

## CONTAINER FOR FLAT PANEL

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### BACKGROUND OF THE INVENTION

#### 1. Field of the Invention

The present invention relates to a container for flat panel, more particularly a container for taking custody of or transporting flat panels used for parts of flat display devices and the like in a good condition without  
10 destroying them.

#### 2. Description of the Related Art

In flat display devices such as liquid crystal  
15 display devices and plasma display devices, electrodes or separating walls are formed on glass substrates by means of screen printing and the like, and the glass substrates are to be transported to the another factory to assemble or re-process them during a process of producing these  
20 substrates. In this case, a container is required for taking custody of and transporting the glass substrates without destroying them or contaminating the surfaces of them.

Further, a construction of a container permitting an  
25 air shield and direct transport between clean rooms is

required, when these substrates are transported.

The conventional container, however, was not the one permitting direct transport of flat panels such as glass substrates used for flat display devices between clean rooms without destroying the panels and contaminating the surfaces thereof.

#### SUMMARY OF THE INVENTION

In view of the foregoing circumstance, the object of the present invention is to provide a container for flat panel which is able to take custody of or transport a plural of flat panels such as glass substrates used for flat display devices without destroying them and contaminating the surfaces of them. The other object of the present invention is to provide a container for flat panel permitting direct transport of flat panels between clean rooms.

To achieve the above-mentioned object, a container for flat panel of the present invention comprises:

a lower end holding resilient member disposed on a bottom end of a lower end bottom groove to which a lower end of the flat panel contained in the container is inserted, and

an upper end holding resilient member having a belt shaped portion covering an upper end of the flat panel

along the longitudinal direction thereof.

Preferably, the upper end holding resilient member has an U-shaped cross section, a pair of fitting rods extending along the longitudinal direction thereof are attached at both sides of both ends of the longitudinal direction thereof, and each end of each fitting rod is attached removably in an engagement groove of an adapter attached in said container.

Further, the upper end holding resilient member may be formed to have the belt-shaped portions and support portions alternately and continuously along one direction. The support portions hold the fitting rods respectively.

The lower end holding resilient member is preferably a rope-shaped rubber member attached in a bottom of an attachment groove extending substantially perpendicular to the lower end holding groove of a lower end holding block provided with a plural of the lower end holding grooves. The lower end holding block is preferably attached in the bottom of the container.

Shock absorber members are preferably attached in the both sides of the container. The shock absorber members are provided with guide grooves into which the sides of the flat panels are inserted slidably.

Preferably, the inside of the container is purged

with an inert gas. The inert gas is preferably blew into the space between respective flat panels held in the container. As the inert gas, nitrogen gas is preferable in consideration of handling operation, transportation cost and so on.

Preferably, a drying agent box is attached removably in the container. It is because the moisture inside the container can be removed. Preferably the drying agent box is provided with a bore hole having a filter for adjusting the inside pressure of the container. Because it should be considered that the container is transported by airplane and the like.

Preferably, the outside of the container is covered by an outer box which is able to be disassembled and be assembled repeatedly. Preferably, the container of the present invention is taken custody of and is transported in the state that the container is contained in the outer box. The outer box may be disassembled in the semi-clean room and only the container therein may be transported into the clean room.

In the container for flat panel of the present invention, the flat panels such as glass substrates contained in the container are held at each upper end of flat panel by the upper end holding resilient member and are held at each lower end of flat panel by the lower end

holding resilient member. Namely, a plural of the flat panels are held to be sandwiched between up and down directions. Accordingly, the flat panels held resiliently between up and down directions are not destroyed, even if the vibration is exerted to the container. Further, since there are spaces between the flat panels, the surfaces of the flat panels are not contaminated. Especially in case of blowing the inert gas such as nitrogen gas into the space between the flat panels, it may be possible to protect effectively from adhesion of dusts or particles on the surfaces of the flat panels.

Further, in case that the upper end holding resilient member is comprised of the belt shaped portion having substantially U-shaped cross section, the upper end portion of the flat panel is covered by the upper end holding resilient member so that the holding of the upper end is secured and a strong construction capable of bearing not only up and down vibrations but also front, back, left and right vibrations is obtained.

In accordance with the present invention, the construction of covering the outside of the container by the outer box makes it possible also to prevent from adhesion of dusts and particles on the surfaces of the container itself, so that the container is able to be

transported directly between clean rooms.

#### BRIEF DESCRIPTION OF THE DRAWINGS

Other objects and features of the present  
5 invention will be described in detail with reference to  
accompanying drawings, in which

Figure 1 is a schematic perspective view of a  
container of an embodiment of the present invention,

Fig. 2 is a decomposed perspective view showing the  
10 inside of the container,

Fig. 3A and 3B are schematic views showing holding  
constructions with upper end holding resilient members,

Fig. 4A is a perspective view of a lower end holding  
resilient member,

15 Fig. 4B is a partial cross section along the IVB-IVB  
line showing in the Fig. 4A, and

Fig. 5 is a schematic decomposed perspective view of  
the outer box.

#### 20 DESCRIPTION OF THE PREFERRED EMBODIMENTS

As shown in Fig. 1, the container 2 for flat panel of  
the present embodiment comprises a rectangle shaped main  
container 4 having an opening portion 3 at the upper end  
thereof. The main container 4 is comprised of a complex  
25 material of synthetic resin and metal such as aluminum.

A lid member 6 is attached removably on the opening portion 3 of the main container 4. The lid member 6 is comprised of the same material as that of the main container 4. One-touch control type lock members 8 are  
5 attached on the mutually opposite side walls of the container 4 near the opening portion. The lock members are able to engage removably with projection pieces 10 formed on the corresponding portions of the lid member 6. The engagement of the projection pieces 10 with the lock  
10 member 8 makes it possible to fix the lid member 6 on the opening portion of the main container 4 and to seal off inside. In case of opening the lid member 6, the lock members 8 are operated to release the engagement with the projection pieces, so that the lid member 6 is able to be  
15 removed with one touch control.

One side wall (side wall having narrower horizontal width in this embodiment) of the main container 4 is provided with a sight glass for viewing inside, through which the inside of the container is able to be viewed  
20 for confirmation. The sight glass may be disposed on the other side wall of the container 4.

In the present embodiment, handles 14 are provided on the both side walls having narrower widths of the main container 4. The container 2 is capable of being carried  
25 by gripping the handles.

Leg portions 16 are attached outside the bottom of the main container 4. An opening portion 18 for box is provided with the main container 4 at the lower end portion of the wider side wall thereof. A drying agent box 20 is inserted removably into the opening portion. In the drying agent box 20, drying agent such as silica gel is contained so that the moisture inside the container is able to be removed.

In the present embodiment, a front wall 22 of the drying agent box is provided with bore holes having a filter for adjusting the inside pressure of the container. The bore holes 24 having the filter permit the flow between inside and outside of the container 2 in order to adjust the inside pressure of the container when the container is transported by airplane and the like. As the filter attached with the bore holes 24, such as a paper filter may be used.

In the present embodiment, lower end holding blocks 30 shown in Figs. 4A and 4B are disposed inside the bottom wall of the main container 4 of Fig. 1 in the predetermined distances along the longitudinal direction X of the bottom wall. The block 30 is comprised of for example resin form. The bottom surface of the block 30 is provided with an attaching plate 31. The attaching plate 31 is comprised of metal plate of stainless steel and the

like. The plate 31 is attached inside the bottom wall of the main container 4 by means of bolt, screw and the like.

On the upper surface of the block 30, a plural of lower end holding grooves 32 are formed substantially parallel along the X direction and in the predetermined distances along the Y direction (which is perpendicular to the X direction). Lower ends of the glass substrates are inserted respectively in the lower end holding grooves 32 as shown in Fig. 4B. Namely, the number of the lower end holding grooves 32 formed thereon corresponds to the number of the glass substrates capable of containing in the container 2.

As shown in Figs. 4A and 4B, an attaching groove 36 extending along the Y direction substantially perpendicular to the lower end holding grooves 32 is formed across the center of the lower end holding grooves 32. The depths of these lower end holding grooves and the attaching groove 36 are substantially the same and are preferably 10 - 15 mm, more preferably 12 - 13 mm. Each groove width of the lower end holding grooves 32 is preferably the width of approximately 50 - 110 % of the thickness of the glass substrate 34, more preferably the width of approximately 80 - 95 % of the same. In case that the width is too small, the insertion of the lower end of the glass substrate 34 tends not to be easy, while

in case that the width is too big, the holding of the lower end of the glass substrate tends not to be stable.

The groove width of the attaching groove 36 is determined by such as an outer diameter of a rope-liked lower end holding resilient member 38 disposed in the bottom of the groove 36 and is substantially the same as the groove width of the lower end holding groove 32. In the present embodiment, the rope-shaped lower end holding resilient member 38 is comprised of a member which is other than silicone rubber and which has elasticity. Examples of the member include diene rubbers such as styrene-butadiene rubber (SBR), butadiene rubber (BR), isoprene rubber (IP), acrylonitrile-butadiene rubber (NBR) and chloroprene rubber (CR), butyl rubber (IIR), ethylene-propylene-diene terpolymer rubber (EPDM), acrylic rubber, chlorosulfonated polyethylene rubber, fluororubber, urethane rubber, polysulfide rubber, foam of any of the rubbers mentioned above and foam of urethane or nylon. As shown in Fig. 4B, the lower end of the glass substrate 34 inserted in the lower end holding groove 32 is placed on the lower end holding resilient member 38 to hold it by means of the elastic force thereof.

As shown in Figs. 1 and 2, spacers 40 and shock absorber members 42 are disposed inside the side walls

located both ends along the longitudinal direction X of the main container 4. The spacer 40 is used for adjusting the width inside the container 2 in case of containing the glass substrates 34 having different widths along the X direction and the material thereof is not particularly limited but preferably the light one.

The shock absorber member 42 may be comprised of the same plastic form as the block 30 shown in Figs. 4A and 4B, for example. Each of the shock absorber members 42 is provided with guide grooves 44 extending in parallel along the up and down direction and in the predetermined distances along the Y direction. The arrangement distances of the guide grooves 44 are substantially the same as the arrangement distances of the lower end holding grooves 32 of the block 30 shown in Figs. 4A and 4B. As shown in Fig. 2, both side ends of the glass substrate 34 are inserted slidably into these guide grooves. Note that the holding of the glass substrate 34 is secured by both of the above-mentioned lower end holding resilient member 38 and the below-mentioned upper end holding resilient member 50 or 50a. The guide grooves 44 of the shock absorber member 42 only play a roll of guiding. In these foregoing view, each groove width of the guide grooves 44 is made bigger than each groove width of the lower end holding grooves 32 by

preferably 5 -40 %, more preferably 10 - 25 %.

The shock absorber members 42 and spacers 40 are provided with perforated holes 46 at the positions between the guide grooves and at the both end positions along the laminating direction of glass substrates. These perforated holes 46 are connected with a conduit tube 55 shown in Fig. 1 to permit gas flow. The conduit tube 55 is provided with a valve 62 and a supply port 64. A nitrogen gas cylinder (not shown) is to be connected to the supply port 64 and the valve 62 is to be controlled, so that nitrogen gas may blow in from the perforated holes 46 to purge the inside of the container with nitrogen gas. Since these perforated holes 46 are formed between the guide grooves 44, the nitrogen gas may blow between the glass substrates 34 held in the container 2.

As shown in Figs. 1 and 2, adapters 56 are attached respectively on the inner walls of the container over the spacers 40 (near the opening portion 3) in the main container 4. The adapter 56 is provided with engagement grooves 58 in the predetermined distances along the Y direction. These engagement grooves 58 are formed thereon so that each groove is located at both side positions of each glass substrate contained in the container as shown in Fig. 3A. Namely, the grooves 58 are formed at alternately different positions from the guide grooves 44

shown in Fig.2.

As shown in Fig. 2, each end portion of fitting rods 52 attached at both sides of both ends of the longitudinal direction of the upper end holding resilient member 50 shown in Fig. 2 may be engaged in each groove wall portion of each engagement groove 58.

As shown in Figs. 2 and 3A, the upper end holding resilient member 50 is comprised of a belt-shaped portion 51 having U-shaped cross section and is for example comprised of the same material as that of the lower end holding resilient member 38 shown in Figs. 4A and 4B. The belt-shaped portion 51 of the resilient member 50 is preferably comprised of a sponge of which surface is covered by a sheet for preventing static electricity. It is because of preventing static electricity.

The fitting rods 52 holding the belt-shaped portion 51 of the upper end holding resilient member 50 at both sides along the longitudinal direction are for example comprised of stainless steel and are designed to protrude from both ends of the longitudinal direction of the resilient member 50. As shown in Fig. 3A, both ends of the fitting rods are able to be engaged in the groove wall portions of the engagement grooves 58 of the adapters 56. A stopper member 59 shown in Fig. 2 is mounted removably on the adapter 56 respectively so that

the fitting rods 52 are fixed in the engagement grooves 58 of the adapter 56 and consequently each upper end holding resilient member 50 holds and covers the upper end of the glass substrates 34 respectively along the longitudinal direction thereof as shown in Fig. 3A.

Note that the upper end holding resilient member of the present invention may be an upper end holding resilient member 50a on which belt-shaped resilient portions 51a having U-shaped cross section are formed continuously from a sheet material as shown in Fig. 3B. The sheet material is comprised of elastic sheet made from the same material as that of the resilient member 50. The sheet material is processed by means of molding, heating and/or pressing to form belt-shaped portions 51a and support portions 53 alternately and continuously along the Y direction. The support portions 53 hold the fitting rods 52 respectively. The fitting rods 52 of the resilient member 50a arranged in the predetermined distances may be fixed in the engagement grooves 58 of the adapter 56.

The container 2 of the present invention is taken custody of and transported in condition that the container is contained in the outer box 60 which is able to be disassembled and assembled repeatedly as shown in Fig. 5. Note that the container 2 is contained in the

outer box 60 in the condition that the nitrogen gas cylinder is connected to the supply port 64 to purge inside the container 2 with nitrogen gas.

5 The outer box 60 is comprised of a bottom plate 62 provided with such as rollers 64 for transportation, side plates 68 and 70 placed upward on the four side of the bottom plate 62, and a lid member 72 with a handle 74 covering the upper end of the side plates 68, 70. These plates are able to be disassembled and assembled  
10 repeatedly.

When the glass substrates are to be taken out from the container 2, at first, the outer box 60 is disassembled and the container 2 is taken out. The work for disassembling the outer container 60 is conducted in  
15 the semi-clean room. The container 2 taken out from the outer box 60 is then transported into the clean room and the lid member 6 shown in Fig. 1 is removed from the main container 4. After that, stopper 59 shown in Fig. 2 are removed from the adapter 56, so that it is possible to  
20 disconnect the upper end holding resilient members 50. Then, the upper end holding members 50 are disconnected from the engagement grooves 58, so that it is possible to pull up each glass substrate along the guide groove 44. Then, the glass substrates 34 are taken out from the  
25 container.

When each glass substrate is to be contained in the container 2, the operation may be conducted in reverse order described above.

5 In the container 2 for flat panel of the present embodiment, the glass substrates contained in the container 2 are held at each upper end of the flat panel by the upper end holding resilient members 50 or 50a as shown in Figs. 3A, 3B and are held at each lower end of the glass substrates 34 by the lower end holding  
10 resilient members 38 as shown in Fig. 4B. Namely, a plural of the glass substrates 34 are held to be sandwiched between up and down directions.

Accordingly, the glass substrates 34 held resiliently between up and down directions are not destroyed, even if  
15 the vibration is exerted to the container 2. Further, since there are spaces between the glass substrates 34, the surfaces of the glass substrates 34 are not contaminated. Especially, since it is designed that nitrogen gas is blew into the spaces between the glass  
20 substrates through the perforated holes 46 shown in Fig. 2, it may be possible to protect effectively from adhesion of dusts or particles on the surfaces of the glass substrates 34.

Further, since the upper end holding resilient member  
25 50 is comprised of the belt shaped portion 51 or 51a

having substantially U-shaped cross section, the upper end portion of the glass substrate 34 is covered by the upper end holding resilient member 50 or 50a as shown in Figs. 3A and 3B, so that the holding of the upper end portion of the glass substrate 34 is secured and a strong construction capable of bearing not only up and down vibrations but also front, back, left and right vibrations is obtained.

Further, in accordance with the present embodiment, as shown in Fig. 5, the construction of covering the outside of the container 2 by the outer box 60 makes it possible to prevent from adhesion of dusts or particles on the surfaces of the container itself, so that the container is able to be transported directly between clean rooms.

Note that the present invention is not restricted to the above-mentioned embodiments and may be modified in a variety of modes within the spirit of the present invention.

For example, the flat panels capable of being contained in the container of present invention is not restricted to the glass substrates, but may be another flat electronic parts.

As mentioned above, in accordance with the container for flat panel of the present invention, it is possible

to take custody of or transport a plural of flat panels such as glass substrates used for flat display devices without destroying them and contaminating the surfaces of them.

## C L A I M S

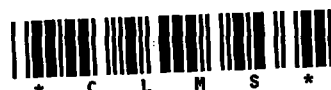
5           1. A container for flat panel, comprising:

          a lower end holding resilient member disposed on a  
bottom end of a lower end bottom groove to which a lower  
end of the flat panel contained in the container is  
inserted, and

10           an upper end holding resilient member having a belt  
shaped portion covering an upper end of the flat panel  
along the longitudinal direction thereof.

          2. The container for flat panel as set forth in claim  
15       1, wherein said upper end holding resilient member has an  
U-shaped cross section, a pair of fitting rods extending  
along the longitudinal direction thereof are attached at  
both sides of both ends of the longitudinal direction  
thereof, and each end of each fitting rod is attached  
20       removably in an engagement groove of an adapter attached  
in said container.

          3. The container for flat panel as set forth in claim  
25       1, wherein the inside of said container is purged with an  
inert gas.



4. The container for flat panel as set forth in claim 1, wherein said lower end holding resilient member is a rope-shaped rubber member attached in a bottom of an attachment groove extending substantially perpendicular to the lower end holding groove of a lower end holding block attached in the bottom of the container.

5. The container for flat panel as set forth in claim 1, wherein shock absorber members are attached in the both sides of the container and the shock absorber members are provided with guide grooves into which the sides of the flat panels are inserted slidably.

6. The container for flat panel as set forth in claim 1, wherein a drying agent box is attached removably in the container and the drying agent box is provided with a bore hole having a filter for adjusting the inside pressure of the container.

7. The container for flat panel as set forth in claim 1, wherein the outside of the container is covered by an outer box which is able to be disassembled and be assembled repeatedly.

8. The container for flat panel as set forth in claim



1, wherein said upper end holding resilient member is formed to have the belt-shaped portions and support portions alternately and continuously along one direction.



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