

BLAST PROTECTIVE WINDOWS

FIELD OF THE INVENTION

The present invention relates to blast protective building construction generally and more particularly to blast protective windows.

BACKGROUND OF THE INVENTION

In recent years there has been a move away from the construction and use of bomb shelters in domestic dwellings. Efforts are being made to provide blast protection in at least one room of each dwelling unit, without substantially changing the normal appearance and function of the protected room.

Applicant/assignee has developed a blast protective door which is particularly useful in such a protected room.

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SUMMARY OF THE INVENTION

The present invention seeks to provide a blast protective window assembly. In accordance with a preferred embodiment of the present invention, the external window is retrofittable in existing construction.

There is thus provided in accordance with a preferred embodiment of the present invention a protective window comprising a peripheral frame including a plurality of elongate generally planar members each formed with a peripheral lip, a plurality of generally U shaped elongate members, each having an elongate protrusion and a pair of flanges which are welded to a corresponding elongate generally planar member, so as to define a space between the peripheral lip and the protrusion, a peripheral glass pane sealing and mounting member disposed interiorly of the protrusions and having a glass pane sealingly engaged therewithin and a retaining flange welded to each protrusion for retaining the glass pane sealing and mounting member in place.

Preferably, all of the above elements with the exception of the glass pane sealing and mounting member, are formed of steel and joined by welding.

Additionally in accordance with a preferred embodiment of the present invention, each U shaped elongate member has a pair of flanges, an outer one of which is located up against the lip so as to define the space between the peripheral lip and the protrusion. Preferably the inner one of the pair of flanges, together with the retaining flange define a peripheral pocket wherein the glass pane sealing and mounting member is retained.

Further in accordance³ with a preferred embodiment of the present invention, a peripheral resilient seal may be located in the space between the peripheral lip and the protrusion.

The window may be mounted on hinges or alternatively may be otherwise mounted. Preferably it is provided with internal locking bolts, retractably extending through one or more of the elongate protrusions for engagement with suitably positioned locking sockets in a window frame.

There is also provided in accordance with a preferred embodiment of the present invention a slidable blast protective window assembly including:

a window frame assembly defining a plurality of tracks;

a blast protective panel slidably disposed within the window frame assembly and being movable from a storage position to a blast protective position by sliding motion along the tracks, and

rollers, supporting the blast protective panel and being located interiorly of the panel.

In accordance with one preferred embodiment of the present invention, the window frame assembly includes a rebound protective flange disposed outwardly of the blast protective panel. Preferably the rebound protective flange is directly connected to anchor members which are adapted to be anchored in concrete forming a wall in which the window frame assembly is located. In accordance with a preferred embodiment of the present invention the anchor members extend through apertures formed in the remainder of the window frame.

Additionally in accordance with a preferred embodiment

of the present invention, blast protective panel support rollers are provided adjacent both top and bottom corners of the panel and move on tracks which are located along both the bottom and the top of the window frame assembly, adjacent tracks which accommodate the panel.

Further in accordance with a preferred embodiment of the present invention a handle and stopper element is attached to the panel to enable a user to slide it along the tracks and is configured to prevent the panel from sliding into an extreme position which could cause injury to a user's hand grasping the handle.

Additionally in accordance with a preferred embodiment of the present invention the window frame assembly includes at least one collapsible elongate member disposed inwardly of the panel and at the periphery thereof, which is operative as a shock absorber to generally non-resiliently absorb the shock of a blast impinging on the panel from outside the panel.

Additionally in accordance with a preferred embodiment of the present invention, the slidable blast protective window assembly may include a protective window of the type described hereinabove.

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BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be understood and appreciated more fully from the following detailed description, taken in conjunction with the drawings in which:

Figs. 1A and 1B are simplified illustrations of a blast protective window assembly constructed and operative in accordance with a preferred embodiment of the invention in an open orientation, mounted in a building and seen respectively from the outside and from the inside;

Figs. 1C and 1D are simplified illustrations of a blast protective window assembly constructed and operative in accordance with a preferred embodiment of the invention in a closed orientation, mounted in a building and seen respectively from the outside and from the inside;

Fig. 1E is a top view illustration of the window assembly of the present invention as seen in Figs 1C and 1D;

Figs. 2A and 2B are illustrations of the window assembly of the present invention installed in two mutually reversed orientations;

Fig. 3 is a partially cut away view of part of the assembly of Figs. 1A - 1E;

Figs 4A and 4B are detailed illustrations of parts of the apparatus of Figs. 1A - 3;

Figs. 5A and 5B are illustrations of a locking arrangement employed in the apparatus of Figs. 1A - 4B in respective unlocked and locked orientations;

Fig. 6 is an exploded view of part of the apparatus of

Figs. 1A - 5B;

Fig. 7A is a detailed exploded view illustration of the mounting of a roller on a blast protective panel forming part of the apparatus of Figs. 1A - 6;

Fig. 7B is an detailed exploded view illustration of the mounting of a roller on a blast protective panel forming part of the apparatus of Figs. 1A - 6 in accordance with a preferred embodiment of the present invention;

Fig. 8A is a sectional illustration of part of the apparatus of Figs. 1A - 6;

Fig. 8B is a sectional illustration of part of the apparatus of Figs. 1A - 6 in accordance with a preferred embodiment of the present invention;

Figs. 9A and 9B are sectional illustrations of alternative arrangements of the part of the apparatus shown in Fig. 8;

Figs. 10A and 10B are simplified illustrations of the operation of the apparatus of Fig. 8 under respective blast and rebound conditions;

Fig. 11 is an illustration of one arrangement for lifting a blast protective panel to permit replacement or maintenance of rollers mounted thereon;

Figs. 12 and 13 illustrate operation of the apparatus of Fig. 11 in respective lowered and raised operative orientations;

Fig. 14 is an illustration of a protective window assembly constructed and operative in accordance with a

preferred embodiment of the present invention;

Figs. 15 and 16 are respective partially exploded view and assembled view illustrations of the protective window of Fig. 14;

Figs. 17A and 17B are respective exploded view and assembled view sectional illustrations of the protective window taken along the lines XVII - XVII in Fig. 14;

Figs. 18A and 18B are sectional illustrations of the protective window taken along the lines XVIII - XVIII in Fig. 14, in respective open and closed orientations; and

Figs. 19A and 19B illustrate the window of Fig. 14 in respective locked and unlocked orientations.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

Reference is now made to Figs. 1A - 7A and 8A, which illustrate a blast protective window assembly constructed and operative in accordance with a preferred embodiment of the present invention. The assembly comprises a window frame assembly 10, typically comprising a plurality of window frame elements 12 which are welded together at their respective corners together with an end member 13 to define a generally rectangular window frame. The window frame elements 12 are preferably formed, as by stamping from steel, preferably of thickness 3 mm.

Fixed to window frame assembly 10 at the outer facing side thereof, as seen in Fig. 1A is a stationary decorative panel 14, typically formed of asbestos cement and preferably having a decorative and weather and corrosion resistant outer facing surface. A sliding shutter 15 is arranged for slidable positioning along a track 16.

A slidable blast protective panel 18 is arranged to slide along a channel 19 between a storage position wherein it is located behind stationary protective panel 14 and a closed position wherein it covers a window opening 21. Panel 18 is provided with four rollers 22 located adjacent each of the four corners thereof and each removably mounted thereto preferably by means of a bolt 24, a washer 26 and spacers 28 and 29 which cooperate with a threaded aperture 30 formed in the panel 18. The rollers 22 at the bottom of panel 18 extend downwardly from the panel and travel along a track 20. Track 20 is preferably defined by a U-shaped channel member 31 which is preferably welded to frame element 12.

According to another embodiment of the present invention illustrated in Figs. 7B and 8B, a grooved wheel 52 is mounted onto plate 18 by means of a mounting pin assembly including a mounting pin 53, a washer 54 and a mounting element 55, fixed to the plate, as seen in Fig. 7B. As seen in Fig. 8B, the grooved wheel 52 rides on a track 56 having a generally triangular cross-section which is integrally formed with a window frame member 58. A hollow bar element 59, preferably of square cross section, is welded or otherwise attached to frame member 58 underlying track member 56, in order to provide enhanced structural strength.

It is a particular feature of the present invention that the channel member 31 (Fig. 8A) or the bar element 59 (Fig. 8B) serves as a non-resilient blast shock absorber, as may be seen from a consideration of Fig 10A, which illustrates expected non-elastic deformation of member 31 in response to a blast outside panel 18.

Channel 19 is defined by an outer wall of member 31, by frame element 12 and by an elongate right angle bracket 32, which is disposed outwardly of element 31 and spaced therefrom and is preferably welded to frame element 12. Bracket 32 defines a rebound protective flange 34 which surrounds the panel 18 on three sides, when the panel is in a closed position.

It is also a particular feature of the present invention that the flange 34 serves as a non-resilient blast shock absorber, as may be seen from a consideration of Fig 10B, which illustrates expected non-elastic deformation of member 32

in response to a blast outside panel 18.

In accordance with a preferred embodiment of the present invention a plurality of anchor members 36 are welded to bracket 32. Preferably, anchor members 36 are arranged to extend through suitably formed apertures in frame element 12 and to be anchored in poured concrete surrounding the frame.

Window opening 21 is additionally defined by an intermediate frame member 38, which is also operative together with an inner panel 40, spaced from panel 14, to define a volume 42 which is filled with poured reinforced concrete, as seen particularly well in Figs. 1B and 1D. Panel 40 is preferably made of 5 mm thick steel and is preferably operative to prevent shrapnel from a blast outside the panel 14 from passing therethrough. Volume 42 may be defined at the interior by a suitable retaining panel 44, which may be formed of asbestos-cement or any other suitable material. Panel 44 may be plastered over or be formed with an interior decorative finish.

A sealed window assembly is preferably located in window opening 21, for providing protection against ingress of toxic agents into a protected room.

A combination handle and stopper member 48 is mounted onto panel 18 for enabling a user to move the panel 18 from a storage position, as seen in Figs. 1A and 1B to a protective position, as seen in Figs. 1C, 1D and 1E. The handle and stopper member 48 is located and configured such that the user's hand when engaging the handle defined thereby, cannot be forced against either a side frame element 49 or intermediate frame member 38.

Preferably a simple mechanism is provided for locking the panel 18 in a locked position, as seen in Figs. 1C, 1D and 1E. The locking mechanism, which is particularly illustrated in Figs. 5A and 5B includes a slidable locking bar assembly 50 mounted on side frame element 49 and an apertured engagement element located on panel 18. Fig. 5A illustrates an unlocked orientation, while Fig. 5B illustrates locking engagement.

It is a particular feature of the present invention that the protective window assembly is upside down symmetric and can be installed in any suitable orientation. Figs. 2A and illustrate that either left opening or right opening window arrangements may be realized with entirely the same apparatus, merely by installing the apparatus upside down. This upside down installation possibility is enabled by the provision of rollers 22 at both the top and bottom of the panel 18.

Reference is now made to Figs. 9A and 9B which illustrate two alternative embodiments of the track arrangement shown in Fig. 8. In Fig. 9A, element 31 is turned upside down to define a channel in which rollers 62 travel. The functionality of element 31 as a shock absorber remains unchanged, but the placement and/or the size of the rollers is changed accordingly.

Fig. 9B illustrates an alternative embodiment in which each roller 22 in the embodiment of Fig. 8 is replaced by a pair of rollers 64 and 66, mounted on opposite sides of a panel 68. Here, members 31 and 32 are replaced by a combination track and channel defining shock absorbing elongate member 70 which is non-elastically deformable both under the blast and the rebound.

Reference is now made to Figs. 11 - 13. It is appreciated that panel 18 may remain in its storage position for many years without being moved. In order to preserve the slidability of the panel, the rollers 22 may require service or replacement from time to time. It is a particular feature of the present invention that the rollers 22 are interior of the panel 14, thus enabling them to be accessed from the inside, since outside access is impractical.

Due to the extreme weight of the panel 18, removal of the rollers can only be done conveniently if apparatus is provided for raising and then supporting the panel 18 during roller replacement.

Accordingly, in accordance with a preferred embodiment of the present invention, a cam tool 80 is provided for engagement with a suitably positioned recess or aperture formed on an inside surface of panel 18. As seen in Figs. 12 and 13, due to the eccentric outer surface of cam tool 80, the tool can be inserted into the aperture 82 when a flat surface 83 of the tool lies against a surface a frame element 12. Subsequent rotation of tool 80, employing a handle 86, is operative to raise the panel 18 and thus free rollers 22 for replacement.

Reference is now made to Figs. 14 - 19B, which illustrate a protective window which is suitable for use in new construction and is also retrofittable in existing construction. The window may be employed without any further protective apparatus or alternatively may be incorporated in a blast protective assembly as shown in Fig. 1B. In the context of the apparatus of Fig. 1B, the protective window may constitute the

sealed window assembly is preferably located in window opening 21, for providing protection against ingress of toxic agents into a protected room.

The protective window of Figs. 14 - 19B comprises a window frame 100, which may be any suitable window frame, preferably formed of steel. The window frame may form part of the blast protective apparatus shown in Figs. 1A - 1D, but need not be associated with additional protective apparatus.

In accordance with a preferred embodiment of the present invention, the protective window also comprises a peripheral frame 102, which is preferably hinged onto frame 100 in a conventional manner by means of hinges 104. The peripheral frame 102 preferably includes a plurality of elongate generally planar members 106 each formed with a peripheral lip 108.

A plurality of generally U-shaped elongate members 110, each having an elongate protrusion portion 112 and a pair of respective outer and inner flanges 114 and 116 are each welded, as by spot welding, to a corresponding elongate generally planar member 106. The arrangement is preferably such that the outer elongate edge of flange 114 lies against the base of lip 108, as shown in Fig. 17B, so as to define a space between the peripheral lip 108 and the protrusion portion 112.

A peripheral glass pane sealing and mounting member 120, preferably formed of a resilient gas sealing member, such as rubber, is disposed interiorly of the protrusion portions 112. A glass pane 122, typically of thickness 6 mm, when a protective plate such as plate 18 (Fig. 1A) is provided, or 12 mm when no

additional protection is provided, but alternatively of any suitable thickness, is sealingly engaged within sealing and mounting member 120. A retaining flange 123 is preferably bolted to each protrusion for retaining the glass pane sealing and mounting member in place. It is to be appreciated that the thickness of glass pane 122 can be changed as required or desired.

Preferably, all of the above elements with the exception of the glass pane sealing and mounting member 120, are formed of steel and joined by welding.

It is noted that preferably inner flange 116, together with retaining flange 123 defines a peripheral pocket wherein the glass pane sealing and mounting member is retained.

Further in accordance with a preferred embodiment of the present invention, a peripheral resilient seal 124 may be located at least partially in the space between the peripheral lip 108 and the protrusion portion 112. Preferably peripheral resilient seal 124 includes a plurality of leaves 126, 128, 130 and 132, each supported on a base 134, which lies against an outer facing wall of protrusion portion 112.

In the illustrated preferred embodiment, leaves 126 and 128 lie in the space between protrusion portion 112 and lip 108 and provide two stage sealing therebetween. Leaves 130 and 132, which are preferably longer than leaves 126 and 128 extend beyond lip 108 and provide enhanced gas sealing between the window and the frame 100, when the window is closed, as shown in Figs. 18A and 18B.

The peripheral frame 102 may be mounted on hinges 104

as shown or alternatively may be otherwise mounted. Preferably it is provided with internal locking bolts 140 and 142, retractably extending through one or more of the elongate protrusion portions 112 for engagement with suitably positioned locking sockets 144 in the window frame 100. Locking bolts 140 and 142 are typically manually operated by a conventional locking handle member 146 in a conventional manner. An additional locking member 148 may be directly mounted on handle member 146, also in a conventional manner.

It is a particular feature of the present invention that all of the window constructions described above are suitable for installation in right or left opening configurations without requiring modification.

It will be appreciated by persons skilled in the art that the present invention is not limited by what has been particularly shown and described hereinabove. Rather the scope of the present invention is defined only by the claims which follow:



C L A I M S

1. A protective window comprising a peripheral frame including a plurality of elongate generally planar members each formed with a peripheral lip, a plurality of generally U shaped elongate members, each having an elongate protrusion and a pair of flanges which are welded to a corresponding elongate generally planar member, so as to define a space between the peripheral lip and the protrusion, a peripheral glass pane sealing and mounting member disposed interiorly of the protrusions and having a glass pane sealingly engaged therewithin and a retaining flange welded to each protrusion for retaining the glass pane sealing and mounting member in place.

2. Apparatus according to claim 1 and wherein said peripheral frame is mounted in a blast protective window assembly and forms a sealing window portion thereof.

3. A slidable blast protective window assembly including:
a window frame assembly defining a plurality of tracks;
a blast protective panel slidably disposed within the window frame assembly and being movable from a storage position to a blast protective position by sliding motion along the tracks;

rollers, supporting the blast protective panel and being located interiorly of the panel; and

a protective window according to claim 1 mounted in said window frame assembly.



4. A slidable blast protective window assembly including:
a window frame assembly;
a blast protective panel slidably disposed within the window frame assembly and being movable from a storage position to a blast protective position by sliding motion;
rollers, supporting the blast protective panel;
a rebound protective element disposed outwardly of the blast protective panel; and
a protective window according to claim 1 mounted in said window frame assembly.
5. A slidable blast protective window assembly including:
a window frame assembly;
a blast protective panel slidably disposed within the window frame assembly and being movable from a storage position to a blast protective position by sliding motion;
rollers, supporting the blast protective panel, and wherein said window frame assembly, said blast protective panel and said rollers are configured and arranged such that the window assembly may be installed upside down without requiring substantial modification; and
a protective window according to claim 1 mounted in said window frame assembly.
6. A slidable blast protective window assembly including:
a window frame assembly;



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a blast protective panel slidably disposed within the window frame assembly and being movable from a storage position to a blast protective position by sliding motion;

rollers, supporting the blast protective panel;

at least one collapsible elongate member disposed inwardly of the panel and at the periphery thereof, which is operative as a shock absorber to generally non-resiliently absorb the shock of a blast impinging on the panel from outside the panel; and

a protective window according to claim 1 mounted in said window frame assembly.

7. A slidable blast protective window assembly including:
a window frame assembly defining a plurality of tracks;
a blast protective panel slidably disposed within the window frame assembly and being movable from a storage position to a blast protective position by sliding motion along the tracks; and

rollers, supporting the blast protective panel and being located interiorly of the panel.

8. A slidable blast protective window assembly including:
a window frame assembly;
a blast protective panel slidably disposed within the window frame assembly and being movable from a storage position to a blast protective position by sliding motion;
rollers, supporting the blast protective panel; and

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a rebound protective element disposed outwardly of the blast protective panel.

9. A slidable blast protective window assembly including:

a window frame assembly;

a blast protective panel slidably disposed within the window frame assembly and being movable from a storage position to a blast protective position by sliding motion;

rollers, supporting the blast protective panel, and wherein said window frame assembly, said blast protective panel and said rollers are configured and arranged such that the window assembly may be installed upside down without requiring substantial modification.

10. A slidable blast protective window assembly including:

a window frame assembly;

a blast protective panel slidably disposed within the window frame assembly and being movable from a storage position to a blast protective position by sliding motion;

rollers, supporting the blast protective panel; and

at least one collapsible elongate member disposed inwardly of the panel and at the periphery thereof, which is operative as a shock absorber to generally non-resiliently absorb the shock of a blast impinging on the panel from outside the panel.

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