

May 25, 1954

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2,679,467

PRESSURE BLOWOUT SAFETY CLOSURE

Filed July 21, 1951

3 Sheets-Sheet 1

Fig. 1.

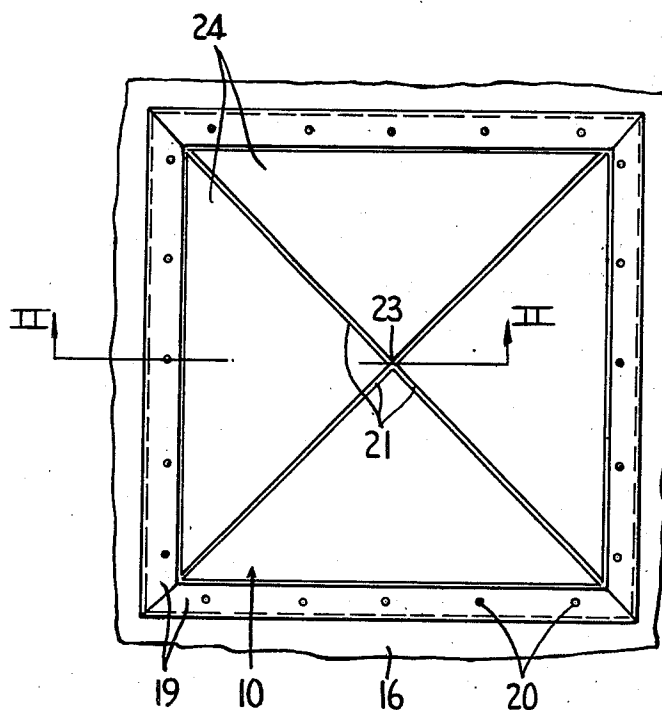
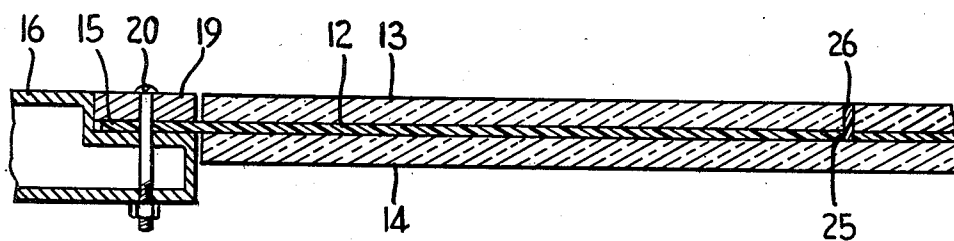


Fig. 2.



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Fig. 3

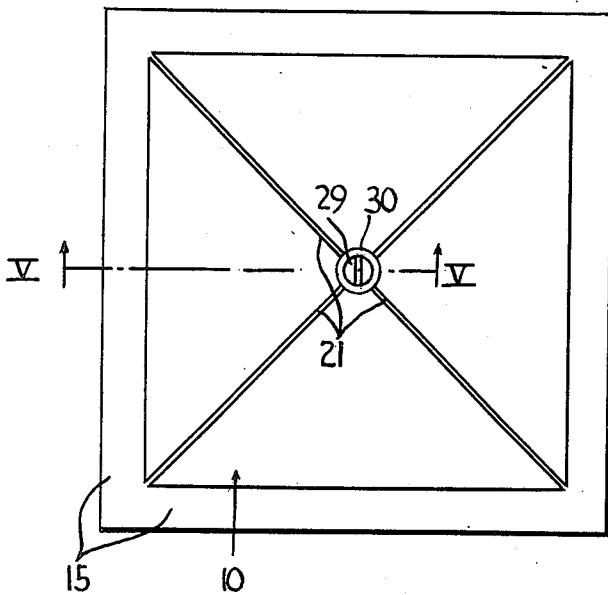
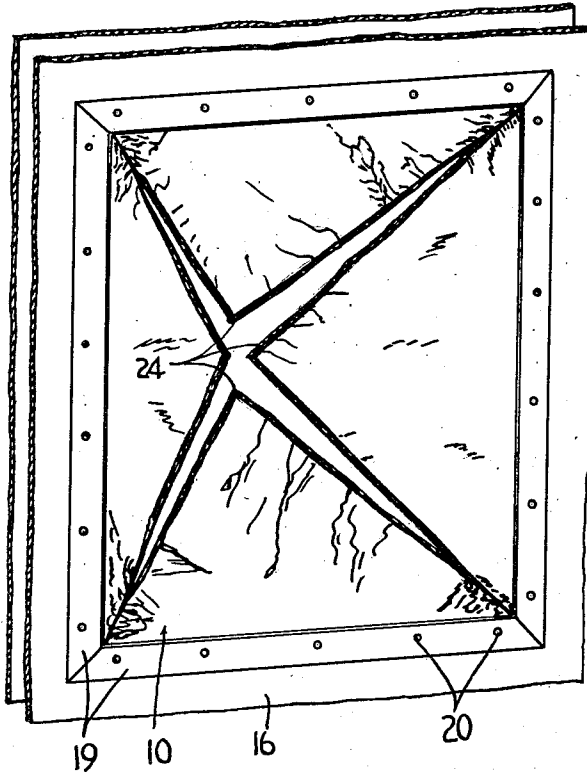


Fig. 4.

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Fig. 6.

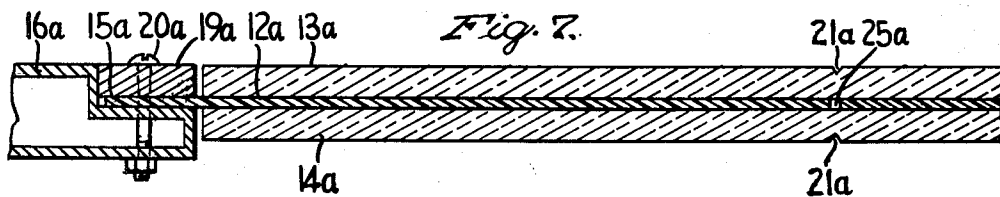
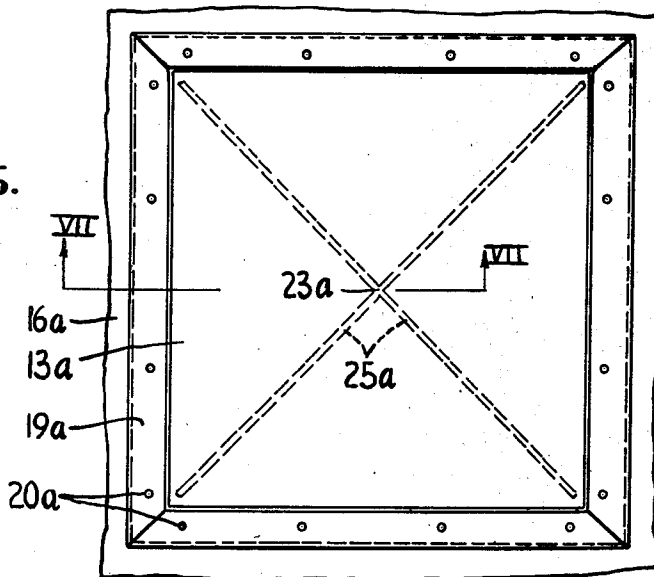


Fig. 7.

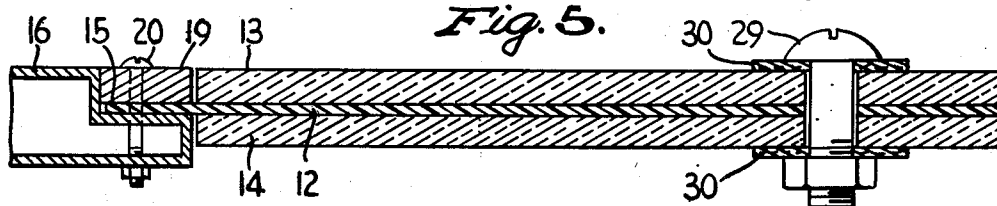


Fig. 5.

Fig. 8.

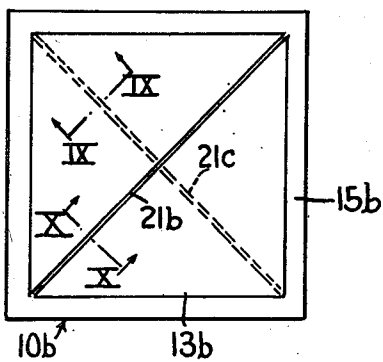


Fig. 9.

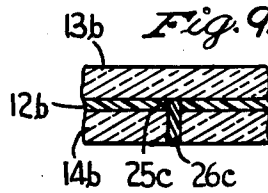
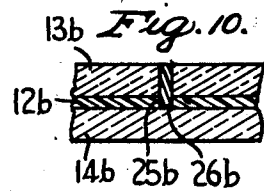


Fig. 10.



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UNITED STATES PATENT OFFICE

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PRESSURE BLOWOUT SAFETY CLOSURE

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4 Claims. (Cl. 154—2.73)

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This invention relates to transparent closures and it has particular relation to safety closures adapted to rupture under predetermined explosion pressure and then can be substantially restored to function as an effective closure.

One object of the invention is to provide an improved explosion closure so designed as to rupture along predetermined areas under pressure resulting from an explosion, or from other pressures, and also so designed that the ruptured segments can be restored substantially to their original position.

Another object of the invention is to provide an improved laminated transparent unit capable of being ruptured and the resulting segments replaced and secured substantially in the original plane of the unit in the form of an effective closure.

Another object of the invention is to provide an improved method of making a laminated unit having predetermined rupturing characteristics.

Another object of the invention is to provide an improved method of making a laminated unit having characteristics which cause it to rupture along predetermined areas under pressure resulting from explosions, and to render it restorable to an effective closure unit after it has been ruptured.

In locations where explosions may occur, for example at arsenals, explosive manufacturing plants, and in numerous areas in time of war, the effect of the pressures exerted by explosions upon windows may involve breakage that cannot be repaired except by replacement of the glazing unit. Under the impact of the explosion pressures, window units may shatter, or large segments may be blown out bodily.

Also the problem of replacement of windows in the wake of a destructive explosion is a serious one. It is very important under certain circumstances that the windows be closed and/or replaced immediately.

The invention described herein is directed to the problem of providing a transparent window closure that responds to pressures in such manner that the window is breakable along predetermined areas to define segments which can move inwardly or outwardly from the plane of the original closure unit and which can be restored to the plane of such original unit a short time after it has been ruptured. Laminated glass or plastic can be employed as window elements for the purposes of this invention. In one type of window, a rectangular laminated unit is manufactured in such manner that an interlayer of plastic material extends beyond the edges of the

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outside plates so as to be mountable upon frame members which are clamped upon opposite sides thereof. In this way the unit is flexibly mounted in the frame defining the window. Examples of this general type of closure structure are found in U. S. Patents 2,427,557, dated September 16, 1947, and 2,293,656, dated August 18, 1942.

Both of the outer plates, or only one of them, can be scored or split diagonally while the marginal edge portions of the plastic interlayer remain intact and upon mounting in the frame support as described, the window can be forced outwardly from its plane and ruptured along the diagonal lines. The segments resulting from the broken unit swing outwardly upon the flexible mounting edges in a hinging action. Since the marginal portions are flexible and the rupture is effected along the diagonal areas, the segments can be swung back into substantially their original position and fastened in this position. The joints along the diagonal lines of breakage can be filled with mastic, or putty, or other material which will serve to seal the joints.

In the drawings:

Fig. 1 is a fragmentary front elevation of a closure unit in which the invention has been incorporated; 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 perspective of a closure unit which has been subjected to pressure breakage; Fig. 4 is a front elevation of a closure unit with segments thereof restored to their original position after they have been displaced; 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 front elevation of another form of structure similar to that shown in Fig. 1; Fig. 7 is a cross section on a larger scale taken substantially along the line VII—VII of Fig. 6; Fig. 8 is a front elevation of another form of closure unit in which the invention has been incorporated; Fig. 9 is a cross section on a larger scale taken substantially along the line IX—IX of Fig. 8; Fig. 10 is a cross-section of another form similar to Fig. 9.

In practicing the invention, there is provided a rectangular laminated closure unit 10 which is composed of a sheet interlayer 12 of transparent plastic such as vinyl acetal resin and plate glass 13 and 14 adhered upon opposite sides thereof. The composite elements 12, 13, and 14 are laminated in a conventional manner so that the plate glass structure and plastic interlayer form a unitary closure member adapted to be installed as a window or other similar structure.

Marginal edges 15 of the plastic extend beyond

the edges of the plate glass around the four edges thereof and provide a flexible connection between the glass plates and a surrounding supporting framework 16. The flexible edges 15 are clamped between the marginal portions of the framework and suitable framing strips 19 by means of bolts 20 which extend through the marginal portions of the plastic as well as through the frame members 16 and 19.

As shown in Figs. 1 and 2, the plate glass 13 on one side of the unit is split diagonally to form diagonal splitting areas 21 intersecting in the central portion of the unit at a location indicated at 23. Such splitting of the unit divides it into four triangular segments 24 each normally having one of its angular portions pointing toward the area 23 where the splitting lines intersect.

The segments 24 are slightly separated, for example approximately .04 of an inch, before the final lamination of the glass is accomplished; that is, before the unit is placed in an autoclave. The interlayer sheet 12 is also split, as indicated at 25, along areas substantially coextensive with the areas of splitting of the glass plate. The spaces along the splitting areas between adjacent segments 24 and the corresponding splitting areas of the interlayer sheet are filled with suitable spacing material, for example, vinyl chloride 26, to maintain proper spacing between the segments during the pressing operation which is incidental to the lamination of plate glass. Well known examples of laminating glass are disclosed in U. S. Patents 1,781,084, dated November 11, 1930 and 1,870,693, dated August 9, 1932. After the laminating operations have been completed, the vinyl chloride spacing elements 26 can be removed.

In the event of an explosion in the neighborhood where closure units of the type described above are installed, the unit 10 will rupture under the explosive force and the glass segments 24 will define the area of breakage of the plate glass 14 which has not been split but which will rupture substantially along the lines of the splitting areas 21 adjacent thereto. The laminated glass segments then assume the position indicated in Fig. 3. That is, they are forced outwardly. It has been found that the unit will break and the segments of the unit will assume the angular position indicated in this figure regardless of whether the force of the explosion is applied on the side of the unit having the splitting areas or on the other side of the unit where the plate glass was continuous in its original laminated form.

As a result of the explosion, the flexible marginal portions 15 can bend more or less freely to permit the broken segments of the glass to swing outwardly. The unit can be repaired, at least to an effective degree and to the extent of substantially closing the unit, by moving the segments back to substantially a common plane corresponding to the plane of the original unit. Then by applying a bolt 29 at the central intersecting area 23, together with washers 30 engaging opposite sides of the unit in overlapping relation to the segments 24, these elements can be reassembled.

The areas of separation between adjacent segments 24 after restoration to their original common plane can be filled with sealing material such as putty or mastic, or covered with strips of adhesive tape, or so-called cellophane tape, which will maintain a substantial closure against entrance of air or gases.

As shown in Figs. 6 and 7, a unit 10a similar to the unit 10 is mounted in the same manner in

frame structure elements 16a and 19a that are clamped by means of bolts 20a on opposite sides of the interlayer margins 15a. However, in this arrangement, the plate glass 13a and 14a on both sides of the interlayer 12a was continuous. Only the plastic interlayer 12a is split diagonally, as indicated at 25a, from the four corners of the unit. The areas 25a of splitting intersect, as indicated at 23a, at the central portion of the unit in substantially the same manner as the areas of splitting 25 intersect at 23 in the arrangement described with reference to Figs. 1 and 2. In an installation of this type, the areas of splitting of the plastic interlayer will define the lines of breakage of the unit under the force of an explosion. However, since the glass itself is not split, the unit will be stronger. In a unit of this type the glass can be thinner.

If desired a filler of more or less non-adherent spacing material, such as vinyl chloride, can be applied in the areas 25a to maintain proper separation of the interlayer sections in the manner shown at 26 in Fig. 2.

The installation shown in Figs. 3 and 4 can be repaired in the same manner as that described above with reference to the use of bolt and washer elements corresponding to the bolt 29 and washers 30.

If desired, the glass plate structure on both sides, or on one side, of the unit can be cut or scored as indicated at 21a, to facilitate splitting thereof along the lines defined diagonally across the unit when it is subjected to the forces of an explosion. The cut or scored portions 21b can be designated as splitting areas.

In another form of the invention as illustrated in Figs. 8, 9, and 10, a unit 10b similar to the unit 10 is mountable along its marginal portions 15b in the same manner as that described with reference to the mounting of the unit 10 between elements 16 and 19. In this arrangement, the plate glass elements 13b and 14b on opposite sides of the vinyl acetate interlayer 12b are split only in one direction. That is, the plate glass 13b is split along one diagonal area 21b while the plate glass on the other side of the interlayer is split along a similar diagonal area 21c which is transverse to the splitting area 21b. In other words, the splitting area 21b extends diagonally from the upper right hand corner of the unit 10b to the lower left hand corner thereof, whereas the splitting area 21c extends diagonally from the upper left hand corner to the lower right hand corner of the unit 10b. It is to be noted that the interlayer 12b is split diagonally in both directions as indicated at 25b and 25c and that suitable spacing material 26c, such as vinyl chloride, is applied in the same manner as the vinyl chloride 26 is applied in the construction described above.

Although more than one form of the invention has 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 various changes can be made therein without departing from the spirit and/or scope of the invention as exemplified in the appended claims.

What is claimed is:

1. A transparent laminated closure member comprising glass sheets adhered to opposite faces of a thermoplastic interlayer which projects beyond the edges of the sheets to provide for flexible mounting of the member within a structure opening, one of the glass sheets being formed of four triangular sections disposed in spaced rela-

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tion to define intersecting diagonal splitting lines upon which the continuous glass sheet and the plastic of the closure member can rupture without separation from the structure when one face of the closure member is exposed to a sudden force as from a nearby explosion.

2. A laminated closure member for a structure opening comprising superposed glass sheets adhered to opposite faces of a thermoplastic interlayer which projects beyond the edges of the closure member to provide a flexible mounting means to the adjacent structure, one of the glass sheets and the interlayer being cut along intersecting diagonal lines extending between opposite corners of the cut glass sheet to provide four spaced triangular segments adhered to the uncut glass sheet, the uncut glass sheet normally forming a continuous glass member suspended within the structure opening by the uncut extensions of the thermoplastic layer and breaking along the cut lines of the glass sheet and interlayer without separation from the uncut portions of the interlayer upon application of an unusual force as by a nearby explosion.

3. A transparent closure member for a structure opening and adapted for rupturing along predetermined lines without separation from the supporting structure upon application of an unusual force, comprising a continuous transparent normally rigid and brittle member substantially corresponding to the shape of the structure opening but smaller in size, a flexible member adhered to one face of the continuous member and extending beyond the edges thereof to form a flexible mounting means for the continuous member within the structure opening, a plurality of substantially triangularly shaped spaced

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transparent members adhered to the flexible member and overlying the continuous member to define lines of rupture of the continuous member, the continuous member forming the sole means spanning the spaces between the spaced members.

4. A transparent closure for a structure opening and adapted for rupturing along predetermined lines without separation from the supporting structure upon application of an unusual force, comprising two superposed continuous transparent normally rigid and brittle members substantially corresponding to the shape of the structure opening but smaller in size, a thermoplastic member disposed between and adhered to adjacent faces of the superposed members, the thermoplastic member extending beyond the edges of the superposed members for flexibly suspending them upon the structure and within the structure opening, and predetermined lines of rupture of the superposed members formed in the thermoplastic member by cutting thin strips from the latter member along intersecting diagonal lines disposed within the area defined by the perimeter of the superposed members.

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