perspective view illustrating an inner rail, an outer rail having a rail retainer in the frame, and a width expander having a threaded rod and a fixing piece.

Fig. 5 is a cross-sectional view of the outer rail having the rail retainer shown in Fig. 4.

Fig. 6 is an explanatory cross-sectional view showing a state of the sheet to be held for explaining a procedure of a method for holding the sheet by using the sheet holding device shown in Fig. 1.

Fig. 7 is another explanatory cross-sectional view showing a state of the sheet having been held for explaining the procedure of the method for holding the sheet by using the sheet holding device shown in Fig. 1.

Fig. 8 is an enlarged view of an engaging portion between a corner end of the inner rail and a protrusion of the outer rail shown in Fig. 7.

Fig. 9 shows an exemplary arrangement of the panels according to the present invention adopted as a facade border.

Fig. 10 shows another exemplary arrangement of the panel according to the present invention adopted as a backwall.

Fig. 11 shows further another exemplary arrangement of the panel according to the present invention adopted as a top of a suspended ceiling.

Description of Embodiments

[0016] Hereinafter, a preferable embodiment of a sheet holding device and a panel including the same will be described with reference to the accompanying drawings.

[0017] Figs. 1 to 2 illustrate a sheet wall 200 including three panels 100 as an exemplary arrangement of the panels 100 each having a sheet 50 having been stretched thereover in an embodiment of the present invention. The sheet 50 is made of a thin and light synthetic resin (e.g., polyester resin), and may be a plain sheet or a sheet provided with a preferable design such as a specific character or pattern. The sheet 50 may be illuminated from a rear surface thereof to make the design of the sheet outstanding for increasing an advertising effect.

[0018] Specifically, the sheet wall 200 includes the three panels 100 standing and sequentially connected at a right angle, a plurality of support members 101 each having a prismatic shape for respectively supporting the panels 100 from their rear side, and side plates (end plates) 102 for covering the rear side (particularly, the support members 101) of the panels 100 at ends thereof.

[0019] Each of the support members 101 may be made of a prismatic material which is light and has a specific rigidity. Adoptable for the support member 101 is a prismatic member (e.g., “MAXIMA light” that is the product name and produced by OCTANORM GmbH) made of aluminum or an aluminum alloy, or a prismatic wooden material and the like. In the

inner rail 3 to be expanded by the width expander 4, and having a property of partially expanding in the direction of the width W in an elastic deformation. For instance, a vinyl chloride resin is selected.

[0033] In the embodiment, a plurality of width expanders 4 are arranged at a distance therebetween in a longitudinal direction of the inner rail 3. For example, ten width expanders 4 may be arranged at every distance of 30 cm in the inner rail 3 having the total length of 3 m. Meanwhile, the holding device according to the present invention may include at least one width expander 4.

[0034] The width expander 4 can expand the width W of the inner rail 3 as shown in Figs. 4 and 6 to 7. The width expander 4 in the embodiment includes a fixing piece 15 which is movable in the insertion direction D1 and the opposite direction D2 thereto while coming into contact with the pair of opposite oblique surfaces 12a, 13a, and a fixing piece moving part 16.

[0035] The fixing piece 15 has side surfaces 15a, 15a in the opposite directions perpendicularly intersecting the insertion direction D1, the side surfaces 15a, 15a being curved in such a way as to separate from each other as advancing forward in the insertion direction D1. Therefore, the fixing piece 15 has a substantially semi-circular or semi-ellipsoid cross section with the curved opposite side surfaces 15a, 15a.

[0036] The fixing piece 15 has a threaded hole 15b extending in the insertion direction D1. Although the threaded hole 15b in the embodiment is a through hole, the threaded hole 15b may not penetrate through when having an enough depth for the fixing piece 15 to move between a position of the inner rail to be expanded (see Fig. 6) and a position of the inner rail having been expanded (see Fig. 7).

[0037] As shown in Figs. 4 and 6, the fixing piece 15 is supported by a member supporting protrusion 3e at a predetermined position in an inside space 3d of the inner rail 3. The member supporting protrusion 3e has a flat and tongue-like shape extending in the longitudinal direction of the inner rail 3, and has a cutout at a prospected arrangement position for the fixing piece 15. The fixing piece 15 is inserted in the cutout of the member supporting protrusion 3e, and supported at the predetermined position in the longitudinal direction of the inner rail 3.

[0038] Any structure may be adoptable so long as the fixing piece moving part 16 can move the fixing piece 15 in the insertion direction D1 and the opposite direction D2. The fixing piece moving part 16 in the embodiment comprises a threaded rod 17 extending in the insertion direction D1 to engage the threaded hole 15b, and a regulator 18 such as a washer for regulating a relative movement of the threaded rod 17 to the pair of components 12, 13 in the insertion direction D1. The threaded rod 17 passes across a slit 3b defined between the pair of components 12, 13 of the inner rail 3. The threaded rod 17 has a head 17a exposed to the

instance, the end portion 51 of the sheet 50 may be temporarily held on the four sides of the frame 2 under a weak holding force, and then a fine adjustment of the stretching of the sheet 50 may be horizontally and vertically executed. Thereafter, the end portion 51 of the sheet 50 may be held on the four sides of the frame 2 under a stronger holding force. Alternatively, the end portion 51 may be held on the left and right two sides of the frame 2 when the sheet 50 is horizontally stretched, and thereafter may be held on the upper and lower two sides of the frame 2 when the sheet 50 is vertically stretched.

[0047] Instead, the end portion 51 may be held on only the left and right two sides of the frame 2 when the sheet 50 is horizontally stretched, or may be held on only the upper and lower two sides of the frame 2 when the sheet 50 is vertically stretched.

[0048] In the embodiment, the operation of expanding the width of the inner rail 3 by the width expander 4 is executed in the manner described below in detail. Specifically, as shown in Figs. 6 to 7, the threaded rod 17 is rotated to move the fixing piece 15 in the opposite direction D2 that is opposite to the insertion direction D1 of coming in the recess 9, thereby causing the fixing piece 15 to push the pair of components 12, 13 in the directions of separating from each other to open while pressing the pair of opposite oblique surfaces 12a, 13a of the pair of components 12, 13. In this manner, the width W of the inner rail 3 is easily expandable.

[0049] In the embodiment, as shown in Figs. 7 to 8, the rail retainer 8 in the outer rail 6 is formed with a protrusion 11 at an opening of the recess 9. Hence, when the corner end 3c defined by the side surface 3a of the inner rail 3 engages with the protrusion 11, the end portion 51 of the sheet 50 can be firmly held at the engaging portion. Furthermore, it is possible to avoid a risk that the inner rail 3 falls off from the recess 9 to the outside.

[0050] After the end portion 51 of the sheet 50 is held in the recess 9 on each of the four sides of the frame 2 in the holding step, an excess of the end portion 51 of the sheet 50 coming out of the recess 9 may be cut or folded into the recess 9 subsequently to the holding step.

[0051] Finally, the opening of the recess 9 is covered by the decorative cover 5. The decorative cover 5 is arranged to entirely cover the opening of the recess 9 at the front side of the frame 2 as shown in Figs. 1 to 2. A way of attaching the decorative cover 5 to the frame 2 is not particularly limited in the present invention. For instance, as shown in Fig. 7, the decorative cover 5 is formed with a protrusion 5a and a receiver 5b. The protrusion 5a is caused to engage the cover engagement hole 6c of the outer rail 6 in the frame 2, and the receiver 5b is caused to receive the cylindrical protrusion 3f provided on the surface of the inner rail 3. Therefore, the decorative cover 5 can be supported at the plurality of positions. The decorative cover 5 having this configuration consequently achieves a decrease in the risk of falling-off after its attachment while being removably attached.

piece 15.

[0065] (8) In the sheet holding device 1 according to the embodiment, the rail retainer 8 in the outer rail 6 is formed with a protrusion 11 protruding inward at an opening of the recess 9 as shown in Figs. 5 and 7 to 8. This configuration eliminates the risk that the inner rail 3 having been expanded falls off from the recess 9, since the inner rail 3 in the expanded state is in contact with the protrusion 11 after being inserted in the recess 9. For the fine adjustment of the stretching of the sheet 50, the corner end 3c defined by the side surface 3a of the inner rail 3 is caused to engage with the protrusion 11. Owing to the engaging, the fine adjustment of the stretching of the sheet 50 is easily executable with increased accuracy while the end portion 51 of the sheet 50 is held under an appropriate holding force.

[0066] Even another configuration without the protrusion 11 at the opening of the recess 9 as described above can achieve the holding of the end portion 51 of the sheet 50 in the recess 9 by sandwiching the end portion 51 of the sheet 50 between the opposite side surfaces 3a, 3a of the inner rail 3 and the inner walls 10 defining the recess 9 and facing the opposite side surfaces 3a, 3a. However, the configuration including the protrusion 11 is preferable from the perspectives of the above-described advantageous operational effects, i.e., the prevention of the falling-off of the inner rail 3 from the recess 9, and the easier fine adjustment with the increased accuracy owing to the engaging between the corner end 3c of the inner rail 3 and the protrusion 11.

[0067] (9) The sheet holding device 1 according to the embodiment further includes a decorative cover 5 which covers the opening of the recess 9 as shown in Figs. 3 and 7. In this configuration, the decorative cover 5 can conceal the inner rail 3 inserted in the recess 9 from the outside by covering the opening in the recess 9 after the attachment of the sheet 50. Consequently, more beautiful appearance is attainable. Additionally, a process of, for example, making the surface of the decorative cover 5 shiny and smoothy in terms of beauty contributes to further improvement in the beautiful appearance of the sheet holding device 1.

[0068] The sheet holding device 1 may include no cover which covers the opening of the recess 9. Even the configuration without the cover can provide the above-described advantageous operational effects of the present invention, i.e., the increased sheet workability resulting from the expanded width of the inner rail 3 and achievement in the fine adjustment of the stretching.

[0069] (10) In a method for holding a sheet by using the sheet holding device 1 according to the embodiment, as shown in Figs. 6 and 7, the end portion 51 of the sheet 50 is sandwiched between the inner rail 3 and the rail retainer 8 of the frame 2 while being in contact with the opposite side surfaces 3a, 3a of the inner rail 3, and is disposed in this state in the gaps 19 defined between the inner walls 10 defining the recess 9 of the rail retainer 8 and the inner rail 3.

fixing piece 15 in these directions as shown in Fig. 4. However, the present invention should not be limited to this configuration.

[0077] In the present invention, any structure which can expand the width W of the inner rail 3 is adoptable as the width expander of the present invention. For instance, adoptable as a width expender for expanding a width of an inner rail whose pair of components are linearly movable in directions of coming closer to each other and directions of separating from each other like Modification (A) is a width expander having a mechanical structure or a mechanism such as a fluid-driven jack which can linearly move the pair of components in the directions of coming closer to each other and the directions of separating from each other.

[0078] (C) In the embodiment, as shown in Fig. 6, the pair of components 12, 13 of the inner rail 3 respectively have the pair of opposite oblique surfaces 12a, 13a. The fixing piece 15 having the semi-circular or semi-ellipsoid cross section presses the pair of opposite oblique surfaces 12a, 13a, thereby expanding the width of the inner rail 3. However, the present invention should not be limited thereto.

[0079] In another modification of the present invention, the fixing piece 15 may have a pair of oblique surfaces inclining with respect to the insertion direction D1 on the periphery thereof for pressing the corresponding portions of the pair of components 12, 13 in the directions of separating from each other to open.

[0080] (D) In the embodiment, the plurality of width expanders 4 are arranged at a distance therebetween in the longitudinal direction of the inner rail 3 as shown in Fig. 4. However, the present invention should not be limited thereto. For instance, in further another modification of the present invention where an inner rail 3 is made of a material having a specific rigidity, only a single width expander 4 provided at a middle position of the inner rail 3 can expand the width W of the inner rail 3 over its entire length. Alternatively, even in a case where the inner rail 3 is made of a soft resin, a width expander 4 which includes a single fixing piece 15 having almost the same length as the entire length of the inner rail 3 can expand the width W of the inner rail 3 over the entire length.

[0081] Each of these modifications includes the single width expander 4 at the corresponding position, and hence the operation (of, specifically, rotating the threaded rod 17) by the width expander 4 is required only once.

[0082] Hereinafter, the present invention will be briefly discussed in accordance with the above-described embodiments.

[0083] A sheet holding device according to an embodiment of the present invention is a sheet holding device for holding an end portion of a sheet to be stretched over a predetermined place, the sheet holding device including: an inner rail capable of changing a width of the inner rail; a

CLAIMS

1. A sheet holding device for holding an end portion of a sheet to be stretched over a predetermined place, the sheet holding device comprising:

an inner rail capable of changing a width of the inner rail;

a frame including a rail retainer having a recess for accommodating the inner rail; and

a width expander for expanding the width of the inner rail, wherein

gaps are defined between inner walls of the recess and the inner rail when the inner rail is accommodated in the recess, the gaps allowing the end portion of the sheet to be disposed in the gaps,

the sheet holding device has a function that the width expander expands the width of the inner rail, so that the end portion of the sheet disposed in the gaps is sandwiched between the widthwise opposite side surfaces of the inner rail and the inner walls facing the opposite side surfaces, and held in the recess, and

the inner rail has a pair of components which are connected by a hinge at a forward position in an insertion direction of coming in the recess, and are capable of opening and closing in the width direction.

2. The sheet holding device according to claim 1, wherein

a plurality of width expanders are arranged in a longitudinal direction of the inner rail.

3. The sheet holding device according to claim 1 or 2, wherein

the inner rail is made of a soft resin having a property of partially expanding in a width direction in an elastic deformation, the partially expanding occurring at only a portion which is near to a receiving point of an expansion force of expanding the width of the inner rail by the width expander.

4. The sheet holding device according to claim 1, wherein

the pair of components respectively have a pair of opposite oblique surfaces inclining in directions of separating from each other as advancing in the insertion direction, and

the width expander includes a fixing piece which is movable in the insertion direction and the opposite direction while coming into contact with the pair of opposite oblique surfaces, and a fixing piece moving part for moving the fixing piece in the insertion direction and the opposite direction.

5. The sheet holding device according to claim 4, wherein

the fixing piece has side surfaces in the opposite directions perpendicularly intersecting the insertion direction, the side surfaces being curved in such a way as to separate from each other as advancing forward in the insertion direction.

6. The sheet holding device according to claim 4 or 5, wherein

the fixing piece has a threaded hole extending in the insertion direction, and

the fixing piece moving part comprises a threaded rod extending in the insertion direction to engage the threaded hole.

7. The sheet holding device according to any one of claims 1 to 6, wherein

the rail retainer has a protrusion protruding inward at an opening of the recess.

8. The sheet holding device according to any one of claims 1 to 7, further comprising

a cover which covers the opening of the recess.

9. A panel comprising:

the sheet holding device according to claim 1; and

a sheet having an end portion held by the sheet holding device.