality of plate materials put thereon in a horizontally stacked state via inserting paper sheets, and hold-down plates are provided along the respective four sides of the bottom plate to press the plate materials from their side surfaces via inserting paper sheets protruding from the plate materials.

21. The plate material packing box according to claim 20, wherein each hold-down plate is detachable from the bottom plate or openable as it falls down outside of the bottom plate.

22. The plate material packing box according to claim 20, wherein a cushion material is provided between the inserting paper sheets and the hold-down plates.

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