March 17, 1959 G. B. HAAS 2,877,515

INSULATED METAL-FRAMED WINDOW SASH

Filed Nov. 1, 1957

3 Sheets-Sheet 1

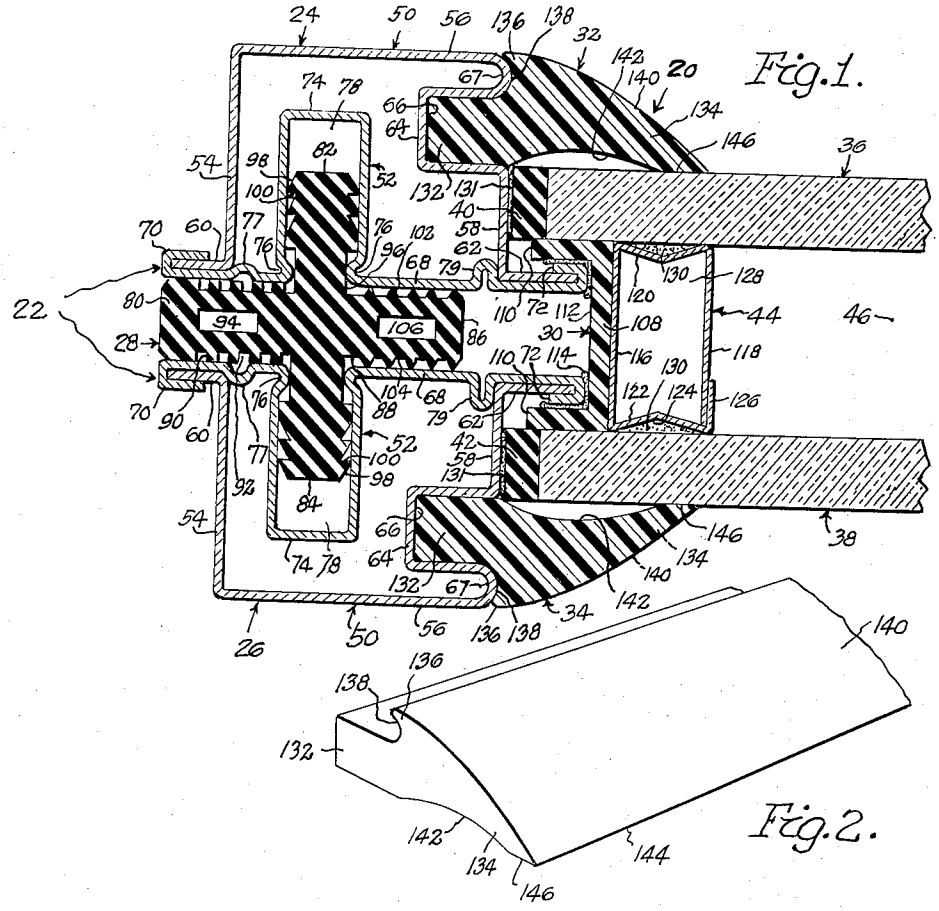


Fig. 1.

Fig. 2.

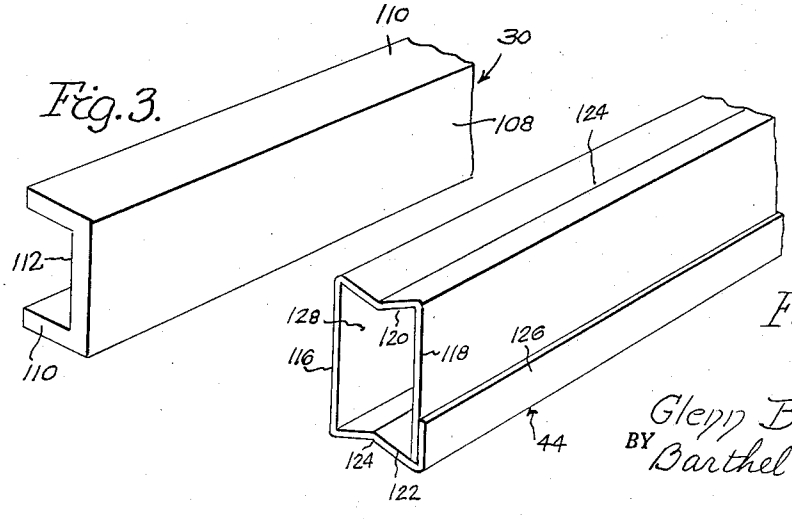


Fig. 3.

Fig. 4.

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3 Sheets-Sheet 2

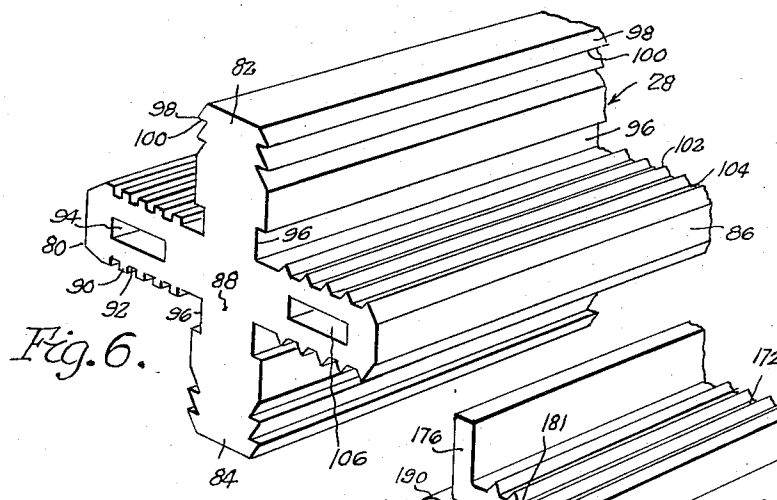


Fig. 6.

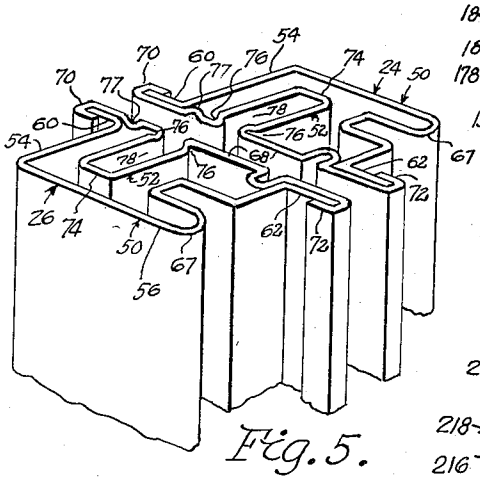


Fig. 5.

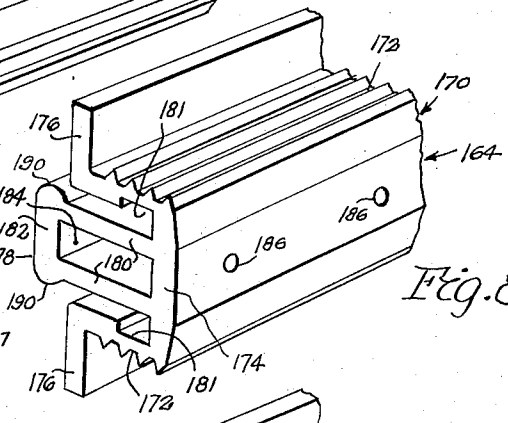


Fig. 8.

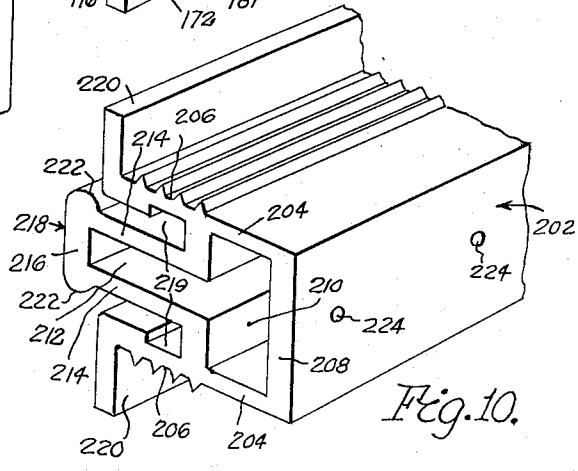


Fig. 10.

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3 Sheets-Sheet 3

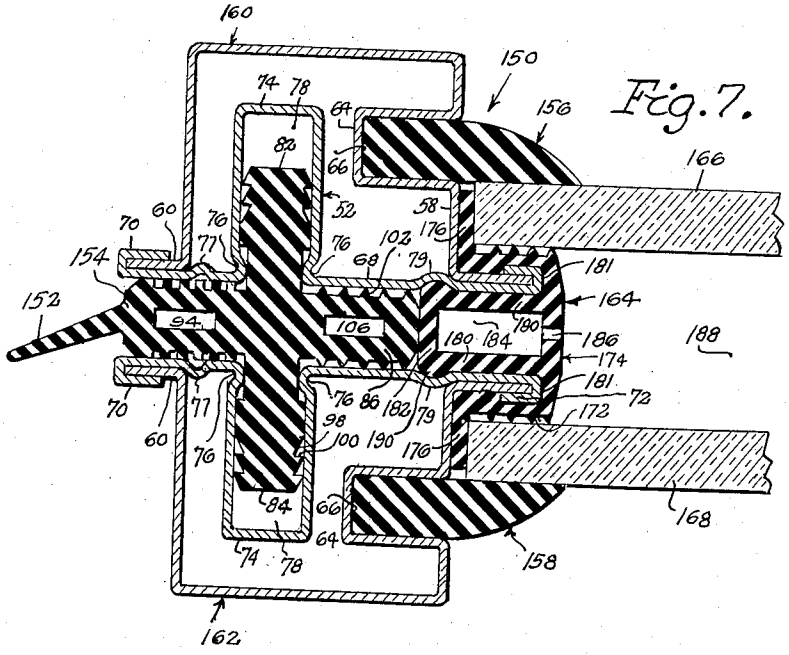


Fig. 7.

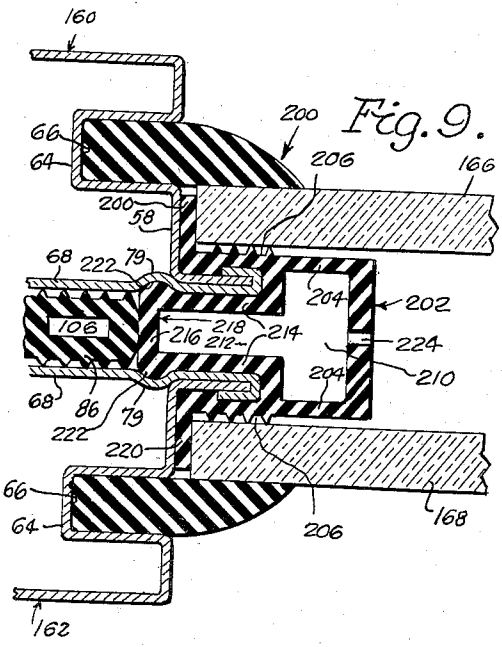


Fig. 9.

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2,877,515

INSULATED METAL-FRAMED WINDOW SASH

Glenn B. Haas, Oak Harbor, Ohio, assignor to Window Products, Inc., Oak Harbor, Ohio, a corporation of Ohio

Application November 1, 1957, Serial No. 693,964

14 Claims. (Cl. 20—56.5)

This invention relates to window sash structures and, in particular, to metal-framed double-pane window sash.

One object of this invention is to provide a metal-framed double-pane window sash construction wherein the frame structure has external and internal units of hollow sheet metal which are heat-insulated from one another by novel heat-insulating members and held in assembly with one another and with the window panes by novel spacing in insulating members, additional means of novel construction being provided for absorbing moisture from the air space between the double window panes, which are substantially sealed against the entrance of outside air, moisture, dust or other undesired foreign matter.

Another object is to provide an insulated metal-framed double-pane window sash wherein the panes are held in assembly by relatively rigid pane-retaining strips of plastic material which extend completely around the sash frame and are seated in the external and internal units thereof.

Another object is to provide an insulated metal-framed double-pane window sash construction of the foregoing character wherein the moisture-absorbing means includes a hollow tube containing a desiccant and so formed that its interior communicates with the air space between the window panes to withdraw moisture therefrom.

Another object is to provide an insulated metal-framed double-pane window sash as set forth in the object immediately preceding, wherein a heat-insulating member is interposed between the desiccant tube and the sash frame to heat-insulate the space between the window panes and assist sealing thereof, so as to prevent water vapor from entering therein, this heat-insulating member being of sufficient rigidity to prevent the inner and outer sash frame units or "moldings" from moving outward or inward relatively to one another, thereby also serving as a coupling member.

Another object is to provide a heat-insulated metal-framed double-pane window sash as set forth in the preceding objects, wherein the desiccant tube has grooved opposite sides filled with a yieldable sealing compound which effectively seals the space between the window panes from the entrance of water vapor, regardless of rising or falling temperatures and humidity conditions and of sudden changes therein.

Other objects and advantages of the invention will become apparent during the course of the following description of the accompanying drawings, wherein:

Figure 1 is an enlarged fragmentary cross-section through a heat-insulated metal-framed double-pane window sash construction having a desiccating device for removing moisture from the space between the window panes;

Figure 2 is a frgamentary perspective view of a short length of one of the pane-retaining strips used in the window sash construction of Figure 1;

Figure 3 is a fragmentary perspective view of a short length of the coupling member used between the external and internal sash frame units shown in Figure 1;

Figure 4 is a fragmentary perspective view of a short length of the desiccant tube also used in the window sash construction of Figure 1;

Figure 5 is a fragmentary perspective view of a short length of sheet metal sash frame or molding of Figure 1, showing the outer and inner units thereof separated from one another but omitting the panes, spacers and heat-insulating members;

Figure 6 is a fragmentary perspective view of a short length of the cruciform spacing member used in the window sash construction of Figure 1;

Figure 7 is a fragmentary cross-section through a modified double-pane window sash construction employing a different desiccant holder from that of Figure 1;

Figure 8 is a fragmentary perspective view of a short length of the desiccant holder of Figure 7;

Figure 9 is a fragmentary cross-section of a further modified double-pane window sash construction employing a still different desiccant holder of enlarged capacity; and

Figure 10 is a fragmentary perspective view of a short length of the enlarged capacity desiccant holder used in the further modified construction of Figure 9.

Referring to the drawings in general, Figures 1 to 6 inclusive show a portion of a heat-insulated sealed metal-framed double pane window sash installation, generally designated 20, as consisting generally of a sash frame or molding assembly 22 having external and internal sash frame units 24 and 26 respectively separated from one another by outer and inner heat-insulating spacers, generally designated 28 and 30, and external and internal pane-retaining members 32 and 34 of similar construction adapted to hold in assembly the external and internal window panes 36 and 38 respectively. The window panes 36 and 38 are also insulated from the external and internal frame units or moldings 24 and 26 by external and internal heat-insulating strips 40 and 42 respectively. Finally, a tubular desiccant holder, generally designated 44, is mounted in the air space 46 between the external and internal panes 36 and 38 and is adapted to hold a desiccant for removing moisture from the space 46. Additional sealing compound used in the installation 20 is described below at the locations where it is installed.

Referring to the drawings in detail, the external and internal sash frame units or moldings 24 and 26 of the frame structure 22 are of similar construction although oppositely-facing, hence to avoid duplication a single description of both, with the same reference numerals, should be sufficient. Each unit 24 or 26 consists of a generally-channel-shaped external member, generally designated 50, and an internal closure member, generally designated 52, secured thereto as described below, in order to form the hollow box-section unit 24 or 26. The external member 50 has three sides 54, 56 and 58 arranged respectively at approximate right angles to one another and provided with oppositely-extending edge flanges 60 and 62 respectively at the free edges of the sides 54 and 58 (Figure 1). The side 58 is also provided with a channel portion 64 forming an elongated recess or groove 66 for receiving one of the pane-retaining members 32 or 34, as the case may be. The junction between the sides 56 and 58 is rounded as at 67.

The internal closure member 52 consists of an elongated sheet metal strip 68 having reversely-bent opposite edge portions 70 and 72 respectively receiving the edge flanges 60 and 62 respectively of the external member 50 in tight clamping engagement. Each strip 68 is also provided with a channel portion 74 with indentations 76 at the opposite sides of the mouth thereof forming a channel

or groove 78 for receiving one of the lateral portions of the heat-insulating cruciform spacer 28, as described below. The external and internal members 50 and 52 of each sash frame unit or molding 24 or 26 are conveniently formed from sheet metal by a metal rolling process on conventional metal rolling machinery, sheet aluminum being preferred because of its lightness and corrosion-resisting characteristics. The external and internal members 50 and 52 of the units 24 and 26 are securely united to one another and clamped together by rolling over the reversely-bent edge portions 70 and 72 of the internal member 52 upon the edge flanges 60 and 62 of the external member 50. In addition, each internal member 52 is provided with a pair of ribs 77 and 79 (Figure 1), the former located adjacent and engaging the junction corner of the side 54 with the edge flange 60 and the latter located adjacent the junction corner of the side 58 with the edge flange 62.

The heat-insulating outer spacer 28 which at the same time holds together and insulates from one another the external and internal sash frame units or moldings 24 and 26 is in the form of an elongated extrusion (Figure 6) of resilient material, such as natural or synthetic rubber or a resilient synthetic plastic, such as vinyl resin, and is of approximately cross-shaped or cruciform cross-section with an outer arm 80, lateral arms 82 and 84, and an inner arm 86, all projecting radially from a central elongated core 88 of approximately rectangular cross-section. The outer arm 80 is of approximately rectangular cross-section with parallel alternately-ridged and grooved opposite sides 90 and 92 respectively, and is provided with an internal hollow space or chamber 94 of elongated approximately rectangular cross-section. The alternately ridged and grooved portions 90 and 92 resiliently engage and grip the inner walls or strips 68 of the closure members 52.

The lateral arms 82 and 84 of the heat-insulating spacer 28 are similarly provided outwardly from the core 88 with central channels 96 adapted to receive the indentations 76 of the closure members 52 and outer alternate saw-toothed ridges 98 and grooves 100. The saw-toothed ridges 98 are directed toward the core 88 in ratchet-tooth fashion so as to facilitate insertion into the grooves 78 in the channel portions 74 of the closure members 52 yet to resist withdrawal therefrom. In this manner, the external and internal hollow box-like frame units 24 and 26 are held in assembly with one another yet insulated against the free conduction of heat or cold therebetween. The word "cold" in this connotation is used in its popular sense rather than in its scientifically accurate sense, which is of course the absence of heat.

The fourth or inner arm 86 of the insulating spacer 28 also has parallel ridges 102 of V-shaped cross-section and grooves 104 of truncated V-shaped cross-section, together with an internal hollow space or chamber 106 similar to the hollow space or chamber 94 in the arm 80. This arm 86 (Figure 1) fits between and engages the strips 68 of the closure members 52.

The inner heat-insulating spacer 30 (Figures 1 and 3) is in the form of an elongated extrusion of channel-shaped cross-section, made from a relatively rigid insulating material, such as a rigid vinyl resin having a central or web portion 108 and spaced parallel lateral flanges 110 bounding a channel 112. The latter is of a width sufficient to receive the inner central portion of the hollow sash frame or molding unit 22, namely the reversely-bent portions 72 of the external and internal sash frame units 24 and 26 respectively, and the inner edge flanges 62 gripped thereby. A layer 114 of yieldable sealing compound and of L-shaped cross-section is inserted between the reversely-bent portions 72 and the corners of the channel 112 into which they fit in order to tightly and hermetically seal the junction between the reversely-bent portions 72 and the web and flanges 108 and 110 of the inner heat-insulating spacer 30. The inner heat-insulating spacer 30 is also of the desired width for separating the external and internal panes 36 and 38 and is sufficiently rigid to prevent the external and internal sash frame units or moldings 24 and 26 from moving apart and in this respect serves as a coupling member. The sealing compound 114, known colloquially in the window sash industry as "gunk," is conventional, a number of such compounds being available on the open market and known to engineers skilled in building structures. Certain of such sealing compounds, for example, contain asphaltic materials, or rubber or synthetic rubber, and have the property of yieldingly deforming to compensate for expansion or contraction while maintaining a tight hermetical sealing of the joint in which they are located.

The tubular desiccant holder 44 is preferably rolled from sheet metal, such as sheet aluminum, and is of roughly rectangular cross-section with parallel main walls 116 and 118 (Figures 1 and 4) and opposite side walls 120 and 122 of shallow V-shaped cross-section providing shallow grooves 124 of similar cross-section. The side wall 122 has an approximately perpendicular flange 126 disposed in loosely overlapping relationship with the main wall 118 so as to permit the flow of air between the desiccant chamber 128 and the air space 46 between the external and internal panes 36 and 38. A layer 130 of yieldable sealing material similar to that of the layers 114 is inserted in the shallow grooves 124 in engagement with the inner sides of the panes 36 and 38 to effect a hermetical seal therebetween.

From Figure 1 it will be seen that the main walls 116 and 118 of the desiccant holder 44 have overall widths approximately the same as the overall width of the inner insulating spacer 30 for effective sealing purposes. The desiccant chamber 128, as its name indicates, contains a drying agent, preferably in powdered form, such as calcium chloride, silica gel or the like, the fit of the main wall 118 and the overlapping flange 126 being tight enough to prevent the escape of desiccant yet loose enough to permit "breathing," meaning the passage of air between the chambers 128 and 46 for removal of the water vapor from the air in the air space or chamber 46.

The pane-retaining members 32 and 34 and the heat-insulating strips 40 and 42 hold in position and further insulate the external and internal panes 36 and 38 from the metal moldings or sash frame units 24 and 26. The heat-insulating spacing members 40 and 42 are in the form of elongated bars of relatively rigid syntheic plastic material, such as the relatively rigid vinyl resin used for the inner insulating spacers 30. The heat-insulating strips 40 and 42 also serve as spacers between the edges of the panes 36 and 38 and the respective walls 58 of the external and internal sash frame units or moldings 24 and 26 (Figure 1). A thin layer 131 of the same yieldable sealing compound used in the layers 114 and 130 is also preferably placed between each insulating member 40 or 42 and the adjacent molding wall 58 to hermetically seal the joint therebetween.

The external and internal pane-retaining members 32 and 34 are of similar construction but oppositely-facing shape, hence one description is sufficient for both. Each such pane-retaining member 32 or 34 (Figures 1 and 2) in cross-section roughly resembles the side elevation of a claw hammer with the hammer head omitted, in that it has a base portion 132 of approximately rectangular cross-section adapted to fit snugly into the recess 66 of the channel portion 64 of the external or internal sash frame member or molding 24 or 26 in the channel-shaped external member 50 thereof. Each pane-retaining member 32 or 34 also has a nose portion 134 which in cross-section roughly resembles half of an arrowhead and, like an arrowhead, has an overhanging lateral rib 136 outside a groove 138 of arcuate cross-section shaped to fit the rounded portion 67 of the external member 50 (Figure 1). The nose portion 134 has a convex approximately

cylindrical outer surface 140 and a concave approximately cylindrical inner surface 142 terminating short of the edge 144 of the nose portion 134 in a substantially flat intervening portion 146 engageable with the outer surface of the window pane 36 or 38. The pane-retaining members 32 and 34 are of relatively rigid yet resilient synthetic plastic material so as to maintain the window panes 36 and 38 in firm engagement with the opposite flanges 110 of the inner spacer 30 and with the sealing compound 130 in the shallow V-grooves 124 in the side walls 120 and 122 of the desiccant holder 44.

In the assembly of the installation 20, the hollow external and internal sash frame units or moldings 24 and 26 are joined to one another by pushing them upon the lateral arms 82 and 84 of the outer heat-insulating spacer 28 so that the latter are squeezed into the recesses 78 of the channel portions 74 where their ratchet-toothed ridges 98 hold them firmly in position against separation. At the same time, the walls 68 of the closure members 52 are forced firmly into engagement with the respective ribs 90 and 102 of the arms 80 and 86, while the indented or constricted portions 76 enter the undercut channels 96 in the arms 82 and 84. The inner spacer 30 is then squeezed into position after the layers 110 of sealing compound have been spread over the reversely-bent portions 72 (Figure 1), firmly sealing and holding the inner edges of the units 24 and 26 in position against separation. The strips 40 and 42—coated on their outer surfaces with a layer 131 of sealing compound, are then placed in position, the desiccant holders 44 filled with a suitable desiccant are inserted against the inner spacers 30 and the panes 36 and 38 placed in position. The pane-retaining members 32 are then pushed into position (Figure 1) with their base portions 132 entering the channels 66 and their nose portions 134 engaging the outer surfaces of the panes 36 and 38 at the flattened surfaces 146 thereof. It will be understood, of course, that the outer and inner sash frame units 24 and 26 are arranged in hollow or open-centered form, generally in a rectangular shape, with the panes 36 and 38 correspondingly rectangular and with the various spacing members 28, 30, 40, 42 and 32, 34 extending around the four sides of the open-centered rectangle.

In operation, the sash installation 20, according to the particular building structure, is fixed in position, as in a picture window, slides vertically, as in a double-hung sash, slides horizontally, as in a gliding window structure, or swings upon pivots, as in the awning-type or casement type windows. The desiccant within the chambers 128 of the desiccant holders 44 absorbs moisture from the air in the space 46 between the window panes 36 and 38, keeping it in a constantly dry condition so as to prevent any fogging or clouding thereof. The layers 130 of sealing compound assist in maintaining a tight sealing engagement, preventing any outward or inward passage of air into the space 46, regardless of changes in temperature. Under actual tests, alternating between periods of eight to twenty-four hours at a water-saturated atmosphere of 120° F., and a frigid atmosphere at 0° to minus 5° F. and back into the heated humid atmosphere again, the installation 20 of the present invention was found to prevent fogging completely, notwithstanding these sudden and large changes of temperature and humidity.

The modified double-pane sash installation, generally designated 150, shown in Figures 7 and 8, is generally similar to that shown in Figure 1, except that a different construction of desiccant holder and inner spacer is used, hence similar parts are designated with the same reference numerals. An additional fin 152 is optionally added to the outer insulating spacer 154 which is otherwise substantially the same in construction as the outer insulating spacer 28 of Figures 1 and 6, and the overhanging portion 138 has been omited from the pane-retaining members 156 and 158 respectively. The external and internal hollow sash frame units or mountings 160 and 162 are

almost identical in construction with the corresponding units 24 and 26 of Figure 1. In place of the inner spacer 30 and desiccant holder 44 of Figures 1, 3 and 4, however, a modified combined inner spacer and desiccant holder, generally designated 164, is interposed between the external and internal panes 166 and 168 respectively. The member 164, shown in detail in Figure 8, consists of an elongated body of resilient synthetic plastic material having a channel-shaped outer portion 170 with grooved and ribbed side walls 172 joined by a bridging wall or web 174 having oppositely-extending edge flanges 176 disposed in a substantially common plane (Figure 8). Disposed within the channel of the channel-shaped outer portion 170 is a hollow rib 178 having side walls 180 disposed parallel to one another and to the ribbed side walls 172, and forming undercut channels 181 therebetween. The hollow rib 178 is provided with a connecting wall 182 which, with the side walls 180 and bridging wall 174, provides a desiccant chamber 184 for receiving a desiccant material preferably in powdered form, such as calcium chloride, silica gel or the like, holes 186 being provided in the wall 174 to cause the chamber 184 to communicate with the air space 188 between the window panes 166 and 168. The connecting wall 182 has rounded enlargement ribs 190 at its opposite edges.

The assembly of the installation 150 is similar to that of the installation 20 previously described, especially as regards the assembly of the hollow box-like outer and inner sash frame units or moldings 160 and 162 upon the outer insulating spacer 154 of cross-shaped cross-section. The desiccant holder and spacer 164 is then forced into position with the inner edges of the units 160 and 162 entering the channels 181 and with the flanges 176 disposed between the units 160 and 162 and the edges of the panes 166, the desiccant material having previously been placed in the desiccant chamber 184, the rounded enlarged edges 190 entering the indentations 79. The pane-retaining members 156 are then inserted in their respective channels, holding the panes 166 and 168 firmly against the ribbed side walls 172 of the members 164.

In operation, the desiccant within the chamber 184 in each member 164 withdraws the moisture from the air entering through the holes 186 and maintains the air space 188 between the panes 166 and 168 in a dry condition, preventing the clouding or fogging of the window panes. The ribbed side surfaces on the various members provide sealing engagement between the various surfaces, as described above in connection with Figure 1, and prevent the entrance of outside air into the air space 188, and expansion and contraction is taken care of by the resilience of the spacing members 154, 164 and 156, 158.

The modified double-pane sash installation, generally designated 200, shown in Figures 9 and 10 is generally similar to the installation 150 shown in Figures 7 and 8, except for the construction of the combined inner spacer and desiccant holders 202 which extend around the outer edges of the window panes 166 and 168. Each of the desiccant holders 202 differs from the desiccant holders 164 in the provision of extensions 204 on the ribbed side walls 206, the extensions providing with the bridging wall 208 an extension 210 to the desiccant chamber 212 included between the side and connecting walls 214 and 216 of the hollow rib 218, undercut channels 219 being provided as before between the side walls 206 and 214. The edge flanges 220, as before, extend outward from the ribbed side walls 206 in a substantially common plane and the connecting wall 216 has rounded projecting rib-like edges 222, as before.

The assembly of the installation 200 is substantially the same as that of the installation 150 described in connection with Figures 7 and 8, and its operation differs only in the additional amount of desiccant provided by the extension chamber 210 of the desiccant chamber 212. The air circulates through the holes 224 similar to the

holes **186** of Figure 8 and water vapor is removed in the same manner.

What I claim is:

1. An insulated metal-framed window sash comprising open-centered external and internal metal sash frame structures having facing surfaces disposed in spaced substantially parallel relationship and having outer and inner peripheries, the inner periphery of each frame structure having a window pane edge seat thereon, an elongated outer insulating spacing member of heat-insulating material disposed in the space between said facing surfaces near the outer peripheries of said frame structures in abutting relationship therewith, said frame structures at their inner peripheries having inwardly-projecting spaced parallel extension portions, external and internal window panes mounted in spaced parallel relationship in the open centers of said frame structures with their edges disposed adjacent said pane seats, an elongated inner insulating spacing member of heat-insulating material disposed in the space between said facing surfaces near the inner peripheries of said frame structures and having an outwardly-facing recess therein receiving said extension portions, elongated pane edge insulating spacing members of heat-insulating material disposed between the edges of said panes and their respective seats in said frame structures, and pane retainers mounted in said frame structures in abutting engagement with said panes.

2. An insulated metal-framed window sash, according to claim 1, wherein an elongated hollow desiccant holder is disposed in the inter-pane space between said panes adjacent said inner insulating spacing member, said desiccant holder having therein a desiccant chamber disposed in communication with said inter-pane space.

3. An insulated metal-framed window sash, according to claim 1, wherein the inner spacing member is of channel cross-section with its channel constituting said recess.

4. An insulated metal-framed window sash, according to claim 1, wherein a layer of yielding sealing material is disposed between said inner spacing member and said extension portions.

5. An insulated metal-framed window sash, according to claim 1, wherein a layer of yielding sealing material is disposed between said pane edge insulating spacing members and said pane seats.

6. An insulated metal-framed window sash, according to claim 2, wherein a layer of yielding sealing material is disposed between said desiccant holder and each of said panes.

7. An insulated metal-framed window sash, according to claim 6, wherein the desiccant holder has opposite sides disposed adjacent the inner surfaces of said panes and wherein said sides have recesses therein containing said yielding sealing material.

8. An insulated metal-framed window sash, according to claim 7, wherein the recesses consist of elongated longitudinally-extending grooves in said sides.

9. An insulated metal-framed window sash, according to claim 1, wherein the inner spacing member is of relatively rigid material and the outer spacing member is of relatively flexible material.

10. An insulated metal-framed window sash, according to claim 2, wherein the desiccant holder consists of a metal tube.

11. An insulated metal-framed window sash, according to claim 10, wherein the metal tube has loosely overlapping longitudinal edge flanges with an air circulation passageway therebetween.

12. An insulated metal-framed window sash, according to claim 1, wherein the pane edge insulating spacing members are integral with the inner insulating spacing member and extend transversely therefrom.

13. An insulated metal-framed window sash, according to claim 12, wherein the inner insulating spacing member contains a desiccant chamber disposed in communication with the space between said panes.

14. An insulated metal-framed window sash, according to claim 13, wherein the desiccant chamber is of approximately T-shaped cross-section.

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