



# UNITED STATES PATENT OFFICE

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## DOUBLE GLASS WINDOWPANE

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1 Claim. (Cl. 20—56.5)

This invention relates to a multiple glass window pane structure having a heat insulating space for air or some other medium between the panes.

More specifically it relates to improvements in the structure of the double glass window pane which was the subject of U. S. Patent 2,173,649 of September 19, 1939. According to the Patent 2,173,649 the window panes are mounted in separate channels in a frame of strip material which may be of metal such as copper, a thermoplastic sealing compound being used to seal the insulating air space between the panes and bond the parts together.

The efficacy of multiple glass window panes with an insulating air space to maintain a temperature differential between the panes, is of course dependent on the maintenance of the seal between the parts.

It has been found that failure of the seal may occur under the more onerous conditions in which the multiple glass window panes are used. In actual practice the temperature differential may be as much as 130° F. If the panes are large, the differential expansion or contraction of the panes may reach proportions sufficient to cause failure of the seal by transverse shear stress. Where, in addition, the panes are subjected to vibrations and shocks, as in vehicles for instance, the difficulties of maintaining a seal are increased.

In the aforesaid patent the strip material was formed with a separating ridge of bulbous cross-sectional contour between the channels for the panes of glass, to give the strip material a degree of transverse flexibility sufficient to permit of a comparatively large degree of differential movement and expansion and contraction of the window panes without destruction of the seal.

In some instances however it may be desirable to have the panes so closely spaced as to leave insufficient space for a separating ridge of the foregoing character.

The object of the present invention is a frame of strip material having a section of considerable transverse flexibility, without a separating ridge between two channels.

Another object of the invention is a multiple window pane with a spacer for the panes separate from the frame of strip material. A further object of the invention is a multiple glass window pane having desiccating or dehydrating means for the air confined within the insulating air space.

The above and other objects of the invention will be apparent as the description proceeds.

According to the present invention the panes are spaced from each other in a frame of strip material formed with a channel for the panes provided with a corrugated section below the part thereof occupied by the panes to give the strip material a degree of transverse flexibility. The panes are spaced apart in the channel by means of a spacing strip provided with flanges which bear against the edges of the panes. There is clearance space between the panes and the sides of the channel and below the edges of the panes with their spacing strip, for an adequate amount of sealing compound to bond the panes to the sides of the channel.

During assembly, lateral pressure may be applied against the panes to clamp the spacing strip between the panes and prevent the sealing compound from exuding into the insulating air space.

The channel of the strip material of the frame has a corrugated section below the part thereof occupied by the panes provided by deeply indented longitudinal grooves in the sides of the channel to form a narrowly waisted section. The narrowly waisted section gives the strip material a degree of transverse flexibility sufficient to permit of a comparatively large degree of differential expansive and contractive movement of the window panes, without destruction of the seal.

The drawing shows the various parts of a multiple glass window pane unit and the manner in which they are assembled.

In the drawing:

Fig. 1 shows a completed double glass window pane unit in perspective.

Fig. 2 shows an enlarged section on line 2—2 of Fig. 1.

Fig. 3 is an enlarged section on line 3—3 of Fig. 1.

Fig. 4 is a sectional view of a part of a construction with panes more closely spaced than that of Figs. 2 and 3.

Referring now particularly to Figs. 1 to 3, the panes of glass 1 and 2 are held in separated relationship in frames of suitable material such as copper, and consisting of side members 3 and 4, end members 5 and 6 and corner pieces 7, 8, 9 and 10. The side and end members are cut with mitered ends from suitable strip copper, rolled to the section shown most clearly in Figs. 2 and 3.

As shown most clearly in Figs. 2 and 3, the

frame members 3, 4, 5 and 6 are of channel section with a corrugated or narrowly waisted section formed by deeply indented longitudinal grooves 11 and 12 in the sides 13 and 14 respectively of the channel.

The panes are spaced apart by suitable spacers 15 in the form of channel strips of suitable material such as copper with flanges 16 and 17 which bear against the edges of the panes.

The spacers 15 are such as to provide the required separation between the panes and when the panes with their spacers are in their proper position in the channels, there is clearance space for an adequate amount of sealing compound 20 in the channels below the panes with their spacers and between the panes and the sides of the channel.

Any suitable thermoplastic compound may be used for sealing the panes in their frames. Vinyl acetate has been found very suitable for the purpose. It may be conveniently used in the form of strips or rolls of thin sheet material or in any desired extruded section. In assembling, the panes, the metal strip of the frames, and the spacers being cut to proper size, the requisite quantity of thermoplastic compound is placed in the channel of the strips of the frame. The two panes separated by the spacers 15 with their surfaces adjacent to the panes preferably covered with a thin strip or layer 22 of thermoplastic are placed in the channel of one side strip and the opposite side strip is placed over the opposite edge of the panes. The ends of the panes are then in turn set into the end strips, a thin strip 24 of thermoplastic is placed over the corners and the corner pieces are pushed on.

The assembly with all its component parts separated by the thermoplastic is then placed in a suitable jig, having spring means exerting a pressure tending to squeeze all the parts together into their proper position.

The entire assembly, including the jig, is next placed in an oven, and heated to an even temperature sufficient to soften the thermoplastic sealing compound to the point where it is at least gummy or tacky. In the case of vinyl acetate, this occurs at a temperature of 300° F. When such a temperature is maintained for a sufficient period of time, the window pane assembly is squeezed together by the spring pressure of the jig and the thermoplastic seals the space between the panes and the sides of the channel and below the edges of the panes.

Particularly when the panes are large, it has been found desirable to hold them in a vertical position in the oven to avoid sagging due to the weight of the panes. When this is done, it may be necessary to provide small chaplets (not

shown) in the bottoms of the channels of the strips of the frame, to prevent the panes from sinking to the bottom of the channels.

If desired, two opposite holes 26 and 27 respectively, may for instance, be provided in one or more of the spacers 15 and one of the frame strip members as shown in Fig. 2, and connected by a piece of tubing 28 to provide a definite path for the egress of air from between the panes as it expands in the oven, and for the ingress of air between the panes as the assembly is returned to room temperature.

As shown in Fig. 3, the channel in the spacers 15 may conveniently provide space for a dehydrating agent to remove all moisture from the air within the insulating air space. A chamber 30 to hold calcium chloride or any other suitable dehydrating agent sealed off from the external air, but communicating with the air between the panes through suitable holes such as 31, can be provided in one or more of the spacers 15. The chamber may be formed by a strip of material 33 having upturned ends (not shown) defining the ends of a chamber of suitable length in one or more of the spacers 15. The strip material 33 is of course fastened to the spacer 15 by any suitable means which may be the thermoplastic sealing compound to close and seal the chamber after the dehydrating agent has been placed therein and before assembly of the frame.

The form of construction shown in Fig. 4 is essentially that of Figs. 1, 2 and 3, except that as shown, the panes are more closely spaced and the spacer 40 is of T-section rather than of channel section. It will be appreciated that in those cases where glass fiber or other material is placed between the panes, this material will itself serve as a separating means and make unnecessary the use of any separators, such as those shown in Figs. 2, 3 and 4.

I claim:

A multiple window pane structure having panes spaced from each other in a frame of strip material for its edges, said strip material being formed with a channel for the panes, said channel having a narrowly waisted section between its base and the part thereof occupied by the panes and clearance space between the panes and the sides of the channel for an adequate amount of sealing compound to bond the panes to the sides of the channel; said waisted section giving the strip material a degree of transverse flexibility to permit differential thermal expansive and contractive movement of the panes in their planes, and an accommodating movement of the sides of the channel to which they are bonded.

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