March 15, 1960 E. S. PERSSON 2,928,144

FRAME STRUCTURES

Filed Jan. 23, 1959 2 Sheets-Sheet 1

FIG. 1

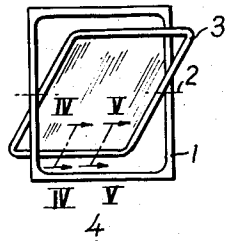


FIG. 2

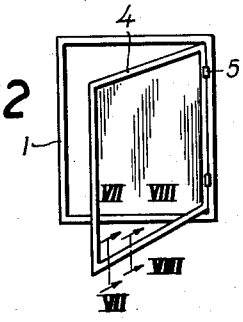


FIG. 8

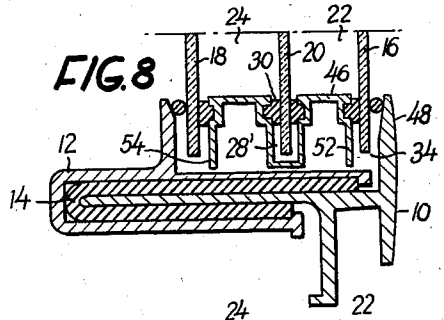


FIG. 7

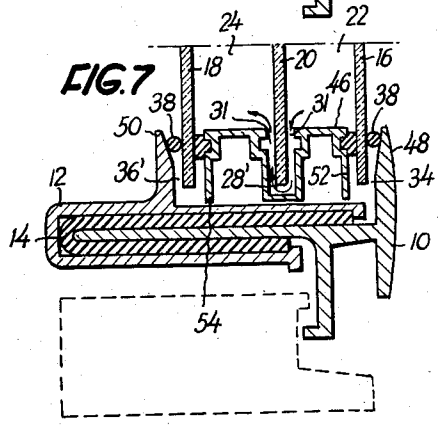


FIG. 9

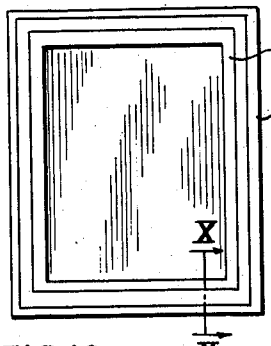


FIG. 10

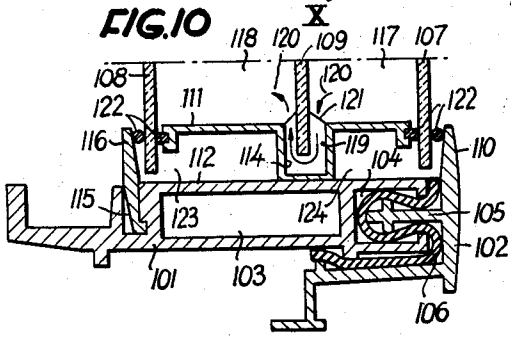
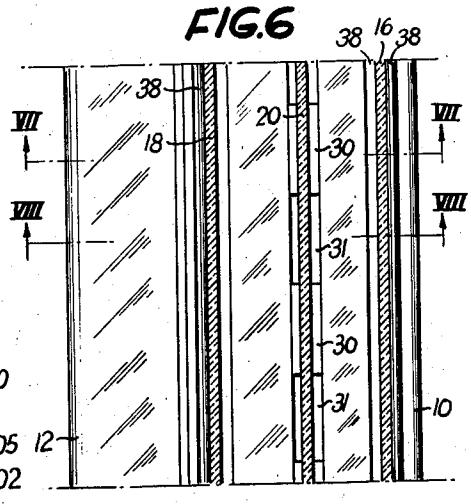


FIG. 6



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FRAME STRUCTURES

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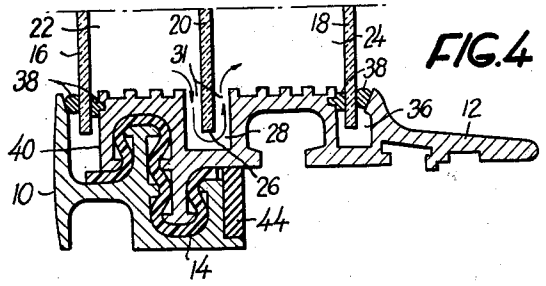


FIG. 4

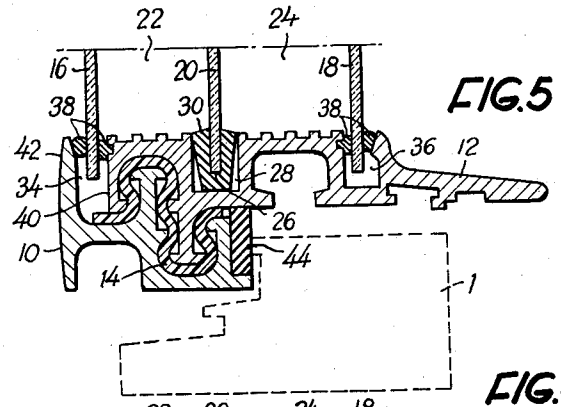
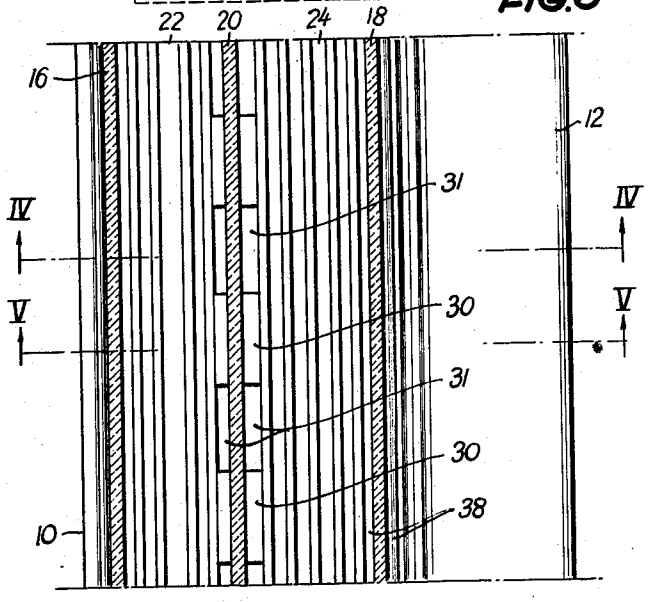


FIG. 5

FIG. 3



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2,928,144

FRAME STRUCTURES

Eric Sigfrid Persson, Malmo, Sweden

Application January 23, 1959, Serial No. 788,687

Claims priority, application Sweden November 8, 1955

2 Claims. (Cl. 20—56.5)

This application is a continuation in part replacing my copending patent application Serial No. 561,092, filed January 24, 1956, now abandoned and claiming convention-priority from the Swedish patent application No. 10,033/55, filed November 8, 1955. The present application relates back to said application Serial No. 561,092 and to the said Swedish application for all dates and right incident to the filing thereof.

My original application referred to windows, wherein the window sash contains an inward pane, an outward pane and an intermediate pane arranged in the space between said first-mentioned panes and dividing said space into an outward air space and an inward air space. The window sash is composed of an outer frame and an inner frame which are rigidly interconnected into a window-sash while preventing a heat-conducting metallic contact between the inside of the window-sash and the outside thereof, and in that the outer-frame constitutes a support for the outward pane, while the inner frame supports the inward pane and also carries the intermediate pane. In this construction, the outward air space as well as the inward air space will be limited at their circumference by parts of the inward sash, which at a low outdoor temperature has a considerably higher temperature than that of the outward sash by reason of the heat insulation between the frames. This aids toward keeping an increased temperature in the air spaces, so that the risks of water of condensation depositing on the surfaces of the panes facing the air spaces are reduced.

The present invention has for its primary object to improve the window frame structure to enable employment thereof not only for windows but also for building walls or panels and further by an improved construction of the inner or main frame supporting the inner pane and the intermediate pane.

A further object of the invention is to strengthen the main or inner frame by the improved construction thereof to obtain a stiff window frame adapted to carry big and heavy window panes.

The objects of the improvement is obtained substantially by forming the inner or main frame with a tubular or boxlike cross section whereby this frame includes a cavity or air cell extending around the frame, thus improving the heat insulation between the outdoor side and the indoor side of the frame. Furthermore, the tubular or box-like shape of the frame involves an augmented stiffness, whereby the frame is more apt to carry three or more panes even if they are big and heavy.

The invention will be explained more in detail hereinafter, reference being had to the accompanying drawings, in which—

Figs. 1 and 2 are diagrammatic perspective views of a couple of different window types, to which the invention is applied. Fig. 3 shows a portion of the inner edge of a window-sash constructed in accordance with the invention and having panes inserted into the same. Fig. 4 shows a cross section on line IV—IV in Figs. 1 and 3, and Fig. 5 shows a cross section on line V—V in Figs.

1 and 3. Figs. 6, 7 and 8 show, in the same manner as Figs. 3, 4 and 5, the window according to Fig. 2. Fig. 9 is a front view of the improved window or panel construction and Fig. 10 illustrates a cross-section on line X—X of Fig. 9 on an enlarged scale.

In the drawings, 1 designates a window frame of wood, metal or plastic or of wood with a covering of metal or plastic, said frame being provided, according to Fig. 1, with a sash 3 suspended therein on horizontal pivot hinges 2 and, according to Fig. 2, with a sash 4, which is laterally suspended on hinges 5.

In the construction according to Figs. 3–5, the sash consists of an outer frame 10 and an inner frame 12 of sectioned metal bars interconnected with an intervening packing 14 of heat-insulating material. The sash contains three window glasses, namely, an outward pane 16, an inward pane 18 and an intermediate pane 20. The air space between the outward pane 16 and the intermediate pane 20 is designated the outward air space 22, and the air space between the panes 20 and 18 is designated the inward air space 24. The communication between the air spaces 22 and 24 is provided by the fact that the edge portion of the intermediate pane 20 is at its actual edge 26 as well as at the lateral surfaces adjacent to said edge located freely in a channel 28 in the sash for a considerable distance of the length of said edge. In order that the intermediate pane shall be retained in its place in the middle of the channel 28, distance pieces or supports 30 may be fitted between the edge of the pane and the channel 28. These distance pieces may consist of fillets from a soft material, such as rubber, felt or the like. Between the distance pieces there are left openings 31, through which the air passes down from the outward space 22 and about the edge of the intermediate pane and up into the inward space in order then to flow past the upper edge in a similar manner.

The air spaces 20 and 24 are sealed against the surrounding atmosphere by the fact that the edges of the panes 16 and 18 are received in channels 34 and 36, respectively, and tightening fillets 38 are squeezed between the lateral surfaces of these channels and the window glasses. Similar tightening or holding fillets may be arranged at the vertical edges of the intermediate pane 20, so that a seal is obtained at these edges for the whole or a portion of the length thereof. The lower edge 26 of the intermediate pane 20 is kept at a suitable distance from the sides and the bottom of the channel 22 by the supports 30, and the upper edge is located somewhat below the upper limiting surfaces of the sash channel 28, so that air passages are provided both about the lower and the upper edges of the intermediate pane 20 (Figs. 1 or 2, 3 and 5).

The inner or inward frame 12 extends in the construction according to Figs. 3–5, with its outward edge as to the inside of the outward pane 16, and the channel 34, wherein the outward pane 16 is located, is formed between a flange 40 on the outward edge of the inner frame and a flange 42 on the outer frame 10 paralleling the same. The frames 10 and 12 are kept together by means of flanges on the frames engaging each other in the intervening spaces, and the heat insulating packing material 14 extends in these spaces, so that the inner frame 12 is entirely insulated from the outer frame. Only the inner frame 12 borders upon the air spaces 20 and 24, which for this reason are not cooled down by the cold outer frame 10 at a low outdoor temperature.

Inserted between the frames 10 and 12 is an inwardly facing fillet 44 serving in the closed position of the window as an abutting member for the sash composed of the frames 10, 12.

The construction according to Fig. 2 and Figs. 6–8

differs from the embodiment now described substantially only with respect to the shape of the sections of the outer frame **10** and the inner frame **12**, which are simpler in regard to the interengaging parts and also by the fact that they are devoid of channels for panes. Thus the intermediate pane **20** has its edges sunk into a channel **28'** in a supporting moulding **46**, which is loosely introduced between a flange **48** on the outer frame **10** paralleling the plane of the window and a flange **50** on the inner frame likewise paralleling the plane of the window. The edge of the outward pane **16** is located in a channel or rabbet **34'** between the flange **48** and a flange **52** on the supporting moulding **46** paralleling the same, and the edge of the inward pane **18** is located in a channel or rabbet **36** between the flange **50** and a flange **54** on the supporting moulding **46** paralleling the same.

The intermediate pane **20** is retained in the middle of the channel by means of short distance pieces **30** leaving openings **31** between them free, so that air may pass from the outward air space **22** into the channel **28'** and beyond the edge of the intermediate pane and up into the inward space **24**, as in the preceding embodiment. The upper edge of the intermediate pane is located freely in the channel **28'** in a similar manner, so that the air may here also pass freely by, that is to say from the inward air space **24** to the outward air space **22**, when the outdoor temperature is lower than the indoor temperature. The outward and inward panes are retained in their places by means of fillets **38**, which also seal the air spaces **22** and **24** against the external air.

The profile of the inner frame **12** is U-shaped, and the profile of the outer frame **10** is substantially T-shaped and introduced between the shanks of the first-mentioned profile with a pad of a heat-insulating material **14**. The window-sash or wall panel consists of the composed frames **10**, **12**.

The construction according to Figs. 6–8 facilitates convenient mounting even of ordinary window glass, inasmuch as the panes **16**, **18**, **20** permit of being introduced one at a time. The intermediate pane **20** is inserted into its channel **28'** in the supporting moulding **46**, before the supporting moulding is introduced into its place in the frame **12**. The frames **10**, **12** are shut up in each other into the position shown only after the pane **18**, the supporting moulding with the intermediate pane **20** and the pane **16** have been located in their places.

Figs. 9–10 illustrates in what manner the inner or main frame (**12**) may be modified to obtain the improved heat insulation and stiffness.

In Figs. 9–10, **101** designates the main frame consisting of the metal rail of a tubular or boxlike section, and **102** denotes the holder frame, which is made from metal fillets of a simpler cross-sectional configuration. The void of the main frame is designated by **103**. Substantially outside the latter, the main frame **110** is provided with an outwardly facing channel **104** having a flange **105** on the holder frame **102** projecting into the same. The frame **102** hereby retains a layer **106** of heat-insulating material between the frames **101** and **102**, so that the latter will be heat-insulated from one another. This in turn involves that the main frame **101** facing inwardly toward the room is prevented by heat transmission to the holder frame **102** from assuming the low temperature of the latter frame in cold weather. The void **103** of the main frame also contributes to a certain heat insulation.

In the construction shown, the main frame carries three glass panes, namely, an outer pane **107**, an inner pane **108** and an intermediate pane **109**. The outer pane is also supported by the holder frame **102**, that is to say by means of an inwardly projecting flange **110** of the holder frame. The flange **110** keeps the outer pane **107** against a supporting bed **111**, which is formed by a rail from metal, plastic or the like extending along the inner edge surface **112** of the main frame. Said rail is formed with a channel **114** for the intermediate pane **109**. The inner pane **108** is retained between the supporting bed **111** and a gripping flange **116** projecting removably into a slot **115** of the supporting bed inside the void of the same.

The supporting bed serves not only to keep the window panes in their places but also to facilitate the insertion thereof. In the construction shown in Fig. 10, the supporting bed also has a special purpose, namely, to mediate communication between the two air spaces **117** and **118**, in which the intermediate space between the outer pane **107** and the inner pane **108** is divided through the intermediate pane **109**. The channel **114** is understood to be wider than the thickness of the intermediate pane **109**, and the intermediate pane is located with its edge at some distance from the bottom of the channel **114**, so that air clearances **119** are provided, through which air may flow from the generally colder outer air space **117** round the lower edge of the intermediate pane **109** and upwardly into the inner air space **118**, as shown by the arrows **120**. The upper edge of the intermediate pane **109** may be arranged in the same manner as the lower one, whereby the air is permitted at the top to flow from the inner air space **118** back to the outer one **117**. Supporting pieces **121** may be arranged at suitable mutual distances to keep the intermediate pane **109** in its proper position in the middle of the channel **114**.

The air spaces **117**, **118** shut off the outdoor air and the indoor air by tightening strips **122** inserted between the sides of the inner and outer panes **107**, **108** on the one hand and the corresponding supporting surfaces of the flanges **110**, **116** and of the supporting bed **111** on the other hand.

In cold weather, the main frame generally has a temperature higher than that of the holder frame **102**, and as it extends as far out as to the outer pane **107**, it will not have a cooling effect on the air in the air spaces **117** and **118**. In the construction according to Fig. 10, the supporting bed **111** also forms air spaces **123**, **124** toward the main frame, whereby the latter is further insulated relatively to the air spaces **117**, **118** between the window panes.

The heat-insulating measures taken aid in combination with the air circulation between the air spaces **117**, **118** toward preventing the occurrence of steam or moisture on the window panes.

The embodiments shown have been described with the assumption that the window is brought into use in places where the outdoor temperature is generally lower than the indoor temperature. It is obvious, however, that windows of the described constructions are not only suitable in places with extremely low temperatures, but also have corresponding advantages and function in a corresponding manner at very high outdoor temperatures.

The intermediate pane may possibly consist of some other material than the remaining panes, for instance of coloured glass or plastic. If desired, the intermediate pane may be made from a softer material which is more heat-insulating than the glass of the outward pane and the inward pane.

The main frame **12** of the embodiments shown Fig. 3–5 and Figs. 6–8, respectively, may be formed with a boxlike web similar to that shown in Fig. 10 to improve its stiffness and the heat or cold insulation qualities of the structure.

What I claim is:

1. A frame structure comprising an outer frame, an inner frame rigidly connected with the outer frame and having a longitudinal communication channel in its inner edge, an outward pane supported by the outward frame, an inward pane supported by the inner frame, an intermediate pane extending with its top and bottom edges into said channel in the inner frame and dividing the space between the outward pane and the inward pane into air spaces communicating by way of said channel, said inner frame having a boxlike cross section enclosing an air

cavity and a connecting channel formed at an edge thereof facing outwards in a direction at right angles to the panes, and heat insulating means mounted in said channel between the inner frame and the outer frame to prevent, together with said air cavity, heat transfer between the inside and the outside of the frame structure.

2. A frame structure as claimed in claim 1 in which the inner frame comprises a supporting bed for the window panes along the inner edge of said inner frame, the communication channel for the intermediate pane being located in said supporting bed, and means sealing the air spaces between the panes relatively to the outer atmosphere.

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