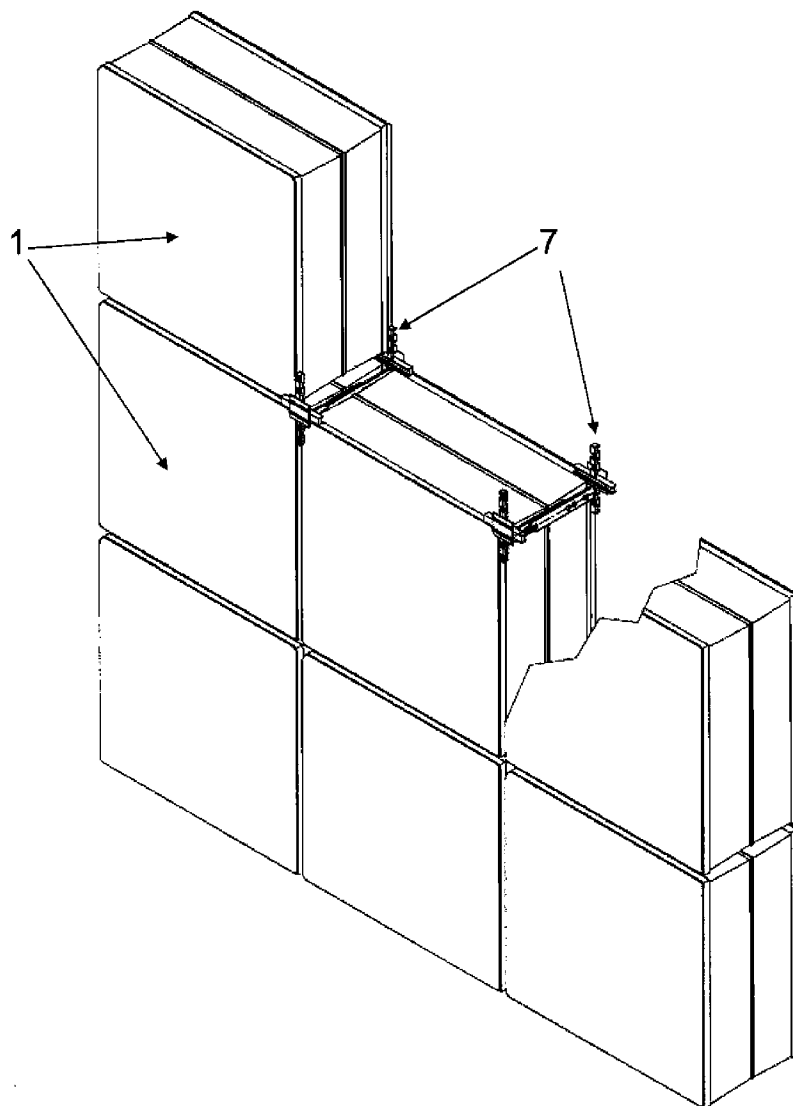




US 20100139191A1

(19) **United States**(12) **Patent Application Publication**
Atherton(10) **Pub. No.: US 2010/0139191 A1**(43) **Pub. Date: Jun. 10, 2010**(54) **COLD SEAL GLASS BLOCK AND
ENERGY-EFFICIENT PANEL****Publication Classification**(51) **Int. Cl.**
E04C 1/42 (2006.01)
E04C 2/54 (2006.01)
(52) **U.S. Cl.** **52/306; 52/561; 52/582.1**(76) **Inventor: Peter R. Atherton, Export, PA (US)**Correspondence Address:
REED SMITH LLP
P.O. BOX 488
PITTSBURGH, PA 15230-0488 (US)(21) **Appl. No.: 12/632,352**(22) **Filed: Dec. 7, 2009****Related U.S. Application Data**(60) **Provisional application No. 61/120,137, filed on Dec. 5, 2008.****ABSTRACT**

Glass blocks and glass block panel assemblies with improved thermal and solar heat gain resistance are described. The blocks are comprised of two symmetric glass elements, one that would face the exterior of a building and another that would face the interior of a building, separated by a second material that acts as a thermal break between the inside and outside of a building. The thermal break may optionally encircle one or more pieces of material that become enclosed in the block for performance or aesthetic purposes. Additional adhesives and sealants may be used as needed to insure structural and functional reliability of the block. For application into building structures, wall and window installation methods are also described including spacers that help ensure quality block alignment.



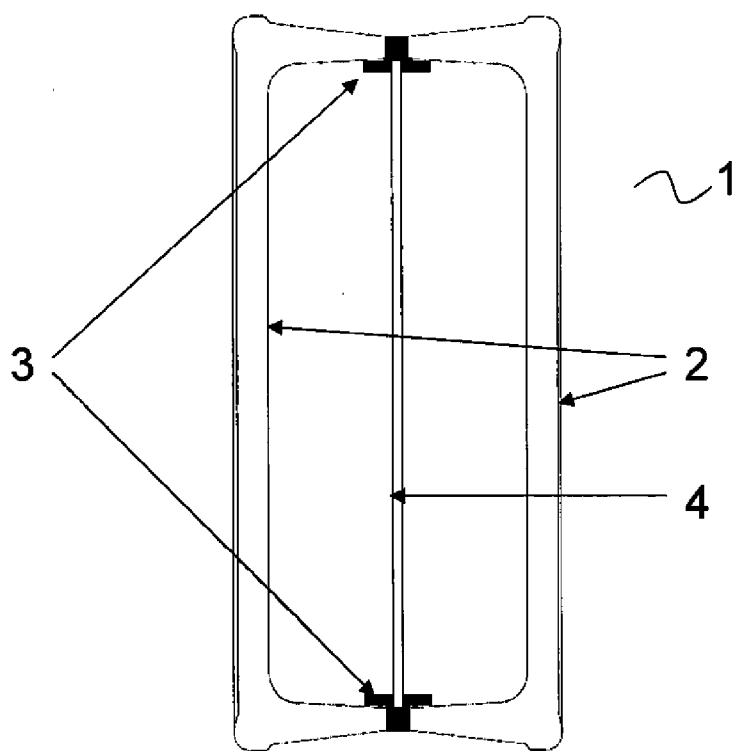


Figure 1

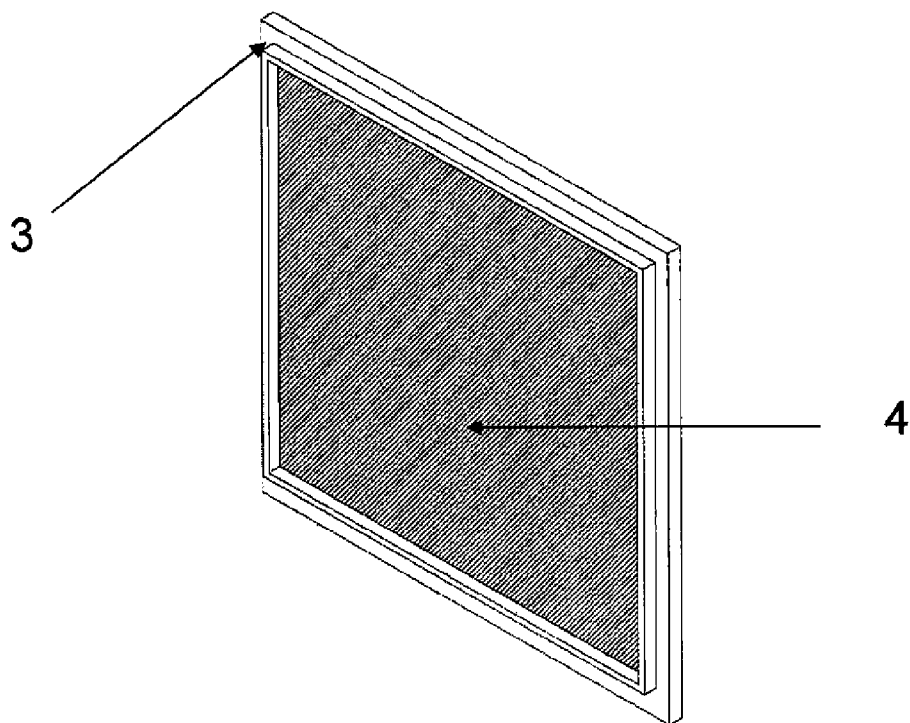


Figure 2

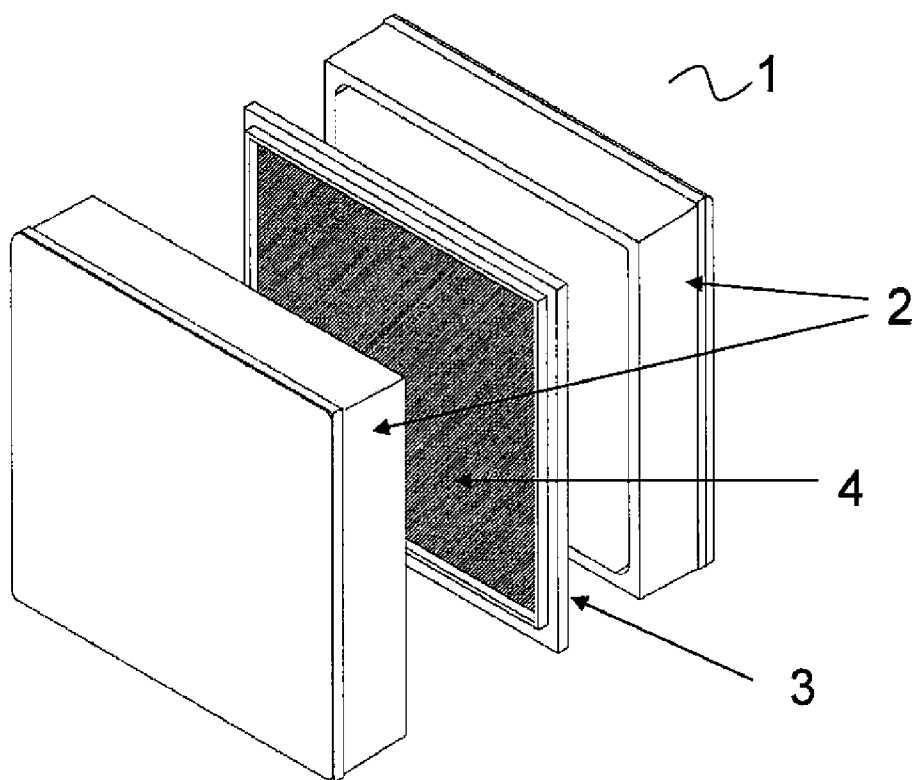


Figure 3

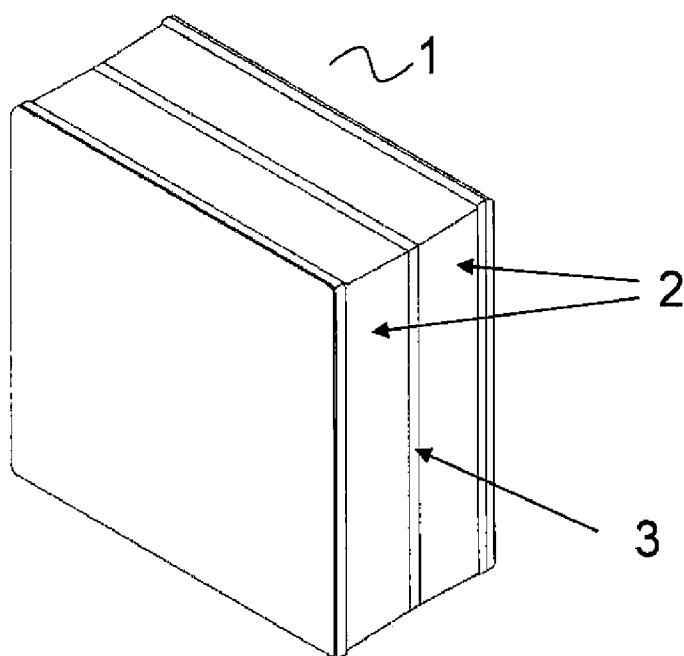


Figure 4

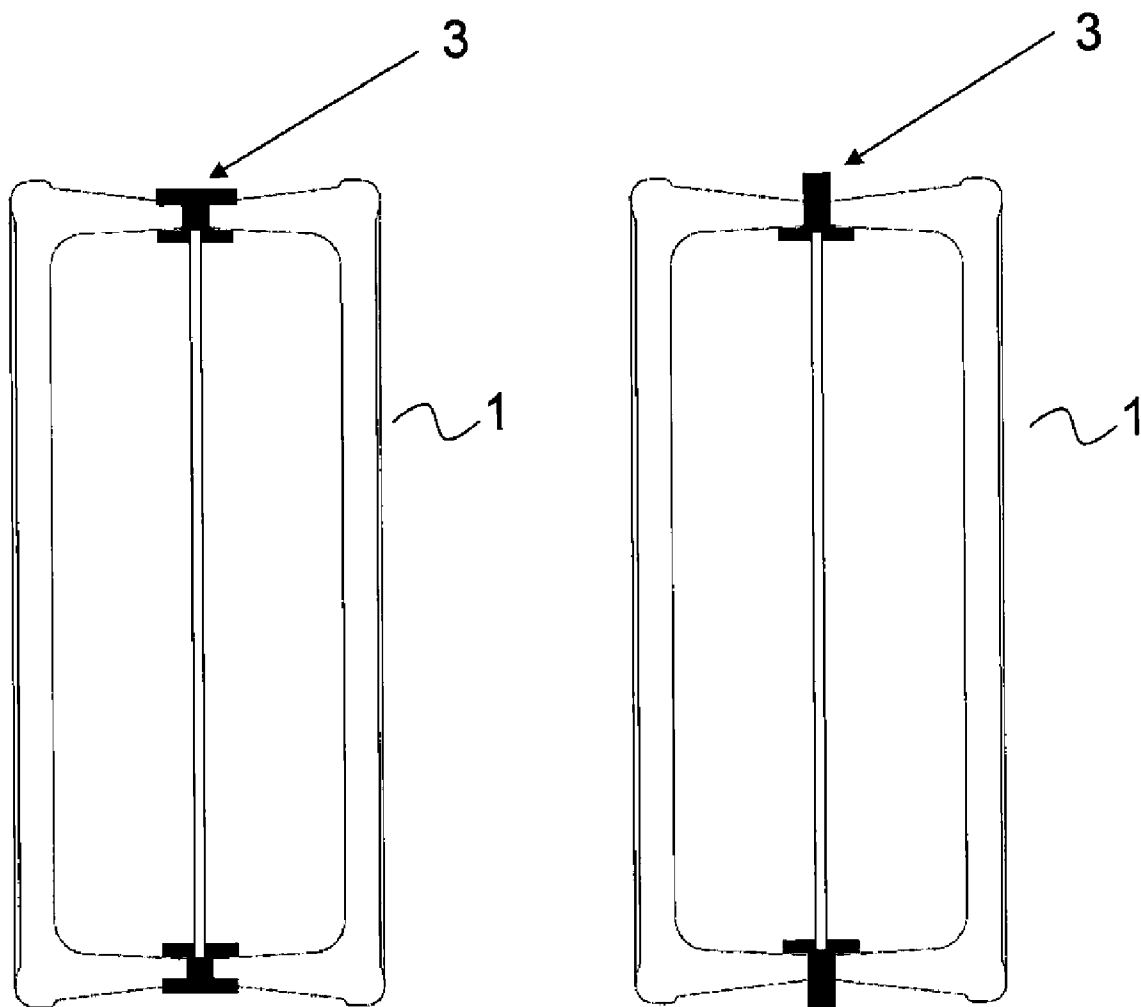


Figure 5

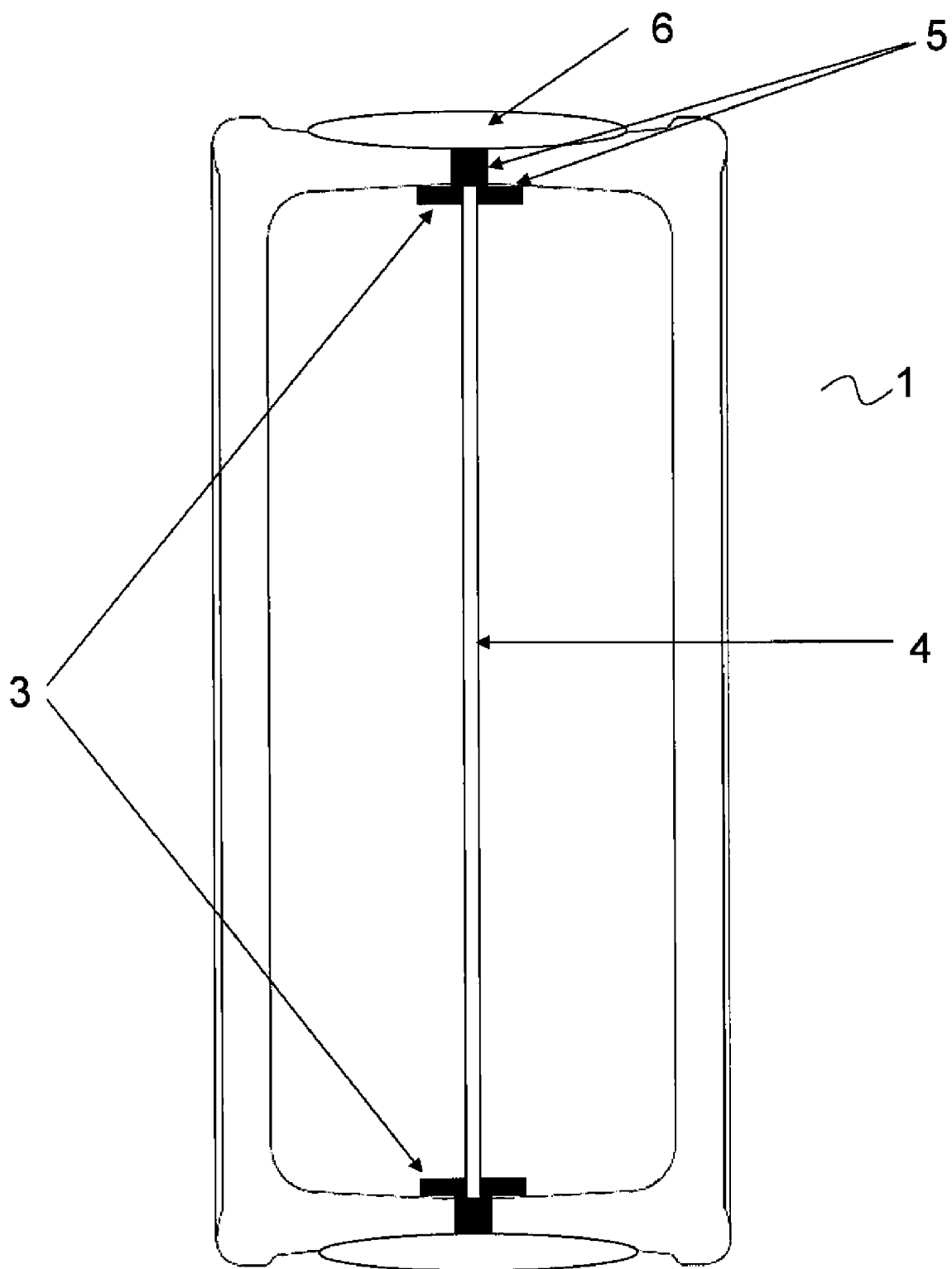


Figure 6

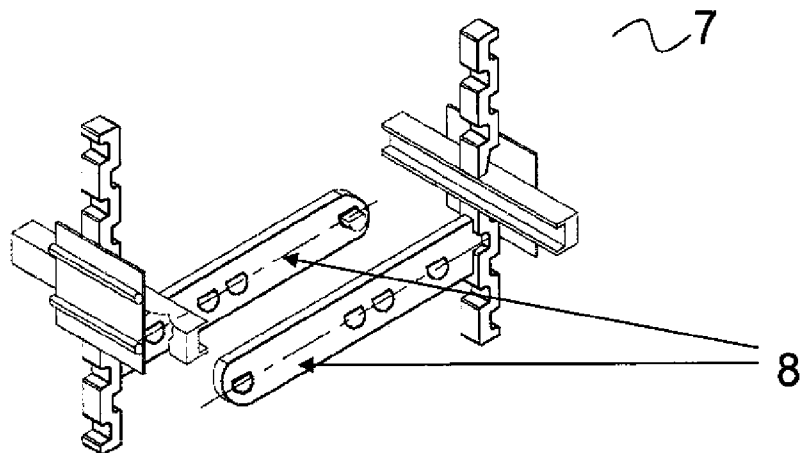


Figure 7

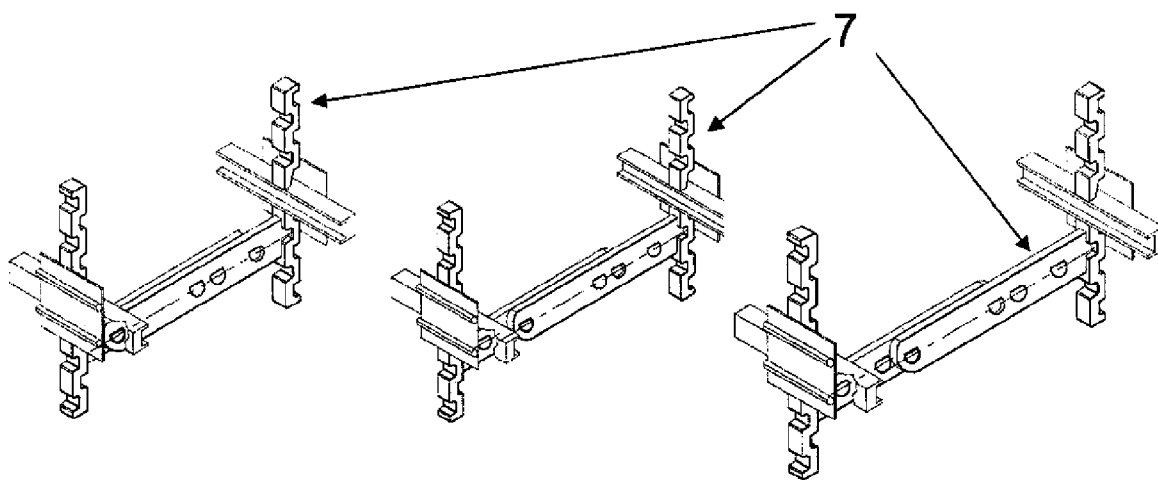


Figure 8

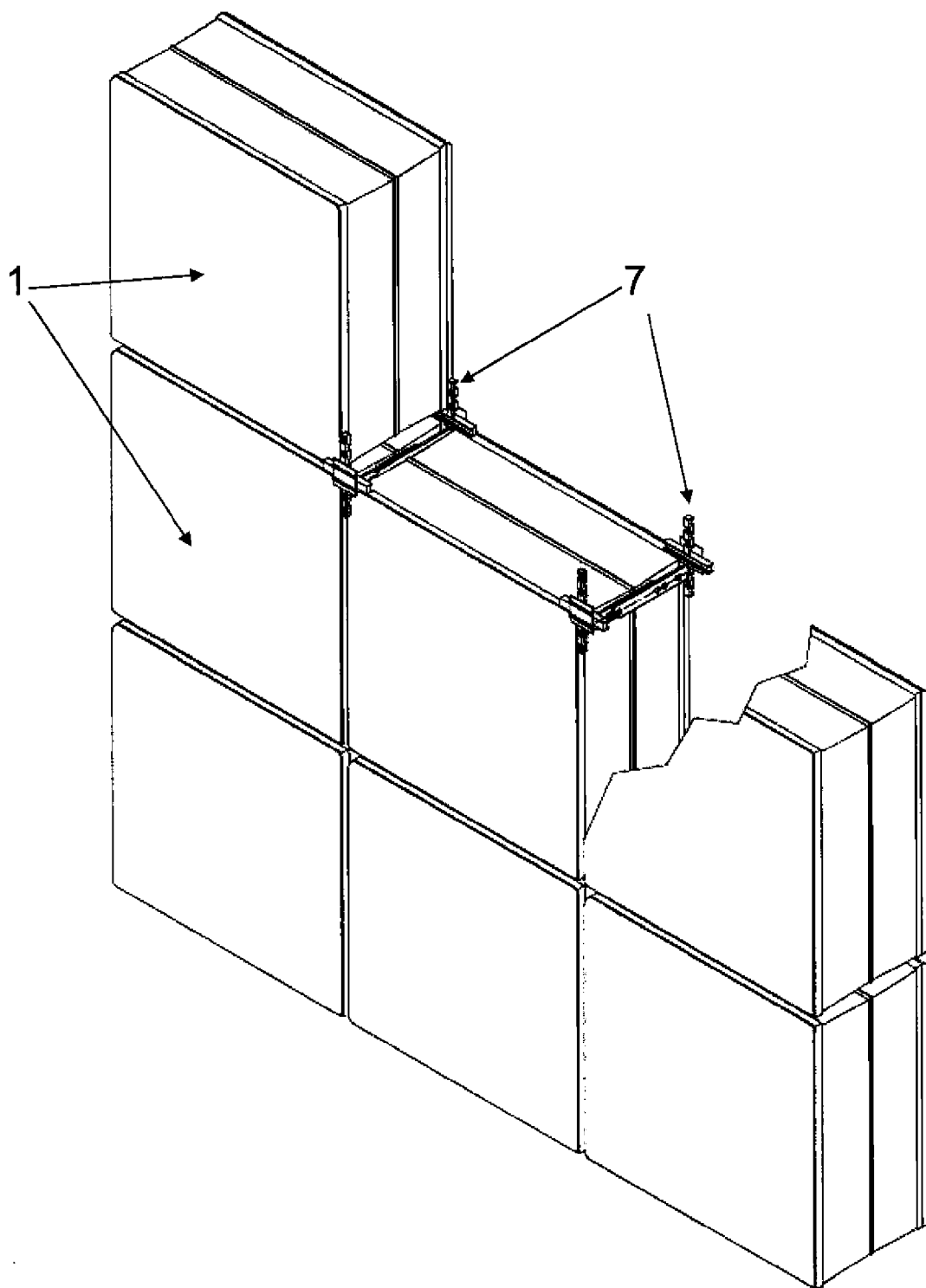


Figure 9

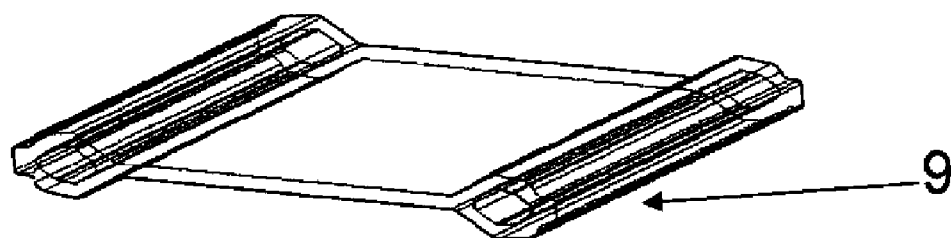


Figure 10

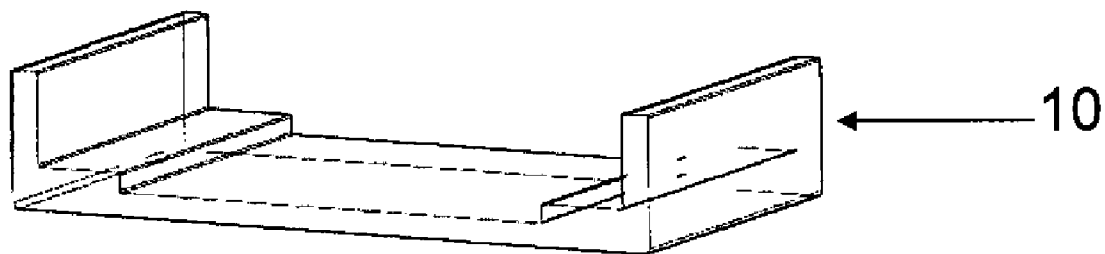


Figure 11

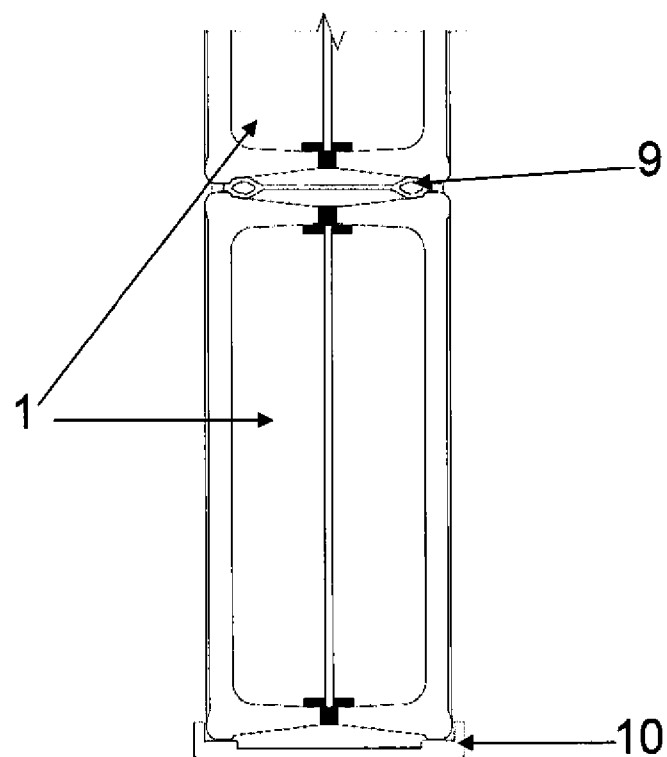


Figure 12

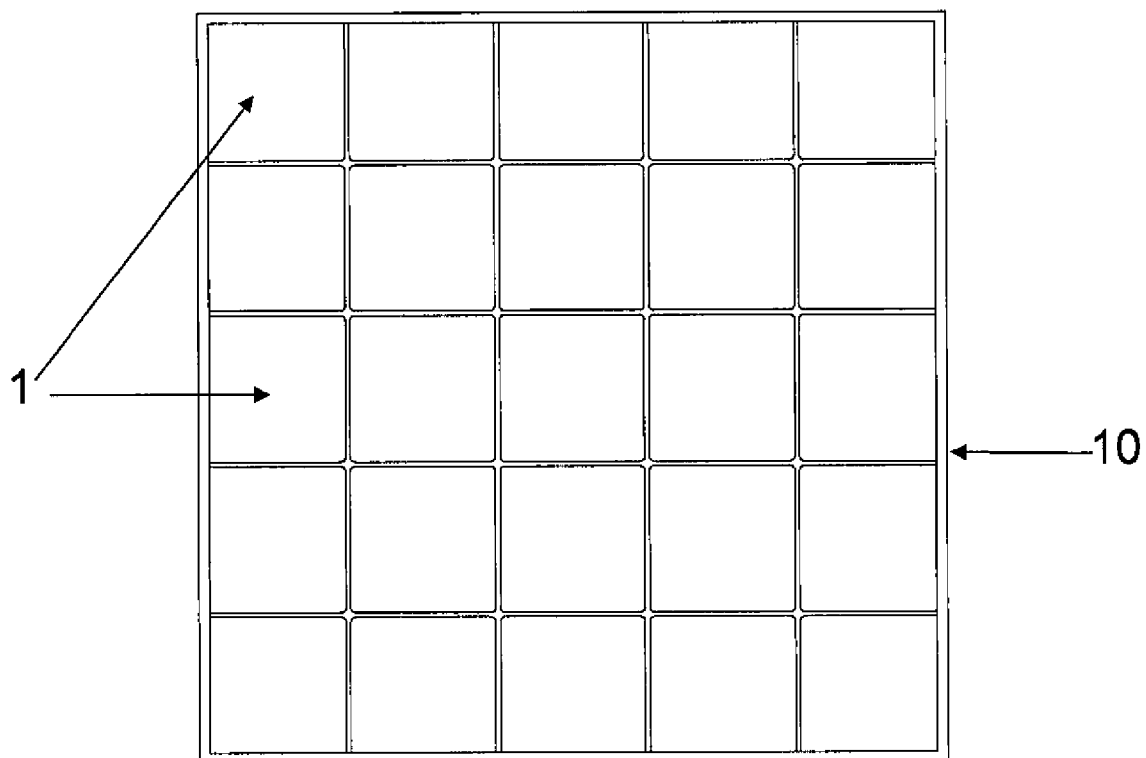


Figure 13

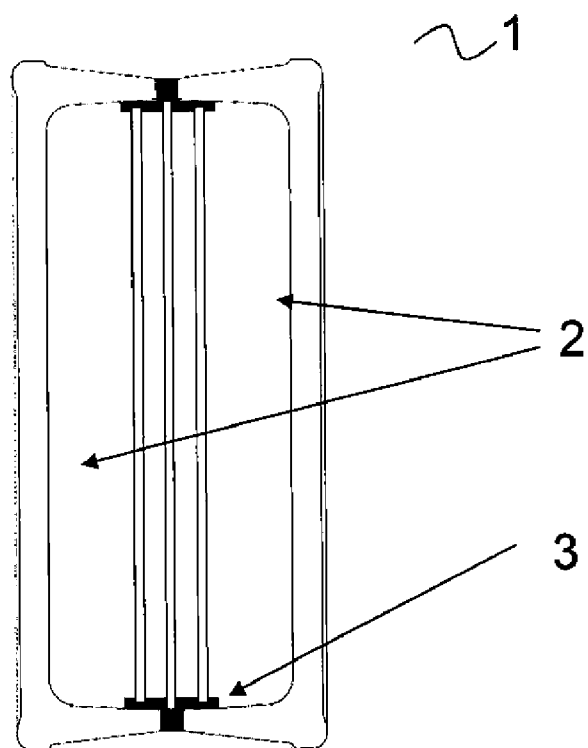
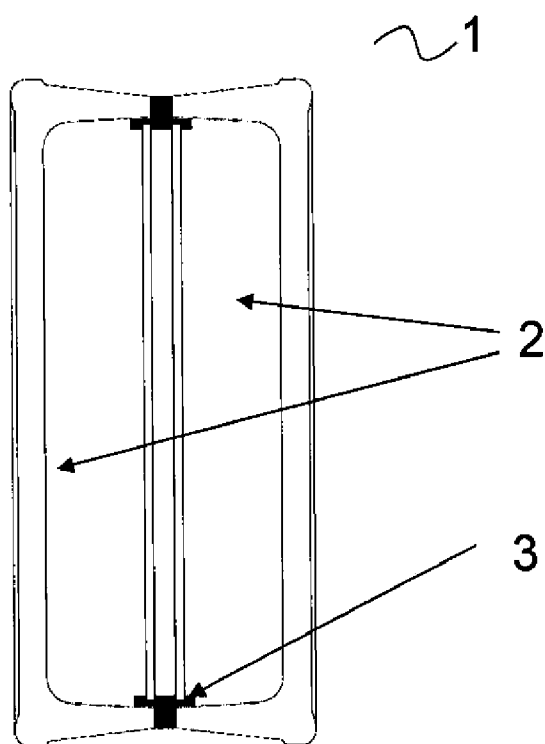


Figure 14

COLD SEAL GLASS BLOCK AND ENERGY-EFFICIENT PANEL

BACKGROUND OF THE INVENTION

[0001] 1. Prior Application

[0002] This application claims priority from U.S. application Ser. No. 61/120,137, filed Dec. 5, 2008, entitled "Cold Seal Glass Block and Energy Efficient Panel".

[0003] 2. Field of the Invention

[0004] This invention relates to glass blocks and glass block panel assemblies with improved thermal and solar heat gain resistance and improved alignment capabilities.

[0005] 3. Background of the Invention

[0006] Glass blocks manufactured today get many of their durable physical attributes from the fact that they are sealed when the glass is very hot. Molten glass at the edges of the half-blocks come together in the manufacturing process and form a hermetic seal. Because of the heat involved in the process, most of the moisture is removed from the atmosphere inside of the block. The result is a glass block that will have frost points that are typically near zero degrees Fahrenheit.

[0007] There have been many efforts to modify glass blocks or manufacture them differently for both decorative and performance purposes. Two of the most critical performance characteristics for energy efficiency are (1) reducing heat gain from radiant solar energy and thermal conductivity primarily in hotter climates, and (2) reducing heat loss through thermal conductivity in colder climates. To reduce thermal conductivity between the inside and outside of a building, a "thermal break" can be introduced into the glass block so that heat cannot travel directly through the glass. To further improve energy efficiency, material can be introduced inside the block to create pockets of air that reduce the effects of convection. Materials introduced into the block or coatings applied to interior faces of the block can be used to reduce radiant energy transmission.

[0008] Some have cut or drilled glass blocks in order to get materials or coatings inside, but those processes may set up fracture points that can lead to the glass blocks breaking apart under stressful pressure and temperature conditions. Even considering water jet or laser cutting processes, a far safer and more mechanically robust method is to form holes, slots or half blocks with molten glass during the molding or sealing processes.

[0009] Once material or coatings are introduced into a glass block, it is critical that the block is sealed correctly. Key challenges in sealing a glass block are (1) eliminating latent moisture in the atmosphere from being captured inside of the block when it is sealed and (2) stopping moisture from leaking into the block after it is sealed.

[0010] Prior attempts have been made to introduce "partitions" into a glass block for performance and aesthetic purposes. U.S. Pat. No. 2,167,764 to Lytle discloses concepts for glass blocks with one or more interior dividers that could be made of various materials and held together with various sealing methods. U.S. Pat. No. 5,160,566 to Ashby et al. describes the insertion of a decorative material into a hollow glass block through a slot cut into one side of the block, then sealed after insertion. While Lytle and Ashby describe partition materials in a glass block, they do not describe a second material used to hold the partitions or used as a thermal break;

and while there is some discussion of thermal performance with additional cavities there is no description of low-emissivity materials.

[0011] U.S. Pat. No. 6,260,317 to Fisher discloses a method for welding two half blocks with an interior "baffle," creating two chambers, but makes no mention of a thermal break. In U.S. patent application Ser. No. 10/376,372, Wilkinson describes a process of cutting hollow glass block in half and then sealing it together with a translucent sheet in middle for aesthetic purposes, but likewise makes no mention of a thermal break. U.S. Pat. No. 6,553,733 to Hock et al. describes structure comprising of two half glass blocks sealed together with an internal capsule, optionally with one or more performance "partitions" that included a low-emissivity option. Also included were a variety of capsule configurations that included the concept of a thermal break into which the two half blocks could be seated and sealed. While the capsule approach is interesting from a performance point of view, it adds a lot of complexity and cost to a glass block product; and advances in materials and coatings since then can enable a higher performing solution without the cost and complexity of a capsule.

[0012] Accordingly, it is an object of the present invention to provide lower-cost glass blocks and glass block panel assemblies with improved thermal and solar heat gain resistance and improved alignment capabilities in windows and panels.

SUMMARY OF THE INVENTION

[0013] The disclosure herein describes a cold seal glass block structure and assembly method that will improve energy efficiency over the prior art while improving quality, reliability and cost. Also disclosed are fixtures designed specifically for the assembly of the of those glass blocks into energy efficient panels and windows specifically to insure quality block alignment.

[0014] In traditional glass block manufacture, symmetric half glass blocks are pressed individually and then fused together by heating the edges to melting temperature while squeezing them together to hermetically seal them. Sealed blocks are then put through a long annealing process to insure mechanical strength. Quality half glass blocks can be made by pressing the half blocks using molten glass and then bypassing the sealing operation and completing the annealing process. Once cooled, the half glass blocks can be used to make the cold sealed glass blocks.

[0015] In a separate operation, a frame is made by a molding or extrusion process so that the frame geometry conforms to the geometry of the open side of the half glass block. The material used is one that will act as an insulator to limit thermal energy from passing through the sides of the block between the interior and exterior of the building. That frame material and associated sealants will be strong enough to hold the block together in a wall or window application, but will also be soft enough where glass contact is made to compensate for irregularities in the glass. Optionally, one or more pieces of rigid low-emissivity material will be enclosed by the frame creating partitions that isolate air into chambers and limit the transmission of radiant energy. Optionally, the frame could extend beyond the outside edge of the block to provide additional insulation between blocks in a mortar installation.

[0016] In one embodiment of the present invention, a cold seal glass block is made by assembling the two half glass blocks and the insulating frame with optionally one or more

rigid low-emissivity materials. Depending on the frame material, sealants may be used to hold the block together structurally and to seal the block enclosure from moisture getting into the block cavity. Desiccated materials may be used as needed to absorb latent moisture inside the cavity. Desiccated materials may take the form of sealants, granules, tape or be part of the frame or partition materials themselves. Block materials may also be preheated before assembly to remove ambient moisture and to improve adhesion between sealants and adjoining materials.

[0017] The cold seal glass block introduces changes in geometry around the block seam and changes in block thickness, so that existing components for mortar and sealant-spacer installations will not work properly. Components designed specifically to adapt to such geometric irregularities are described herein. For mortar wall installations, a new mortar spacer enables masons to adjust to the new block thickness as well as more commonly used glass blocks. For window assemblies, new vinyl spacer and channel designs enable easy assembly with sealants like structural silicone.

BRIEF DESCRIPTION OF DRAWINGS

[0018] For the present invention to be clearly understood and readily practiced, the present invention will be described in conjunction with the following figures, wherein like reference characters designate the same or similar elements, which figures are incorporated into and constitute a part of the specification, wherein:

[0019] FIG. 1 illustrates a cross-section view of one embodiment of the present invention.

[0020] FIG. 2 illustrates one embodiment of a frame with a low-emissivity partition.

[0021] FIG. 3 illustrates basic components of two half glass blocks and the frame with a low-emissivity partition in an exploded view.

[0022] FIG. 4 illustrates one embodiment with the frame flush to the half glass block outer surface.

[0023] FIG. 5 illustrates two embodiments with the frame extending beyond the half glass block outer surface.

[0024] FIG. 6 illustrates an assembled embodiment of the present invention and the location of potential sealant applications.

[0025] FIG. 7 illustrates two mortar spacers aligned for assembly.

[0026] FIG. 8 illustrates three assemblies for the traditional 3" and 4" blocks as well as the 3.5" embodiment of the present invention.

[0027] FIG. 9 illustrates the use of the mortar spacer in aligning cold seal glass blocks prior to the application of mortar between the blocks.

[0028] FIG. 10 illustrates a vinyl spacer for one embodiment of the present invention.

[0029] FIG. 11 illustrates a vinyl channel for one embodiment of the present invention.

[0030] FIG. 12 illustrates a cross-section view of assembly of the present invention with a vinyl spacer and channel.

[0031] FIG. 13 illustrates a front view of assembly of the present invention with a vinyl spacer and channel.

[0032] FIG. 14 illustrates cross-section views of the present invention with two partitions and of the present invention with three partitions.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS OF THE INVENTION

[0033] It is to be understood that the figures and descriptions of the present invention have been simplified to illustrate elements that are relevant for a clear understanding of the invention. The detailed description will be provided hereinbelow with reference to the attached drawings.

[0034] With reference to FIGS. 1-4, the preferred embodiment of the present invention 1 consists of a frame 3 holding one or more a low-emissivity glass or mylar partitions 4 and enclosed by two half glass blocks 2.

[0035] Although half glass blocks 2 can be made by cutting a glass block in half, the preferred embodiment is composed of half blocks without the fracture points that can be left by cutting glass with a saw, water jet or laser. In the preferred embodiment, half glass blocks 2 are made by pressing the half blocks 2 and then annealing them. Once cooled, the half glass blocks 2 can be used to make the cold sealed glass block 1.

[0036] The frame 3 can be made of any appropriate material that conforms to the joining edge of the half glass blocks 2 so that they will fit snugly when assembled together. Window insulated glass units (IGUs) have been using thermoplastic compounds to make spacers that insulate between panes of glass for many years, and more recently have been using insulating silicone foam to make window spacers. Both materials can incorporate a desiccant to absorb moisture inside of the IGU. The preferred embodiment of the frame 3 may use a similar material to gain the insulating and desiccating properties as used in IGUs.

[0037] The partition 4 is an optional material that is contained by the frame 3, and serves to subdivide the glass block 1 into two chambers. Although air is a great insulator, the chamber in a typical glass block is large enough to allow convection currents that actually reduce the insulation. Introducing a partition 4 makes the two resulting chambers more narrow, thereby reducing the effects of convection currents on insulation.

[0038] Energy efficiency in the window industry has benefited greatly by the use of low-emissivity materials. The materials allow the passage of light in the visible spectrum while filtering out rays in the infrared spectrum, which means that we can see light through the materials while thermal radiation is inhibited. The best performing material in use today for thermal efficiency and visible light transmission is glass with a low-emissivity soft-coat, which is selected for the preferred embodiment of the partition 4. The soft-coat glass is more challenging to handle in manufacturing and is more susceptible to damage from moisture, however, so hard coated glass, Mylar, solar films or low-emissivity coatings on the inside glass block faces could be alternatives, depending on the desired result.

[0039] In order to hold the block assembly together and insure a good seal against moisture intrusion, various sealant and adhesive combinations can be used as illustrated in FIG. 6. For the locations where glass edges of the half blocks 2 contact the outer edge 5 of the frame 3, a strong adhesive that can also help seal from moisture intrusion is preferred. This is common practice in the IGU industry. It may also be desirable to have a secondary seal 6 over the outer frame edge 5 as is common practice in the IGU industry. One material com-

monly used in IGUs as a secondary seal is a butyl formulation, but the preferred embodiment would use a hot-melt butyl that cures. It is a sealant used in more structural IGUs like sliding doors. It offers better moisture resistance, more structural strength, and it cures, thereby making it less susceptible to deformation or failure at higher temperatures.

[0040] Glass blocks are typically installed with mortar like masonry systems, or with structural silicone optionally with a spacer system. For mortar applications, masons often use mortar spacers to lay the blocks up with good alignment (FIG. 9). Current mortar spacers are available for 3" and 4" thicknesses, which cannot be used when the glass block 1 has a 3½" thickness in its preferred embodiment. As shown in FIG. 7, an adjustable mortar spacer 7, consisting of two spacer components 8 aligned for assembly, can be used to handle the 3½" thickness, as well as the 3" and 4" thick blocks as illustrated in FIG. 8. Not only does this minimize the chance of having the wrong mortar spacer, but it also simplifies the purchasing process for the customer and logistics process for the supplier and manufacturer.

[0041] One challenge with mortar installations is that mortar is not a very good insulator. As mentioned in Hock et al., the frame 3 and associated sealants could be extended beyond the outside edge of the glass block 1 to reduce thermal transmission and form a more robust enclosure, as illustrated in FIG. 5.

[0042] Glass block windows are often assembled with a structural silicone, and where larger windows are needed, vinyl spacers are often used between the blocks to help with alignment and to improve structural integrity. Traditional glass blocks have a symmetric concave geometry along the sides of the block with a small ridge around the center-line of the block; and vinyl spacers were designed to fit that geometry. The preferred embodiment of the present invention will instead have the frame material around the centerline of the block with the possible protrusion of frame material or even an irregular protrusion of sealant. Consequently, vinyl spacers used in traditional blocks that fit tightly to the traditional centerline geometry will not fit into the side of the present invention. It also must fit with the new 3½" block thickness. As shown in FIGS. 10 and 12, a vinyl spacer 9 may be designed to fit snugly with the glass block frame 3 while leaving space for variability in the frame edge 5 and associated sealants 6. As shown in FIGS. 11 and 12, a vinyl channel 10 overcomes the same geometry and dimensional issues by conforming to the glass block frame 3 while leaving space for variability in the frame edge 5 and associated sealants 6. An assembly detail is illustrated in FIG. 12, and a front view of an assembled panel is illustrated in FIG. 13.

[0043] Although the invention has been described in terms of particular embodiments in an application, one of ordinary skill in the art, in light of the teachings herein, can generate additional embodiments and modifications without departing from the spirit of, or exceeding the scope of, the claimed invention. Accordingly, it is understood that the drawings and the descriptions herein are proffered by way of example only

to facilitate comprehension of the invention and should not be construed to limit the scope thereof.

What is claimed is:

1. A block comprising:
 - a first block half;
 - a second block half; and
 - a frame, wherein the frame is positioned between and aligns the first block half and the second block half so that said block halves and said frame define a complete enclosure.
2. The block of claim 1, wherein the frame has an edge geometry that conforms to the edge geometry of said block halves.
3. The block of claim 1, wherein the frame comprises a thermal insulator between said block halves.
4. The block of claim 1, wherein the frame contains a desiccant.
5. The block of claim 1, wherein the frame holds one or more partitions inside said block and wherein said one or more partitions divide the interior of said block into a plurality of chambers.
6. The block of claim 5, wherein said one or more partitions allow visible light to pass through said block while limiting transmission of radiant energy through said block.
7. The block of claim 1, further comprising a sealant over the exterior edge of said frame and adjoining edges of said block halves.
8. The block of claim 1, further comprising a desiccant inside said block.
9. The block of claim 1, wherein said block halves are heated before assembly.
10. The block of claim 1, wherein said block halves are heated during assembly.
11. A glass block panel comprising:
 - a plurality of glass blocks, wherein each of said plurality of glass blocks comprise a first block half, a second block half, and a frame, wherein the frame is positioned between and aligns the first block half and the second block half so that said block halves and said frame define a complete enclosure; and
 - a plurality of spacers positioned between and aligning said glass blocks with each other in a mortar panel assembly.
12. The glass block panel of claim 11, wherein said spacers are adjustable to multiple glass block thickness settings.
13. A glass block panel comprising:
 - a plurality of glass blocks, wherein each of said plurality of glass blocks comprise a first block half, a second block half, and a frame, wherein the frame is positioned between and aligns the first block half and the second block half so that said block halves and said frame define a complete enclosure; and
 - a plurality of spacers positioned between and aligning said glass blocks with each other in a silicone panel assembly.
14. The glass block panel of claim 13, further comprising a channel around the perimeter of said glass block panel.

* * * * *