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D. T. DOWNES
LAMINATED GLASS UNIT

2,576,392

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Fig. 1

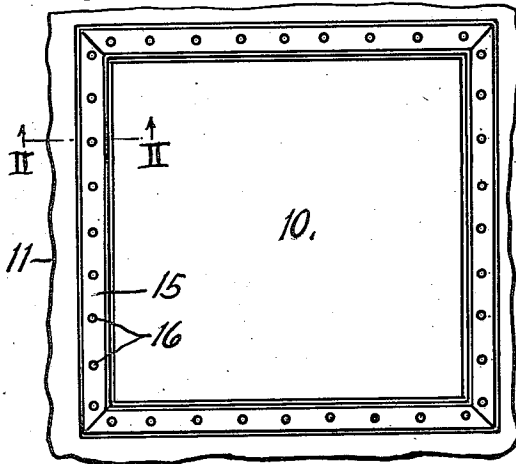


Fig. 4

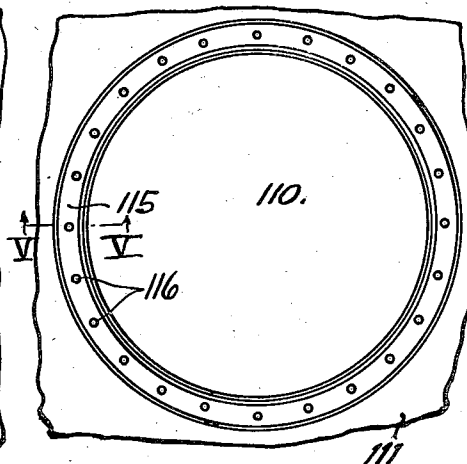


Fig. 2

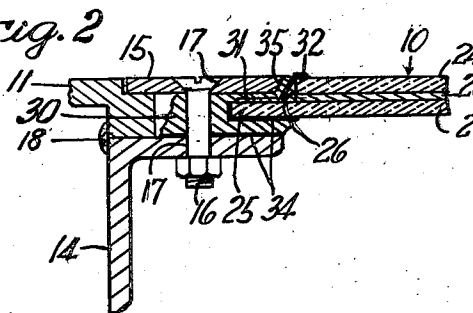


Fig. 5

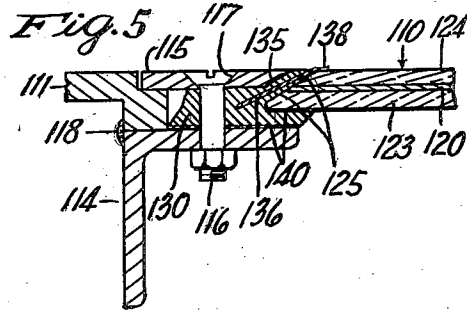


Fig. 3

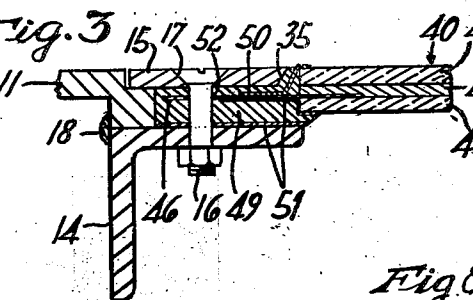


Fig. 6

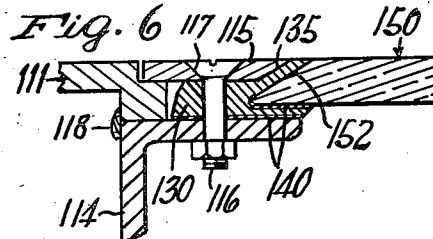


Fig. 7

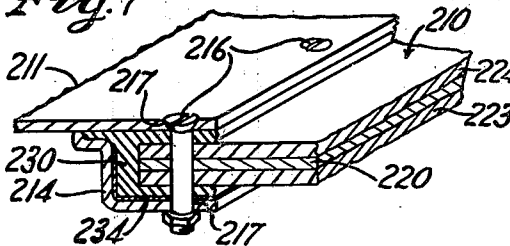
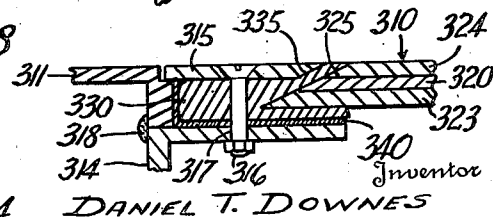


Fig. 8



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2,576,392

LAMINATED GLASS UNIT

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2 Claims. (Cl. 189—64)

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This invention relates to window panels and it has particular relation to the marginal mounting of such window panels.

One object of the invention is to provide improved glass or resinous panels mounted in such manner as to leave panel edges free from stresses and to render the panels capable of withstanding fluid pressure of relatively great magnitude without breaking or leaking.

Another object of the invention is to provide an improved edge sealing structure for window panels.

In one form of the invention, a window panel is mounted by setting its edges in a body of mastic or plastic which is too soft to impose excessive stresses upon the glass, but which can be readily molded to conform to the contour of supporting members while the panel edges are imbedded therein. After the window panel has been positioned properly and the clamping or supporting frames have been properly positioned, the mastic, which is self-curing, becomes set into the form of a tough matrix. The particular type of mastic used for this purpose is yieldable and permits the glass, or other transparent panel, to bend under the influence of fluid or other pressures without the imposition of binding and excessive shearing action which would occur if the edges were tightly clamped. This type of mounting, in which the window panel is floating in the mastic is particularly adapted to be incorporated in structures wherein it is difficult to obtain accurate alignment of the panel edges with the supporting frames, for example, in airplanes where curving or streamlining and appreciable flexibility of the aircraft body are involved.

In the drawing, Fig. 1 is a fragmentary elevation of a window installation; Fig. 2 is a fragmentary cross section, on a larger scale, taken substantially along the line II—II of Fig. 1; Fig. 3 is a fragmentary cross section similar to Fig. 2 and including another form of marginal construction of a laminated window panel; Fig. 4 is a fragmentary elevation of another form of window installation; Fig. 5 is a fragmentary cross section on a larger scale, taken substantially along the line V—V of Fig. 4; Fig. 6 is a fragmentary cross section similar to Fig. 5 and including another form of marginal construction; Fig. 7 is a fragmentary perspective of a window panel of laminated resin, together with supports therefor; and Fig. 8 is a cross section similar to Fig. 5 and illustrating a plastic panel and mountings therefor.

Referring to Figs. 1 and 2, a laminated glass

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window panel 10 is mounted in wall section 11 and is held in place therein by means of inner and outer frame members 14 and 15 surrounding the panel. Fasteners 16 extending through openings 17 in the frame members hold the latter in proper position. If desired, the inner frame members 14 can be welded, as indicated at 18, to the wall section.

The window panel 10 comprises a sheet interlayer 20 of organic plastic, such as vinyl acetal resin, upon opposite sides of which inner and outer glass plates 23 and 24 are bonded in conformity with conventional practice employed in laminating glass. As shown in Fig. 2, the inner glass plate 23 has a marginal extension 25 throughout the perimeter of the panel to form a rabbeted portion 26. A body of mastic material 30 which is relatively soft is applied around the marginal extension 25 and fills the rabbeted portion as it is pressed by the supporting frame members 14 and 15 in response to the tightening of the fasteners 16. The mastic yields easily and can be pressed or forced into the spaces between the frame members and the overlapping extension 25 on opposite sides of the latter. Strip metal 31 is placed upon the extension 25 and is so formed that a portion of it extends diagonally and then into the form of a lip 32 which overlaps and lies flush along the outer side of the outer glass plate 24 at the edge of the latter. Before the mastic body is applied to the panel, sealing tape 34 adhesive on both sides is also applied along the inner frame support 14 and along the extension 25. This tape can be of the form and composition described in the application of Wallace P. Marshall, Serial No. 540,851, filed June 17, 1944, for Sealing Material, and which is now Patent No. 2,460,181 issued on January 25, 1949.

After the elements of the installation have been assembled in the manner specified, the mastic material, which is polymerizing in character, is permitted to stand until it becomes cured and set. It is then of such strength as to resist pressure forces imposed against the glass, although it is yieldable to such extent as to conform to the movement of the glass under the influence of bending stresses caused by fluid pressure, such as that encountered in airplanes, or otherwise. It is to be understood that the frame supports 14 and 15 are spaced from and overlap the extension 25 and that the inner edge of the frame member 15 is beveled as indicated at 35.

In applying the mastic which is relatively soft, a device such as a caulking gun can be employed

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to force the material into the space between the frame members 14 and 15. The nozzle of the gun is applied successively to the openings 17 that subsequently receive the fasteners. In the preliminary mounting of the frame members, only a few of these fasteners are applied to insure proper preliminary assembly of the elements. After the mastic has been forced into the space between the frames and around the panel edges, all of the fasteners are then applied to hold the mastic in proper form about the glass edges. In this relation the mastic becomes set and slight shrinkage occurs. In order to compensate for this shrinkage, the fasteners are again tightened until the frames fit snugly upon the mastic.

Mastic material suitable for use in an installation of this kind can be composed of alkyd resin which has a consistency somewhat like thick molasses. In a container holding the resin, styrene is added and stirred intimately therewith on a steam bath at a temperature of about 120° F. until a solution is formed. Then the bath is cooled at room temperature in a cold water bath. Aluminum metal powder, together with a filler which can be in the form of calcium carbonate (CaCO₃) or resin dust is stirred into the bath preferably with a mechanical stirring device. Additional stirring with a thin wire will eliminate entrapped air. The resin dust can be formed from a product known as CR-39 described in the patent to Muskat et al., No. 2,370,565, dated February 27, 1945. An additional ingredient in the form of cobalt resinate or benzoyl peroxide is added to the material as a drier and catalyst.

The final consistency of the material can be controlled by the addition of maleic anhydride which can be varied in the ratio of 0 to 1 part of maleic acid for 4 parts of alkyd resin in the bath. The maleic acid is added to increase the hardness of the mastic which can be quite firm when used in connection with marginal mounting of window panels made of resins such as methyl methacrylate, or of CR-39 above identified.

The following formula has proved to be satisfactory for producing the mastic material specified:

	Parts by weight
Alkyd resin.....	84
Styrene.....	56
Aluminum metal powder.....	14
Neutral filler.....	105
Cobalt resinate.....	2

In the form of structure shown in Fig. 3, the wall 11, mounting frames 14 and 15 with welding 18 and fasteners 16 extending through opening 17 are the same as those described with reference to Figs. 1 and 2. However, another form of laminated panel 40 is shown in which outer and inner plates of glass 41 and 42 are bonded upon opposite sides of a sheet interlayer 45 of organic plastic, such as vinyl acetal resin. Strip metal 46 is disposed between the marginal portions of the glass plates and is held in place by the interlayer 45. The outer marginal portion of the strip metal extends beyond the edges of the glass plates and is embedded in a body of mastic 49 in the same manner as the extension 25 is installed. Likewise, a metal strip 50 and sealing tape 51 are applied to this installation and correspond to the similar installations 31 and 34 described above. It is to be understood that the

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fasteners 16 extend through openings 52 formed in the strip metal 46. The openings are somewhat larger than the fasteners in order to permit appreciable play of the metal which moves slightly in response to pressure applied to the panel.

Referring to Figs. 4 and 5, a circular laminated window panel 110 is mounted in a wall section 111 and is held therein by means of inner and outer circular frame members 114 and 115 surrounding the panel. Fasteners 116 secured through openings 117 in the frame members hold the latter in proper assembled relation. If desired, the inner frame member can be welded, as indicated at 118, to the wall.

The window panel 110 includes an interlayer 120 having glass plates 123 and 124 bonded upon opposed sides thereof. The interlayer is composed of organic plastic, such as vinyl acetal resin.

The edges of plates 123 and 124 are beveled, as indicated at 125, to form a continuous beveled structure of the composite laminated unit. Mastic material 130 of the same type as that described above with reference to Figs. 1 and 2 surrounds the panel 110 which projects into the mastic to such extent as to cover both sides of the beveled margin. The inner edge of the frame member 115 has a beveled edge 135 that is spaced in opposed relation to the beveled portions 125 of the panel. Strip metal 136 can be placed diagonally in the mastic in the space between the beveled edge of the frame member and the beveled edge of the panel. The outer portion of the strip overlaps the outer glass plate 124 in the form of a lip 138. Sealing tape 140 of the same type as the tape 34 is applied between the mastic and the frame member 114 and between the mastic and the inner marginal portion of the panel. In this arrangement, pressure from the inner side of the structure is resisted by the mastic between the beveled portion of the panel and the frame member 115. The strip metal 135 also strengthens the structure against pressure thus imposed.

In Fig. 6 the same structure as that shown in Fig. 5 is shown with the exception that a panel 150 of glass which is not laminated is used instead of the laminated panel 110 and the strip metal 136 is omitted. The panel 150 has a beveled marginal portion 152 which functions in the same relation to the frame member 115 as that described with reference to the beveled portions 125. Since the structure is otherwise identical the same reference characters are employed to indicate corresponding parts.

As illustrated in Fig. 7, a resinous window panel 210 is mounted in a wall section 211 and is held in place therein by means of frame structure 214 surrounding the panel and overlapping its edges. Fasteners 216 extending through the panel and through openings 217 formed in the wall section and in the frame structure hold the latter in proper assembled relation.

The laminated window panel 210 comprises a sheet interlayer 220 of organic plastic, such as vinyl acetal resin, upon opposite sides of which inner and outer plates 223 and 224 of methyl methacrylate resin are bonded. These plates can also be in the form of the CR-39 resin referred to above. The resin plates are harder than the interposed sheet of plastic 220.

A body of mastic material 230 which is relatively soft and workable is applied around the marginal portions of the panel 210 in the same

manner as the mastic 30 is applied to the structure described with reference to Figs. 1 and 2. Before the mastic body 230 is applied to the panel sealing tape 234 corresponding to the tape 34 is applied as a lining to the inner side of the frame structure 214. Such tape is not required along the marginal portions of the resinous window panel 210 because the mastic adheres and bonds firmly to such panel. After the mastic 230 has become set the fasteners are tightened in order to compensate for whatever shrinkage that may have occurred during the setting action.

In view of the more flexible character of the resinous window 210 the mastic 230 used in mounting the panel can be made firmer and harder than the mastic 30 in which the edges of the glass panels are imbedded. In order to secure the desired additional hardness, maleic anhydride in the proportions indicated above is added in processing the mastic body.

Referring to Fig. 8, a laminated window panel 310 is mounted in a wall section 311 and is held therein by means of inner and outer frame members 314 and 315 surrounding the panel in the same manner as that described with reference to Fig. 1. Fasteners 316 secured through openings 317 in the frame members hold the latter in proper assembled relation. If desired, the inner frame member can be welded, as indicated at 318, to the wall section.

The laminated panel 310 comprises a sheet interlayer 320 of organic plastic, such as vinyl acetate resin, upon opposite sides of which inner and outer plates 323 and 324 of methyl methacrylate resin are bonded. These plates can be in the form of the CR-39 resin referred to above. The resin plates are harder than the interposed sheet of plastic 320.

The edges of the plates 323 and 324, together with the interlayer 320, are beveled, as indicated at 325, to form a continuous beveled edge of the composite laminated unit 310. Mastic material 330 of the same type as that described above with reference to Figs. 1 and 2 surrounds the unit or panel 310 which projects into, and is bonded to, the mastic to such extent as to cover both sides of the beveled margin. The surface of the panel 310 is thus disposed flush with the surface of the wall section. The outer edge of the frame member 315 has a beveled edge 335 which is spaced in opposed relation to the beveled portion 325 of the panel. Sealing tape 340 of the same type as that described above can be applied as a lining along the inner sides of the frames 314. However, the mastic and plastic panel adhere very tenaciously to each other and form an efficient seal without the intervening tape. The mastic is applied between the frame members in the same manner as that described with reference to the other figures of the drawing.

From the foregoing description, it will be understood that the edges of the window panel whether composed of glass or resins, are supported directly in floating relation in a body of mastic which is molded to the form of the margins of the panel and the supporting frame structure. Hence, localized stresses which might result from irregular fitting of the frame structure and panel are obviated. Likewise, since the mastic body is yieldable, though sufficiently strong to withstand relatively great pressure

forces imposed upon the panel, the latter can flex uniformly under the action of such pressure forces.

Although illustrative forms of the invention have been shown and described in detail it will be apparent to those skilled in the art that the invention is not so limited but that changes can be made therein without departure from the spirit of the invention or the scope of the appended claims.

I claim:

1. In a windowed wall section, a glass panel having reduced marginal portions, a body of yieldable mastic material sealed to said reduced marginal portions, said mastic material constituting a matrix holding the reduced marginal portions imbedded therein, frame supports surrounding the panel in overlapping relation to the reduced marginal portions and holding the mastic material on opposite sides of the mean plane of the panel, the mastic material constituting a spacing and supporting medium between the panel and frame supports on opposite sides of the reduced marginal portions and supporting said panel in floating relation, said mastic material having approximately the following formula:

	Parts by weight
Alkyd resin	84
Styrene	56
Aluminum metal powder	14
Neutral filler	105
Cobalt resinate dryer	2

2. In a windowed wall section, frame supports defining a panel-receiving opening in the wall section and the frame supports in cross section defining a continuous channel, a homogeneous mass of mastic material in its final form being pliable and yieldable substantially filling said channel the entire length thereof, a bendable window panel having a marginal extension of less thickness than the body of the panel and being at least partially embedded in said mastic in the channel throughout its perimeter and said panel being bendable while it is disposed in said yieldable mastic, and strip metal having a portion lying substantially coextensively with the marginal extension inside the channel and having another portion extending at an angle thereto and overlapping an adjacent portion of the panel outside the channel.

DANIEL T. DOWNES.

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