Nov. 16, 1965 XAVIER FRANZ LEISIBACH ALSO KNOWN AS XAVER LEISIBACH 3,217,454

WINDOW STRUCTURE

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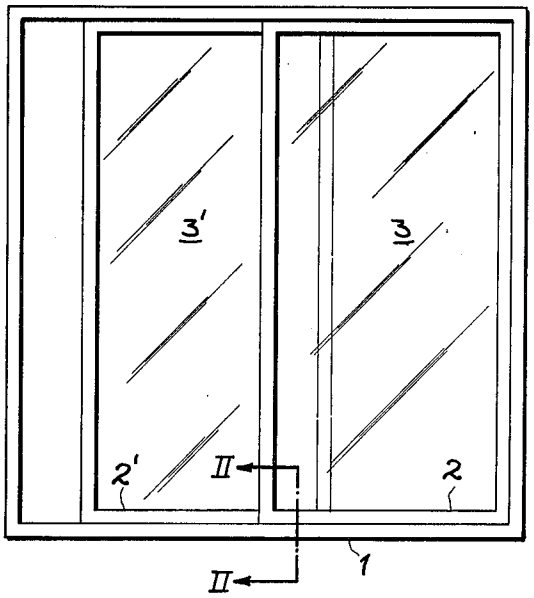
Fig.1



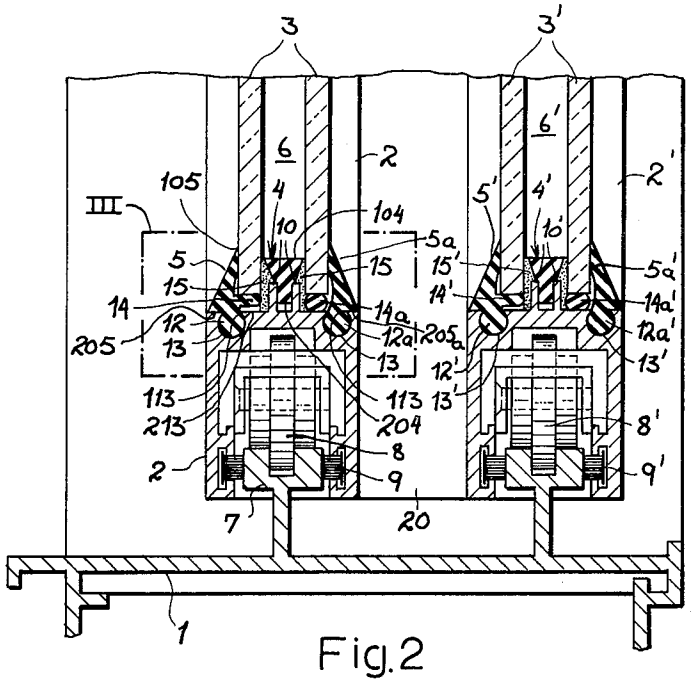


Fig.2

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Fig.3a

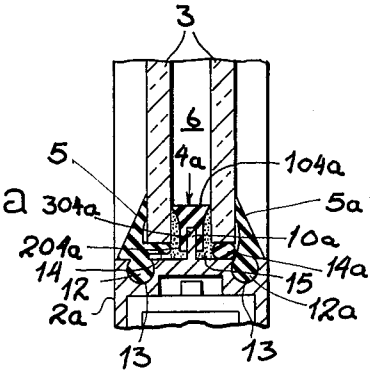


Fig.3b

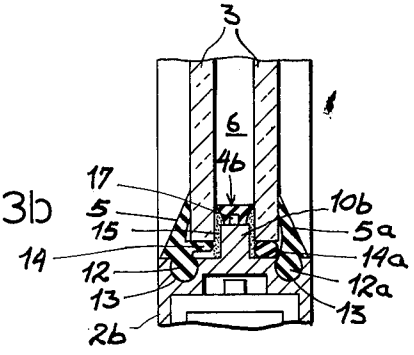
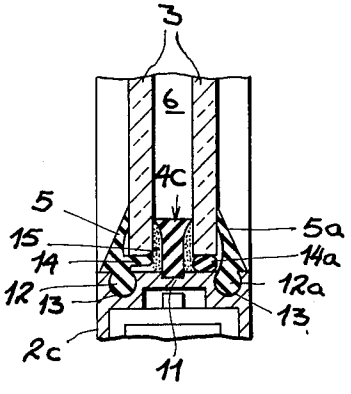


Fig.3c



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3,217,454

WINDOW STRUCTURE

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Claims priority, application Germany, Feb. 7, 1961, A 36,667
1 Claim. (Cl. 52—398)

My present invention relates to window structures and, more particularly, to a window construction in which two or more panes are held in a common sash, as described in my copending application Ser. No. 171,365, filed February 6, 1962, of which my present application is a continuation-in-part.

In this copending application I have pointed out that changes in atmospheric temperature and humidity, generally accompanied by a temperature differential on both sides of the window so that the two panes are often exposed to different ambient conditions, subject window structures of this type to severe tests and tax their mechanical stability and their resistance to moisture penetration. It was difficult in the past to assemble dual- or multiple-pane windows in such manner that the space between adjacent panes was sufficiently airtight to prevent the generation of convection currents or the deposition of moisture on the inner glass surfaces. In many instances, therefore, it was necessary to dispose a drying agent, such as silica gel, in the intervening space and/or to provide special passages for flushing that space with a dry gas such as nitrogen.

One of the principal reasons for the aforementioned difficulties derives from the fact that metallic frame elements are good thermal conductors so that, at low temperatures, the vapors unavoidably present between the panes will tend to condense, whereas nonmetallic frame members are generally composed of wood and are so highly porous that it is difficult to prevent penetration of moisture into this space.

To avoid these difficulties it has been proposed hitherto to provide double-window structures with elastomeric glazing strips which are preformed and are inserted into grooves in the sash and generally extend somewhat from these grooves to define channels receiving the panes. In one construction of this type, a tight seal is ensured by seating the panes on a ledge of the glazing strip abutting a shoulder or support ridge of the sash directly below the pane and thereafter forcing another portion of the glazing strip into a channel in the sash so that the strip bears upon a marginal portion of the pane. In other arrangements, this portion of the strip is detached from that portion upon which the pane rests and is so dimensioned that, while it is forced into the groove in the sash, it bears resiliently upon the panes. In still further known constructions of this general type, the pane does not rest upon the ledge of the glazing strip but instead is frictionally supported by two portions of the strip engaging opposite faces of each pane.

While such arrangements overcome some of the more significant disadvantages mentioned above, especially with regard to the conductivity of the sash in contact with the panes, they introduce an entirely new problem. It is well known that the elastomeric sealing strips of this nature tend to loose their resiliency at an early stage and to stiffen so that, in spite of the fact that the sealing strip may have been bearing originally upon the panes, their rigidity subsequently eliminates any such resilient compression and the required seal. It is, therefore, a principal object of my present invention to provide an improved window structure of the type set forth in which all of the aforementioned drawbacks are avoided.

A more specific object of this invention is to provide a window structure making use of a sealing strip whereby stiffening of the strip will not impose the great difficulties encountered heretofore.

In accordance with the present invention I provide, within a sash which may be of any conventional type (e.g., sliding, swinging or stationary), a spacing frame of low thermal conductivity engaged on opposite sides by a pair of spaced window panes, the frame constituting the sealing or glazing strip mentioned above and being mounted in a sash consisting of a light, nonporous material such as lightweight metal (e.g., aluminum) having means for holding both the panes and the glazing strip in close contact with one another. The invention resides in undercutting at least one of the grooves of the sash for reeciving an outer portion of the glazing strip which may be integral or formed from a plurality of separate portions, this undercut groove having a constriction past which an enlarged bead of the glazing strip can be forced.

According to a principal feature of this invention, the undercut portion of the groove is of generally circular cross-section with a surface of the sash underlying the pane being substantially tangential to the cylindrical surface forming the interior wall of the undercut region. The corresponding portion of the glazing strip is complementarily shaped so that its bead has a generally cylindrical configuration. These features of the invention afford two main advantages over prior-art structures utilizing glazing strips received within a groove in the sash: On the one hand, the undercut nature of the groove and enlarged bead adapted to be forced through the constricted opening in to the groove precludes undesirable and spontaneous movement of the glazing strip out of the sash upon thermal contraction and expansion of the latter as frequently occurs with conventional glazing strips. It may be noted, parenthetically, that it has been proposed hitherto to provide at least the outer portions of such glazing strips with a multiplicity of formations for increasing the frictional interengagement between juxtaposed surfaces of the sash and glazing strip; these have not been successful, however. On the other hand, even stiffening or some degree of shrinking of the glazing strip cannot decrease the sealing pressure with which the strip bears against the pane; the sealing strip has a pane-engaging edge which, in effect, constitutes the load element of a lever fulcrumed about the axis of the cylindrical groove and the bead.

According to a more specific feature of the present invention, the glazing strip is provided with an abutment laterally spaced from the cylindrical groove away from the pane and engageable by the sash for preventing it from swivelling about the aforementioned axis away from the pane. Moreover, the glazing strip is, according to the invention, provided with a lever arm underlying the pane and tending to swivel the glazing strip about the axis so that its sealing edge engages a marginal portion of the pane with a force determined by the weight of the pane. Thus, even after some stiffening of the glazing strip, the weight of the pane upon the lever arm of the lower glazing strip will maintain a sealing engagement; the abutment serves to maintain the remaining strips about the periphery of the pane in engagement therewith.

Still another feature of the present invention resides in the provision of an intermediate portion of the glazing-strip means disposed between the panes and which, in

profile, converges toward the periphery thereof; the intermediate glazing portion has a relatively wide head whose edges bear upon relatively narrow marginal portions of the pane. This intermediate portion of the glazing-strip means is supported at its narrow shank outwardly from this head so that the head is, to some degree, shiftable laterally of the panes during thermal changes of the dimensions of the window structure.

Still another feature of the instant invention resides in the provision of at least one inner ridge on the sash between the panes and extending inwardly beyond the periphery of the panes while being straddled by the frame or glazing strip. The shank of the intermediate portion of the glazing strip can then be mounted upon this ridge in such manner as to be deflectable laterally thereof. The interengagement of the glazing strip with the sash may be supplemented by the provision of an adhesive, preferably of elastomeric material, which can be introduced between the engaging edges of the head of the intermediate portion and the periphery of the panes along the shank.

Suitable strip materials of low thermal conductivity include synthetic and natural rubbers, e.g., porous or microporous rubber, along with other substances conventionally used as heat insulators. The sash, in turn, may be composed of extruded profiles of metal, preferably aluminum, integrally formed with the necessary ridges or grooves to accommodate the panes and the sealing strip. It will be understood that, even with strips of relatively high porosity, the penetration of moisture into the space between the panes will be prevented by the intervening layer of adhesive.

The above and other objects, features and advantages of the present invention will become more readily apparent from the following description, reference being made to the accompanying drawing in which:

FIG. 1 is a front-elevational view of a window structure of the type to which the present invention is applicable;

FIG. 2 is an enlarged cross-sectional view taken along the line II—II of FIG. 1; and

FIGS. 3*a*, 3*b* and 3*c* are fragmentary sectional views drawn to the scale of FIG. 2, representing different modifications of that part of FIG. 2 encompassed within the area III thereof.

The window shown in FIG. 1 comprises a pair of slidable sashes **2**, **2'** within an outer frame **1** which is representative of any conventional embrasure or other support for such sashes. The two sashes **2**, **2'** are identical except for a conventional outrigger strip **20** on the former for preventing the flow of air between the sashes. Only the sash **2** and its associated elements will be described in detail with the identical parts having primed reference numerals in sash **2'**.

As illustrated in FIG. 2, the sash **2** carries a pair of panes **3** spaced apart by a glazing-strip means **4**, **5** of rubber or similar, preferably elastomeric, thermally insulating material. The glazing strip means thus includes an intermediate portion or inner frame **4** and a pair of outer portions **5**, **5***a*. The latter are provided with respective beads **12**, **12***a* of generally cylindrical configuration which are received in the complementary (i.e., cylindrical) undercut grooves **13**, extending all around the inner periphery of the sash on either side of the pair of panes **3**. These grooves open via the constrictions **113** at the surfaces **213** of the sash underlying pane **3**, the constrictions having a width less than the diameter of the beads **12**, **12***a*.

The space **6** between the panes **3** is shielded against the atmosphere by adhesive layers **15** (e.g., of rubber cement) which likewise extend along the entire inner periphery of the sash and help secure it to the intermediate portion **4** of the glazing-strip means and the panes.

As previously indicated, the intermediate portion **4** has

an enlarged head **104** and converges outwardly in the direction of the peripheries of the panes to form a shank **204** which is received between a pair of ridges **10** integrally formed on the sash and extending inwardly therebeyond. The head **104** is thus resiliently deflectable upon thermal alteration of the dimensions of the sash. A packing strip **14***a*, independent of strip **5***a*, underlies the right-hand pane **3** (FIG. 2) to support the latter while the other pane is carried by a lever arm **14** integral with glazing strip portion **5** whose load arm includes an edge **105** urged into contact with a marginal portion of the respective pane by the weight thereof, strip **5** being fulcrumed upon the axis of the cylinders **12**, **13**. Abutment ledges **205**, **205***a*, outwardly of the panes, are provided on the outer portions **5**, **5***a* flanking the beads **12**, **12***a* for engagement with the surface **213** to prevent the glazing strip portions **5** and **5***a* from being deflected outwardly about their respective axes.

The sash **2** is provided with several rollers **8** (only one shown) which ride in a horizontal groove of a flange **7** on the bottom of frame **1** whereby he sashes **2** and **2'** may be rolled back and forth in the conventional manner. Packing strips **9** of felt or the like are interposed between the inner faces of the U-profile of the sash and the T-shaped flange **7**. This construction, known per se, is shown merely for the sake of completeness and is representative of any conventional sash mounting.

In FIG. 3*a* I show a construction otherwise identical with that described in connection with FIG. 2 except that the sash **2***a* has a single ridge **10***a* matingly received within a peripheral groove **304***a* in the shank **204***a* of the intermediate portion or inner frame **4***a* whose head **104***a* has edges bearing upon the marginal portions of the panes. Again, this enlarged head is deflectable, as indicated above, the adhesive layers **15** not materially impeding such deflection.

In a further modification, shown in FIG. 3*b*, the sash **2***b* has a relatively wide ridge or rib **10***b* overlain by the intermediate portion **4***b*. Studs **17** (only one shown) rise from the rib **10***b* at spaced locations therealong and are imbedded in the shank of the intermediate portion or inner frame **4***b* to lock it into position with its enlarged head bearing against the panes.

In FIG. 3*c*, I have shown the sash **2***c* formed with an inner peripheral groove **11** accommodating the outer edge of the shank of intermediate portion or inner frame **4***c*, which is here illustrated to be of T-shaped profile.

Structural modifications of the space arrangements described and illustrated are, of course, possible without departing from the spirit and scope of my invention as defined in the appended claim.

I claim:

In a window, in combination, a profiled metallic sash formed with at least one inner ridge extending over its entire circumference, an inner frame of at least partly complementary profile matingly engaging said sash, said frame consisting of a material of low thermal conductivity, a pair of panes held in said sash and contacting said frame from opposite sides, and a pair of sealing strips independent of said frame anchored in said sash, said strips resiliently bearing upon the outer surfaces of said panes over a marginal zone extending all around their circumference whereby said panes are urged toward said frame; said ridge projecting into the space between said panes and being received in a mating groove of said frame; said frame registering with substantially all of said marginal zone and constituting the only structural member bridging said panes, at least one of said strips having a generally cylindrical foot received within a complementary recess in said sash, said one of said strips having an integral lateral flange intermediate said marginal zone and said sash while underlying the corresponding pane for urging the respective strip against the pane.

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