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(54) **MULTI-GLAZED WINDOW ASSEMBLY AND METHOD THEREFOR**

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(21) Appl. No.: **19/198,100**

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Related U.S. Application Data

(63) Continuation-in-part of application No. 18/986,626, filed on Dec. 18, 2024, which is a continuation of application No. 17/849,135, filed on Jun. 24, 2022, now Pat. No. 12,297,693, which is a continuation-in-part of application No. 16/735,566, filed on Jan. 6, 2020, now abandoned, which is a continuation-in-part of application No. 15/418,953, filed on Jan. 30, 2017, now Pat. No. 10,526,836.

Publication Classification

(51) **Int. Cl.**

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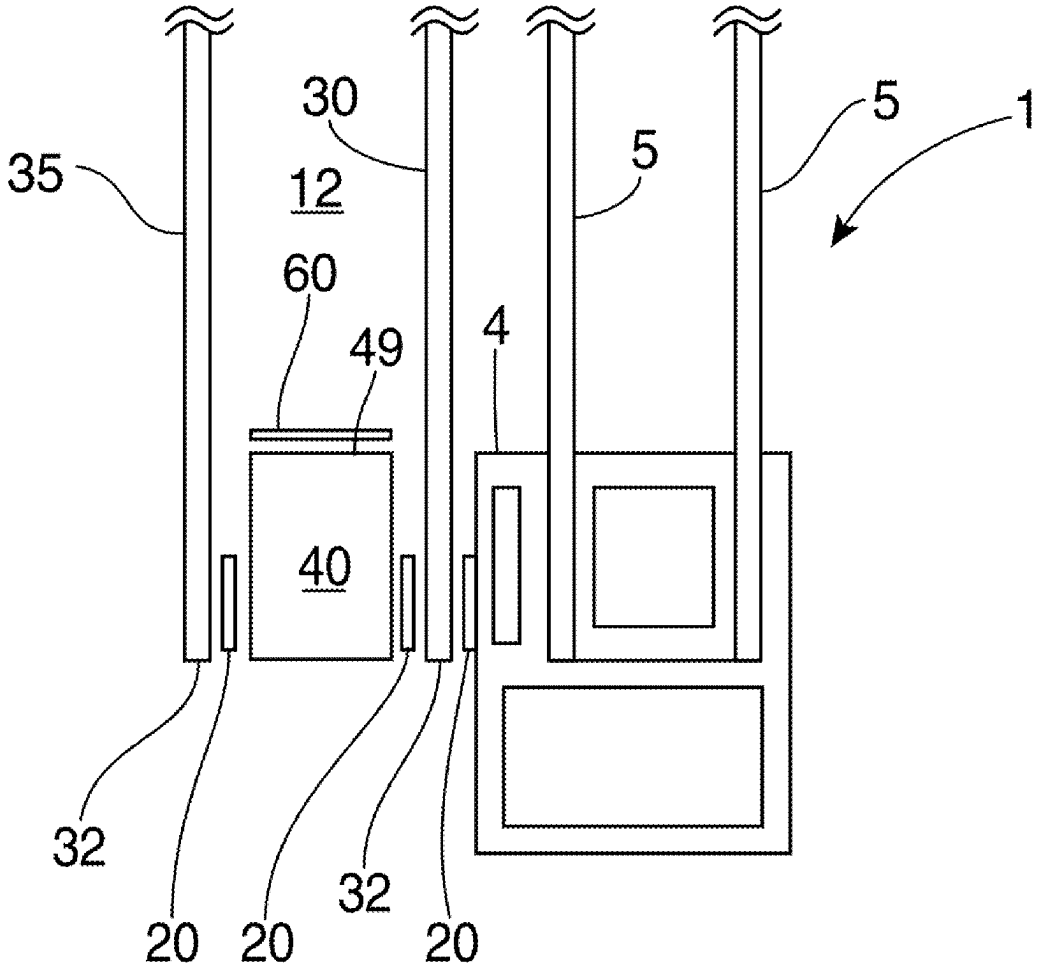
E06B 3/56	(2006.01)
E06B 3/663	(2006.01)
E06B 3/673	(2006.01)

(52) **U.S. Cl.**

CPC ***E06B 9/02*** (2013.01); ***E06B 3/56*** (2013.01); ***E06B 3/66323*** (2013.01); ***E06B 3/66352*** (2013.01); ***E06B 3/66366*** (2013.01); ***E06B 3/66376*** (2013.01); ***E06B 3/6733*** (2013.01)

(57) **ABSTRACT**

A multi-glazed window assembly is presented herein. The assembly includes a plurality of glazing layers arranged in a parallel relation to one another and defining at least one insulating airspace there between. The assembly also includes a perimeter spacer assembly and a resilient foam outer wrapping. The perimeter spacer assembly is attached along a length of an interior surface of the outer wrapping defining at least one interior channel. An intermediate glazing layer is mounted within the channel while outer glazing layers are disposed on opposing sides of the intermediate glazing layer and laterally spaced therefrom. The resilient foam outer wrapping then extends entirely around a collective perimeter of the glazing layers, thereby creating a multi-glazed window assembly formed with a gasket-like foam outer surface and with minimal seams and material.



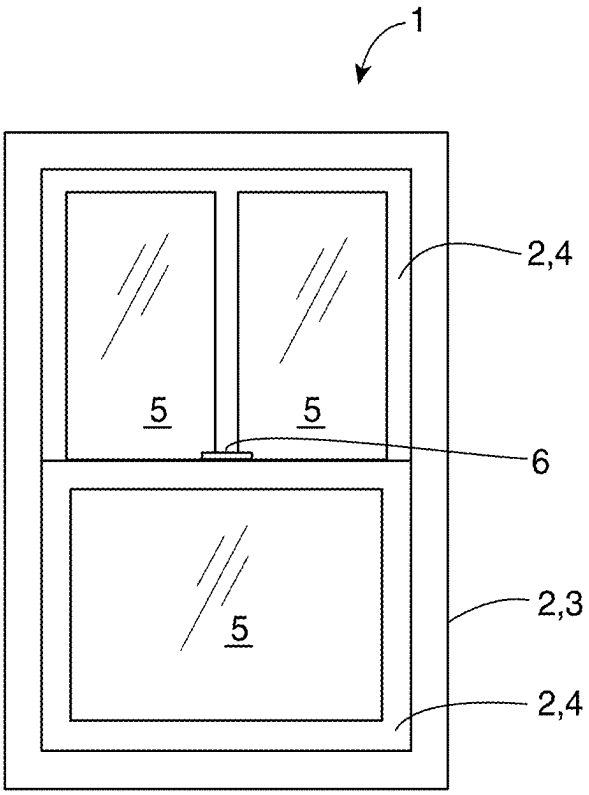


FIG. 1
(Example Window Unit)

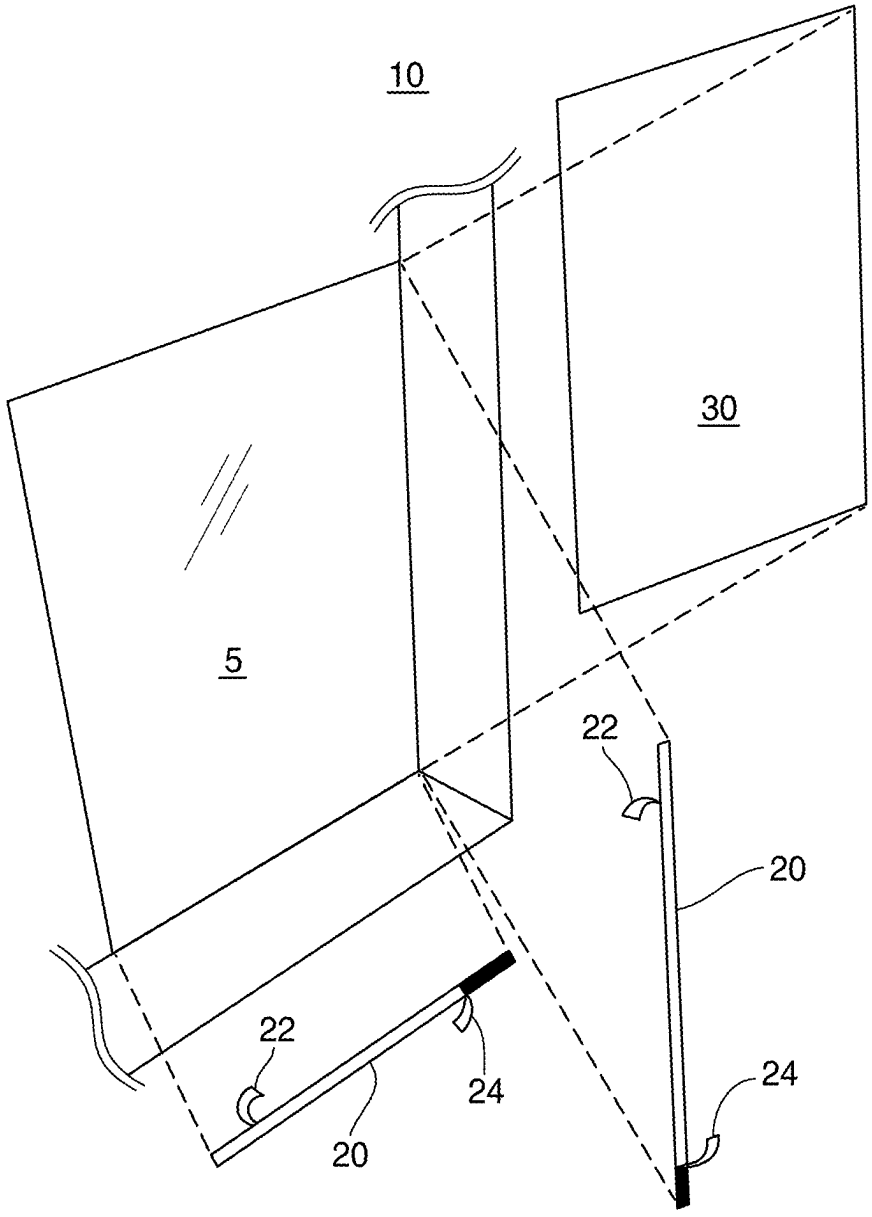


FIG. 2

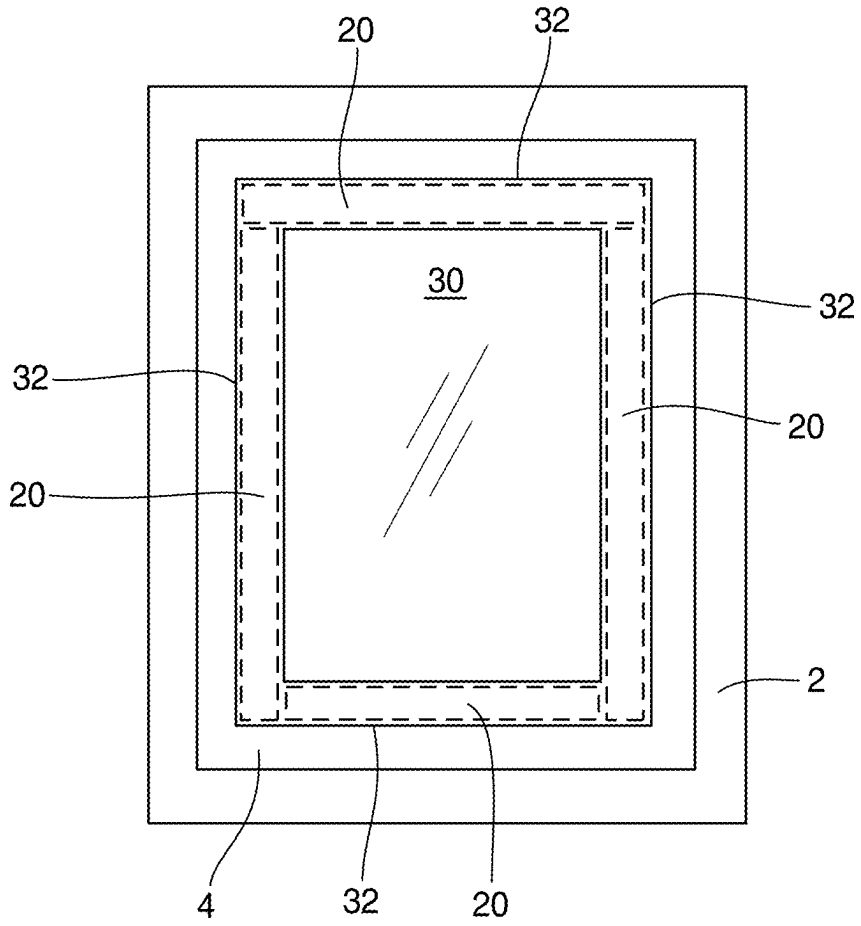


FIG. 3

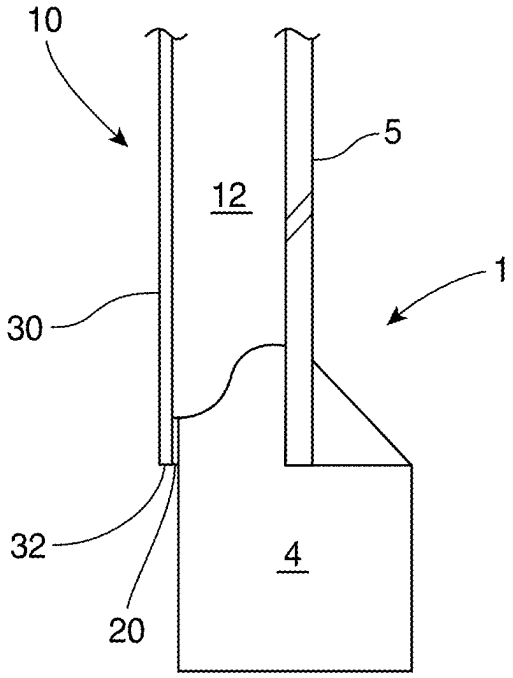


FIG. 4

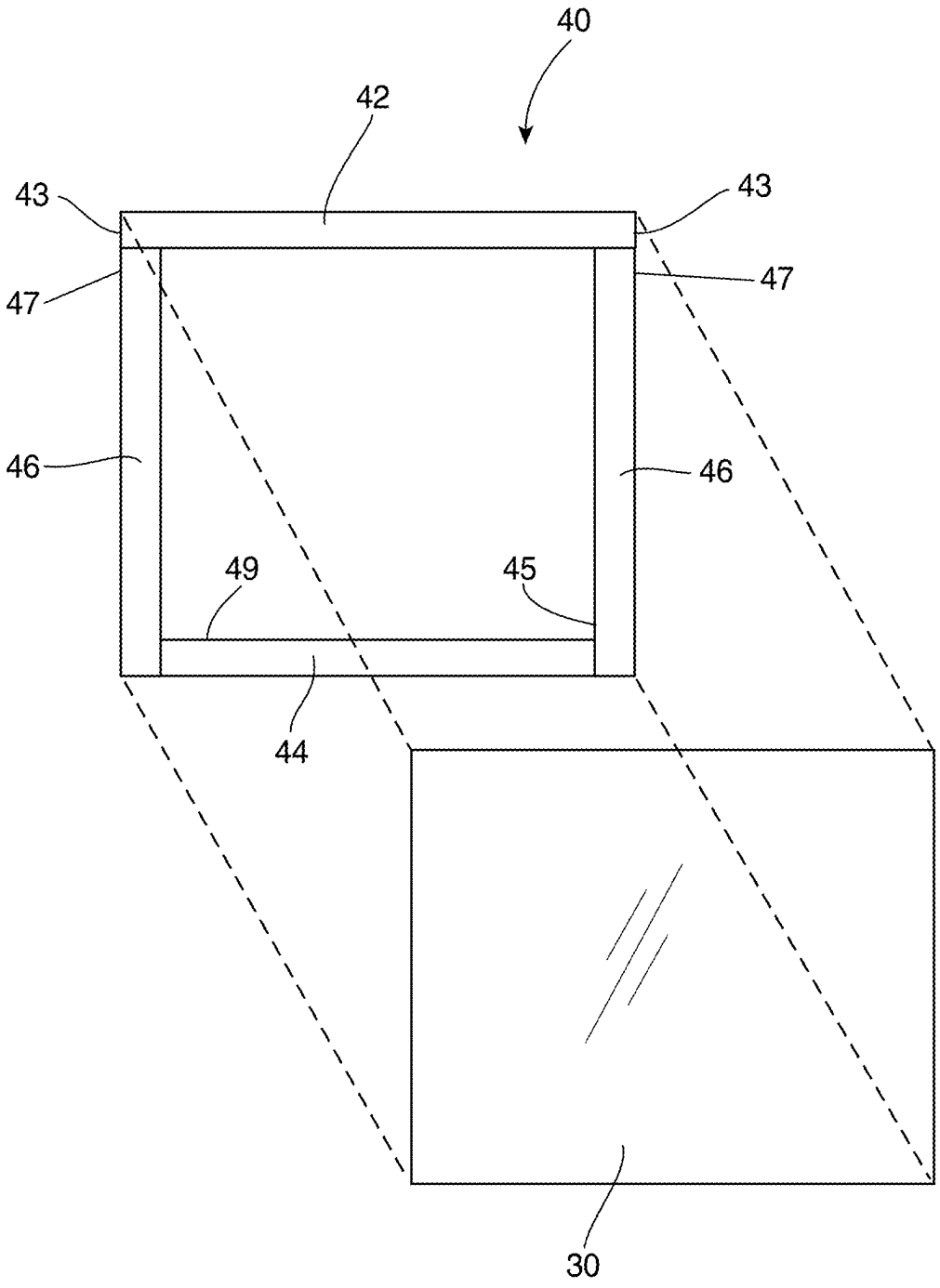


FIG. 5

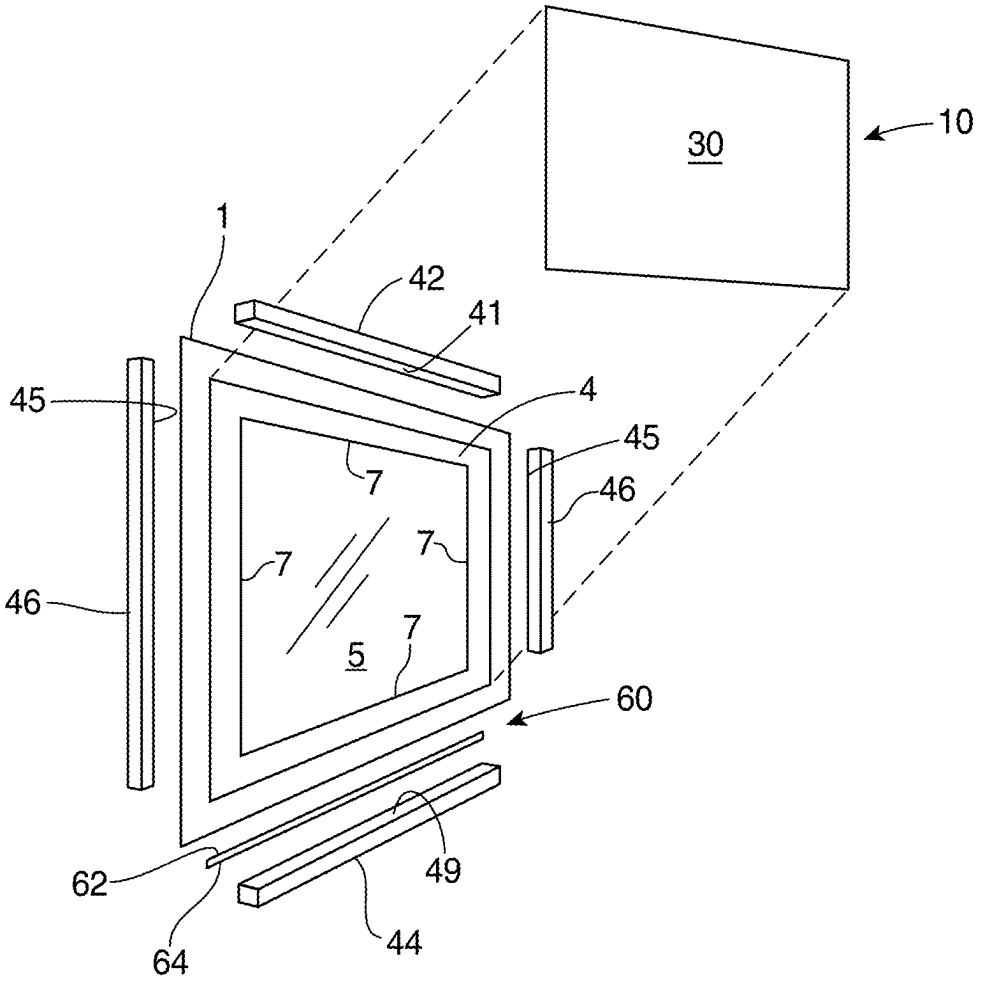


FIG. 6

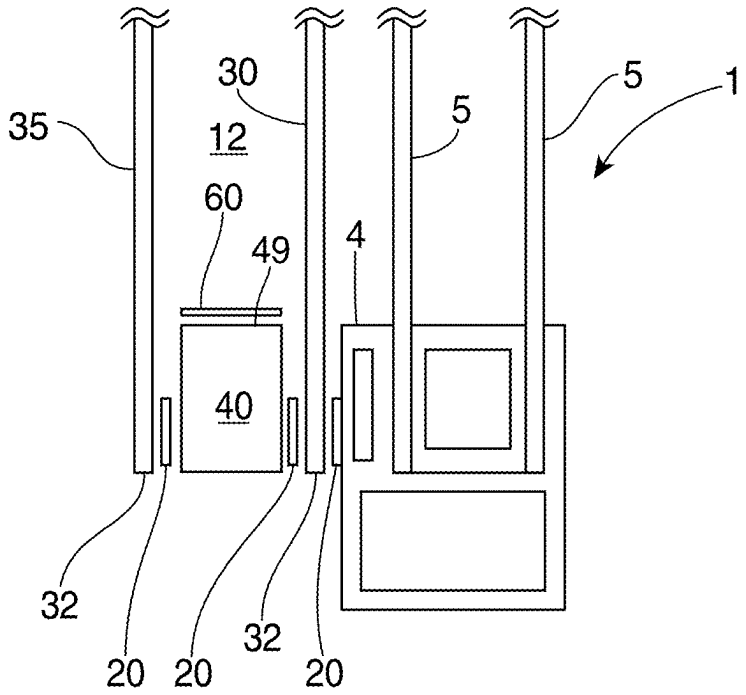


FIG. 7

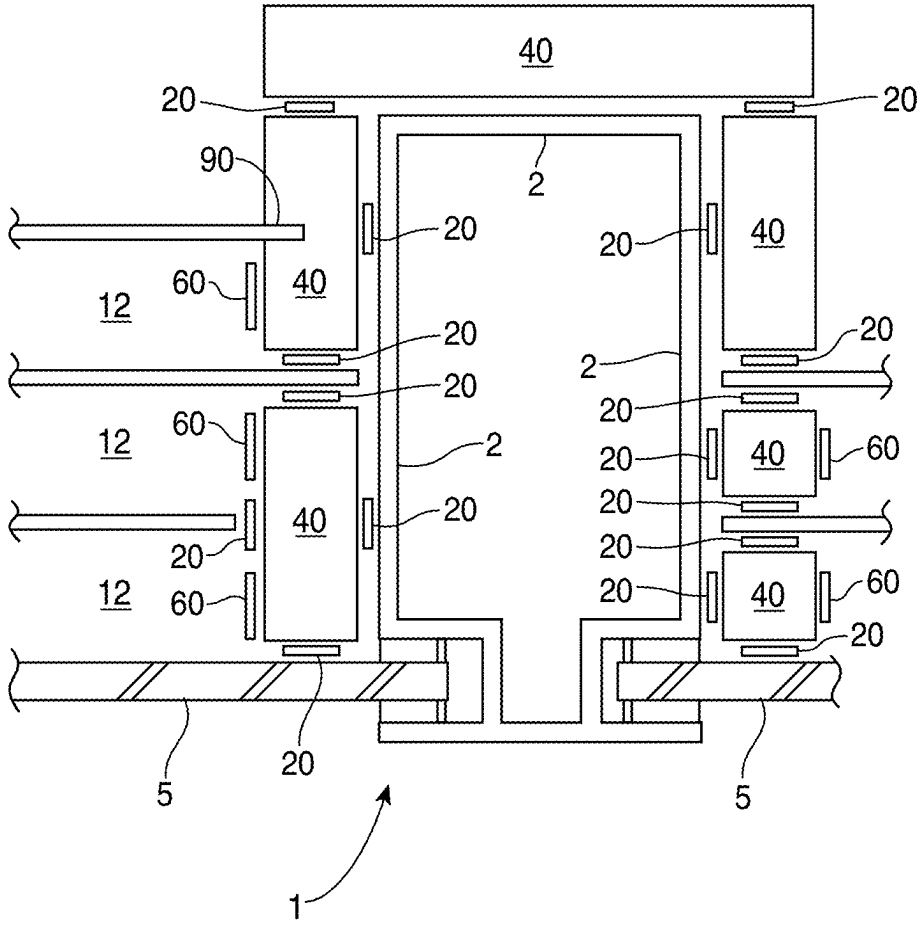

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FIG. 8

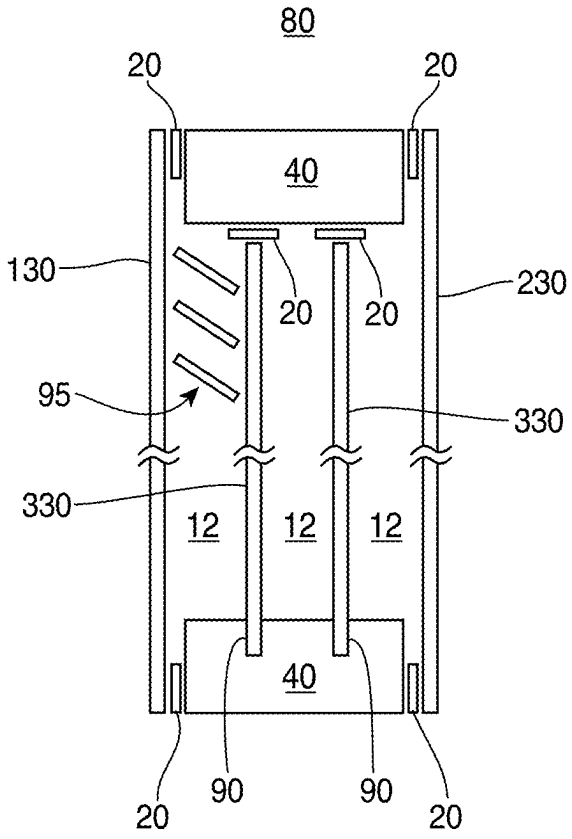

FIG. 9

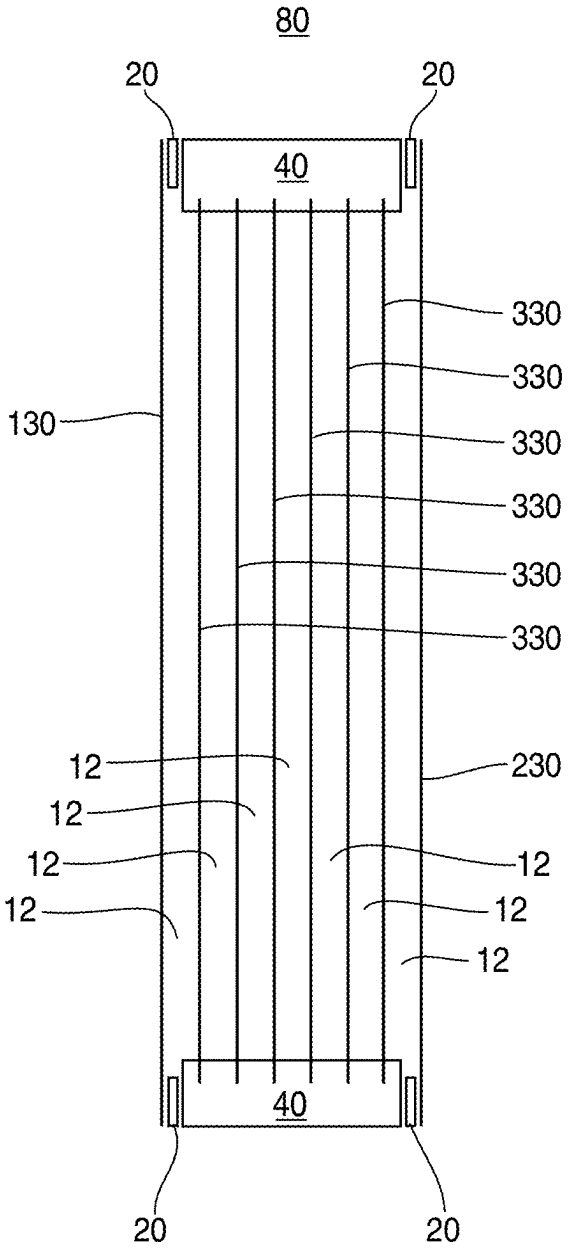
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FIG. 10

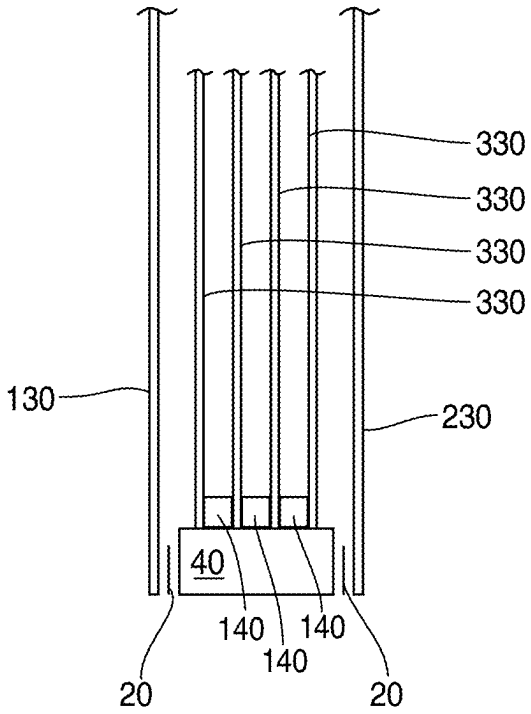

FIG. 11

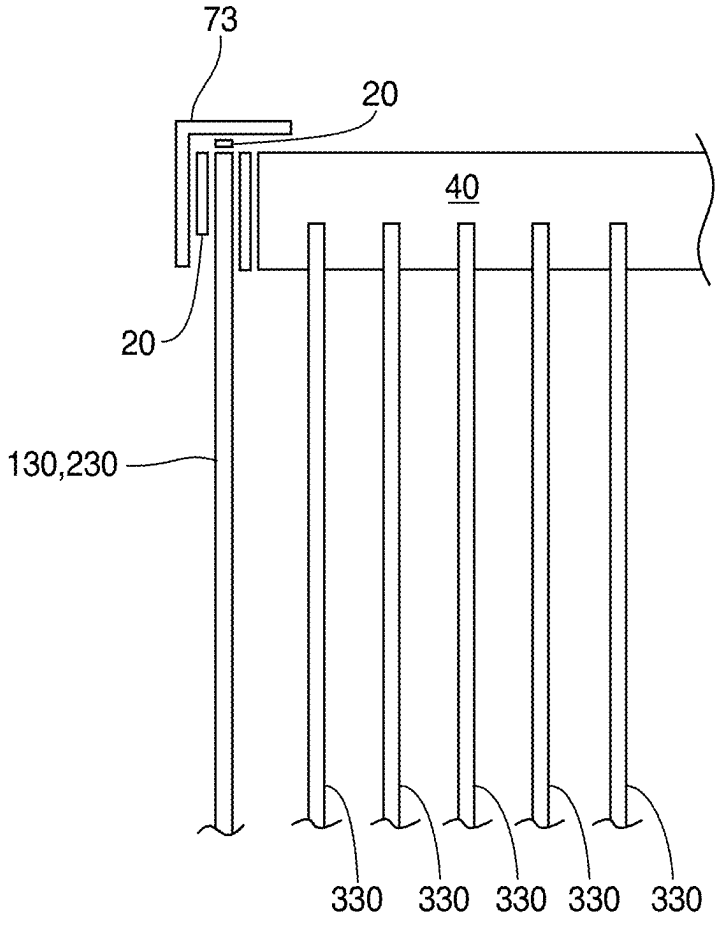

FIG. 12

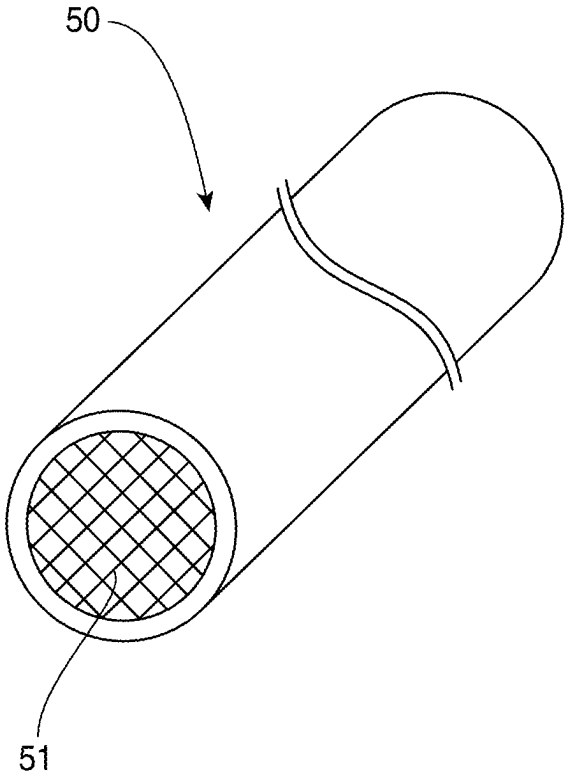

FIG. 13

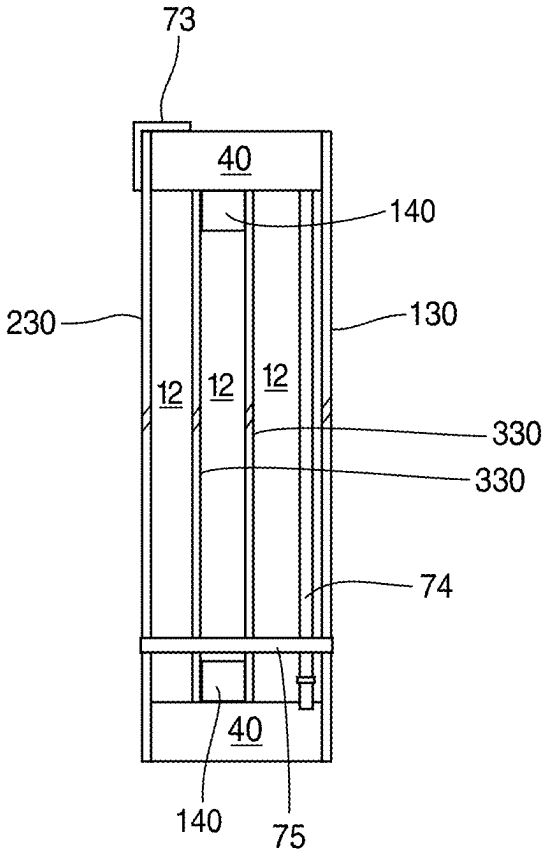

FIG. 14

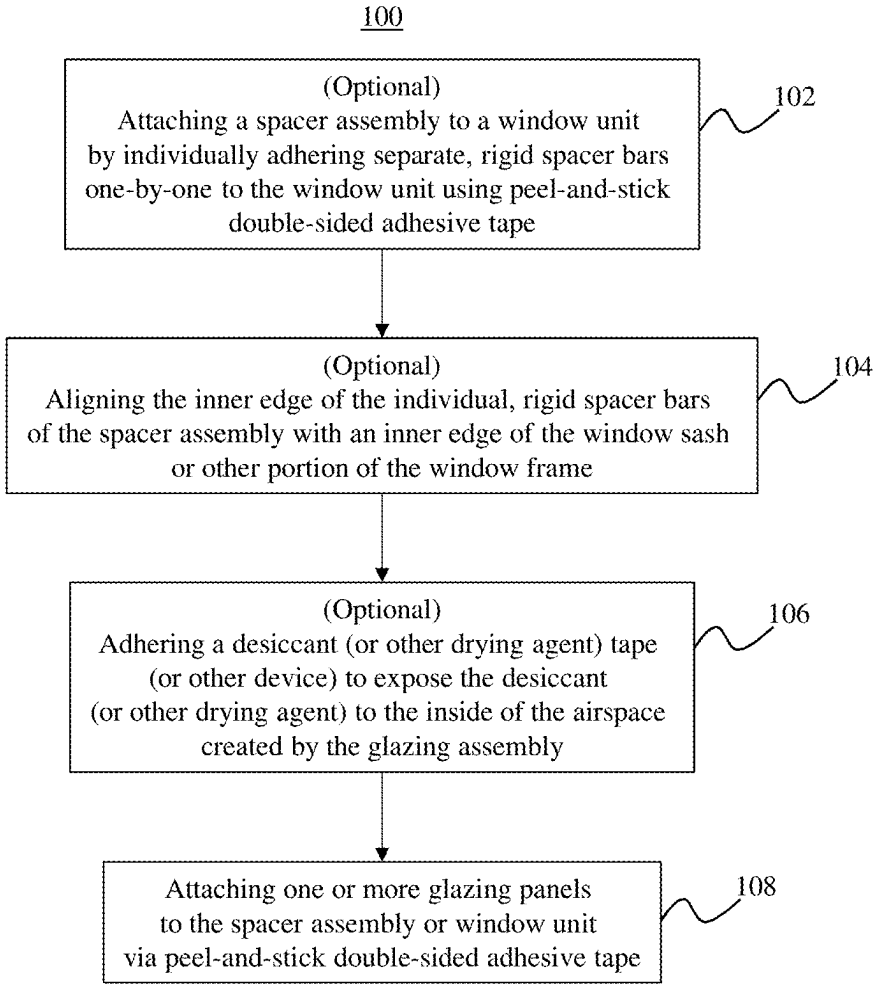
100
(Optional)
Attaching a spacer assembly to a window unit by individually adhering separate, rigid spacer bars one-by-one to the window unit using peel-and-stick double-sided adhesive tape
102
(Optional)
Aligning the inner edge of the individual, rigid spacer bars of the spacer assembly with an inner edge of the window sash or other portion of the window frame
104
(Optional)
Adhering a desiccant (or other drying agent) tape (or other device) to expose the desiccant (or other drying agent) to the inside of the airspace created by the glazing assembly
106
Attaching one or more glazing panels to the spacer assembly or window unit via peel-and-stick double-sided adhesive tape
108

FIG. 15

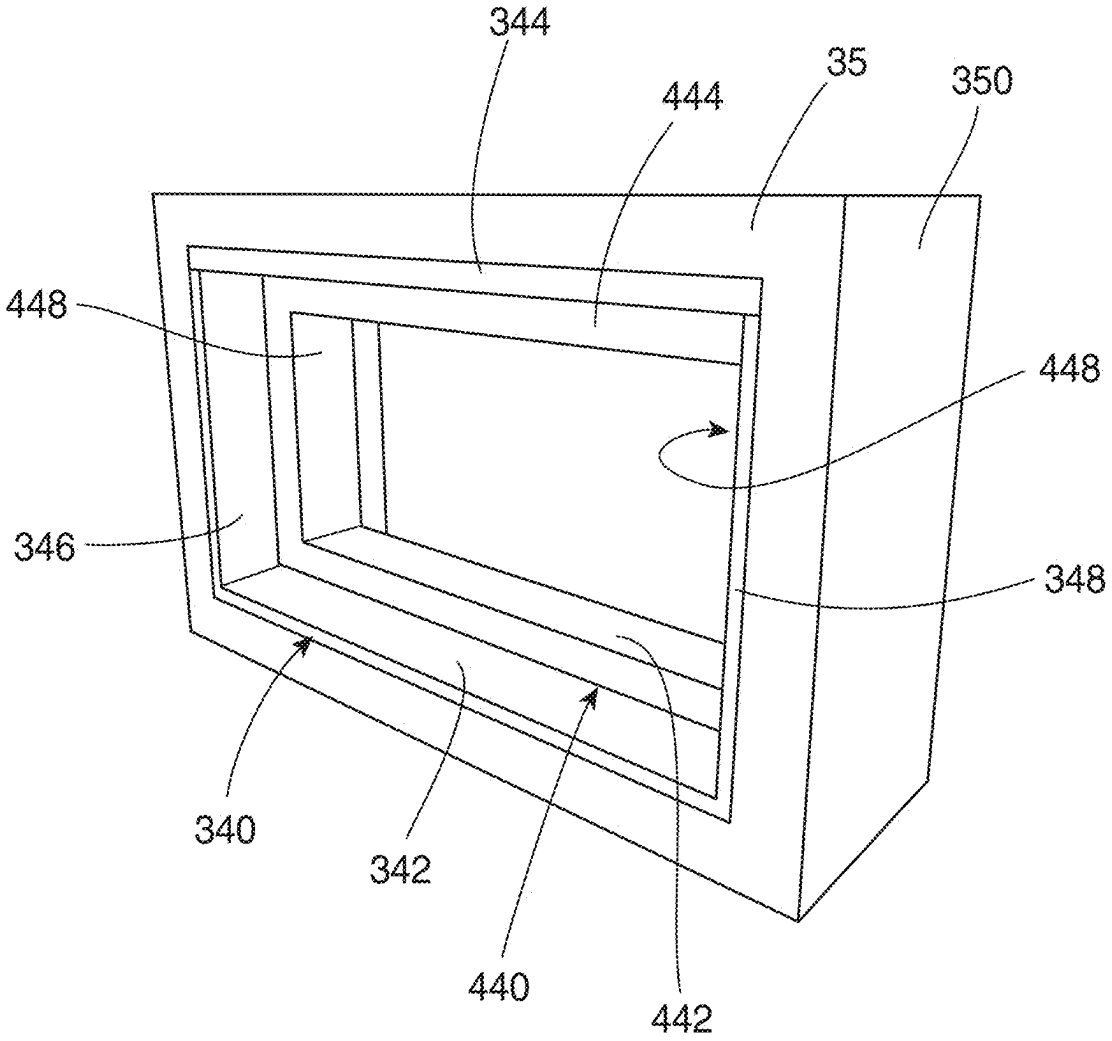

FIG. 16A

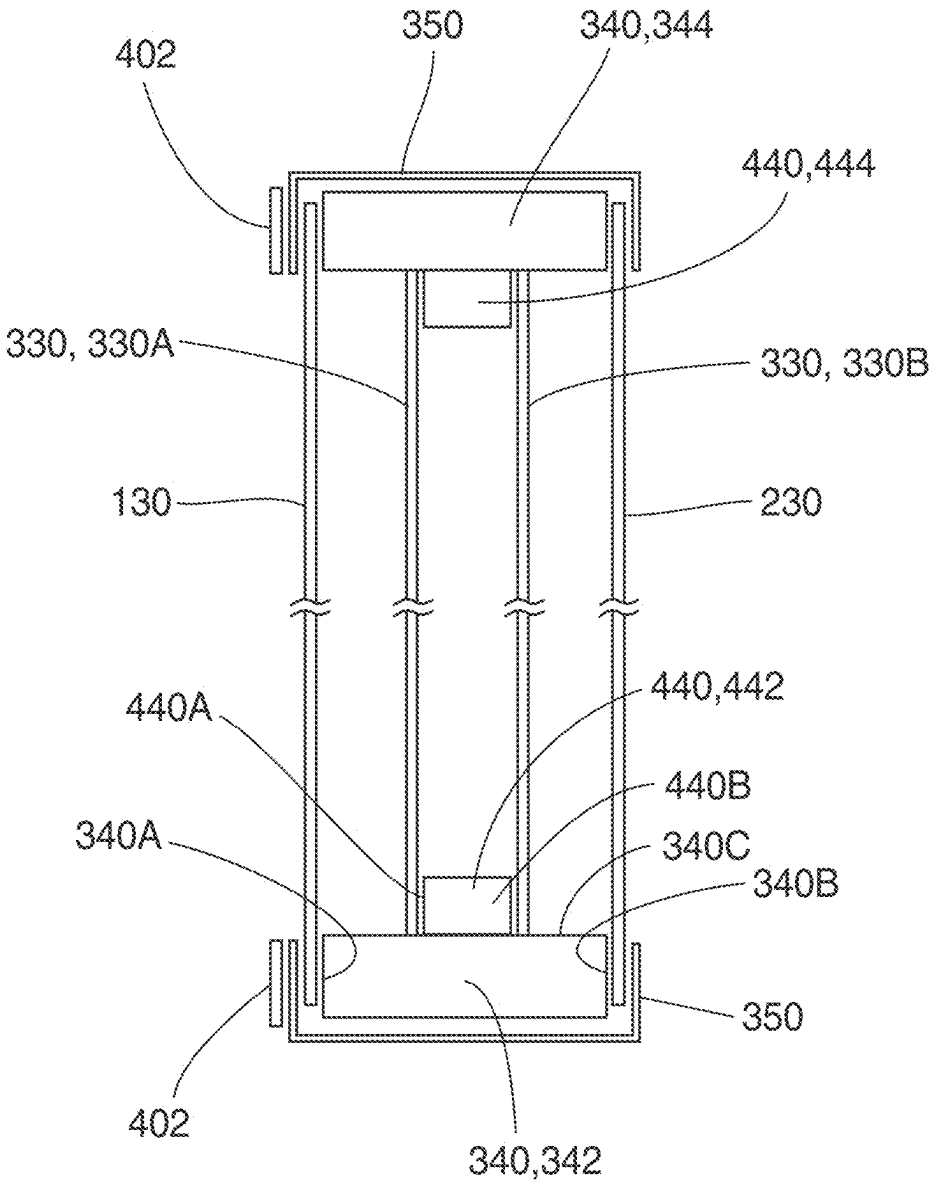
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FIG. 16B

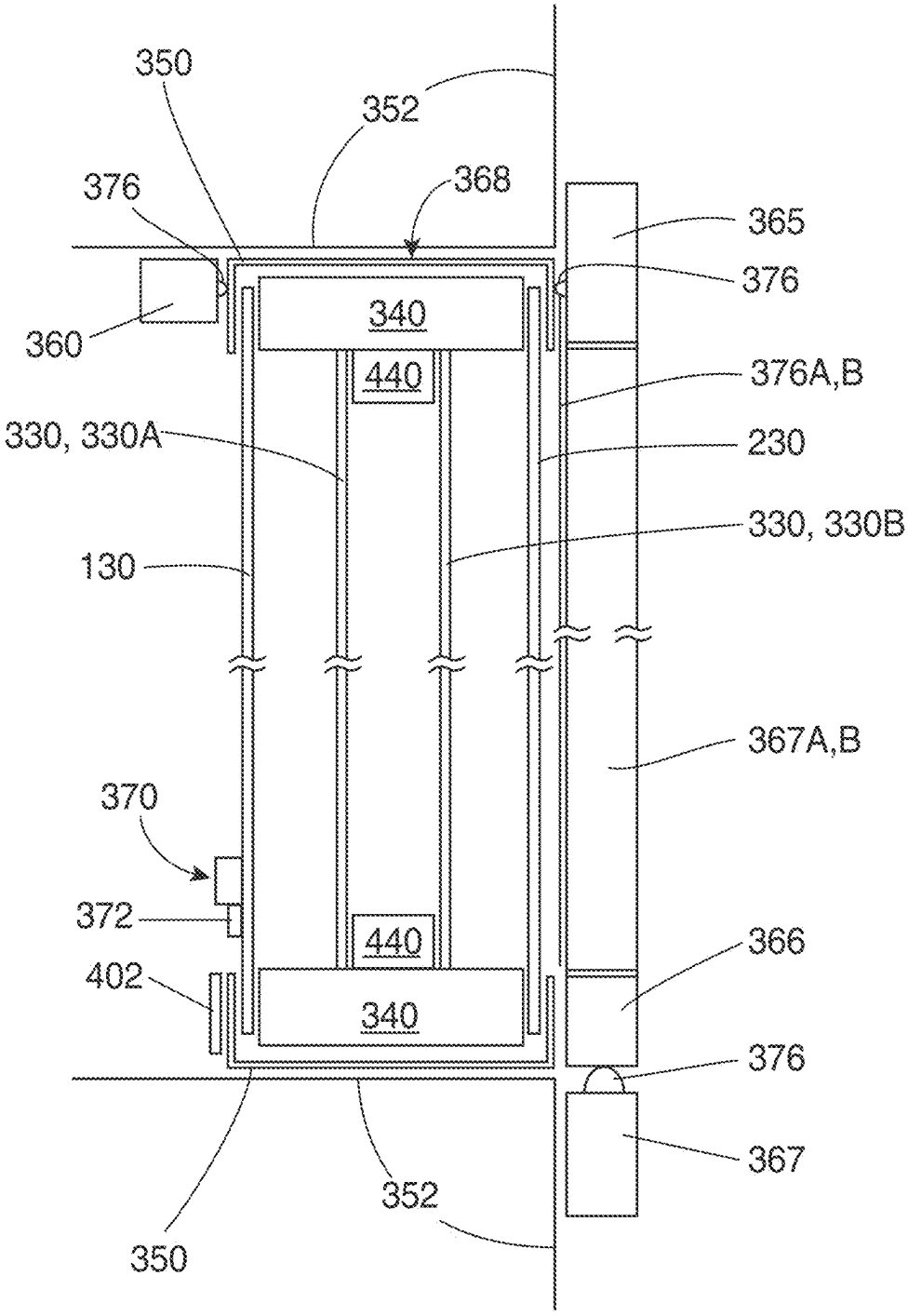
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FIG. 16C

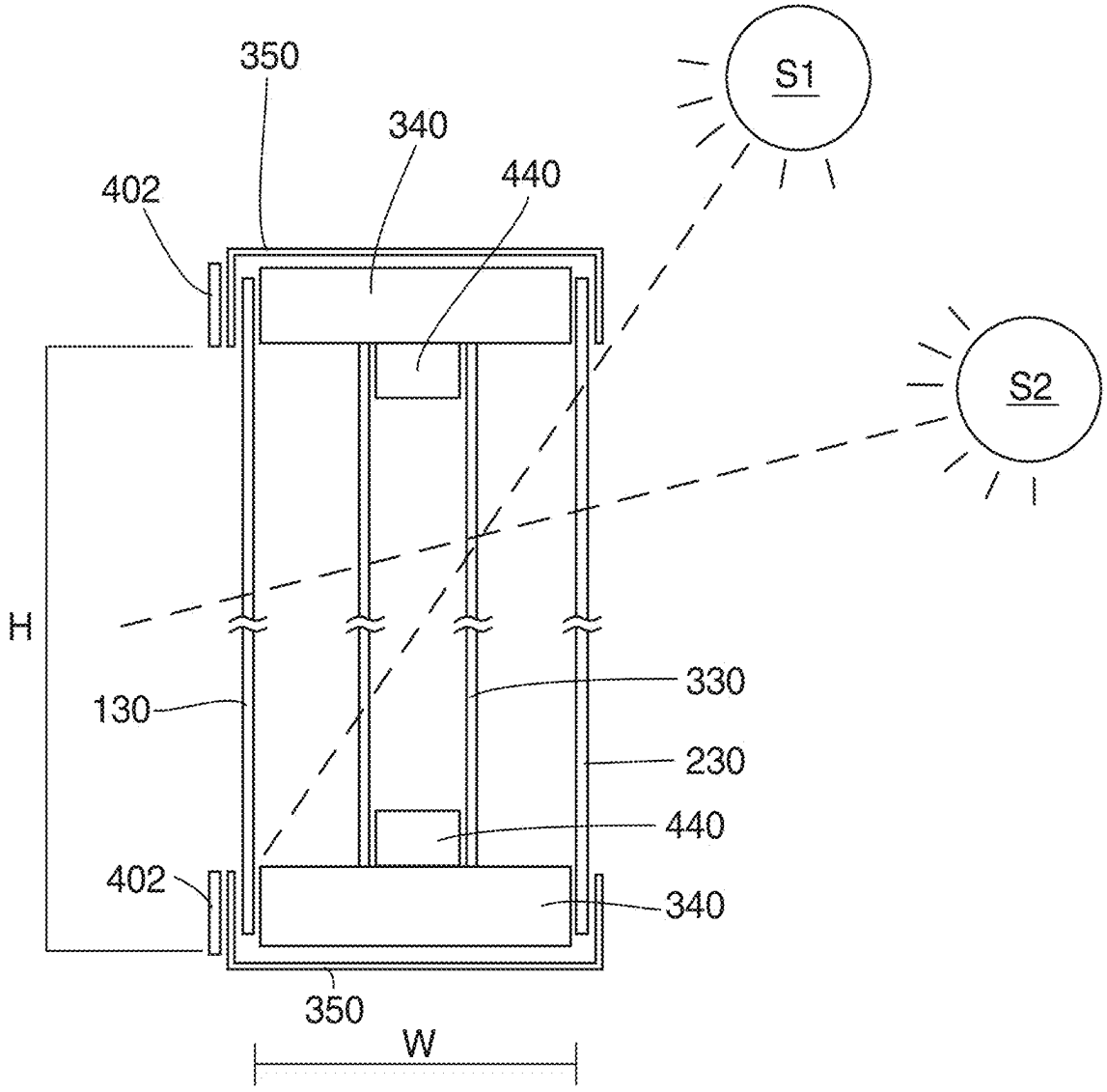

FIG. 16D

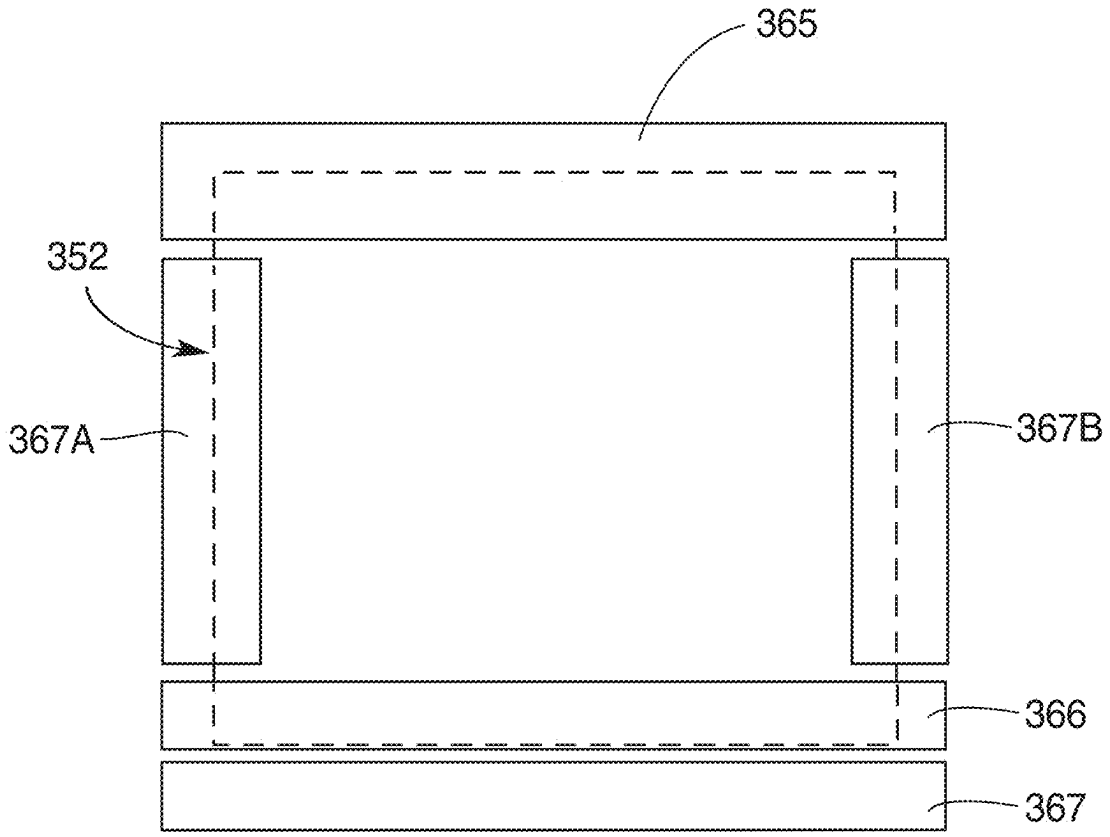

FIG. 16E

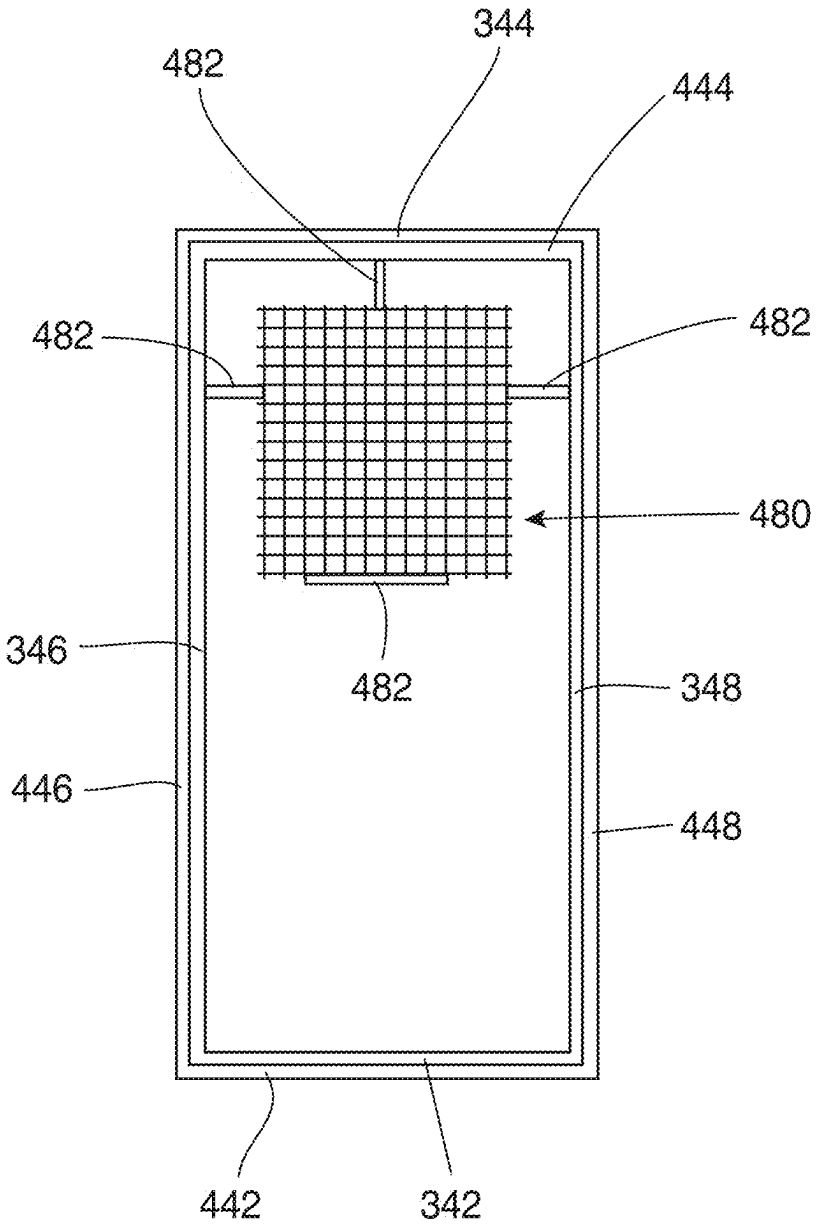

FIG. 17

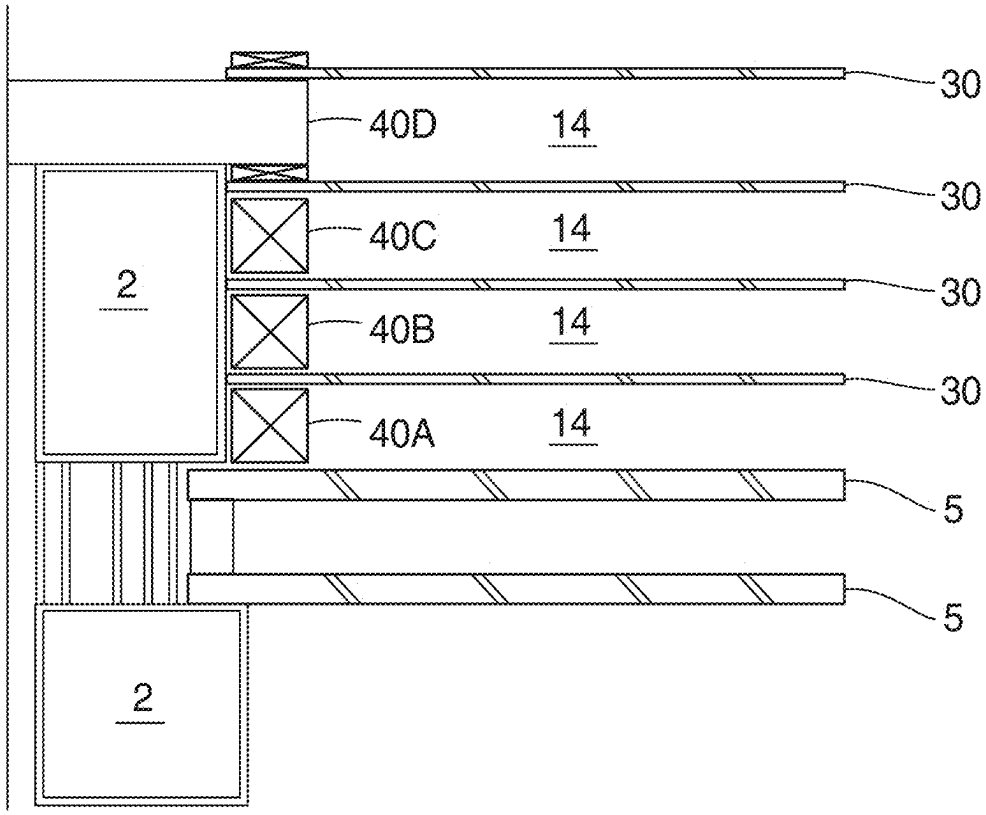

FIG. 18

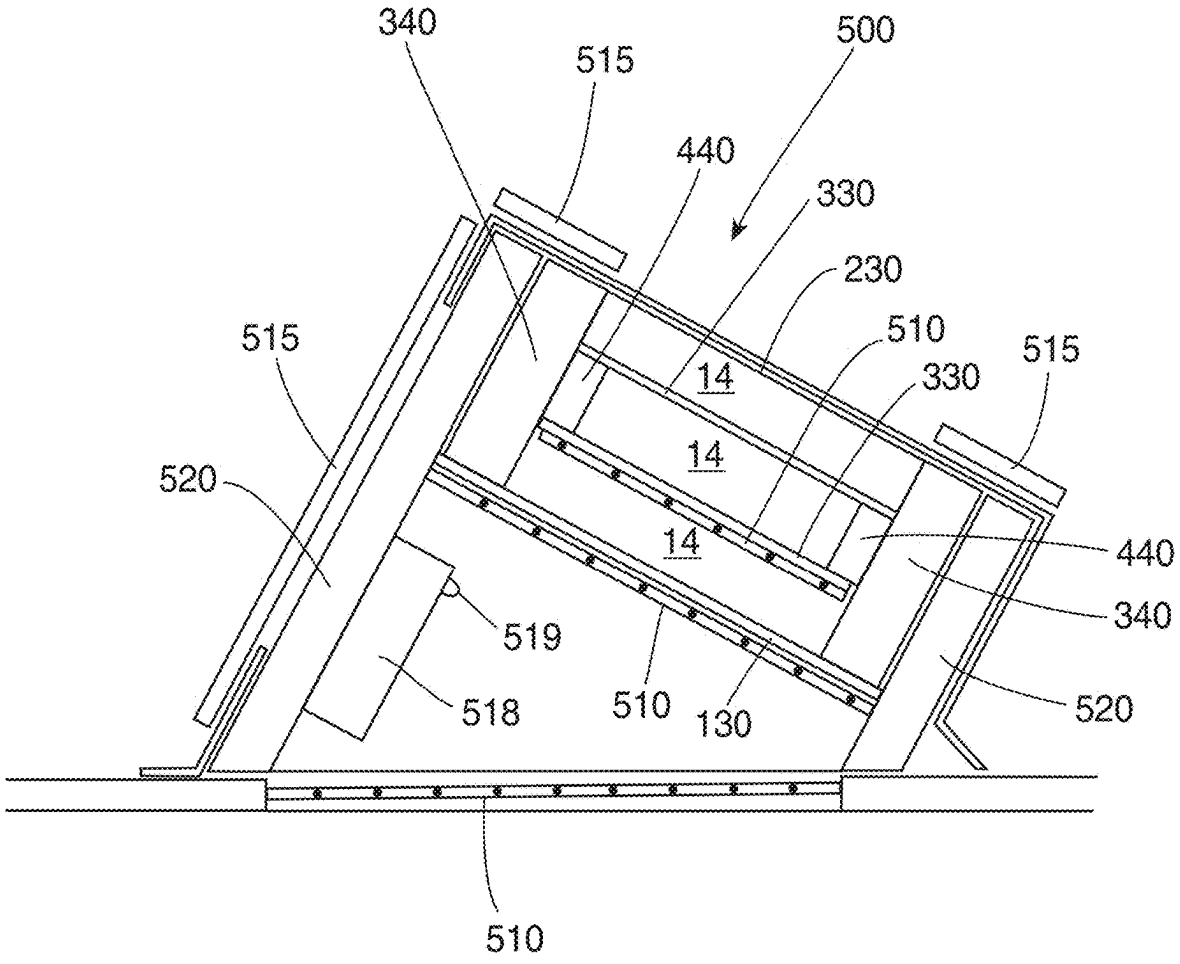
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FIG. 19

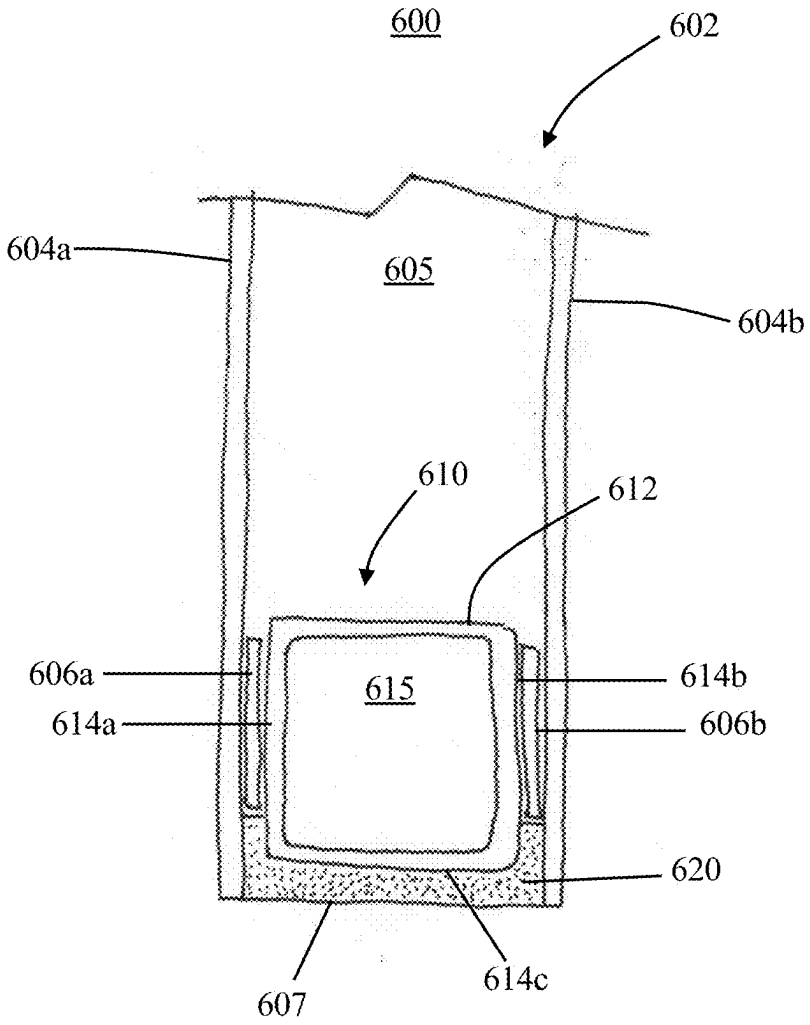
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FIG. 20A

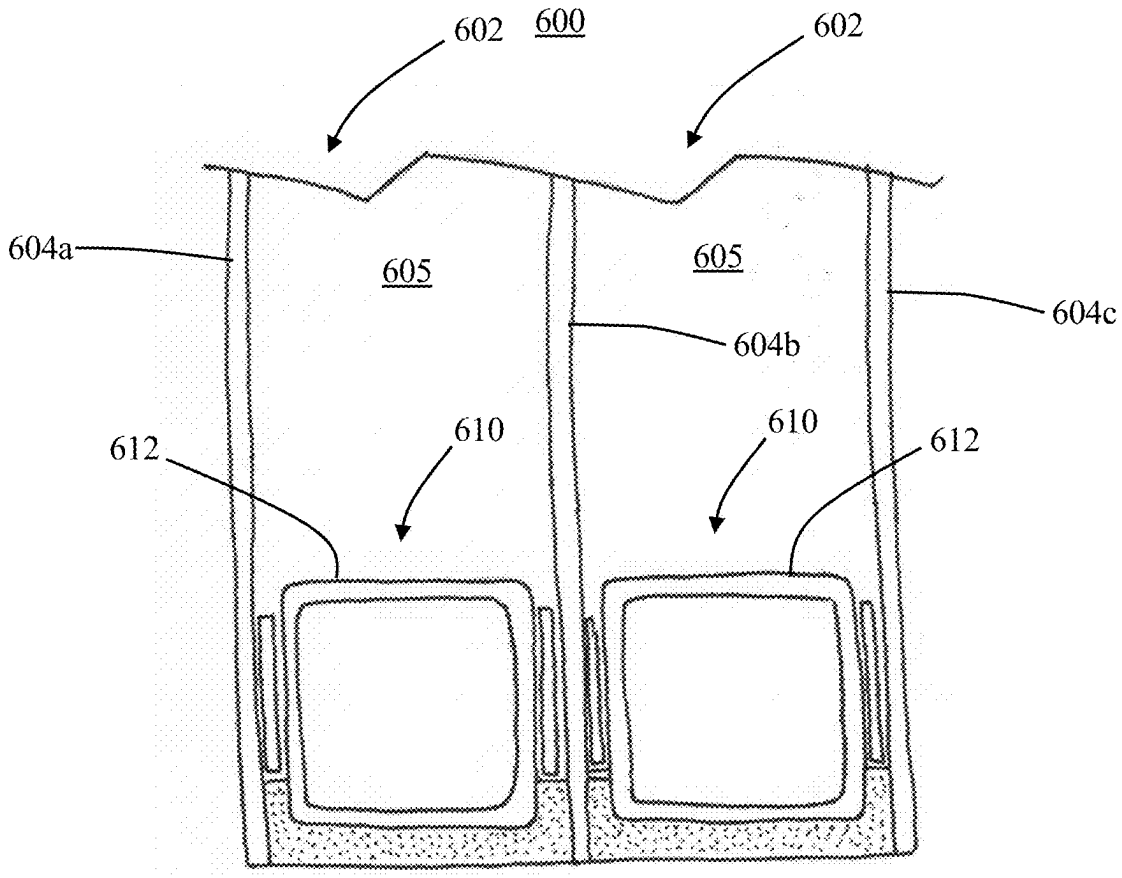

FIG. 20B

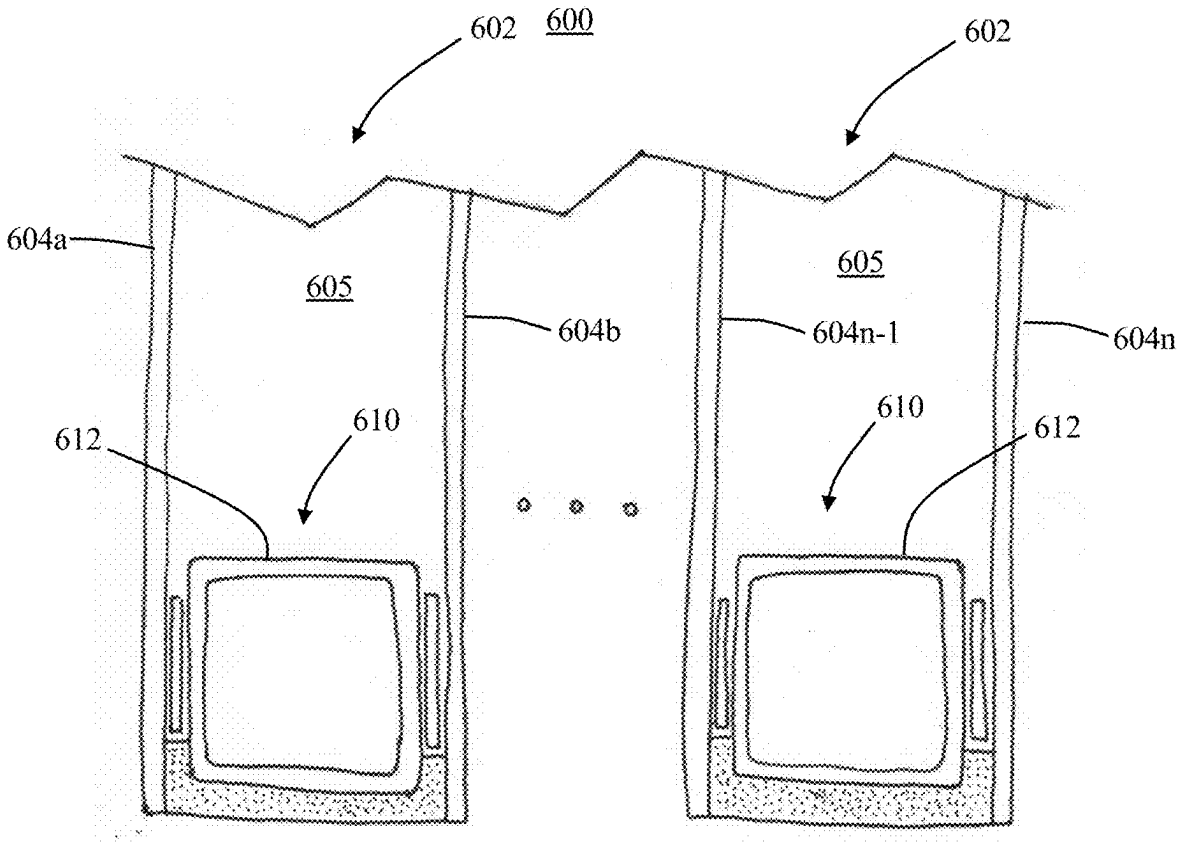

FIG. 20C

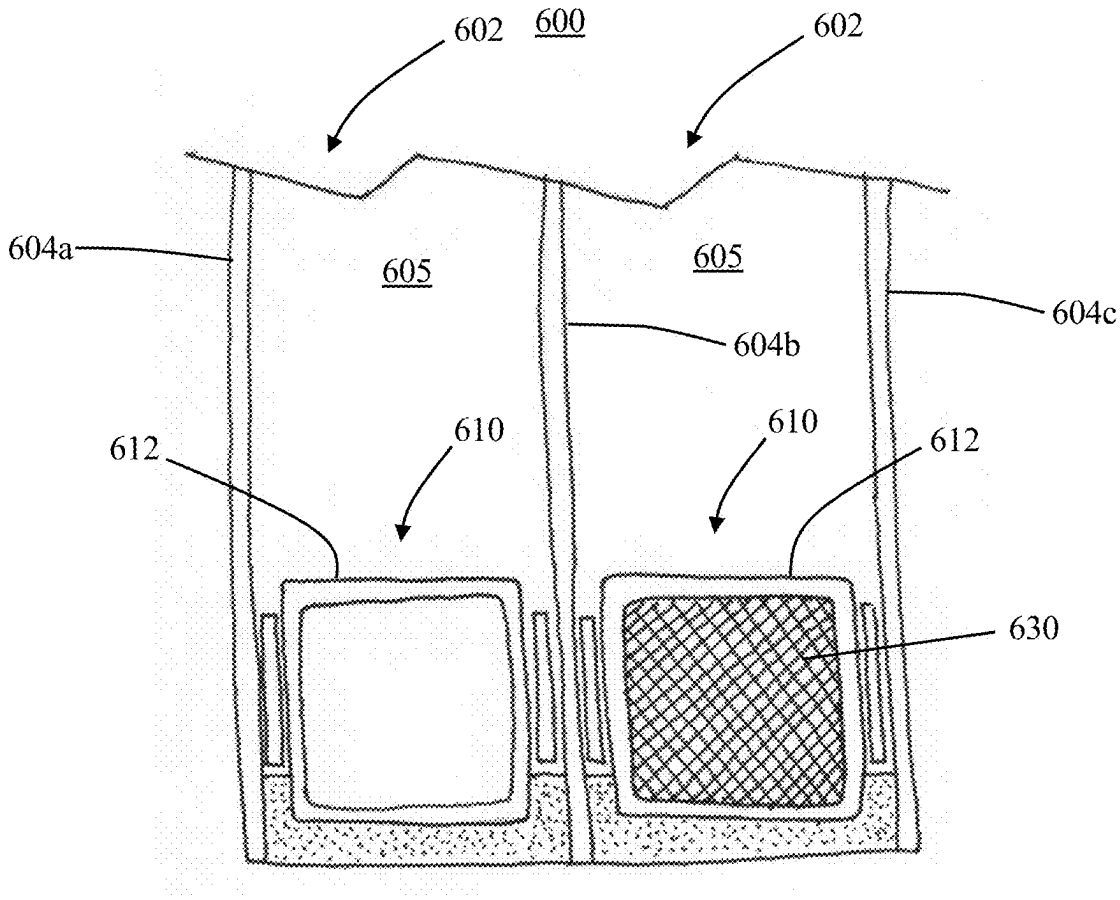

FIG. 21

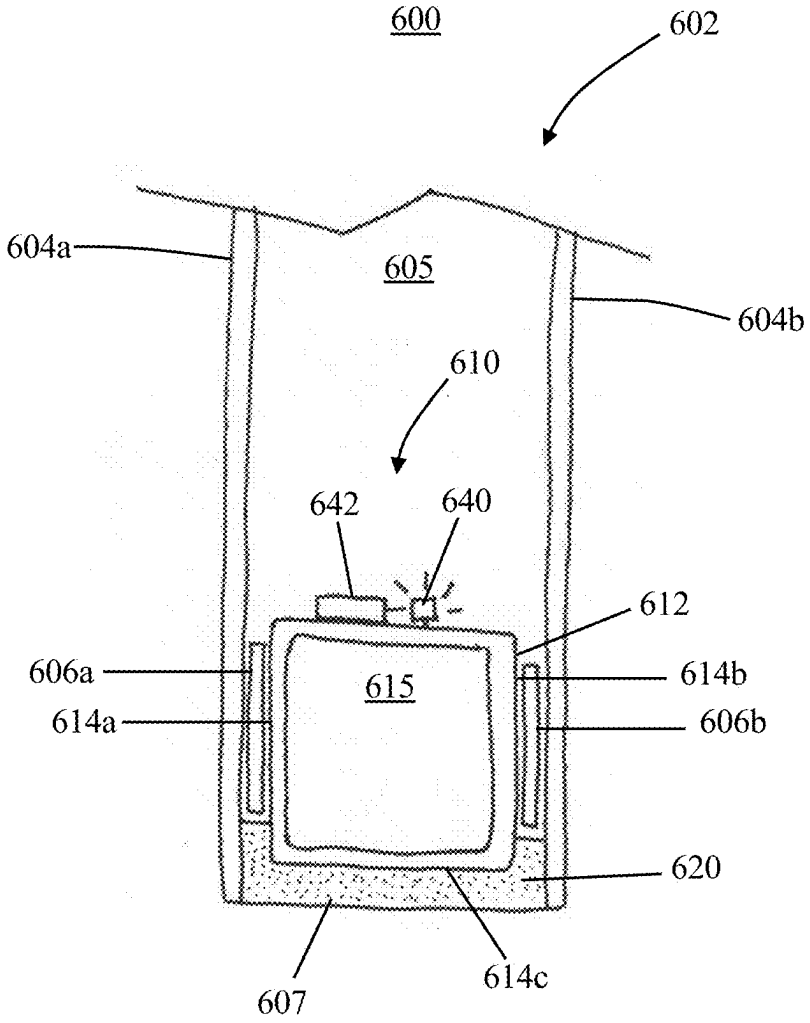
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FIG. 22A

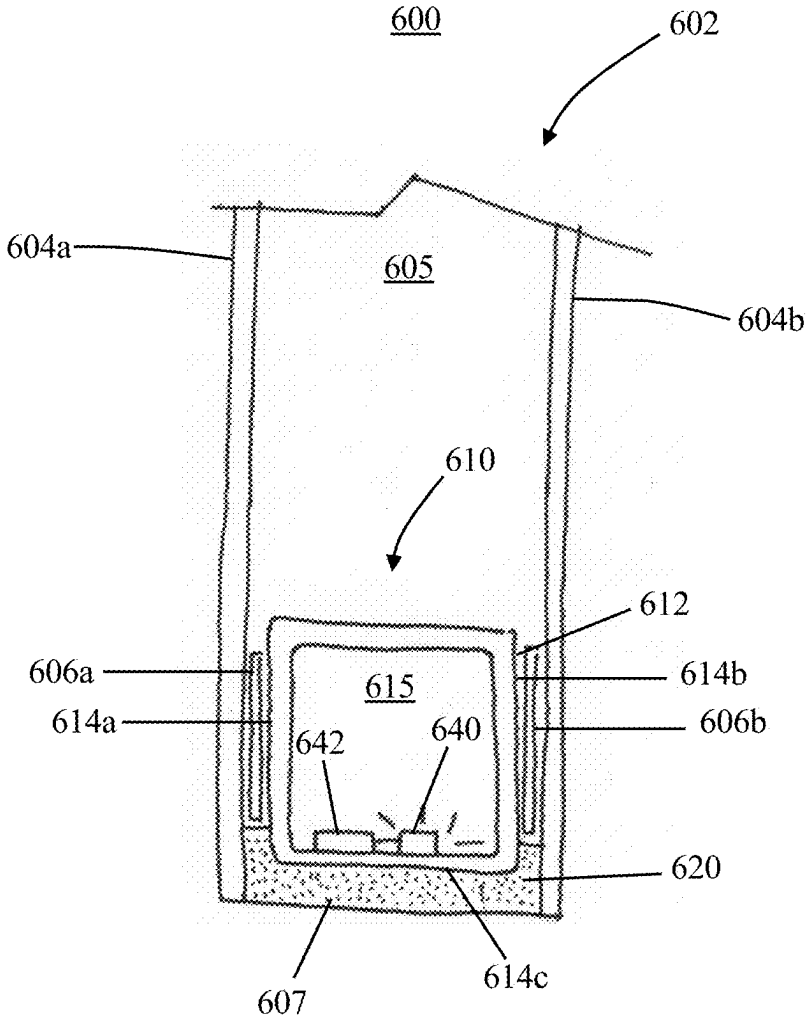
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FIG. 22B

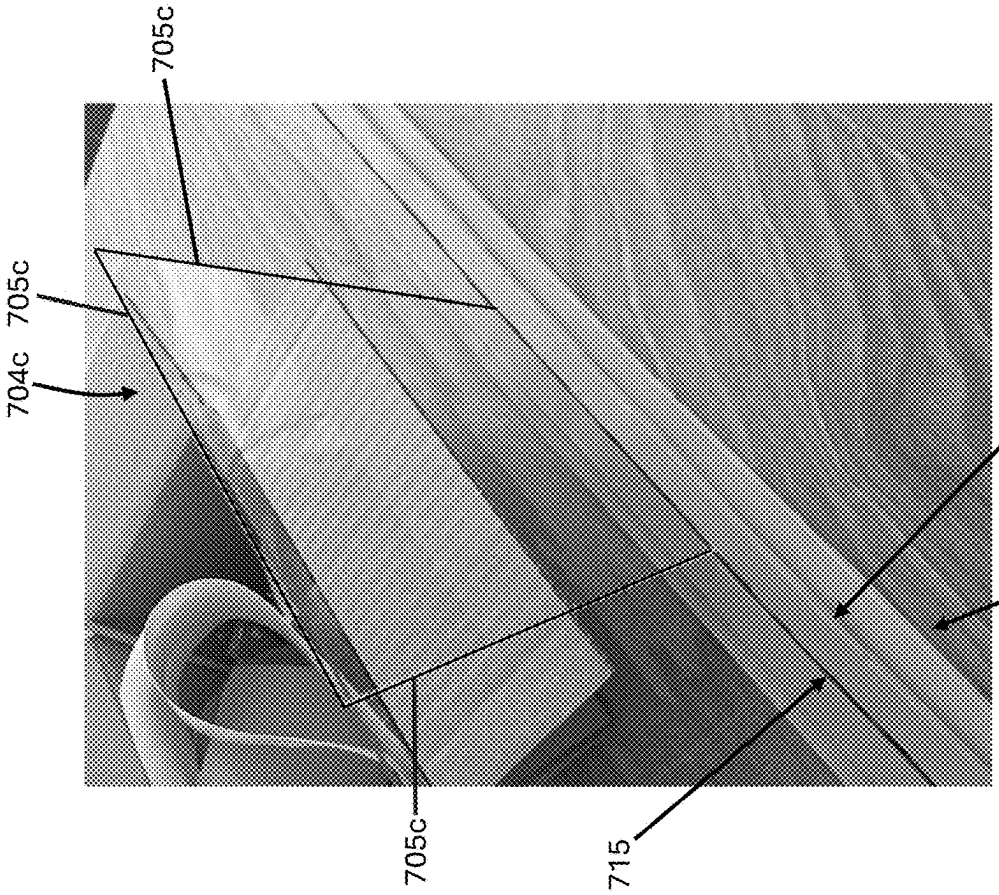

FIG. 23B

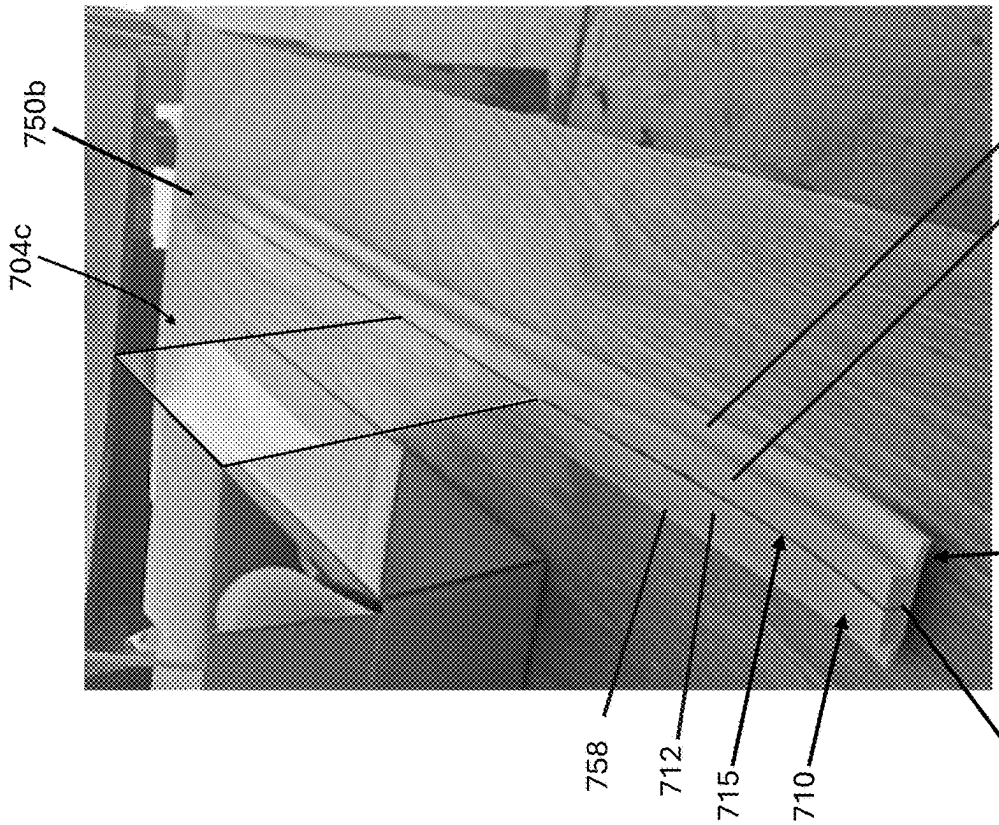

FIG. 23A

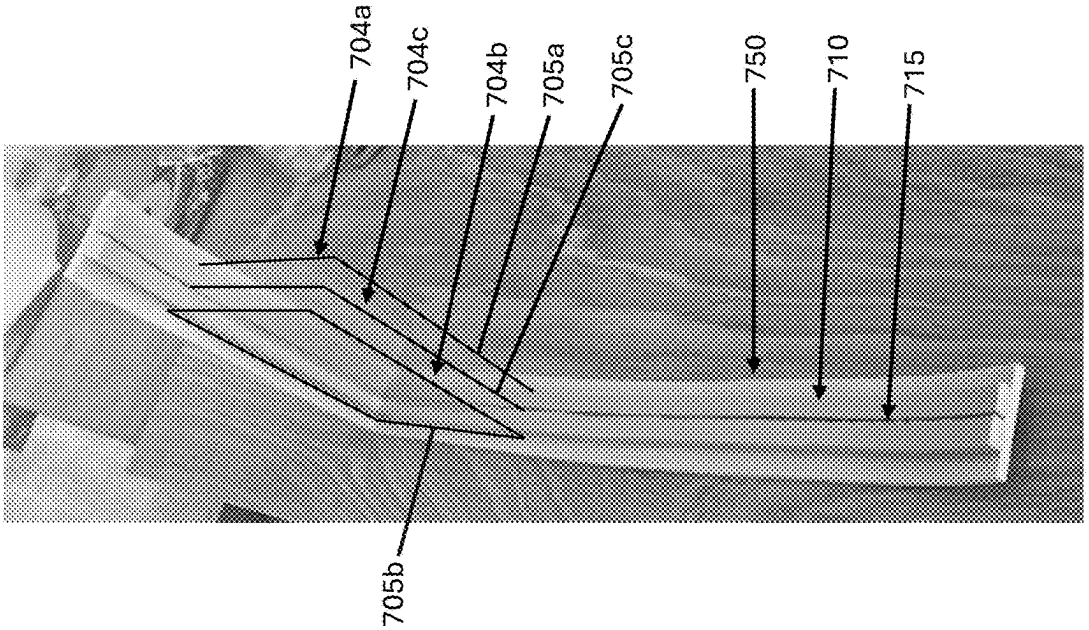

FIG. 23D

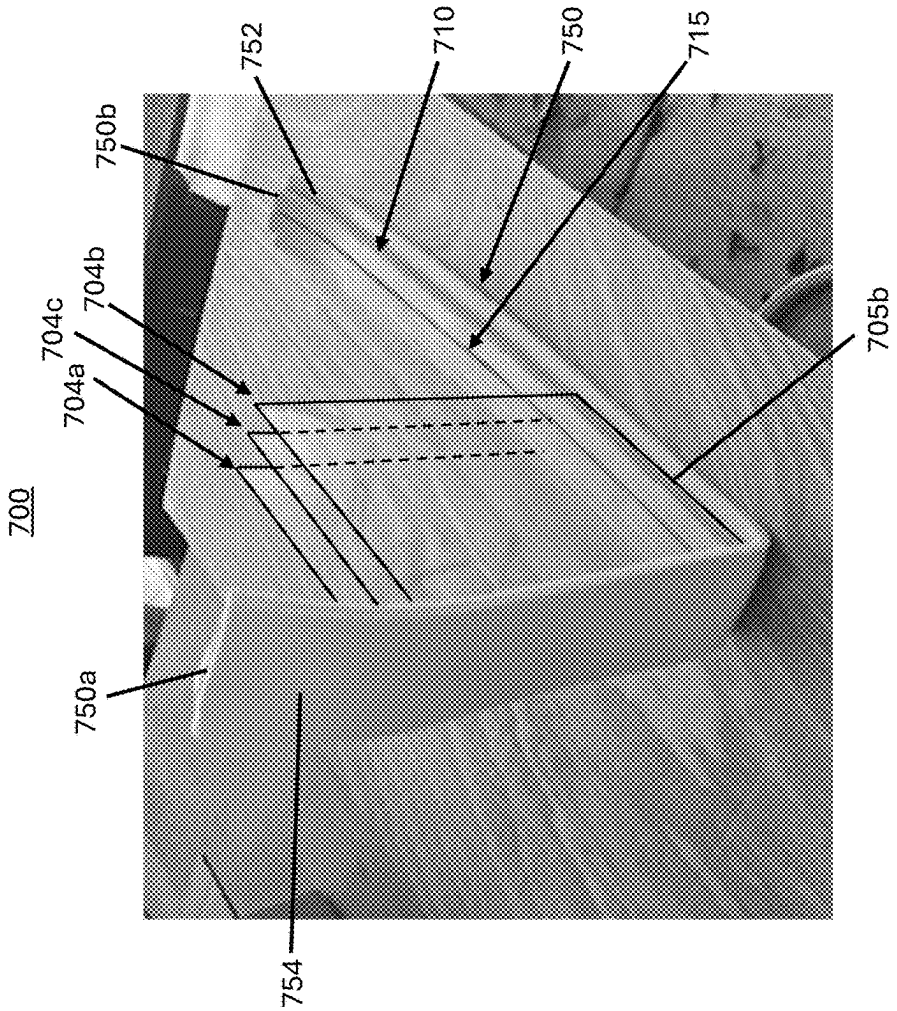

FIG. 23C

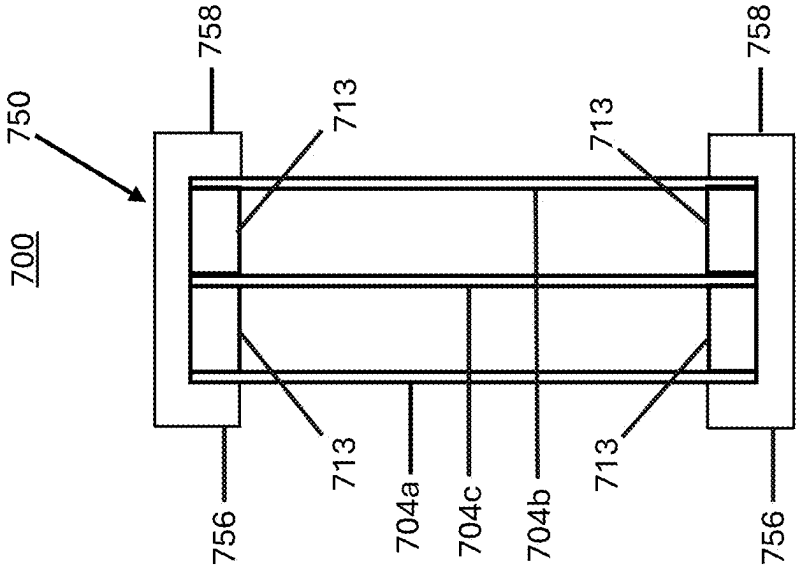

FIG. 24B

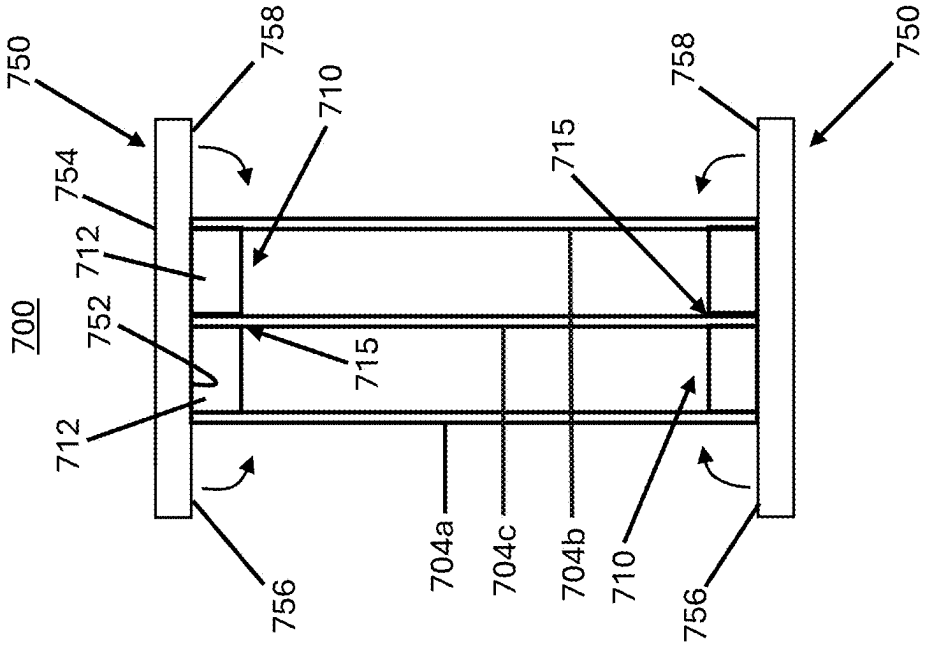

FIG. 24A

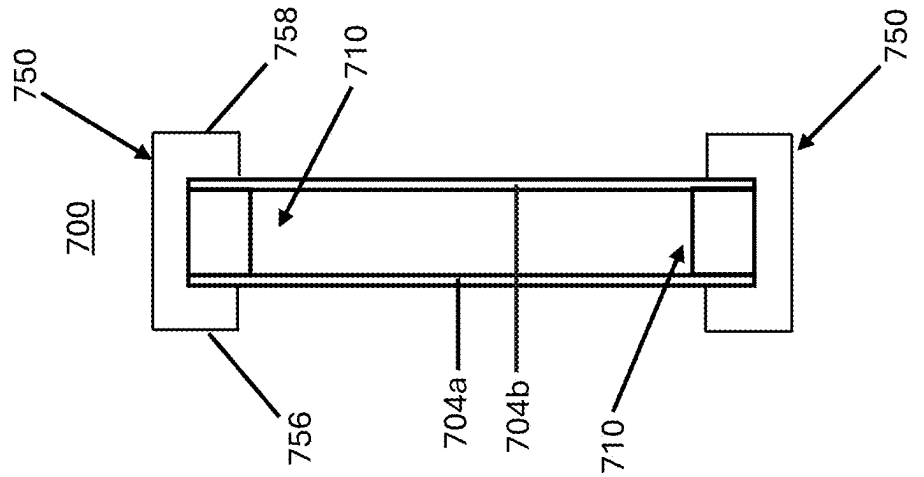

FIG. 25B

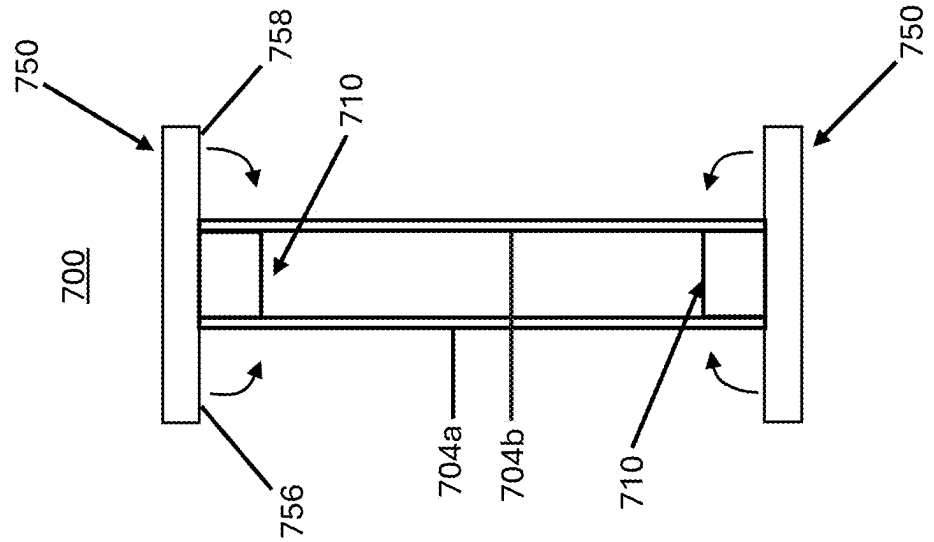

FIG. 25A

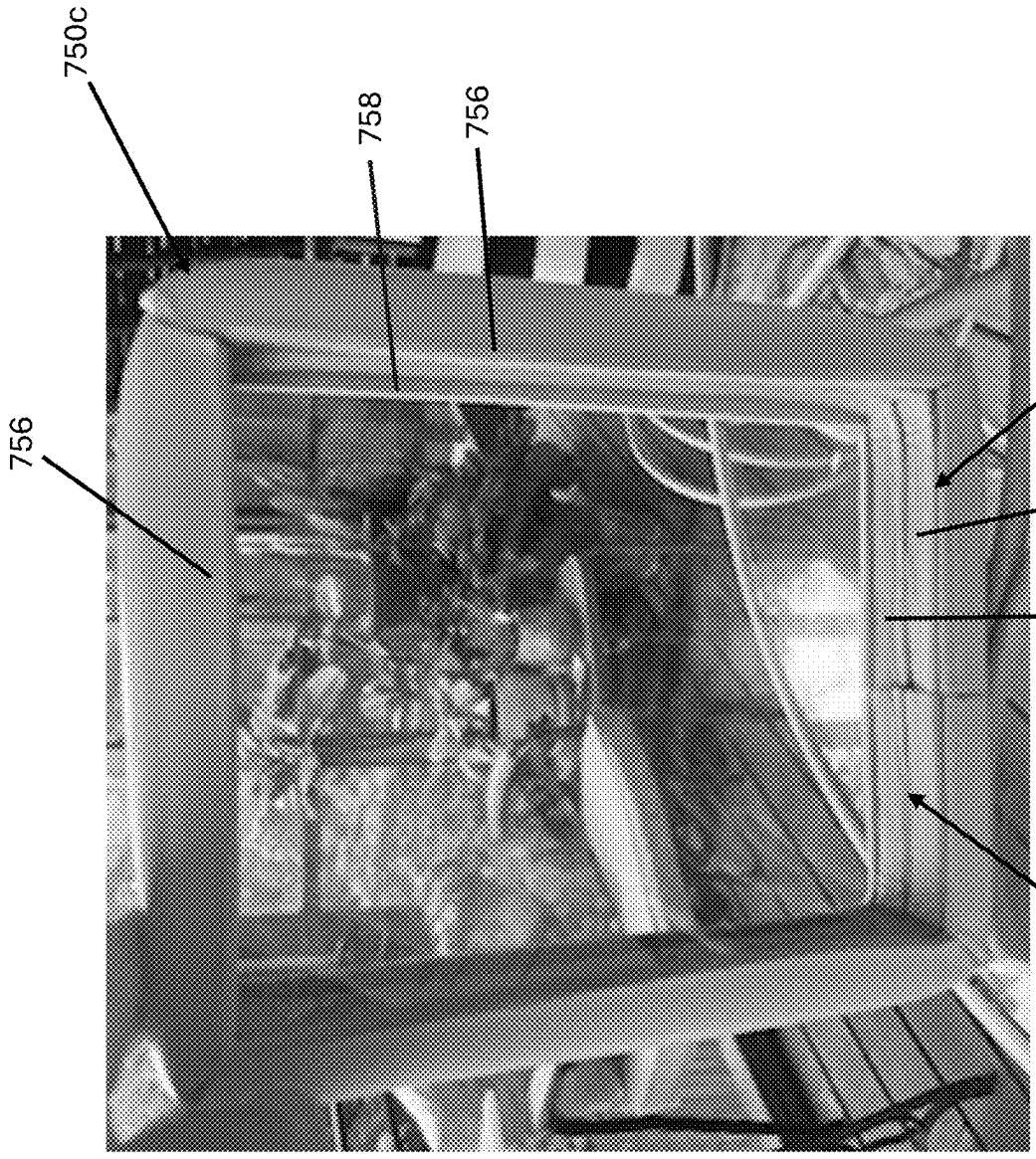

FIG. 26

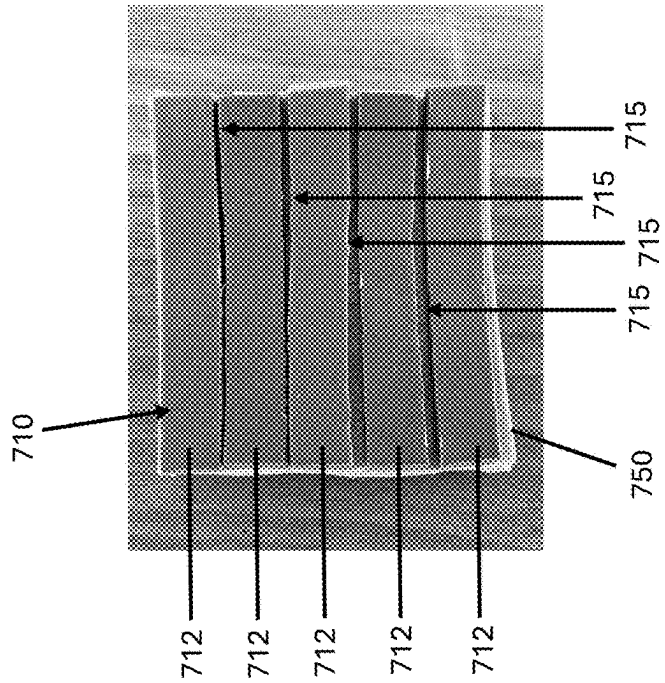

FIG. 27A

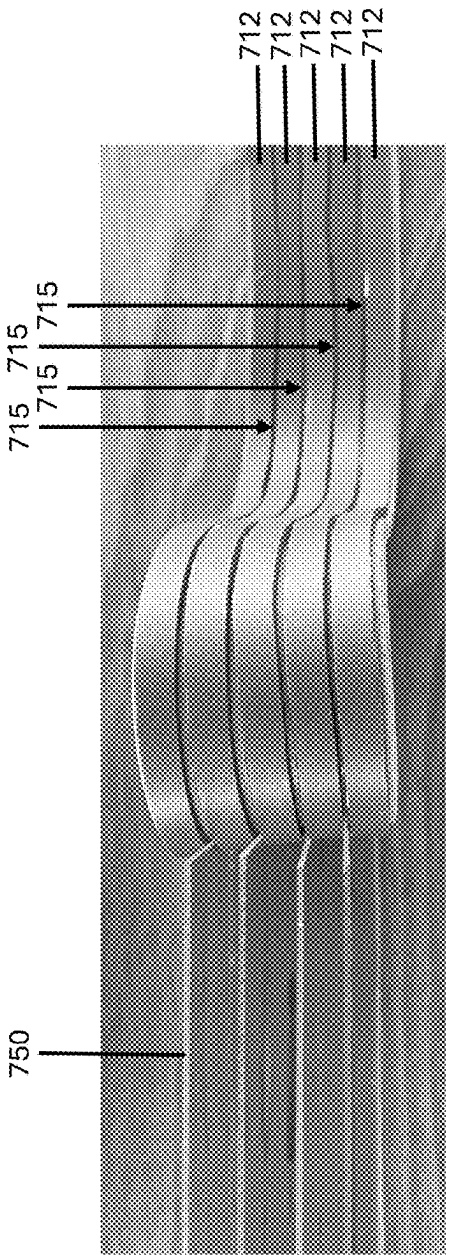

FIG. 27B

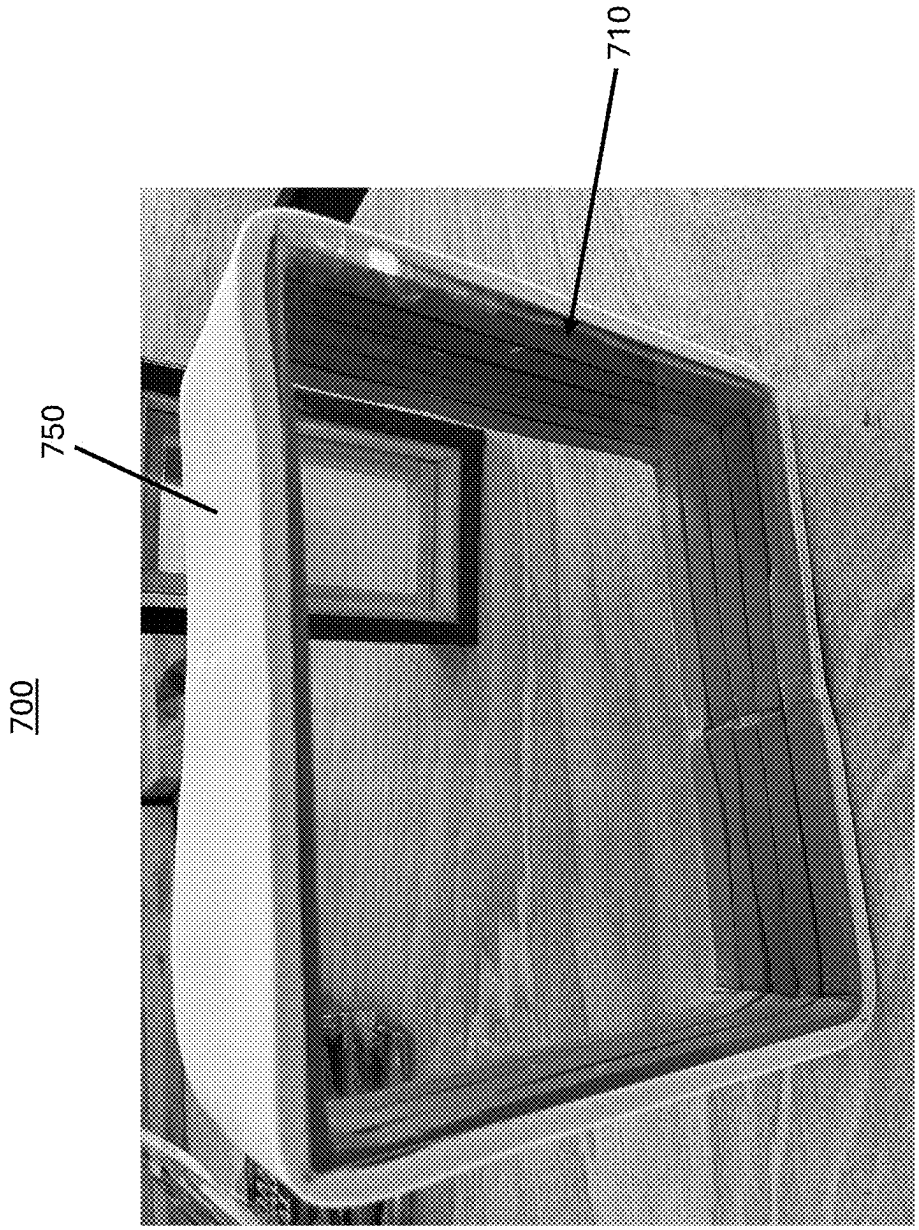

FIG. 27C

MULTI-GLAZED WINDOW ASSEMBLY AND METHOD THEREFOR

CLAIM OF PRIORITY/CROSS REFERENCE TO RELATED APPLICATIONS

[0001] The present application is a Continuation-In-Part (CIP) of U.S. patent application Ser. No. 18/986,626 filed on Dec. 18, 2024, which is a Continuation Patent Application of U.S. patent application Ser. No. 17/849,135 filed on Jun. 24, 2022, which is a Continuation-In-Part (CIP) Patent Application of U.S. patent application Ser. No. 16/735,566 filed on Jan. 6, 2020, which is a Continuation-In-Part (CIP) Patent Application of U.S. patent application Ser. No. 15/418,953 filed on Jan. 30, 2017 (now U.S. Pat. No. 10,526,836).

[0002] The contents of all of the above-referenced, previously-filed patent applications, namely, U.S. patent application Ser. No. 18/986,626 filed on Dec. 18, 2024, U.S. Patent Application No. 17,849,135 filed on Jun. 24, 2022, U.S. patent application Ser. No. 16/735,566 filed on Jan. 6, 2020 and U.S. patent application Ser. No. 15/418,953 filed on Jan. 30, 2017, are incorporated herein in their entirety by reference.

STATEMENT OF GOVERNMENT INTERESTS

[0003] One or more inventions described herein was/were made with Government support under a Phase I, Small Business Innovation Research (SBIR) Award No. 2017-33610-26989 awarded by the United States Department of Agriculture (USDA). The Government may have certain rights in the invention.

FIELD OF THE INVENTION

[0004] The present invention is generally directed to a window glazing assembly and a method of installing a window glazing assembly to either an already-installed window unit or as a new construction window unit. The glazing assembly is adapted to provide one or more insulated airspaces to the window unit, thereby increasing the thermal insulating capabilities of the window. Retrofits offer an easy-to-install, do-it-yourself (DIY) application. New construction or replacement windows of the present invention offer the capacity for double, triple, quadruple or more thermal performance than existing windows.

BACKGROUND OF THE INVENTION

[0005] Many window units, e.g., windows in homes, buildings and/or commercial storefronts, lose or dissipate heat at an astounding rate. For instance, it is estimated that nearly $28 billion in annual energy used is wasted in that it, quite literally, goes out the window. This is true even though many windows, and in particular modern windows include double or multiple panes.

[0006] Adding insulating airspaces to the inside of the window unit or outside of the window unit can help maintain heat or keep heat in (when needed, for example in winter or cold climates) and restrict heat or keep heat out (when needed, for example in warmer or summer climates). While there are some assemblies that can be used to create insulating airspaces on windows, such assemblies are often quite complicated to install or are difficult to ensure a quality, airtight fit. In addition, some of the current solutions interfere with window operability, meaning that once installed, the additional components added to the window unit oftentimes interfere with or even prevent the window from being opened in the intended manner.

[0007] As a consequence, there is a need in the art for a window glazing assembly that is easy to install in retrofit and new construction applications that can provide a simple way to convert a single or multiple glazed window unit into a further glazed window unit, providing additional window glazing layers and insulating airspaces. It would also be beneficial if the window unit would maintain its original operability, i.e., opening and closing of the window unit is not impeded or substantially impeded by the glazing assembly.

[0008] Further advantages of the proposed glazing assembly include a simple DIY installation. High and affordable performance is desirable, for example, providing insulation with an R-value in the range of R-6 to R-14 or better. In this manner, the R-value of a window unit with the proposed glazing assembly installed may be better than some opaque walls.

SUMMARY OF THE INVENTION

[0009] The present invention of at least one embodiment is generally directed to a window glazing assembly that can convert an existing or already-installed window to a multi-pane or multi-glazed window unit, providing enhanced insulation capabilities. Other embodiments may include a multi-glazed window assembly for use in new construction or replacement windows.

[0010] In particular, the glazing assembly and/or multi-glazed window assembly of at least one embodiment may include an attachment assembly and one or more glazing panels or layers. The attachment assembly may be in the form of a peel-and-stick double sided tape that allows easy attachment of the glazing panel(s) or layer(s) to a selected portion of the window unit, including, but not limited to the window sash or glass window pane, itself. Some embodiments further include a spacer assembly comprising a plurality of spacer bars that may be individually or separately installed, e.g., one by one, around the perimeter of the window (again, to the window sash or glass window pane, itself). The added glazing layer(s) can then be secured or adhered to the spacer assembly, for example, around the perimeter of the glazing layer(s). Some embodiments may include additional or intermediate glazing layers, providing additional insulating airspaces and enhanced performance.

[0011] Typical existing single pane wood sashes often have a depth of about 0.5 inches to 1 inch between the sash face and the glass window pane. Applying a clear, double-sided tape or other attachment assembly to the perimeter of the window sash, and then a clear acrylic glazing layer to the tape creates an insulating airspace which can cut single pane thermal loss and gain in half.

[0012] Desiccant faced tape or other like drying agents or substances can be exposed to the inside of the created or insulated airspace in order to control condensation, fogging and/or moisture therein. An additional insulating airspace can be created using a spacer assembly (e.g., ⅝×⅝ PVC trim) that can be supplied cut-to-measure for easy peel-and-stick application around the perimeter of the sash, glass or other portion(s) of the window unit. The glazing layer can then be applied to the spacer assembly to create the insulating airspace. It should be noted that the glazing layer(s) can include a sheet of transparent or translucent acrylic, although other embodiments may use other materials, such

as glass, etc. As provided herein, the glazing layer(s) can be tinted, e.g., with a window tint film, to provide additional heat resistance or shielding. In further embodiments, the glazing layer(s) may be hurricane wind/impact resistant in order to meet certain building code and other requirements and regulations.

[0013] It should also be noted that the present invention may also be applied to new construction or replacement window units.

[0014] Furthermore, a thick or wide spacer assembly (e.g., ⅝ inch×1.5 inch PVC trim) may be used or attached to inner or outer glazing layers with one or more intermediate glazing layers within the same spacer assembly or frame. This creates further insulating airspaces (e.g. three) when two glazing layers are spaced 0.5 inches apart. When applied to a window unit, the multi-glazing assembly creates even more enhanced insulating capabilities (e.g., with an R-value of R-5 or better).

[0015] In new construction, the inner and outer glazing layers or panels may act as structural diaphragms between the spacer assembly to create a stress-skin panel capable of resisting structural loads. The load-bearing capacity is aided by the additional structural diaphragm created by the intermediate glazing layers through their attachment to the perimeter of the spacer assembly, which effectively acts as both the sash and frame for the window unit. These multi-layered clear-skinned structural diaphragms avoid the use of headers and potentially carry floor or roof loads without added structure. The diaphragms further add to structural lateral resistance as a sheer panel when connected to other structural elements.

[0016] Other embodiments of the present invention include an elongated outer wrapping to which a perimeter spacer assembly is attached. The perimeter spacer assembly defines one or more longitudinal channels within which one or more corresponding intermediate glazing layers are disposed. Outer glazing layers can mount to outer-facing surfaces of the perimeter spacer assembly. The outer wrapping, which in many cases is a single-piece or continuous wrap, is then encircled, wrapped or otherwise belted around the entire perimeter of the glazing layers, creating an insulated multi-glazed window assembly that can be mounted or installed within a window opening of a building. With the continuous outer wrapping fully wrapped around the outer perimeter of the glazing layers, there is only one seam that needs to be joined and/or sealed—the seam formed by the opposing ends of the outer wrapping. This, in essence, minimizes the potential points of seal failure that are common or existent in other window assemblies. For example, a wrapped and edge-sealed window assembly, as disclosed in accordance with at least one embodiment, can replace several (e.g., twenty or more) separate pieces of individually cut, cleaned and secured frames in an R7 fixed window.

[0017] These and other objects, features and advantages of the present invention will become more apparent when the drawings as well as the detailed description are taken into consideration.

BRIEF DESCRIPTION OF DRAWINGS

[0018] FIG. **1** is an elevation view of the inside of an exemplary window unit.

[0019] FIG. **2** is a partial cut-away and exploded view of the glazing assembly as disclosed in accordance with at least one embodiment of the present invention.

[0020] FIG. **3** is an elevation view of a window unit with the glazing assembly of at least one embodiment installed thereon.

[0021] FIG. **4** is a side cut-away view of a window unit with the glazing assembly of at least one embodiment installed on one side thereof.

[0022] FIG. **5** is an exploded view illustrating the spacer assembly and glazing panel as disclosed in accordance with yet another embodiment of the present invention.

[0023] FIG. **6** is a perspective, exploded view of the glazing assembly as disclosed in accordance with at least one embodiment herein.

[0024] FIG. **7** is a side cut-away view of a window unit with the glazing assembly of one embodiment installed on one side thereof.

[0025] FIG. **8** is a plan view of a storefront window with the glazing assembly of at least one embodiment installed thereon and illustrated in a partially exploded fashion.

[0026] FIG. **9** is a side, sectional and at least partially exploded view of the multi-glazed window assembly as disclosed in accordance with at least one embodiment of the present invention.

[0027] FIG. **10** is a side, sectional and at least partially exploded view of the multi-glazed window assembly as disclosed in accordance with another embodiment of the present invention.

[0028] FIG. **11** is a side, sectional, cut-away and at least partially exploded view of the multi-glazed window assembly as disclosed in accordance with another embodiment of the present invention.

[0029] FIG. **12** is a side, sectional, cut-away and at least partially exploded view of the multi-glazed window assembly as disclosed in accordance with yet another embodiment of the present invention.

[0030] FIG. **13** is a perspective end view of a desiccant-filled conduit as disclosed in accordance with at least one embodiment of the present invention.

[0031] FIG. **14** is a side, sectional and at least partially exploded view of the multi-glazed window assembly as disclosed in accordance with another embodiment of the present invention.

[0032] FIG. **15** is a high level flow chart illustrating the method as disclosed in accordance with at least one embodiment of the present invention.

[0033] FIG. **16**A is a perspective view of the window assembly as disclosed in accordance with at least one embodiment of the present invention.

[0034] FIG. **16**B is a cut-away partially exploded view of the window assembly illustrated in FIG. **16**A.

[0035] FIG. **16**C is a cut-away, partially exploded view of the window assembly illustrated in FIG. **16**A and installed within a window opening as a lift-out egress window unit.

[0036] FIG. **16**D is a cut-away, partially exploded view of the window assembly illustrated in FIG. **16**A showing exemplary summer and winter sun rays.

[0037] FIG. **16**E is an exterior to interior view of the window opening showing the second stop and external framing structures as disclosed in accordance with at least one embodiment of the present invention.

[0038] FIG. **17** is a plan view of yet another embodiment of the window assembly of the present invention with at least one diffusion grid installed therein.

[0039] FIG. **18** is a partial cut-away view of a retrofit application of the window assembly as disclosed in accordance with at least one embodiment of the present invention.

[0040] FIG. **19** is a cut-away view of a window or sunlight assembly as disclosed in accordance with at least one embodiment of the present invention.

[0041] FIG. **20**A is a sectional cut-away view of yet another embodiment of the multi-glazed window assembly as disclosed in accordance with at least one embodiment showing two glazing layers, one spacer assembly and one insulating airspace.

[0042] FIG. **20**B is a sectional cut-away view of another embodiment of the multi-glazed window assembly as disclosed in accordance with at least one embodiment showing three glazing layers, two spacer assemblies and two insulating airspaces.

[0043] FIG. **20**C is a sectional cut-away and exploded view of another embodiment of the multi-glazed window assembly as disclosed in accordance with at least one embodiment.

[0044] FIG. **21** is a sectional cut-away view of another embodiment of the multi-glazed window assembly as disclosed in accordance with at least one embodiment showing a thermal storage medium filling material disposed within at least one of the spacer assemblies.

[0045] FIG. **22**A is a sectional cut-away view of another embodiment of the multi-glazed window assembly as disclosed in accordance with at least one embodiment showing a lighting assembly disposed within the insulating airspace.

[0046] FIG. **22**B is a sectional cut-away view of another embodiment of the multi-glazed window assembly as disclosed in accordance with at least one embodiment showing a lighting assembly disposed within the insulating airspace and within the clear tube of the spacer assembly.

[0047] FIG. **23**A is a perspective view of the elongated outer wrapping disposed in an extended orientation with one edge of one intermediate glazing layer disposed within the channel formed by the perimeter spacer assembly, as disclosed in accordance with at least one embodiment of the present invention.

[0048] FIG. **23**B is another view of the embodiment illustrated in FIG. **23**A.

[0049] FIG. **23**C is a perspective view of an intermediate glazing layer and two outer glazing layers partially mounted within the perimeter spacer assembly and elongated outer wrapping, as disclosed in accordance with at least one embodiment of the present invention.

[0050] FIG. **23**D is another view of the embodiment illustrated in FIG. **23**C.

[0051] FIG. **24**A is an end, cut-away view of the multi-glazed window assembly of at least one embodiment with the edge flaps of the elongated outer wrapping extended.

[0052] FIG. **24**B is an end, cut-away view of the embodiment illustrated in FIG. **24**A, with the edge flaps folded over the outer-facing surfaces of the outer glazing layers, as disclosed in accordance with at least one embodiment of the present invention.

[0053] FIG. **25**A is an end, cut-away view of the multi-glazed window assembly of another embodiment with the edge flaps of the elongated outer wrapping extended.

[0054] FIG. **25**B is an end, cut-away view of the embodiment illustrated in FIG. **25**A, with the edge flaps folded over the outer-facing surfaces of the outer glazing layers, as disclosed in accordance with at least one embodiment of the present invention.

[0055] FIG. **26** is a front perspective view of the assembly as disclosed in accordance with at least one embodiment of the present invention.

[0056] FIG. **27**A is a partial view of the inner surface of the elongated outer wrapping and perimeter spacer assembly with four channels formed for four intermediate glazing layers, as disclosed in accordance with at least one embodiment of the present invention.

[0057] FIG. **27**B is another partial view of the inner surface of the elongated outer wrapping and perimeter spacer assembly with four channels formed for four intermediate glazing layers, as disclosed in accordance with at least one embodiment of the present invention.

[0058] FIG. **27**C is a front perspective view of the elongated outer wrapping and perimeter spacer assembly disposed in a wrapped or belted orientation, as disclosed in accordance with at least one embodiment of the present invention.

[0059] Like reference numerals refer to like parts throughout the several views of the drawings provided herein.

DETAILED DESCRIPTION OF THE INVENTION

[0060] As shown in the accompanying drawings, at least one embodiment of the present invention is directed to a window glazing assembly, as generally referenced as **10**, for example, in FIG. **2**. Other embodiments include a multi-glazed window assembly **80** (e.g., as shown in FIGS. **9-12**, and a method of installing a window glazing assembly, as generally referenced as **100** in FIG. **15**. In particular, the window glazing assembly **10** of at least one embodiment of the present invention comprises a retrofit assembly that can be easily applied or installed to existing or already-installed window units **1**. However, it is contemplated that some embodiments of the present invention, and in particular, the multi-glazed window assembly **80** and method **100** can be applied as new construction or as a replacement window.

[0061] In any event, the window glazing assembly **10** and multi-glazed window assembly **80** of certain embodiments of the present invention are structured to provide or otherwise create a dead airspace, for example, between the window glazing assembly **10** and the existing window pane(s) **5** of a window unit **1**, or between inner and outer glazing layers, to increase or provide enhanced insulation on the window unit **1**. For example, certain embodiments of the present invention can be used to reduce thermal loss (e.g. in cold climates) and/or reduce thermal gain (e.g., in warm climates).

[0062] For instance, with reference to the exemplary window unit **1** represented in FIG. **1**, a window unit **1** may include a frame assembly **2** and one or more window panes **5**. The window frame **2** may include an outer frame unit, generally represented as **3**, and a window sash, generally represented as **4**. Particularly, the outer frame unit **3** of the window unit **1** may include the framework that surrounds the entire window unit **1**, and may include, for example, the window head unit, jamb, sill, etc. The head unit is generally the main horizontal part of the top of the window frame, the sill is the main horizontal part of the bottom of the window frame, and the jamb are the main vertical parts forming the sides of the window frame **2**. The window sash **4** is generally

considered the inner portions of the frame **2** that hold or at least partially retain the window pane(s) **5**. Specifically, the window sash **4** often holds or retains the glass portion of the window unit **1** and is made up of horizontal and vertical frame units. Oftentimes, depending on the specific construction of the window unit **1**, the sash **4** may move, for example, up and down, in and out, side-to-side, etc. in order to open and close the window. With reference to the example shown in FIG. **1**, a sash lock **6** locks and unlocks the bottom sash **4**, allowing the bottom sash **4** to move up and down, thereby opening and closing the window unit **1**. Of course, there any numerous other window units **1** with different constructions, layouts, moving parts, non-moving parts, etc. that can be used in accordance with the various embodiments of the present invention, and it should be understood that the example window unit **1** shown in FIG. **1** is for illustrative or exemplary purposes only.

[0063] With reference now to the perspective, exploded and cut-away illustration of FIG. **2**, at least a portion of the window glazing assembly **10** of at least one embodiment is shown. Specifically, the window glazing assembly **10** may include an attachment assembly **20** and one or more glazing panels or layers **30**. For instance, the attachment assembly **20** is structured and/or adapted to easily attach the glazing layer(s) **30** to the window unit **1**, for example, in an overlying or covering relation thereto. In some embodiments, and as shown in FIG. **2**, for example, the attachment assembly may include one or more strips or portions of an adhesive tape that can be applied to the window unit **1**, and upon which the glazing layer(s) **30** can also be attached or adhered. In this manner, the attachment assembly **20**, and in particular, the adhesive tape of at least one embodiment may include a peel-and-stick type of tape with double-sided adhesive surfaces to enable easy application or attachment to the window unit **1** (e.g., to the window sash and/or glass panes) and to the glazing layers **30**.

[0064] For example, still referring to FIG. **2**, the attachment assembly **20**, and in particular the attachment tape may include a peel-and-stick double-sided strip of tape such that a layer **22**, **24** may be peeled off of one or both sides of the tape to reveal the adhesive surface thereof. One of the adhesive surfaces may be adhered to the window unit **1**, for example, at or around the sash **4**, whereas the other adhesive surface can be adhered to the inside of the glazing layer **30**.

[0065] Particularly, the attachment assembly, e.g., the peel-and-stick adhesive strips of one embodiment, may be adhered to a portion of the window unit **1**, for example, either around the sash **4**, another portion of the window frame **2**, and/or in some cases, the window pane(s) itself (particularly in commercial, storefront applications). The strips or attachment assembly **20** may be attached to create a substantially continuous perimeter or otherwise be secured to the window unit **1** in a substantially continuous, end-to-end manner, as generally represented in FIG. **3**, for example. For instance, in the embodiment where the attachment assembly **20** includes a plurality of strips of adhesive tape, the strips can be secured or adhered one by one in an end-to-end or substantially continuous manner in order to create a substantially continuous seal around the perimeter of the glazing layer **30**. This can restrict any unwanted moisture, air, etc. from entering the space between the glazing layer(s) **30** and the existing window pane **5**.

[0066] Furthermore, as shown in FIGS. **3** and **4**, for example, the attachment assembly **20**, and in particular, the peel-and-stick double-sided adhesive tape of at least one embodiment may be secured at, near or proximate an outer perimeter edge **32** of the glazing layer **30**. In this regard, the outer perimeter edge **32** of the glazing layer **30** may be adhered or secured to the window unit **1** via the attachment assembly **20** of at least one embodiment providing a perimeter and edge seal substantially continuously around the glazing layer **30**.

[0067] With reference now to FIG. **4**, a side or cut-away/sectional view is shown with the window glazing assembly **10** installed on one side of a window unit **1**. It should be noted that the assembly **10** can be installed on either or both sides, e.g., the inside and/or the outside, of the window unit **1**. Particularly, in some applications, the glazing assembly **10** may be installed outside, for example, on an upper portion of a window unit **1**, where the lower portion of the window unit **1** slides or moves up in order to open/close the window. This allows the assembly **10** to be installed while maintaining window operability, i.e., maintaining the ability to open/close the window as designed. Other applications (e.g., inside, outside, or both) may differ depending on the style, size and shape of the particular window unit **1**.

[0068] In any event, still referring to FIG. **4**, the assembly **10** creates an airspace, such as an insulated dead airspace **12** between the window pane **5** and the glazing layer **30**. The airspace **12** may be approximately ¼ of an inch to ¾ of an inch thick (measured from the window pane **5** to the glazing layer **30**), although other sizes and dimensions are contemplated within the full spirit and scope of the present invention. In the embodiment shown in FIG. **4**, the attachment assembly is secured to the window sash **4** and the glazing layer **30** is secured or adhered thereto. It should be noted that additional glazing layer(s) **30** may be layered or secured to the inside or outside of the window unit **1** creating additional layered and separated insulated airspaces **12**.

[0069] In yet another embodiment, as shown in FIG. **5**, the assembly **10** of at least one embodiment includes at least one spacer assembly **40** comprising a plurality of spacer bars **42**, **44**, **46**. The spacer assembly **40** is adapted to secure or adhere to the window unit **1**, wherein the glazing layer(s) **30** is secured or adhered to the spacer assembly **40**. This spaces the glazing layer(s) **30** from the window unit **1**. For example, in some instances, depending on the particular construction or design of the window unit **1**, the spacer assembly **40** may be needed in order to space the glazing layer **30** from the window unit **1**, for example, maintaining window operability when applied to the sash. In some cases, and particularly but not limited to some commercial storefront applications, the spacer assembly **40** may be adhered or secured to the window pane(s) **5** itself. For instance, some windows may not have a sash **4** or frame **2** that can be easily used or that can be used to attach the glazing layer(s) **30** to. In such a case, the spacer assembly **40** may be used to create a flat surface upon which the glazing layer(s) **30** can be attached, or it can create a spaced relation between the window pane **5** and the glazing layer **30** for the insulated airspace **12**.

[0070] In some cases, the spacer assembly **40** or spacer bars **42**, **44**, **46** may be substantially rigid or rigid and, as an example, can be constructed of polyvinyl chloride (PVC) trim material, wood, metal, etc. For example, the various spacer bars **42**, **44**, **46** of at least one exemplary embodiment may include ⅝ inch×⅝ inch PVC trim material that can be cut-to-measure and easily applied to the window unit **1**. Of

course, other sizes, dimensions and materials are contemplated within the full spirit and scope of the present invention.

[0071] For instance, in at least one embodiment, the spacer assembly **40** may be adhered to the window unit **1** via a peel-and-stick adhesive tape **20**. The adhesive tape may be already secured to one side of the spacer assembly **40**, or it may be separate such that the user or installer may be able to adhere to the tape or attachment assembly **20** to the spacer assembly **40** and the window unit **1**. Accordingly, in such an embodiment, the attachment assembly **20** used to secure the spacer assembly to the window unit may include a peel-and-stick double-sided adhesive tape that can be secured around the perimeter of the spacer assembly **40** between the spacer assembly **40** and the window unit **1** (e.g., on the sash **4** or window pane **5**) to provide an air-tight and/or weather-tight seal.

[0072] An additional attachment assembly **20**, such as additional peel-and-stick double-sided tape may be adhered or secured to the other or outside surface of the spacer assembly **40** in order to allow the glazing layer(s) **30** to be secured or adhered thereto. Accordingly, the spacer assembly **40** may be secured between the window unit **1** and the glazing layer(s) **30** to create the insulated airspace **12**, as shown in FIGS. **5** and **6**, for example.

[0073] Referring to FIG. **5**, the spacer assembly **40** of at least one embodiment includes a top spacer bar **42**, a bottom spacer bar **44** and two side spacer bars **46**. For instance, in one embodiment, the top spacer bar **42** may include opposite lateral ends **43** that extend to or align with outer lateral edges **47** of the side spacer bars **46**. In this regard, there are no vertical joints between the top spacer bar **42** and the side spacer bars **46**—only the two horizontal joints. This offers structural rigidity in the top spacer bar **42**, which can be used as a structural load bearing support in some implementations. Still referring to FIG. **5**, the bottom spacer bar **44** of at least one embodiment may fit between inner side edges **45** of the side spacer bars **46** such that there are no vertical joints between the bottom spacer bar **44** and the side spacer bars **46**—only the vertical joints.

[0074] Furthermore, in at least one embodiment, the inner edge(s) of the spacer assembly **40**, represented as **41**, **45**, and **49** in FIG. **5** may substantially align with or be adjacent the inner edge of the sash **4**, represented as **7** in FIG. **6**.

[0075] Other installation techniques and alignment of the spacer bars or spacer assembly **40** may be implemented in accordance with the various embodiments described herein.

[0076] With reference now to the cut-away or sectional view of FIG. **7**, an exemplary installation of the glazing assembly **10** on one side of a window unit **1** using a spacer assembly **40** is shown. In this example, window unit **1** includes a double pane window, such that the window unit **1** already includes two (2) panes **5**. In any event, the spacer assembly **40** is shown as being attached to the inner glazing layer **30** via an attachment assembly **20**, such as a peel-and-stick double-sided adhesive tape. Similarly, the outer glazing layer **35** is shown as being attached to the spacer assembly **40** via an additional attachment assembly **20**, which again, may be a peel-and-stick double-sided adhesive tape. Other attachment assemblies structured to facilitate the practice of the present invention in the intended manner are contemplated. Either way, the spacer assembly **40** facilitates in the creation of an insulated airspace **12**, in this example, between an inner glazing layer **30** and an outer glazing layer **35**, with a weather-resistant perimeter seal via the attachment assemblies **20**. It should be noted, however, that the attachment assembly **20** may be secured directly to the window unit **1**, such as at the sash **4**, such that the inner glazing layer **30** shown in FIG. **5** may not be included. In such a case, the spacer assembly **40** facilitates in the creation of an insulated airspace **12** between the window pane **5** and the outer glazing layer **35**.

[0077] In some embodiments, the spacer assembly **40** and the glazing layer(s) **30** may be constructed of materials with similar coefficients of thermal expansion. For example, in some embodiments the spacer assembly **40** may be constructed of a PVC type of material and the glazing layer(s) **30** may be constructed of an acrylic, plastic or glass. In some implementations, the coefficients of thermal expansion for the material selected for the spacer assembly **40** may be substantially the same as the coefficient of thermal expansion for the material selected for the glazing layer(s) **30**, and in particular, the coefficients of thermal expansion may be between 1 and 2 times one another for the different materials or for the spacer assembly **40** and the glazing layer(s) **30**.

[0078] It should also be noted that the glazing layer(s) **30** of some embodiments may be tinted, for example, it may be coated with a window film comprising a tint that is adapted to restrict the passage of sunlight or UV rays there through. Some embodiments of the glazing layer(s) **30** may also be constructed of a hurricane wind or impact resistant material. In this manner, the assembly **10** of the present invention may also serve to provide thermal loss and gain resistance via the tint or window film and/or impact resistance via the material selected for the glazing layer **30**.

[0079] Further embodiments may also include a desiccant or other drying agent disposed on the inside of the airspace **12** or otherwise exposed to the inside of the airspace **12** in order to control moisture or condensation with the airspace **12**. For example, as shown in FIGS. **6** and **7**, in at least one embodiment, a desiccant tape **60** or other drying agent may be adhered to the inside-facing surface(s) **41**, **45**, **49** of the spacer assembly **40** such that a desiccant or drying agent surface **62** of the tape **60** faces inward toward the airspace **12**, and the adhesive surface **64** secures to the spacer assembly **40**. Although, the desiccant tape **60** is shown as being attached to the lower or bottom bar **44**, the desiccant tape **60** may be adhered or attached to any one or more of the bars **42**, **44**, **46** of the spacer assembly **60**. It should also be noted that the desiccant tape **60** may be adhered to the window unit **1** (such as the sash **2**, frame **4**, or window pane **5**) or to the glazing panel **30**, so long as the desiccant surface **62** is exposed to the airspace **12** created by the assembly **10** in order to control moisture, condensation, etc. therein. Other embodiments may use other condensation or moisture control substances or devices, and as such, the present invention is not limited to use of desiccant tape. For example, other types of tape, packets, dry packs, silica gel devices/packs, etc. can be used.

[0080] Other embodiments may include one or more modular ventilated desiccant (or other drying agent) filled conduits or tubes **50** that may be adhered or attached to the inside face of the sash or spacer bar(s), for example, for condensation control. In particular, with reference to FIGS. **13** and **14**, the conduit(s) **50** may include ventilation sections **51**, for instance, at the ends or along the length thereof, for allowing the desiccant substance or other drying agent disposed therein to be exposed to surrounding air or envi-

ronment. In this case, the conduit(s) **50** may be disposed within the insulated airspace(s) **12**, for example, by being secured to a portion of the spacer assembly **40**, the inside-facing surface of one or more of the layers **30**, etc. In yet another embodiment, a desiccant substance (or other drying agent) may be embedded directly in the spacer bar(s) or spacer assembly **40**, for instance, in drilled or other made holes or channels. The holes or channels may include a perforated or ventilated cover in order to allow ventilation between the desiccant substance and the insulating airspace **12**.

[0081] In some cases, the conduit(s) **50** may include or otherwise contain a phase change or heat storage material (PCM), such as, but not limited to a paraffin wax material, in order to moderate the temperature between the inside and outside of the window assembly. For example, a conduit, such as a cross-linked polyethylene pipe, may be disposed between the glazing layers (e.g., around an inside perimeter of one of the glazing layers within the insulated airspace, or in some cases, through the glazing layers. In some cases, the spacer assembly may include a hollow tube filled with or at least partially containing a PCM material.

[0082] It should also be noted that the glazing layer(s) **30** and/or spacer assemblies **40** may be constructed in virtually any shape and size, including curves, and thus should not be deemed limited to the square or rectangular shapes shown in the Figures. For example, a curved spacer assembly **40** and/or glazing layer **30** can be used to create airspaces **12** for barrel vaulted skylights, greenhouses, light transmitting panels, and windows with curves and other unique shapes and sizes. For instance, the spacer bar(s) may be bent along the thickness, along with the attachment assembly or adhesive strips and the acrylic (or other) glazing layer(s) to match the curves or other dimensions of virtually any shape and size window, such as skylights, greenhouses, light transmitting panels, etc.

[0083] Referring now to FIG. **8**, a plan and partially exploded view of the glazing assembly **10** is shown installed on an aluminum frame **2** of a commercial storefront, as an example, with a single layer glass pane **5** towards the exterior. Insulating airspaces **12** are created by applying peel-and-stick attachment tape **20** to the frame **2** and/or a plurality of spacer bars or spacer assemblies **40**. One or more glazing layers **30** can be applied or secured to the spacer assemblies **40**, for example, via attachment tape **20**, fitted channels **90**, etc. Furthermore, as provided herein, desiccant tape **60** or other like drying agents tubes, conduits or channels may be exposed to the inside of the airspaces **12**.

[0084] With reference now to FIGS. **9** through **12**, the window glazing assembly includes a multi-glazed window assembly, referenced as **80**, which may be used for new construction, replacement windows, etc. In particular, the assembly **80** of at least one embodiment includes an inner and outer glazing layers **130**, **230**, and in some embodiments, one or more intermediate glazing layers **330**. Specifically, the inner glazing layer **130** may be facing, exposed to, or disposed on the inside of the building, structure or home, whereas the outer glazing layer **230** may be facing, exposed to, or disposed on the outside of the building structure or home.

[0085] Specifically, the embodiment illustrated in FIG. **9** includes an inner glazing layer **130**, an outer glazing layer **230** and two intermediate glazing layers **330**. The inner and outer glazing layers **130** and **230** are secured to a spacer assembly **40** via an attachment assembly **20**, such as, for example, peel-and-stick double-sided adhesive tape, although other attachment assemblies or mechanisms may be used. As before, the tape may be secured around the outer edges of the glazing layers **130**, **230** to provide a continuous edge or perimeter seal.

[0086] The intermediate glazing layer(s) **330** may be secured to the same spacer assembly **40**. For example, in the embodiment illustrated in FIG. **9**, the intermediate glazing layers **330** are secured at one end (e.g., the bottom end) to the corresponding (e.g. bottom) bar of the spacer assembly **40** via cooperative slots, channels or kerfs **90** cut into the surface of the spacer bar or spacer assembly **40**. At the other end (e.g., top end), the intermediate glazing layers **330** are secured to the spacer assembly **40** via double-sided tape. Other attachment mechanisms, devices, or means are contemplated.

[0087] Also, as shown in FIG. **9**, a shade assembly, generally referenced as **95** is shown as being disposed between two of the glazing layers and within the insulting airspace **12** created thereby. In the illustration, the shading assembly **95** includes a plurality of spaced louvers that can be used to control an amount of light passing through the window assembly **80**. The shade assembly may be fixed or movable and may be secured to the glazing layers and/or to the spacer assembly **40**.

[0088] FIG. **10** illustrates a further embodiment of the multi-glazed window assembly **80**. In particular, inner and outer glazing layers **130**, **230** are adhered to a spacer assembly **40** via an attachment assembly **20**, such as double-sided attachment or adhesive tape around its perimeter. A plurality of intermediate glazing layers **330** are secured in slots or channels along the inside of the spacer bars of the spacer assembly **40** to create seven (7) separate insulating airspaces **12**. This can create a total thermal resistance or R-value of R-**14** or higher. It should also be noted that, the inner and outer glazing layers **130**, **230** of this installation may act as structural diaphragms between the spacer assembly **40** to create a stress-skin panel capable of resisting structural loads. The load-bearing capacity is aided by the additional structural diaphragm created by the intermediate glazing layers **330** through their attachment to the spacer assembly **40**, which, in some installations, can act as both the sash and frame for the window unit. These multi-layered clear-skinned structural diaphragms may avoid the use of headers and potentially carry floor or roof loads without added structure. The diaphragms further add to structural lateral resistance as a sheer panel when connected to other structural elements.

[0089] FIG. **11** illustrates another embodiment with intermediate spacers **140** secured or disposed between some or all of the intermediate glazing layers **330** in order to facilitate connection or attachment of the intermediate glazing layer **330**. For instance, the intermediate spacers **140** may be secured to the inner face of the spacer assembly **40**, providing one or more attachment surfaces for the intermediate glazing layers **330** to attach, as shown. The intermediate spacers **140** may be secured or attached to the spacer assembly **40** via an attachment assembly **20**, such as double-sided tape or other attachment methods or devices. Similarly, the intermediate glazing layers **330** may be secured to the intermediate spacers **140** via an attachment assembly **20**, such as double-sided tape or other methods or devices.

[0090] FIG. **12** illustrates corner edge treatments or covers **73** (e.g., angle section trim) which may be disposed over one or more of the outer exposed corners of the glazing layer(s) **130**, **230** in order to create a finished appearance and, in some cases, additional weather protection, particularly for externally installed assemblies **10**.

[0091] Referring again to FIG. **14**, at least one embodiment may further include a conduit **75**, such as a ventilation tube or conduit, that passes through one or more of the plurality of glazing layers and provide airflow there through. Particularly, in one embodiment, the conduit **75** or ventilation tube may pass through each of the glazing layers **130**, **230**, **330** in order to provide ventilation and/or airflow there through, such as, from outside of the building, through the assembly, and into the inside of the building.

[0092] Still referring to FIG. **14**, at least one embodiment may further include a heat collection and transfer conduit **74**, such as a radiant heat tube, that is disposed within at least one of the airspaces **12**. In the embodiment shown, the heat collection and transfer conduit **74** is attached to the spacer assembly **40** at opposite ends thereof, although other attachments or securement of the conduit **74** is contemplated. In any event, the conduit **74** of at least one embodiment may include a heat transfer fluid or other like substance disposed therein for providing radiant heat collection and transfer.

[0093] With reference now to FIG. **15**, the present invention further comprises a method of installing a glazing assembly **10** to an already-installed window unit or to a new construction window unit. The method, generally referenced as **100**, includes attaching a spacer assembly to a window unit **102**. As provided above, the spacer assembly **40** of at least one embodiment may include a plurality of separate, rigid spacer bars **42**, **44**, **46**. In one embodiment of the method **100**, the individual bars **42**, **44**, **46** may be adhered to the window unit, one-by-one, to create the final spacer assembly **40**. Specifically, rather than assembling a spacer assembly first, and the attaching that assembly to the window unit, the spacer bars **42**, **44**, **46** may be individually attached to the window unit (e.g., to the sash **4**, the window pane **5** or other portions of the frame **2**).

[0094] As above, in one embodiment, the attachment assembly includes a peel-and-stick double-sided adhesive tape. In this manner, the tape or attachment assembly **20** may be adhered to the spacer assembly **40** or the individual bars thereof, which can then be adhered to the window unit **1**. Alternatively, the attachment assembly **20** may first be adhered to the window unit **1**, and then the spacer assembly **40**, and in particular, the individual bars, may be adhered thereto. Either way, the individual or one-by-one placement or installation of the bars **42**, **44**, **46** allows the spacer assembly **40** to obtain a tight, secure and weather-resistant seal around its entire perimeter.

[0095] Furthermore, as shown at **104**, the method **100** may also include aligning the inner edge of the spacer assembly **40**, and in particular, the individual bars **42**, **44**, **46** thereof, to an inner edge of the window frame **2**, such as an inner edge of a window sash **2**.

[0096] Some embodiments also include adhering or installing a desiccant tape or other moisture control device, as shown at **106**. For example, the moisture control device or desiccant tape may be adhered to an inside edge of the spacer assembly **40**, to the window unit **1**, itself, or to any other location, so long as the desiccant portion or other dry material portion is exposed to the inner airspace created by the glazing assembly **10** of the present invention.

[0097] Accordingly, as shown at **108**, the method **100** further includes attaching the one or more glazing layers **30** to the window unit **1** or to the spacer assembly **40** (if used). The glazing panel **30** may be adhered to the window unit **1** or spacer assembly **40** via peel-and-stick tape or other attachment assembly **20** that will create an airtight and weather-resistant seal, preferably around the perimeter of the glazing layer **30**.

[0098] Furthermore, it should also be noted that some embodiments of the present invention, as shown in FIG. **10**, may include additional or intermediate glazing layers **330**, for example, between the window pane **5** and the glazing panel **30** in retrofit situations, or between inner and outer glazing layers **30** in the case of new construction and replacement windows. In this manner, the present invention may create a number of different, individual and spaced airspaces via intermediate spaced glazing layers installed on the inside and/or outside of the window unit **1** or between inner and outer glazing layers **30**. This may be accomplished in a number of different ways. For example, in one embodiment, the spacer bars **42**, **44**, **46** may be thicker (e.g., in the range of 1 inch to 7.25 inches) wide with one or more glazing layers **30** disposed along the width thereof creating a multi-layered glazing assembly with an extremely high thermal resistance and energy efficiency. Particularly, one or more of the intermediate glazing layers can be adhered around its perimeter to the inner face of an intermediate spacer bar **140** (e.g., via glue, tape, etc.) In another embodiment, the spacer bar(s) may include routed slots, channels or kerfs on the inner face thereof for receiving the outer perimeter edge of the intermediate glazing layer(s). In this manner, a plurality of glazing layers may be installed or attached to a spacer assembly creating a plurality of insulated airspaces via a single glazing assembly. In some applications, each ½ inch of insulating airspace, for example, as created by the intermediate glazing layer(s) and/or outer glazing layer(s), forms an R-**2** (or more) thermal resistance. For example, an application with three (3) insulating airspaces, created by using three glazing layers, forms an R-6 (or more) thermal resistance.

[0099] Moreover, in some embodiments, tinting or other window film or overlay, including a diffusion grid, may be used to control or optimize energy or heat loss/gain depending on various factors, including, but not limited to the particular climate zone in which the window is located in the structure, the compass orientation of the window (e.g., does it face north, south, east or west), the exterior shading condition proximate the window, etc. Particularly, tinted glazing panels may be positioned or located toward the exterior of the window unit in a cooling degree-day-dominated climate, in order to maximize heat rejection. Whereas, tinted glazing layers may be positioned or located toward the interior of the window unit in heating degree-day-dominated climates, thereby balancing desirable winter heat gain with summer heat rejection. This will cause light to be absorbed and the reradiated as heat from the tinted glazing panels work in favor of the dominate season.

[0100] Additionally, in some embodiments, one or more of the glazing layers, such as the inner or outer glazing layers **130**, **230**, for example, may be at least partially covered with a film or sheet (e.g., a static film covering) that provides sacrificial and easily replaceable UV and scratch resistance.

[0101] With reference now to FIGS. **16**A, **16**B, **16**C and **16**D yet another embodiment of the multi-glazed window assembly of the present invention is illustrated. In particular, the window assembly may include a perimeter sash assembly **340**, or otherwise a perimeter or first spacer assembly constructed of or comprising a bottom perimeter sash **342**, a top perimeter sash **344**, and side perimeters sashes, such as left side perimeter sash **346** and right side perimeter sash **348**. It should be noted that the perimeter sash assembly **340** of at least one embodiment functions as the window sash, as well as at least a portion of the spacer assembly described herein and used to space a plurality of glazing layers. The perimeter sash assembly **340** may be constructed of wood, PVC, plastic, composite materials, metal, etc.

[0102] As will become apparent herein, and with reference to the Figures, each of the perimeter sashes **342**, **344**, **346**, **348** of the perimeter sash assembly **340** includes an enclosed or inner surface **340**C spanning between a corresponding first (or interior) face **340**A and a second (or exterior) face **340**B. The enclosed surface **340**C of at least one embodiment may be used to define the width of the perimeter sash assembly **340**, which can be measured between a first face **340**A and a corresponding second face **340**B of a common one of the plurality of perimeter sashes **342**, **344**, **346**, **348**.

[0103] Furthermore, an inner spacer assembly **440** may also be included, and is similar to the intermediate spacers **140** disclosed above in accordance with at least one embodiment, and thus may be rigid and/or constructed of wood, PVC, plastic, composite materials, metal, etc. In particular, inner spacer assembly **440** may include at least one bottom spacer **442**, at least one top spacer **444**, and at least two side spacers, such as a left side spacer **446** and right side spacer **448**.

[0104] Each of the spacers **442**, **444**, **446**, **448** of the spacer assembly **440** includes an enclosed first face **440**A and a second face **440**B, opposite one another, as shown in the Figures. The width of the spacer assembly **440** may be measured between a first face **440**A and a corresponding second face **440**B of a common one of the plurality of spacers **442**, **444**, **446**, **448**. With reference to the cut away views of FIGS. **16**B, **16**C and **16**D, the spacer assembly **440** is, in at least one embodiment, separate from the perimeter sash assembly **340** and is attached or fixed to the enclosed surface **340**C of the perimeter sash assembly **340** and the spacer assembly **440** includes a width that is less than the width of the perimeter sash assembly.

[0105] Moreover, an inner glazing layer **130** is attached to the first surface(s) **340**A of the perimeter sash assembly **340** via an attachment assembly **20**. At least one first intermediate glazing layer **330**A is attached to the first surfaces **440**A of the spacer assembly **440**, and at least one second intermediate glazing layer **330**B is attached to the second surfaces **440**B of the spacer assembly **440**. It should be noted that additional spacer assemblies **440** and additional intermediate glazing layers **330** can be included in accordance with the various embodiments of the present invention, as provided above with reference to FIG. **11**, for example. Finally, an outer glazing layer **230** is attached to the second or outer surfaces **340**B of the perimeter sash assembly **340**.

[0106] It should be noted that the various glazing layers **130**, **230**, **330** of the present invention is attached to the corresponding surfaces of the sash assembly **340** and/or spacer assembly **440** via an attachment assembly **20**, which, as described above in accordance with other embodiments, may include, but is not limited to, a double-sided adhesive tape.

[0107] Furthermore, in at least one embodiment, the window assembly may include one or more layers of sealing tape, generally referenced as **350**, adhered or secured to a perimeter of the inner glazing layer **130**, a perimeter of the outer glazing layer **230**, and an exposed portion of the perimeter sash assembly **340** that spans between the inner glazing layer **130** and outer glazing layer **230**, for example, over a top exposed surface of the top perimeter sash **344**, a bottom exposed surface of the bottom perimeter sash **342**, and side exposed surfaces of the side sashes **346**, **348**. In this manner, the sealing tape **350** secures the joints between glazing layers **130**, **230** and the corresponding or adjacent portions of the perimeter sash assembly **340**. This can allow for easy repair of the glazing layers **130**, **230** and can provide waterproof protection to the window assembly. Particularly, in the event one of the glazing layers **130**, **230** becomes damaged or broken, the sealing tape **350** can be removed or partially removed to easily replace the broken or damaged glazing layer **130**, **230**.

[0108] With particular reference to FIG. **16**C, the window assembly **10** of at least one embodiment can be installed within a window opening **352** of a building in a manner to allow the window assembly **10** to be easily removed, for example, in the event an occupant is in need of an emergency exit or egress from the building.

[0109] More specifically, at least two stops or framing sections, such as a first (or interior) stop **360** and a second (or exterior) stop **365** are fixed to the building at or near the window opening **352** in a manner to create or define a channel or space **368** therebetween within which a portion of the window assembly **10** is disposed. The stops **360**, **365** may be constructed of wood, metal, PVC, etc. and may, but need not necessarily, span the entire width of the window opening or a substantial portion of the window opening. For example, in at least one embodiment, stop or framing section **365** is a horizontally elongated structure that may extend from or near one side of the window opening to or near the other side. Similarly, stop or framing section **360** is a horizontally elongated structure that may extend from or near one side of the window opening to or near the other side. FIG. **16**C is a sectional and exploded view showing a cross section of two stops **360**, **365**.

[0110] In the example illustrated in FIG. **16**C, the first stop **360** is secured or fixed to an upper surface of the window opening **352**, while the second stop **365** is spaced from the first stop **365** a sufficient distance such that the top portion of the window assembly **10**, such as the top perimeter sash **344**, is able to slide therein and be disposed between the first and second stops **360**, **365**. In the illustrated embodiment, the second stop **365** is secured to an outside surface of the building and at least partially overhangs the window opening **352** such that a portion of the second stop **365** is aligned with the first stop **360** to define the channel or opening therebetween. Other positions of the first and second stops **360**, **365** are contemplated within the full spirit and scope of the present invention.

[0111] Moreover, a bottom exterior stop or framing section **367** may also be provided and fixed to the exterior of the building, as shown in FIG. **16**C. In some cases, an additional support structure or sill trim frame **366** may be secured to the outside of the window assembly **10**, e.g., secured to the tape

350 or other like portion, in order to allow for attachment with the bottom exterior framing section 367. It should be noted again that FIG. 16C shows a partially exploded view such that adjacent pieces, for example, trim frame 366 is attached to the adjacent tape 350, which is attached to the glazing layers 130, 230, which is attached to the sash assembly 340.

[0112] Still referring to FIG. 16C, vertical side frames 367A, 367B extend or are disposed vertically along the left and right sides of the window opening 352. In this manner, stops or framing sections 365, 366, 367, 367A, and 367B frame the window opening vertically on the left and right sides (via 367A, B) and horizontally on the top and bottom (via stops or frames 365, 366, 367). In some embodiments, vertical framing members 367A and 367B, may extend into or over the window opening such that the framing members 367A and 367B may act as side stops thereby engaging a portion of the perimeter of the window assembly. Accordingly, reference numerals 376A and 376B represent compression gaskets or compression weather stripping disposed between the corresponding vertical stops 367A, 367B and an outer or perimeter vertical edge of the window assembly.

[0113] In other words, vertical stop 367A may be secured to the building on one side of the window opening, partially extending over and into the window opening, and secured or attached against the window assembly with compression weather stripping 376A disposed therebetween. Similarly, vertical stop 367B may be secured to the building on the other side of the window opening, particularly extending over and into the window opening, and secured or attached against the window assembly with compression weather stripping 376B. FIG. 16E illustrates an external view of the stops 365, 367A, 367B and 366 overlapping the window opening 352, as described herein. Similar to other figures herein, FIG. 16E is partially exploded in that stop 367A of at least one embodiment may abut or connect to stop 365 and 366, and stop 367 may abut or connect to stop 365 and 366. Similarly, as shown in FIG. 16C, stop 366 may abut or connect to 377 with a compression weather stripping 376 there between.

[0114] Furthermore, a locking assembly 370 may also be included and disposable between a locked orientation (thereby locking the window assembly 10 in place) and an unlocked orientation (thereby allowing the window assembly 10 to be installed or easily removed, for example, in the event of an emergency exit or egress.) More specifically, the locking assembly 370 is disposed between the window assembly and the window opening 352 or between the window assembly 10 and a fixed portion of the building such as a framing fixture, wall, base, etc.

[0115] As just an example, the one or more locking assemblies 370 of at least one embodiment may include a sliding rail lock or pin 372 that is disposable into a corresponding and aligned locking hole located in a fixed position, for example, on the building or framing fixture(s) of the window opening. Sliding the lock or pin within the corresponding locking hole will cause the window assembly 10 to be secured in place, as shown in FIG. 16C, for example. Removing the lock or pin from the corresponding locking hole will disengage or unlock the locking assembly 370, allowing the window unit 10 to be pushed out of the window opening (e.g., to the right in FIG. 16C) or pulled into the building through the window opening (e.g., to the left in FIG. 16C). Other locking assemblies structured to facilitate practice of the present invention in the intended manner are contemplated herein.

[0116] In some embodiments, one or more handles or finger-pull hardware may be installed on the inside of the window assembly to assist the user in pulling the window assembly away from and completely out of the window opening. This will, thus, create an opening through which an occupant can easily escape or egress, for example, in the event of a fire or other emergency situation.

[0117] In certain embodiments, the window assembly 10 may fit between twenty four inches on center framing or within an opening that leaves twenty two inches minimum of a clear opening for egress, or otherwise an opening that meets emergency egress requirements of building codes. This window assembly 10 can also be installed within the window opening without the use of structural headers, jack and cripple studs that are associated with the installation of conventional windows.

[0118] It should also be noted that, as shown by reference character 376 in FIG. 16C, for example, compression weather stripping can be disposed between various the one or more stops 360, 365, 367 and corresponding portions of the window assembly 10, for example, a portion of the glazing layers 130, 230 thereof, in order to facilitate or create a tight and in some cases waterproof seal therebetween. The locking assembly 370, when locked, can serve to secure the window assembly 10 against the one or more compression weather stripping or gaskets 376.

[0119] Referring now to FIG. 16D, the window assembly 10 of at least one embodiment may be constructed with a window height H and window sash width W or depth that strategically provides passive seasonal shading. For example, the summer sun (generally referenced as S1 in FIG. 16D) is higher in the sky (on south facing elevations, for example) than the winter sun (generally referenced as S2). The window assembly 10 can be constructed or dimensioned such that the summer sun rays are shaded or substantially shaded by the sash assembly 340 (as schematically illustrated) such that the summer sun rays do not enter the building interior or are at least partially, and in some cases, substantially blocked, by the sash assembly 340. In particular, the window assembly 10 may be dimensions such that the summer sun rays may be at least partially blocked by the outer edge of the top sash, such that the rays will fall within the width or depth W of the sash assembly 340 and are thus substantially or at least partially blocked from entering the building interior. This, of course, avoids or reduces solar heat gain on the interior of the building. In this manner, the window height H may be approximately twice or double the size of the sash width/depth W. As just an example, the window height or sash height H may be about five and a half inches, whereas the sash width/depth W may be about two and a half inches-approximately a 2:1 ratio. Of course, other dimensions and ratios are contemplated.

[0120] Conversely, since the winter sun (S2) is lower in the sky than the summer sun (S1), the winter sun rays may pass through the window assembly 10 to provide solar heat gain to the interior of the building.

[0121] With reference now to FIG. 17, a front view of a window assembly of at least one embodiment is shown with the use of a diffusion grid 480 disposed on a portion thereof. Fixed louvers or supports 482 may be dispose within one or more of the insulating air spaces disposed or defined

between adjacent glazing layers **130**, **230**, **330**. The fixed louvers or supports **482** may be adhered or fixed or one or more surfaces of the adjacent glazing layers and can be used to hold or support the diffusion grid **480**. The diffusion grid can be used to provide summer shading, winter gain, and year round daylight bounced deeper into the interior space of the building by diffusing the sun light disposed there through. In some cases, the diffusion grid can be used as providing glare control, as well. In other embodiments, tinting or other light deflection or reduction structures can be used on the surface of one or more of the glazing layers or between adjacent glazing layers. It should be noted that the window assembly shown in FIG. **17** can be a retrofit assembly attachable to an existing window unit, for example, via one or more spacer assemblies, as disclosed herein. In other embodiments, the window assembly may be un the form of a stand-alone window unit for new construction or replacement windows.

[0122] FIG. **18** is an exemplary top-down sectional view of a retrofit window assembly, similar to that shown in FIG. **8** and described above. In particular, an existing window unit may include one or more windows **5** secured to (typically metal or aluminum) frame **2**. This is a common storefront window construction, although not necessarily limited to such. In particular, a first spacer **40**A is secured to one of the exposed existing window units **5** with a glazing layer **30** secured to the opposite side of the spacer **40**A to create an insulating airspace **14** therebetween. The installation may continue with successive, one-by-one installation of spacers **40**A, **40**B, **40**C, **40**D and glazing layers **30** until the desired amount of insulating airspaces **14** or glazing layers **30** is achieved. It should also be noted that spacers **40**A, **40**B, **40**C and **40**D can insulate the existing metal sash **2**.

[0123] More in particular, the installation process begins with the attachment of the first spacer **40**A to the window unit **5**. Then, the first glazing layer **30** is attached to the first spacer **40**A, as shown in the example of FIG. **18**. Next, a second spacer **40**B is attached to the exposed surface of the first glazing layer **30**, and a second glazing layer **30** is attached to the second spacer **40**B. This process continues with alternating installation of spacers **40** and glazing layers. As described above in connection with at least one embodiment, the spacers and glazing layers may be attached via one or more strips of double-sided adhesive tape. Optionally, an interior trim **402** can be installed around the perimeter of the last glazing layer **30** for ornamentation.

[0124] With reference now to FIG. **19**, a further embodiment of the present invention may include a window assembly, or as shown, a skylight assembly **500** with one or more integrated light assemblies or light structures **510**. Specifically, window or skylight assembly **500** may include one or more light emitting diode (LED) structures or arrays **510** structured to emit light into the building interior. For example, the LED structures **510** may be secured to one or more of the glazing layers **30** and/or any framing or enclosure sections, such as the sash assembly **340**, spacer assembly **440** or portions of the skylight structural enclosure elements **520**. In some cases, the LED structures may be secured around the perimeter or near the outer edges of one or more of the glazing layers **30** and/or inside the perimeter of the skylight enclosure **520**.

[0125] Furthermore, and still referring to FIG. **19**, one or more solar or photovoltaic panels **515** can be mounted to the exterior of the skylight enclosure **520** and/or portions of the window or skylight assembly **500**. The solar or photovoltaic panel(s) **515** can be used to charge or supply power to one or more batteries generally referenced as **518**, with a voltage regulation circuit as needed. The one or more batteries **18** are used to supply power to the one or more LED structures **510**. In some embodiments, one or more photocell (or other) light sensors **519** may be included to control the LED structures. In other words, depending on the results of the sensors and the particular sunlight at the time, the light sensor(s) **519** and/or another control assembly can automatically control the light output, by either turning the LEDs on or off, dimming or brightening the LEDs, changing the LED color or hue output, etc. In one example, the skylight assembly **500** can be used to autonomously (vie the sensor(s), LED structure(s) and/or control assembly) provide daylight by day (e.g., by turning off the LED structures during the day) and electric light by night (e.g., by tuning on the LED structures).

[0126] With reference now to FIGS. **20**A-**20**C, yet another embodiment of the multi-glazed window assembly **600** of the present invention is shown. In particular, as shown in FIG. **20**A, the multi-glazed window assembly **600** includes one unit **602**, which has at least two spaced apart glazing layers **604***a*, **604***b*, and at least one spacer assembly **610** disposed between the glazing layers **604***a*, **604***b* while collectively defining an insulating airspace, referenced as **605**. In some embodiments, one or all of the insulating airspaces **605** may include a width (e.g., measured between the inside surfaces of adjacent glazing layers **604***a*, **694***b*) of approximately ¾ inches, although other sizes are contemplated within the full spirit and scope of the present invention. Furthermore, each glazing layer **604***a*, **604***b* may be 0.08 inch acrylic panels, although other sizes and other materials are contemplated and included within the present invention.

[0127] FIG. **20**B illustrates a multi-glazed window assembly **600** with a plurality of (e.g., two) adjacent or side-by-side units **602**. In this embodiment, the two units **602** may share a common, intermediately disposed glazing layer, which is shown as glazing layer **604***b*. More specifically, three glazing layers **604***a-c* are spaced from one another in a generally parallel (but not necessarily) manner to form two insulating airspaces **605**; one or a first insulating airspace **605** disposed or defined between glazing layers **604***a* and **604***b*, and another or a second insulating airspace **605** disposed or defined between glazing layers **604***b* and **604***c*.

[0128] FIG. **20**C is provided to illustrate that several more units **602** can be assembled together in the same or similar manner as that shown in FIG. **20**B to define a multi-glazed window assembly **600** that defines two or more insulating airspaces **605**. In particular, the multi-glazed window assembly **600** of the present invention may define one through nine, or more, insulating airspaces **605**. Each insulating airspace **605** may include a spacer assembly **610** disposed between adjacent glazing layers **604***a-n* as provided herein. As shown, glazing layers **604***a-n* can be used to define the insulating airspaces **605**. Adjacent units **602** can share a common glazing layer (e.g., as provided in FIG. **20**B), although it is contemplated that in some cases each unit **602** may include distinct pairs of glazing layers such that adjacent units may not share a common glazing layer, but may instead have abutting, adjacent glazing layers.

[0129] It should also be noted that, in at least one embodiment of the present invention constructed in accordance with

the embodiments illustrated in FIGS. **20**A-C may exhibit an R-value of approximately 4.5 with three insulating airspaces (three spacer assemblies **610** and four glazing layers), an R-value of approximately 6.8 with five insulating airspaces (five spacer assemblies **610** and six glazing layers), and an R-value of approximately 9.4 with seven insulating airspaces (seven spacer assemblies **610** and eight glazing layers).

[0130] In any event, the spacer assembly **610** of at least one embodiment includes a clear (e.g., transparent) or partially clear (e.g., translucent) tube **612**. The tube **612** may, in some embodiments, include a square or rectangular cross-section with sharp or rounded corners, however, other shapes, including other polygonal shapes, circular or oval shapes, etc. are contemplated. Furthermore, the tube **612** or spacer assembly **610** of at least one embodiment may be constructed out of acrylic or other like materials. As just an example, the tube **612** may be a ¾ inch thick acrylic square tube, although other materials, shapes and sizes are contemplated within the full spirit and scope of the present invention.

[0131] In addition, the tube **612** or spacer assembly **610** of at least one embodiment may function as the sash or frame of the window assembly. In other words, the assembly **600** of at least one embodiment may eliminate the need for or otherwise replace the sash and frame typically found on many traditional or common window units.

[0132] In some embodiments, the tube **612** of the spacer assembly **610** defines opposing lateral sides, referenced as **614***a*, **614***b* which are attached to the respective glazing layer **604***a*, **604***b*. In some cases, as described in accordance with other embodiments presented herein, the spacer assembly **600** or tube **612** thereof may be attached to the glazing layers **604***a*, **604***b* via peel-and-stick, double-sided adhesive tape, referenced as **606***a*, **606***b*, although other manners of adhering, connecting or attaching the tube(s) **612** to the corresponding glazing layer(s), e.g., **604***a*, **604***b*, **604***n*, is contemplated. It should be noted that in the illustrations provided at least in FIGS. **20**A-**20**C, the double-sided adhesive tape **606***a*, **606***b* is shown separated from the surfaces of the corresponding glazing layer **604***a*, **604***b* and the tube **612**, however, that is for illustrative purposes only and it should be apparent that, in operation, the tape **606***a-b* adhesively contacts the facing surfaces of the glazing layer and tube. The thickness and size of the tape **606***a-b* shown in the drawings is also provided for illustrative purposes and may not be to scale.

[0133] Furthermore, still referring to FIGS. **20**A-C, in at least one embodiment, a sealant **620** may be placed along a longitudinal edge **614***c* of the tube **612**, such as, between a perimeter edge **607** and the tube **612**. In some cases, the sealant **620** may span the entire longitudinal edge or surface **614** while also extending at least partially along the opposing lateral edges or surfaces **614***a*, **614***b* of the tube **612** and between the tube **612** and the corresponding glazing layer(s) **604***a*, **604***b*. This sealant **620** can assist with the secure attachment of the spacer assembly **610** to the perimeter edge **607** and the glazing layers **60***a*, **604***b*. It should also be noted that the sealant **620** may be thinner than shown in the Figures in that the sealant **620** shown is for illustrative purposes and may not be to scale. For example, in one embodiment, the spacer assembly **610** and in particular the tube **612** thereof may be disposed at or approximately at ⅛ inches in from the glazing layer(s) **604***a*, **604***b*, and in some cases, ⅛ inches up (or in) from the perimeter edge **607**. It should also be noted that the distance (e.g., ⅛ inches) between the tube **612** and the glazing layer **604***a*, **604***b* may be measured from the inside surface of the glazing layer, the outside surface of the glazing layer, or the center of the glazing layer.

[0134] It should also be noted that in some embodiments, double-sided adhesive tape can also be used between the tube **612** and the perimeter edge **607** in addition to or instead of the sealant **620**.

[0135] Furthermore, in at least one embodiment, the tube **612** of the spacer assembly **610** may define an open interior space, generally referenced as **615**. In other words, the clear acrylic (or other) tube **612** of the spacer assembly **610** may include an interior area that is generally open or available to be filled with another material. With reference now to FIG. **21**, the cross-hatched shading provided on the interior of at least one of the tubes **612** represents a filling material **630** disposed therein. This filling material **630** may be present in one of the tube(s) **612**, all of the tube(s) **612** or in any number of less than or equal to all of the tube(s) **612**.

[0136] More in particular, the filling material **630** shown in FIG. **21** may include a phase-change material or medium that can provide integral heat or thermal storage designed to reduce the overall energy costs associated with heating or colling the corresponding building or room within which the window assembly **600** is installed. As an example, the filling material **630**, such as the phase-change material, may melt between 67 degrees and 74 degrees Fahrenheit with heat enthalpy of 60,000 BTU/cf. x.048cf in a **2278** window with one perimeter loop of PCM, which is 2880 BTU of latent heat storage/loop. Of course, this is merely exemplary and other materials with other heat storage and the like properties are contemplated as filling materials **630**.

[0137] Furthermore, with reference to FIGS. **22**A and **22**B, in at least one embodiment of the present invention, one or more light assemblies or light sources **640** may be disposed within one or more of the insulating airspaces **605**, and in some cases, within the one or more spacers or tubes **612**. Moreover, the at least one light assembly or light source **640** may be in the form of or otherwise include a light emitting diode (LED) however other light sources are contemplated within the scope of the present invention including compact fluorescent lamps (CFLs), halogen lights, light strips, etc.

[0138] In any event, as shown in FIGS. **22**A-**22**B, the light source **640** may be electrically attached to a power source **642**, such as one or more batteries, although other power sources are contemplated. In particular, the one or more batteries may be replaceable or rechargeable. In some cases, the one or more batteries **642** may be rechargeable wirelessly through the glazing layer(s) such that physical access thereto may not be needed. In other embodiments, a cable (not shown) may be passed from the light source **640** to a location external to the assembly **600** (e.g., through a corresponding hole or channel), which can then be plugged in or electrically connected to a power source.

[0139] The light source **640**, when illuminated, can provide edge-to-edge lighting to the window assembly **600**, for example, by lighting the edges of, between the edges of, and/or to the edges of the glazing layer(s) **604***a-n* and/or the clear tube(s) **612**. This is particularly true with acrylic glazing layers although glass and other materials can also produce edge lighting.

[0140] Furthermore, in at least one embodiment, a light-transmitting thermal storage medium may be disposed between at least two of the glazing layer(s) **604***a-n* and/or within the one or more spacers or clear tubes **612**. For instance, an example of a light-transmitting thermal storage medium may be water, although other mediums, whether liquid, solid or otherwise, are contemplated.

[0141] It should also be noted that, as described in accordance with other embodiments provided herein, the glazing layers **604***a-n* of at least one embodiment transfer structural roof loads of the building within which the assembly **600** is installed. In some cases, the window assembly **600** can be installed without a window header. Furthermore, multiple glazing layers **604***a-n* can act as structural diaphragms of a stress-skin panel, as disclosed in accordance with other embodiments provided herein.

[0142] With reference now to FIGS. **23**A-**24**B, yet another embodiment of the multi-glazed window assembly **700** is shown. More specifically, as with several other embodiments disclosed herein, the assembly **700** includes a plurality of glazing layers, such as, first and second outer glazing layers **704***a*, **704***b*, and, in some cases, at least one intermediate glazing layer **704***c*. It should be noted that, when the assembly **700** is installed within a building or home, either one of the outer glazing layers **704***a*, **704***b* may face in the interior of the building or exterior of the building. In some embodiments, two or more assemblies **700** can be layered such that one of the outer glazing layers of one of the assemblies is adjacent to or faces one of the outer glazing layers of the second assembly.

[0143] Furthermore, it should also be noted that in at least one embodiment, the first and second outer glazing layers **704***a*, **704***b* (or any of the outer glazing layers of other embodiments disclosed herein) may be constructed of or made from a polycarbonate material which can resist scratching and/or yellowing. The at least one intermediate glazing layer **704***c* can be constructed of or made of a polycarbonate material, as well, or acrylic. Other embodiments may use other materials or combination of materials and still fall within the full spirit and scope of the present invention.

[0144] Moreover, still referring to FIGS. **23**A-**24**B, the assembly **700** of at least one embodiment also includes a perimeter spacer assembly, generally referenced as **710**, and an elongated outer wrapping or perimeter wrapping, generally referenced as **750**. The elongated outer wrapping **750** of at least one embodiment is a single-piece and/or unitary construction with a length sufficient to wrap entirely around the collective perimeter edges of the plurality of glazing layers **704***a-c*. In this manner, the length of the elongated outer wrapping **750** of at least one embodiment is at least equal to the length of the perimeter of each of the glazing layers **704***a-c* or at least the largest one, if the glazing layers are different sizes.

[0145] Furthermore, in at least one embodiment, the elongated outer wrapping **750** is made of a resilient material, including for example, a foam material that is flexible and compressible. In particular, as will be described herein, the flexibility of the elongated outer wrapping **750** allows the elongated outer wrapping **750** to be bent, flexed or otherwise wrapped around the perimeter edges of the glazing layers, and in some cases, over a portion of the outer-facing surfaces of the glazing layers. The compressible or resilient nature of the elongated outer wrapping **750** of at least one embodiment allows the entire assembly **700** to be installed within a window frame of a building wherein the resilient elongated outer wrapping **750** can then be pressed against by the frame, wood or other framing elements, etc. to create an air-tight seal there between.

[0146] More specifically, the elongated outer wrapping **750** includes an inner surface **752** and an outer surface **754**. Disposed along a length of the inner surface **752** is the perimeter spacer assembly **710**. In the embodiments of the assembly **10** that include at least one intermediate glazing layer **704***c*, the perimeter spacer assembly **710** defines at least one interior channel **715** within which a perimeter edge **705***c* of the intermediate glazing layer **704***c* is disposed. In this manner, the number of interior channels **715** will match the number of intermediate glazing layers **704***c* used in the assembly **700**. In other words, if there is one intermediate glazing layer **704***c*, then the perimeter spacer assembly **710** defines one interior channel **715**. Therefore, if there are n-number of intermediate glazing layers **704***c*, then there will also be n-number of interior channels **715** defined by the perimeter spacer assembly **710**. Similarly, if there are not any intermediate glazing layers, then the perimeter spacer assembly **710** need not have any interior channels, as shown, for example, in FIGS. **25**A-**25**B.

[0147] With reference again to FIGS. **23**A-**24**B, the perimeter spacer assembly **710** of at least one embodiment the perimeter spacer assembly **710** is attached, e.g., adhesively, to the inner surface **752** of the elongated outer wrapping **750**. Furthermore, in some cases, the perimeter spacer assembly **710** includes a plurality of separate elongated spacers **712** longitudinally attached to the inner surface **752** of the outer wrapping **750** and in a laterally spaced relation with one another to define the channel **715** there between. Other embodiments of the perimeter spacer assembly **710** may be formed of a single piece defining two spacers **712** and a channel **715** or recess disposed there between.

[0148] In some embodiments, the perimeter spacer assembly **710** is formed of a resilient material, such as a foam material. More specifically, the perimeter spacer assembly **710** and/or the individual spacers **712** thereof may include a dense foam tape, such as, but in no way limited to ½ inch to ¾ inch wide by ¼ inch to ½ inch thick, although other sizes are contemplated within the full spirit and scope of the present invention.

[0149] It is also contemplated that in at least one embodiment, the perimeter spacer assembly **10** and the elongated outer wrapping **750** are formed of or constructed of a single piece or unitary construction.

[0150] Still referring to FIGS. **23**A-**24**B, a method of assembling the multi-glazed window assembly **700** of at least one embodiment is illustrated. For example, as shown in FIGS. **23**A-**23**B, with the elongated outer wrapping **750** and the attached perimeter spacer assembly **710** exended in a generally flat or straight orientation, an outer edge **705***c* of the at least one intermediate glazing layer **704***c* can be set into the channel **715**.

[0151] Next, the outer glazing layers **704***a*, **704** can be added, for example, by disposing a perimeter edge **705***a*, **705***b* thereof along a corresponding outer-facing surface **714***a*, **714***b* of the perimeter spacer assembly **710**. More specifically, the perimeter edge **705***a* of the first outer glazing layer **704***a* is disposed against or along a first outer-facing surface **714***a* of the perimeter spacer assembly **710**. Similarly, the perimeter edge **705***b* of the second outer

glazing layer **704***b* is disposed against or along a second outer-facing surface **714***b* of the perimeter spacer assembly **710**. As shown in FIGS. **23**C-**23**D, the glazing layers **704***a-c* form parallel planes with the corresponding perimeter edges **705***a-c* in place.

[0152] Then, the elongated outer wrapping **750**, and the attached perimeter spacer assembly **710**, can be wrapped around the entire collective perimeters of the plurality of glazing layers **704***a-c* until the entire set of glazing layers **704***a-c* are fully wrapped around the perimeter, for example, as shown in FIG. **26**. If the elongated outer wrapping **750** and/or perimeter spacer assembly **710** has some excess length or material, it can be trimmed (e.g., with scissors or a knife) such that the opposing ends **750***a*, **750***b* of the elongated outer wrapping **750** match or meet.

[0153] With the continuous outer wrapping **750** fully wrapped around the outer perimeter of the glazing layers **704***a-c*, there is only one seam that needs to be joined and/or sealed—the seam formed by the opposing ends **750***a*, **750***b* of the outer wrapping. This can be done, for example, with a heavy-duty piece of tape where the ends **750***a*, **750***b* meet after wrapping the window. This, in essence, minimizes the potential points of seal failure that are common or existent in other window assemblies. For example, a wrapped and edge-sealed window assembly, as disclosed in accordance with at least one embodiment, can replace several (e.g., twenty or more) separate pieces of individually cut, cleaned and secured frames in an R7 fixed window.

[0154] Turning to the cut-away end views of FIGS. **24**A-**24**B, the elongated outer wrapping **750** may, in some embodiments, include longitudinal edges **756**, **758** that extend beyond the outer-facing surfaces of the outer glazing layers **704***a*, **704***b*. Those edges **756**, **758** can then fold down over a portion of the outer-facing surfaces of the outer glazing layers **704***a*, **704***b*.

[0155] In at least one embodiment, as shown in FIGS. **24**A, **24**B, the outer edges or flap **756**, **758** that folds down over the outer glazing layers **704***a*, **704***b* may, but need not necessarily, include a length that sufficiently extends to or beyond the top edge **713** of the perimeter spacer assembly **710**. In this manner, with the flaps or edges **756**, **758** folded, the flaps **756**, **758** cover, hide or substantially cover or hide the perimeter spacer assembly **710**.

[0156] Furthermore, the outer wrapping **750** of at least one embodiment acts as a gasket as the window is installed within the window frame opening of the building. The foam or other outer wrapping **750** is not visible on the final installation, since it can and likely will be covered by the window trim panels inside and outside of the building that locks the assembly **700** in place and uses the foam or resilient material of the wrapping as a gasket and backer for caulk finish sealing the perimeter.

[0157] In several embodiments, the entire assembly **700** can be constructed in under thirty minutes, and the only tool that may be needed is a simple cutting tool (e.g., scissors or a knife) to trim excess material, if necessary.

[0158] FIGS. **27**A-**27**C illustrate another exemplary embodiment of the elongated outer wrapping **750** and perimeter spacer assembly **710** constructed to accommodate four intermediate glazing layers with a different one disposed in a different one of the four illustrated channels **715**.

[0159] Since other modifications and changes varied to fit particular operating requirements and environments will be apparent to those skilled in the art, the invention is not considered limited to the example chosen for purposes of disclosure, and covers all changes and modifications which do not constitute departures from the true spirit and scope of this invention. This written description provides an illustrative explanation and/or account of the present invention. It may be possible to deliver equivalent benefits using variations of the specific embodiments, without departing from the inventive concept. This description and these drawings, therefore, are to be regarded as illustrative and not restrictive.

1. A multi-glazed window assembly, comprising:

a plurality of glazing layers arranged in a parallel relation to one another and defining at least one insulating airspace there between, said plurality of glazing layers comprising a first outer glazing layer, a second outer glazing layer, and at least one intermediate glazing layer disposed between said first outer glazing layer and said second outer glazing layer,

a perimeter spacer assembly, and

an elongated outer wrapping, said elongated outer wrapping comprising an interior surface and an exterior surface,

wherein said perimeter spacer assembly is attached along a length of said interior surface of said elongated outer wrapping defining at least one interior channel, wherein a perimeter edge of said at least one intermediate glazing layer is disposed within said interior channel formed by said perimeter spacer assembly,

wherein said elongated outer wrapping extends entirely around a collective perimeter of said plurality of glazing layers.

2. The multi-glazed window assembly as recited in claim **1** wherein a perimeter edge of said first outer glazing layer is disposed along a first outer-facing surface of said perimeter spacer assembly.

3. The multi-glazed window assembly as recited in claim **1** wherein a perimeter edge of said second outer glazing layer is disposed along a second outer-facing surface of said perimeter spacer assembly.

4. The multi-glazed window assembly as recited in claim **1** wherein a perimeter edge of said first outer glazing layer is disposed along a first outer-facing surface of said perimeter spacer assembly, and a perimeter edge of said second outer glazing layer is disposed along a second outer-facing surface of said perimeter spacer assembly.

5. The multi-glazed window assembly as recited in claim **1** wherein said elongated outer wrapping comprises a first edge that folds over at least a portion of an outer-facing surface of said first outer glazing layer.

6. The multi-glazed window assembly as recited in claim **5** wherein said elongated outer wrapping comprises a second edge that folds over at least a portion of an outer-facing surface of said second glazing layer.

7. The multi-glazed window assembly as recited in claim **1** wherein said perimeter spacer assembly is adhesively attached to said interior surface of said elongated outer wrapping.

8. The multi-glazed window assembly as recited in claim **1** wherein said perimeter spacer assembly comprises a plurality of separate elongated spacers disposed along said interior surface of said elongated outer wrapping.

9. The multi-glazed window assembly as recited in claim **1** wherein said elongated outer wrapping is a single, unitary

piece that wraps around said entire collective perimeter of said plurality of glazing layers.

10. The multi-glazed window assembly as recited in claim **1** wherein said elongated outer wrapping comprises a resilient material.

11. The multi-glazed window assembly as recited in claim **10** wherein said elongated outer wrapping comprises a resilient foam material.

12. The multi-glazed window assembly as recited in claim **11** wherein said perimeter spacer assembly comprises a resilient foam material.

13. The multi-glazed window assembly as recited in claim **1** wherein said first outer glazing layer and said second outer glazing layer comprise a polycarbonate material.

14. The multi-glazed window assembly as recited in claim **13** wherein said at least one intermediate glazing layer comprises an acrylic material.

15. A multi-glazed window assembly, comprising:

a plurality of glazing layers comprising a first outer glazing layer, a second outer glazing layer, and at least one intermediate glazing layer disposed between said first outer glazing layer and said second outer glazing layer,

a perimeter spacer assembly, and

an elongated outer wrapping,

wherein said perimeter spacer assembly is attached to an interior surface of said elongated outer wrapping defining at least one interior channel, wherein a perimeter edge of said at least one intermediate glazing layer is disposed within said interior channel,

wherein a perimeter edge of said first outer glazing layer is disposed along a first outer-facing surface of said perimeter spacer assembly, and a perimeter edge of said second outer glazing layer is disposed along a second outer-facing surface of said perimeter spacer assembly,

wherein said elongated outer wrapping comprises a first edge that folds over at least a portion of an outer-facing surface of said first outer glazing layer, and wherein said elongated outer wrapping comprises a second edge that folds over at least a portion of an outer-facing surface of said second glazing layer.

16. The multi-glazed window assembly as recited in claim **15** wherein said elongated outer wrapping extends entirely around a collective perimeter of said plurality of glazing layers.

17. The multi-glazed window assembly as recited in claim **15** wherein said elongated outer wrapping is a single, unitary piece that wraps around said entire collective perimeter of said plurality of glazing layers.

18. The multi-glazed window assembly as recited in claim **17** wherein said elongated outer wrapping comprises a foam material.

19. A multi-glazed window assembly, comprising:

a plurality of glazing layers defining at least one insulating airspace there between, said plurality of glazing layers comprising at least: a first outer glazing layer and a second outer glazing layer,

a perimeter spacer assembly, and

an elongated outer wrapping, said elongated outer wrapping comprising an interior surface and an exterior surface,

wherein said perimeter spacer assembly is attached along a length of said interior surface of said elongated outer wrapping,

wherein a perimeter edge of said first outer glazing layer is disposed along a first outer-facing surface of said perimeter spacer assembly, and a perimeter edge of said second outer glazing layer is disposed along a second outer-facing surface of said perimeter spacer assembly,

wherein said elongated outer wrapping extends entirely around a collective perimeter of said plurality of glazing layers.

20. The multi-glazed window assembly as recited in claim **19** wherein said elongated outer wrapping is a single, unitary piece of foam material that wraps around said entire collective perimeter of said plurality of glazing layers.

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