Abstract:

Embodiments of the present invention are directed to a storm window having a controlled blowout mechanism. In some embodiments a blowout from wind pressure is controlled by the shape and orientation of a rigid window panel. Other embodiments include a venting portion with the storm window. Other embodiments rely on variation in restorative force within resilient material used to make the storm window.
PRESS FIT STORM WINDOW SYSTEM HAVING CONTROLLED BLOWOUT

FIELD OF THE INVENTION

This disclosure relates generally to storm windows, and more particularly to a press fit storm window that may include a facility for controlling blowout events.

BACKGROUND

Storm windows are generally mounted on the outside or inside of main windows of a home or business. They are oftentimes used in cold climates to reduce energy leakage from the windows, for instance, cold air leaking into a house through the main windows. Storm windows may be mounted externally or internally, and are generally made from glass, plastic, or other transparent material. In some instances storm windows may be translucent or opaque.

A method of measuring efficiency of thermal insulation, which is the opposite of a rate of heat transfer, is R-Value. An R-value number indicates the relative resistance to heat flow, where a higher R-value has greater thermal efficiency. The R-value generally depends on the type and size of the insulation system being rated, for example the material selected, its size, thickness, and density. R-values of multi-layer systems equal the total of the individual layered systems.

Many present-day storm window systems are difficult to install and remove.

Generally present-day storm window systems are mechanically attached with mounting hardware to either the inside or outside of the main window. The windows may be heavy and difficult to manipulate. Other, less expensive systems use see-through plastic sheets that are taped or attached to window casings. Sometimes the plastic sheets may be "shrunk" using a heat gun which, when directed at the plastic sheet, causes the sheet to contract, making the sheet taught, and easier to see through. Such prior art systems are, similar to the mechanical systems as described above, difficult and time-consuming to install.

Embodiments of the invention address these and other problems in the prior art.
BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side cutaway view of a portion of a storm window according to embodiments of the present invention.

FIG. 2 is a front view of the storm window of FIG. 1.

FIG. 3 is a diagram illustrating installation of the storm window of FIG. 1 inserted into a main window, according to embodiments of the invention.

FIG. 4 is a detailed view of a corner portion of the storm window of FIG. 1, according to embodiments of the invention.

FIG. 5 is a detailed view illustrating installation of the storm window corner portion of FIG. 4, according to embodiments of the invention.

FIG. 6A is a perspective view of a corner portion of a storm window according to embodiments of the invention.

FIG. 6B is a front view of a corner portion of a storm window according to embodiments of the invention.

FIG. 6C is an edge view of the corner portion of FIG. 6B.

FIGs. 7A, 7B, 7C, and 7D are top cross-sectional view of a various storm windows according to embodiments of the invention.

FIG. 8A is a front view of a storm window according to FIG. 7C or 7D mounted into a vertical window frame according to embodiments of the invention.

FIG. 8B is a front view of a storm window according to FIG. 7C or 7D mounted into a horizontal window frame according to embodiments of the invention.

FIGs. 9A, 9B, and 9C are cross-sectional diagrams of resilient support sections according to embodiments of the invention.

FIG. 10 is a front view of a storm window illustrating choices made when determining a controlled blowout according to embodiments of the invention.

FIGs. 11A, 11B, and 11C are diagrams illustrating a venting system in a storm window according to embodiments of the invention.

FIGs. 12A, 12B, 12C, and 12D are diagrams illustrating another venting system in a storm window according to embodiments of the invention.

FIG. 13 is side view of a storm window retention mechanism according to embodiments of the invention.

FIGs. 14A, 14B, 14C, and 14D are diagrams illustrating yet another venting system in a storm window according to embodiments of the invention that additionally provide an integrated removal mechanism.
FIGs. 15A, 15B, and 15C are diagrams illustrating a retaining system according to embodiments of the invention.

DETAILED DESCRIPTION

Embodiments of the invention are directed to storm windows that may be easily and readily installed in a window frame of an existing window. A transparent portion of the window is generally see-through and may be made from glass, plastic, such as PLEXIGLASS, or other clear, generally rigid material. In other embodiments the window may be translucent, patterned, or opaque. A resilient material forming a resilient support surrounds the edges of the transparent portion, at least in part, such that, when the resilient material is compressed smaller than its natural state, it provides a "righting" or reformation force between the window frame and the transparent portion of the storm window. This reformation force of the resilient material puts pressure both on the window frame and the edge of the storm window and frictionally holds the storm window in place without the need for mounting hardware. The storm window may also include features for keeping it in place should outside forces act on the storm window system, such as a strong wind leaking through the main window, as described below.

FIG. 1 is a side cutaway view of a portion of a storm window according to embodiments of the present invention. A panel 130 is a rigid, transparent panel which serves as the "window" portion of the storm window. As described above, the panel 130 may be made from glass, plastic, such as PLEXIGLASS, or other suitable material. The thickness of the panel 130 is generally thin, such as 1/8, but other thickness panels may be used as well. In some embodiments the panel 130 may include decorative features, such as patterned translucent portions seen in privacy rooms, such as bathrooms. Other decorative features may include stained glass or material that appears to be stained glass. Still other decorative features may include decorative grill work such as iron grill work or material that appears to be such decorative grill work. In other embodiments the panel could be made of metal or wood. Although these embodiments would obviously not be transparent, such storm "windows" or coverings could be used for inside demolition operations where an easily insertable and removable window covering would be beneficial to protect the underlying window. Additionally, if light, sound, or thermal blocking properties were desired, the panel could be selected from an appropriate material without deviating from the scope of the invention.
A resilient support 110 generally includes a bulb portion 103 and a groove portion 107, and is positioned to generally surround at least a portion of the edge of the panel 130. In one embodiment, the resilient support 110 is mechanically held fast to the panel 130 by the "groove" 107 made from space between retaining portions 106, 108. The retaining portions 106, 108 are generally spaced so that they each contact a front or rear surface of the panel 130, thereby keeping the resilient support 110 in place and from moving relative to the panel. In other embodiments an adhesive may facilitate anchoring the resilient support 110 to the panel 130, at least in some portions of their contact. The retaining portions 106, 108 are generally sized to provide enough frictional force to securely hold the panel 130 surfaces. In one embodiment the retaining portions 106, 108 are 1/8" tall, but could vary between approximately 1/32" and approximately 2 inches, depending on the size and material selection of the panel 130. The width of the groove 107 is generally sized to exactly match the thickness of the panel 130, but may be slightly smaller or larger depending on the installation. In some embodiments adhesives could be used to adhere or attach the panel to the resilient support 110, with or without requiring the retaining portions 106, 108.

The bulb portion of the resilient support 110 may take one of several cross-sectional shapes. In FIG. 1, the cross section of the bulb portion 103 of the material making the resilient support 110 is circular, being formed from an outer surface 102 of the support 110 and a center "hole," the surface of which is indicated at 104. The cross section of the bulb portion 103 may take many shapes, as described below, and the "hole" may be partially or fully filled with additional resilient material, or another material, also as described in detail below.

The resilient support 110, as described above, is formed of a yieldable material that deflects or deforms under pressure and, based on its shape and material selection, provides a return reformation force, i.e., the force that the material exerts on the contact point or points of the object causing its deformation. As the resilient support 110 is further deformed, for instance pressing on the material of the support with a finger, the reformation force increases relative to the amount of deformation. In reverse, as the deformation force is reduced, the material of the resilient support 110 produces less and less reformation force until the material returns to its "natural," undeformed state, at which point the reformation force is zero.

In some embodiments the resilient support 110 is a single, uniform material, such as foam. In other embodiments the resilient support 110 is made from a combination of materials, such as a silicone cover or shell filled with a foam insert. The foam insert may be
solid or may further include a cross sectional hole similar to the hole illustrated in FIG. 1. Other materials may also be introduced into the hole, whether or not covered by a silicone shell, such as metal, foam or plastic, shaped in various shapes, all of which together provide the resilient support 110 with the desired reformation force.

Embodiments of the invention may be produced from a large variety in materials, in various shapes and sizes. For instance the resilient support 110, as described above, may be made from foam, silicone, EPDM, or PVC, or derivatives, or any other material having the properties desired. Additionally, as mentioned above, the cross-sectional shape of the resilient material forming the resilient support 110 can be selected for the desired properties of the storm window. For instance the bulb of the resilient support 110 may be circular, oval, spiral, elliptical, square, triangular, or may have an "open" shape, such as L, U, V, or C. In either case, if there is a hole, such as the one illustrated at 104 of FIG. 1, another material or set of materials may fully or partially fill the hole to provide desired qualities of reformatory force, resiliency, compression set (or compression memory), etc. Further, it may be the case that the materials used in the herein-described storm windows are subjected to large temperature variations and therefore should be selected to withstand the expected conditions, or to have their use limited only to conditions where the material properties will be satisfactory. Finally, because the storm windows will generally be exposed to the sun, they should be resistant to radiation, such as UV radiation.

FIG. 2 is a front view of a storm window 200 according to embodiments of the invention. The storm window 200 includes a panel 230 surrounded by sections 210, 212, 214, and 220 of the resilient support 110 described above with reference to FIG. 1. Individual sections of the resilient material may join with mitered corner joints, such as illustrated at 216, 218, or they may join with butt joints, as illustrated at 222, 224. Corner joints 216, 218 and butt joints 222, 224 may be sealed with thermal sealer or adhesive, or may be joined in other conventional methods. In some embodiments the bottom section 220 may be formed of a different material than the other sections 210, 212, 214 based on operational properties desired of the window 200, or based on other reasons. In one embodiment the bottom section 220 is formed of a rigid or semi-rigid material, such as aluminum, to stiffen the panel 230 and to prevent "droop." In other embodiments any of the sections 210, 212, 214, 220 may be formed of a different material, or have a different shape, or other properties, than the others. Also, although a rectangular window is illustrated in FIG. 2, as it is the most common window shape, embodiments of the invention work with storm windows of any shape.
FIG. 3 is a diagram illustrating installation of the storm window 200 of FIG. 2 inserted into a main window 300, according to embodiments of the invention. In installation, the storm window 200 is gently or forcefully inserted into a frame 380 of the main window 300. The size of the storm window 200 is selected such that the overall dimensions of the panel 230 plus the sections 210, 212, 214, and 220, when such sections are in their natural, non-deformed state, is larger than the frame 380 of the main window. Then, as the storm window is inserted, the sections 210, 212, 214, and 220 deflect or deform from their natural state, as described above. When set into a final position, the resilient support 110 (FIG. 1) making up the sections 210, 212, 214, and 220 remains in a continuously deformed state, by virtue of the selection of size of the storm window. Because the resilient material 110 is deformed, it produces the reformation force described above, between the edges of the panel 230 and the frame 380 of the main window 300. This reformation force, in conjunction with the frictional forces where the resilient support 110 meets the frame 380, keeps the storm window 200 in place. As described above, the resilient support 110 keeps the panel 230 in place by virtue of the groove 107 (FIG. 1).

FIGs. 4 and 5 show additional detail of a corner section of a storm window 400, both before (FIG. 4) and during (FIG. 5) installation into a frame 580.

FIG. 6A is a perspective view of a corner portion of a storm window according to embodiments of the invention. In this embodiment a silicone cover 603, 607 may also include nipple sections 601, 609, which may be inserted in a mating receiving portion of a section of resilient material of a resilient support, such as sections 210, 212, 214, or 220 described above. In one embodiment the nipple portion 601, 609 is shaped such that, when inserted into the resilient support, that the outside surfaces of the receiving portion matches to the outside surface of the silicon cover 603, 607, to make a uniform appearance. In another embodiment the sections 601 and 609 illustrated in FIG. 6A are simply sections of the support having a diameter that matches the inside diameters of the silicone cover 605, 607, as well as the inside diameter of a section of the resilient support, thereby providing a joining surface that may be friction fit or otherwise fixed. A groove 617 is formed between retaining portions 605, 615, which is shaped to accept a panel (not illustrated in FIG. 6A). The cover pieces 603 and 607 join at a corner 619.

Further detail of the corner is illustrated in FIGs. 6A and 6B. In particular, a corner piece 637 may be formed of multiple pieces, such as in FIG. 6A, or may be made in a single-constructed piece. The corner piece 637 may include a "fin" 641, formed of a relatively thin piece of material, which may be the same or different material used to make the corner piece.
The fin 641 is generally yieldable and more easily deformed than the corner piece 637 itself. The fin 641 may further include a notch 643, which allows the fin 641 to better deform in a corner of a window frame (not illustrated). In other words, without the notch 643, the fin 641 may "pucker," due to excess material, if placed into a tight corner. In embodiments that include the notch 643, less or no puckering occurs.

Also with respect to FIG. 6B, a curved corner is illustrated (excluding the fin 641) rather than a corner having straight lines. This feature of the design was included because, in many installations, the resilient material tends to bunch up and "buckle" in corners, due to so much material being present. Embodiments of the invention have sought to minimize the amount of material in the corners in a number of ways, such as the rounded corners as illustrated. In other embodiments the corner pieces do not form a 45 degree angle when not installed, and instead are separated by a pie-shaped gap between areas where the horizontal resilient material meets the vertical resilient material before being installed. When installed, the resilient material compresses to fill the corner with a minimum amount, or even no amount of gaps between the resilient material and the window frame.

With respect to dimensions illustrated in FIG. 6B, dimension "a" may extend from approximately 1/4 to 3 inches, dimensions "b" and "c" may be 1/16" - 4," depending on the installation, dimension "d" may be 1/3 - 4.5," and dimension "e" may be 1/8 - 2," again, depending on the size and material selection making the corner piece 637. These dimensions may vary from 10 - 500% depending on the particular details.

As described above, to install the storm window according to embodiments of the invention, first the storm window is sized according to the dimensions of the window frame in which the storm window is being installed. Next the storm window is inserted into the window frame in which a deformable, resilient material of the support is compressed during the insertion. After being placed and set in the window frame, the resilient material of the support exerts a reformation force between the window frame and the resilient support of the storm window. This reformation force coupled with frictional forces between the resilient support and the window frame, and to an extent, to the friction forces holding the panel in place by the resilient support, holds the storm window securely in place.

Although the above method works well for many windows, there are situations when outside forces can overcome the frictional and reformation forces of such a storm window set in a window frame. For instance, older windows were generally manufactured with much larger size tolerances and, combined with years or decades of use, may therefore include large air gaps. When forceful winds blow from outside the window through such air gaps
they may create significant pressure on the storm window mounted inside, which generally forms an air-tight seal by virtue of its ring of resilient material of the support. Other actions can also cause pressure on the storm window, such as airflow caused by other windows in the home opening or closing, pressurizations or depressurizations due to airflow such as HVAC, or other motion due to humans or earthquakes, for example. As a result, the storm window may become unseated from the window frame. When the wind forces are light, the storm window may simply re-position itself within the window frame. When wind forces are strong, however, the storm window may be blown completely out of the window frame, which could fall into the house and cause damage or injury. In any event, if the storm window is unseated by wind or other forces, it is generally no longer seated correctly in the window, such that wind may enter the house, which may significantly reduce the insulation value of the storm window.

FIG. 7A is a top cross-sectional view of a storm window 700 according to embodiments of the invention described above. For example, a panel 706 is held in place by side resilient support sections 702, 704. For clarity, a resilient support section that would otherwise cover the top edge of the panel 706 is omitted. Other than to note that the panel 706 is planar, description of the storm window 700 is omitted for brevity, and can be found above.

FIG. 7B is a top cross-sectional view of a storm window 710 that in many respects is identical to the storm window 700 of FIG. 7A. Importantly, a panel 716 in the storm window 710 is formed with a pre-determined curve along its entire the top edge. The bottom edge (not illustrated) may be similarly curved, which gives the panel 716, overall, a partial-cylinder shape, and thereby creating a relatively stiff construction of the panel. Such a panel 716 is very resistant to bending, under force, across its vertical axis, while it would be more inclined to deflect across its horizontal axis. Using the bended shape of the panel 716 in a storm window such as described above generally creates a more rigid, stronger constructed window that may be able to withstand more force with less material than a conventional storm window having a flat panel, such as the panel 706 described in FIG. 7A. Of course, in other situations it may be preferable that, instead of having a curve along the top and bottom edges, that the curve instead be made across side edges, giving a partial-cylinder shape and resistance to bending across its horizontal axis.

FIG. 7C is a top cross-sectional view of a storm window 720, which is similar to the storm window 710 described above. Different from the storm window 710, the storm window 720 is constructed of a panel having a generally straight portion 726 and a generally curved
portion 727. Similarly, FIG. 7D is a top cross-sectional view of a storm window 730 that includes two curved portions, 735, 737, curved in opposite directions, and having a relatively straight portion 736 therebetween. Various uses of storm windows having curved sections are described below with reference to FIGs. 8A and 8B.

With respect to all of the illustrations 7A, 7B, 7C, and 7D, what is referred to as "top" may as well be referred to as "side," depending on which orientation the storm window is inserted into the window frame, as described in detail below.

FIG. 8A is a front view of a storm window 820 having two curve points, 822 and 824. The curve points 822, 824 are similar to the areas of curvature illustrated with reference to FIG. 7D above. The storm window 820 is illustrated as being mounted within a window frame 840, and being held in place by resilient sections 830, 832, 834, and 836 as described above. The curvatures in the panel of the storm window 820 marked by the curve points 822 and 824 are in opposite directions, though not illustrated in FIG. 8A. The portion of the panel above the curve point 824, near the top of the window frame 840, is curved inward, toward the inside of a house. Similarly, the portion of the panel below the curve point 822 is curved outward, toward the outside of the house.

Such a construction and installation of the storm window 820 of FIG. 8A within the window frame 840 provides a number of advantages, the most important of which is a controlled blowout feature. When wind pressure builds from outside the window and presses through the outside window to apply pressure to the storm window 820, the storm window is mostly likely to release pressure by the top portion of the window 820 moving toward the inside of the house, while the bottom portion and side portions remain relatively stationary. This happens because the curvature of the panel along the horizontal dimension, at the curve points 822, 824, stiffens the panel of the storm window 820 along its horizontal plane. At the same time, the vertical dimension has no additional stiffening measures, therefore, under a force from blowing wind, it is more likely that either the top or bottom edges 836, 832 of the window illustrated in FIG. 8A fails before the side edges 830, 834. Recall, however, that the portion of the panel 820 above the curve point 824 is already curved inward, toward the house, while the portion of the panel below the curve point 826 is curved outward. This configuration makes the top edge 836 of the storm window 820 more likely to move under pressure than the bottom edge 832. It is desirable to force a top edge of a storm window to release before the bottom edge of a window for a number of reasons. First, many people store household items along the bottom edge of a window because the bottom window frame generally provides a flat, wide, horizontal surface. Encouraging the bottom portion of a storm...
window to release before a top portion could cause the storm window to knock such items from the window frame ledge and cause damage to the items or force the homeowner to reposition the items on the ledge. Conversely, the top edge of a window frame provides no such ledge for household items and it would be unlikely that a controlled release at the top edge would cause damage.

FIG. 8B is similar in many respects to FIG. 8A, however the window in the window frame 870 covered by storm window 850 is a horizontal window, rather than a vertical window in FIG. 8A. In such an installation the storm window 850 may include only one curve point 852 or two curve points 852, 854. Differently from the vertical installation referred to in FIG. 8A, if the storm window 850 of FIG. 8B, includes both curve points 852, 854, both of the sections of the storm window beyond the curve points may bend inward toward the house. Regardless of the number and direction of curve points of the windows illustrated in FIGs. 8A and 8B, the windows can be installed in either a horizontal or vertical orientation.

FIG. 9A illustrates another system for pre-disposing one or more portions of a storm window to release from its set position in a window frame before other portions. Similar to the resilient support illustrated in FIG. 1, a resilient support section 910 includes a bulb portion 903 and a groove portion 907. Differently, though, in this embodiment is that the resilient support section 910 includes a series of friction ribs 911 coupled to the bulb portion 903. The friction ribs 911 may be made from the same material as the resilient support section 910 or may be made from another material. If made from another material, the friction ribs 911 are attached to the resilient support section 910 by appropriate methods, such as adhesive or thermal welding.

The friction ribs 911 may be designed so that they provide more frictional force in one direction than another. For instance, with reference to FIG. 9B, it is easier to insert the resilient support section into the window frame, such as during installation, than removing it from the window frame, such as during a wind event. This increased frictional force is due to the shape and positioning of the friction ribs 911. In some embodiments the friction ribs 911 may be relatively long and thin, or, with reference to FIG. 9C, the friction ribs 912 may be relatively large and relatively "chunky." In either case the ribs 911, 912 may be angled in a certain direction relative to a vertical plane of the resilient support section 910. This angling, along with the physical structure of the ribs 911, 912 causes the friction difference depending on direction of movement of the resilient support section 910.
Instead of adding friction ribs to the resilient material making up the support, there are other methods of varying the force at which the resilient support holds a section of storm window in place. For instance, recall from above that the bulb portion of a resilient support section, for example the bulb portion 103 in FIG. 1 can take any shape, and need not be circular in cross section. Further recall that the hole illustrated in FIG. 1 may be filled with material that may change the reformation force of the resilient support sections. Changes in shape, thickness, material selection and the presence or absence of holes, for instance, in the resilient support can change the reformation force of the resilient support when it is holding a storm window in place.

Therefore, selection and control of the properties that affect how much restoration force is being applied by the resilient support in the installed storm window can be used to control how the storm window performs during a wind event. For instance, the hole in the resilient support on the sides of a storm window installation may be filled with a material that has more restorative force than that the material filling the hole in the resilient support attached to the top and bottom of the storm window. In effect, then, the sides of such a storm window are held more firmly to the window frame than the top and bottom. In such a system, during a wind event, the top or bottom are more likely to release than either side, thereby giving a system of controlled blowout. A similar system is illustrated in FIG. 10, in which the top portion 948 of a storm window 930 has a lower resilient force when installed in a window frame than the bottom portion 944 or side portions 942, 946. Various foams or other fillers used inside the hole of the resilient support may have different "compression set" values, which is the percent of original size a material will be restored to after deformation. Therefore, choosing materials having different compression set values to fill the hole in the resilient support allows the designer or builder choices for a material suitable for the particular installation.

Similar considerations can be made in other embodiments. For example, a resilient support having ribs 911 or 912 of FIGs. 9A or 9B may be employed in only those portions of the storm window where extra friction is desired. In such a system, the resilient support that does not include such friction enhancing measures will likely be the first to release in a wind event. In yet another embodiment, the size of the panel itself may be chosen relative to how strongly different portions of the storm window are desired to be held in a window frame. For instance, the width of the storm window, as a percentage of a size of the main window, may be different than the percentage size of the height of the main window. When installed, the resilient support along the sides of such a storm window will be compressed more than the
top or bottom, and the resulting storm window will be more strongly held along the sides than at the bottom or top.

FIG. 11A illustrates a relief vent 970 through an area of a resilient support 960 in a storm window 950. Details are illustrated in FIG. 11B and 11C. FIG. 11B is a side cross sectional view of the resilient support 960 of FIG. 11A. A relief vent hole 972 may be laser drilled or otherwise formed through the material making up the resilient support, providing a portal through which air pressure could pass from one side of the resilient support 960, for instance the side facing the main window, into the room. Of course the relief vent hole would have to be sized such that they provide such an air passage even when the resilient support 960 is compressed. An optional one-way flap 974 would prevent air from the house being forced in the other direction. Other variations of this concept are also possible. The size of the relief vent 970 may be modified to suit the anticipated amount of volume of wind to be vented. Additionally, multiple relief vents 970 may be included within the resilient support 960 and spaced out around the window 950 to allow an adequate volume of air to escape during a wind event.

FIGs. 12A-12D illustrate another embodiment of a vent for storm windows according to embodiments of the invention. In these figures, a storm window 980 having a panel 981 includes a series of openings or perforations 982 formed through the panel. As illustrated on FIG. 12B, the panel 981 is held in place in a groove formed by two retaining portions, 984, 986 in a section of resilient support 983, as described above. In this embodiment, however, the retaining portions 984, 986 are sized differently; in particular, one of the retaining portions is longer than the other. In this configuration the longer retaining portion 986, operates as a one-way flap that opens when sufficient pressure builds behind it. Eventually the retaining portion 986 yields under the pressure, as illustrated in FIG. 12C, and the air pressure, i.e., wind, vents through the perforation 982 and past the retaining portion 986 into the open room. Although this embodiment is illustrated with a retaining portion 986 operating as a flap or valve, additional or different valves or other structures could be used in conjunction with the perforations 982, or other perforations through the window 980. For instance, a magnetic or spring seal or specific one-way valve could allow pressure to escape from behind the window 980, then re-seal when the pressure subsides. A similar concept is illustrated in FIG. 12D, except that, instead of differently sized retaining portions, as in the illustrated embodiments above, retaining portion 984 is the same size as retaining portion 986. An additional pressure relief tab 988 is instead additionally coupled to the section of resilient support 983. Similar to the embodiment illustrated in FIG. 12C, when wind pressure
builds behind the storm window 980, the pressure relief tab 988 yields to allow air to escape into the room through the perforation 982.

FIG. 13 is a side view of a storm window 990, similar to the one described above with reference to FIG. 2, which further includes a retention strap 992 structured to hold the storm window in place should all of the blowout control mechanism described herein fail and a wind event would otherwise cause the window to separate completely from a window frame 980. In this figure the strap 992 includes a connection mechanism 994, such as a snap, which connects to the window frame 980. Of course other connection types could be used, such as hook and loop, direct attachment, etc. Similarly the strap 992 includes a connection mechanism 996 that is connectable to the window 990. In practice an installer would set a bottom of the storm window 990 into the bottom of the window frame, then attach the retention strap 992 to the window frame 980 as well as the storm window 990. The resilient support, not specifically shown in FIG. 12, has enough "give" such that the retention strap can pass between the material and the side of the window frame 980. Of course similar retention mechanisms such as springs, etc. could be used to retain the storm window 990. In the case of a spring retention device, a spring return force could also be used to partially support the storm window in the window frame 980.

FIGs. 14A-14D illustrate yet another venting system in a storm window according to embodiments of the invention that additionally provide an integrated removal mechanism. In FIG. 14A, an outside window 1020 is mounted between a bottom window frame 1030 and top window frame 1032. A press-fit storm window 1060 is set in the window frame, providing storm window coverage for the outside window 1020.

Within the panel or glazing of the storm window 1060 is a channel, or hole 1062, through which a string or other flexible tether passes and is attached to a side of the window frame at an attachment 1044. Coupled to the string are two objects, such as balls 1040, 1050. In a preferred embodiment the balls 1040, 1050 have different weights, and the ball 1040, stationed between the outside window 1020 and the storm window 1060 is the heavier ball.

During the majority of time, the window will appear as it does in FIG. 14A, meaning that the heavier ball 1040, due to gravitational force, pulls the string so that the lighter ball 1050 rests near or against the panel 1060, and specifically near the hole 1062. During a wind event, as illustrated in FIG. 14B, the wind pressure builds in the space between the outside window 1020 and storm window 1060. The wind pressure builds until it dislodges the lighter ball 1050 from its resting position, giving the wind an avenue to vent through the hole 1062, and into the room.
FIGs. 14C and 14D illustrate how the same system can be used in an easy removal system. When a user wishes to remove the storm window 1060 from the window frame 1030, the user pulls on the light ball 1050. This raises the heavy ball 1040 by virtue of the string being pulled through the hole 1062. Further pulling will eventually cause the heavy ball 1040 to contact the inside of the hole 1062, as illustrated in FIG. 14C. Further pulling on the light ball 1050 will cause the heavy ball 1040 to exert pressure on the inside surface of the storm window 1060, eventually dislodging the storm window from the window frame, as illustrated in FIG. 14D. From the position illustrated in FIG. 14D, the user can slip his or her hand into the window frame and detach the string at the attachment 1044 to complete the removal. In an especially large wind event, the same system works to additionally retain the storm window 1060 from a complete blowout should the hole 1062 in the storm window be too small to sufficiently vent the wind pressure.

FIGs. 15A, 15B, and 15C illustrate a storm window integrated retention system according to embodiments of the invention. In these illustrations, a storm window 1100 may be the same type of window described above, i.e., one structured to be press-fit into a window frame. Of course, this facet of the invention is applicable to other types of windows as well.

The storm window 1100 includes a panel 1110, such as glazing or plastic, having a hole 1112 therethrough. Within the hole 1112 is a male portion of a snap, including a stud post 1120, which in turn is attached to a snap stud 1122. The strap 1130 is attached to the panel 1110 by first passing the stud post 1120 through a hole in the strap, then sandwiching the strap between the stud post 1120 and the snap stud 1122.

The strap 1130 further includes a snap hole 1134 (FIG. 15A) through which the snap stud 1122 passes, so that a face surface of the strap 1130 (furthest away from the panel 1110) lies generally flat against the panel when installed, as illustrated in FIG. 15B. A pull tab 1132 may be integrated into the strap 1130, or may be attached separately as illustrated in FIGs. 15A-15C. In the illustrated example the pull tab 1132 is made of a different material than the strap 1130, and is attached to the strap by stitching. Of course other embodiments are possible. In a preferred embodiment the pull tab 1132 is attached to the strap 1130 such that the pull tab extends away from the panel 1110, allowing the user to easily grab the pull tab.

As illustrated in FIG. 15C, a retaining strap 1140 is attached to the window frame (not illustrated) supporting the storm window 1100. The retaining strap 1140 includes a snap cap 1142. When the retention system is installed, the snap cap 1142 is securely fastened onto the stud 1122 supported by the storm window 1100, thereby keeping the storm window in place by the secure retaining strap 1140.
If there is a need to remove the storm window 1100, for example during an emergency when rapid egress is required, the retention system is easily released and the storm window may be moved or completely removed. Specifically, in operation, the user merely grabs the pull tab 1132 and pulls the tab away from the window 1100. Pulling on the pull tab 1132 causes the strap 1130 to lift away from the panel 1110, and the hole 1134 passes over the snap stud 1122 by virtue of the lifting. The strap 1130 then exerts pressure on the retaining strap 1140 (FIG. 15C), and, depending on the diameter of the hole 1134, on the stud cap 1142 as well. This outward pressure causes the snap cap 1142 to release from the snap stud 1122, thereby separating the window 1100 from the retention system.

Recall, however, that the strap 1130 is affixed to the panel 1110 by virtue of the snap post 1120 and other portions of the system. Because the strap 1130 is so attached to the window 1100, continued pulling on the pull tab 1132 allows the user to remove the window from the window frame, or at least dislodge the window far enough to gain access to the outside window, such as illustrated above. Then the user may open the outside window as if the storm window had not been put in place. Thus the retention system allows for rapid egress out of the window by a person in need of exiting through the window that has the storm window mounted within the window frame.

Some embodiments of the invention have been described above, and in addition, some specific details are shown for purposes of illustrating the inventive principles. However, numerous other arrangements may be devised in accordance with the inventive principles of this patent disclosure. Further, well known processes have not been described in detail in order not to obscure the invention. Thus, while the invention is described in conjunction with the specific embodiments illustrated in the drawings, it is not limited to these embodiments or drawings. Rather, the invention is intended to cover alternatives, modifications, and equivalents that come within the scope and spirit of the inventive principles set out in the appended claims.
CLAIMS

1. A storm window system for mounting within a window frame of an existing window, comprising:
   a rigid panel having a front surface, a rear surface, and one or more edge surfaces;
   a deformable material disposed along at least some portions of the edge surfaces of the rigid panel, the deformable material including a yieldable portion and a panel supporting portion, the panel supporting portion of the deformable material structured to secure the deformable material to the rigid panel; and
   a blowout control mechanism.

2. The storm window system of claim 1 in which the blowout control mechanism is a curved portion formed in the rigid pane.

3. The storm window system of claim 2 in which the blowout control mechanism relies on different restorative forces in various portions of the deformable material mounted in respective various positions along the rigid panel.

4. The storm window system of claim 2 in which the blowout control mechanism relies on different frictional forces in various portions of the deformable material mounted in respective various positions along the rigid panel.

5. The storm window system of claim 4 in which at least some portions of the deformable material include ribs.

6. The storm window system of claim 1 in which the blowout control mechanism is a relief vent.

7. The storm window system of claim 6 in which the relief vent is formed in the resilient material.

8. The storm window system of claim 6 in which the relief vent is formed in the rigid panel.
9. The storm window system of claim 1 further comprising a window retention mechanism coupled between the rigid panel and a window frame.
INTERNATIONAL SEARCH REPORT

International application No
PCT/US2010/051503

A. CLASSIFICATION OF SUBJECT MATTER

INV. E06B5/12 E06B7/23

ADD.

According to International Patent Classification (IPC), or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
E06B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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Further documents are listed in the continuation of Box C.

See patent family annex.

Date of the actual completion of the international search
30 November 2010

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14/12/2010

Name and mailing address of the ISA/
European Patent Office, P.B. 581 8 Patenlaan 2
N.L. - 2280 HV Rijswijk
Tel. (+31-70) 340-2040,
Fax: (+31-70) 340-3016

Authorized officer
Kofoed, Peter
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