

"WINDOW ASSEMBLY WITH DRAINING ARRANGEMENT"

The present invention relates to windows, and more particularly to a window assembly having a draining arrangement.

Window assemblies of the type described are known
5 in which an endless encircling chamber is provided
between a window frame and a window sash by a pair of
interior and exterior sealing means disposed between and
engaging sealingly with the window frame and sash, the
window frame having apertures communicating with the
10 chamber and the outside air for pressure equalization
therebetween. At least one of the sealing means is
fixedly received in a groove extending longitudinally in
the window frame at a distance from the aperture. With
this arrangement, the sealing means is liable to become
15 damaged or displaced off the groove when water entered
into the groove by capillary action and trapped therein,
freezes particularly in winter season or at cold districts.
Furthermore, the groove is not wide enough to retain the
sealing means stably in position.

20 According to the present invention, there is provided a window assembly comprising: a rectangular window frame having a groove extending longitudinally along an inside surface thereof; a window sash mounted within said window frame; a pair of interior and exterior sealing means disposed between and coextensive with said
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window frame and sash for defining jointly therewith an encircling chamber, said interior sealing means being fixedly received in said groove; and passage means, extending from said chamber continuously through said interior sealing means and said window frame to the outside air, for draining water off said chamber by gravity.

It is possible by means of the present invention to provide a window assembly having a draining arrangement which prevents water from being trapped in a groove which receives a sealing means fixedly therein.

It is also possible by means of the invention to provide a window assembly which can retain a sealing means stably in a groove.

The invention will be described by way of several examples with reference to the accompanying drawings in which:

Figure 1 is a front elevational view of a window assembly embodying the present invention;

Figure 2 is an enlarged vertical cross-sectional view of the window assembly of Figure 1;

Figure 3, appearing with Figure 1, is an enlarged horizontal cross-sectional view of the window assembly of Figure 1;

Figure 4 is a fragmentary cross-sectional view of a modified window assembly;

Figure 5 is a fragmentary cross-sectional view of another modified assembly; and

Figure 6 is a cross-sectional view taken along

line VI - VI of Figure 5.

Referring now to the drawings, wherein like reference characters designate identical or corresponding parts throughout the several views, and more particularly to Figure 1, a pair of vertical studs 1, 1 and a pair of upper and lower horizontal transoms 2, 2 are connected together at their ends to jointly define therebetween a rectangular opening 3 within which a window assembly is mounted. The window assembly generally comprises a rectangular window frame 4 mounted within the opening 3, and a window sash 5 pivotably mounted within the window frame 4 and tiltable into the interior side.

The window frame 4 includes a pair of upper and lower horizontal pieces 6, 7 (Figure 1 and 2) and a pair of vertical pieces 8, 8 (Figure 1 and 3) connected to the horizontal pieces 6, 7 at their ends to define a rectangular window opening. The upper and lower horizontal pieces 6, 7 are fixed to the transoms 2, 2, respectively. The vertical pieces 8, 8 are fixed to the studs 1, 1, respectively.

The window sash 5 includes a pair of upper and lower horizontal pieces 9, 10 (Figures 1 and 2), and a pair of vertical pieces 11, 11 (Figures 1 and 3) connected to the horizontal pieces 9, 10 at their ends. A pair of closely spaced parallel panes of glass 12 is mounted within the window sash 5.

As shown in Figure 2, the upper horizontal piece or top rail 6 of the window frame 4 comprises a pair of spaced interior and exterior members 20, 21 made of metal such as extruded aluminium and interconnected by a pair of connector bars 22, 22 made of a thermally insulating material. Each of the interior and exterior members 20, 21 has through its full length an elongate hollow cross section defined by four walls 20a, 20b, 20c, 20d; 21a, 21b, 21c, 21d. The lower or inner wall 21d of the exterior member 21 has on its under side a longitudinal groove 23 extending throughout the length thereof, for a purpose described below. The interior and exterior members 20, 21 have a pair of upwardly directed parallel flanges 25, 26, respectively, which is weathertightly fixed to the upper horizontal transom 2. The exterior member 21 also has a downwardly directed flange 24 as an extension of the front wall 21b.

Likewise, the lower horizontal piece or sill 7 of the window frame 4 comprises a pair of spaced interior and exterior members 30, 31 made of metal such as extruded aluminium and interconnected by a pair of connector bars 32, 32 made of a thermally insulating material. Each of the interior and exterior members 30, 31 has through its full length an elongate hollow cross section defined by four walls 30a, 30b, 30c, 30d; 31a, 31b, 31c, 31d. The upper wall 31d of the exterior

member 31 has on its upper side a longitudinal groove 33 extending throughout the length thereof, for a purpose described below. The upper wall 31d has a plurality of apertures 34 (only one being shown) arranged lengthwise thereof at a distance and communicating with the groove 33. Likewise, the lower wall 31c has a plurality of apertures 35 arranged respectively in register with the apertures 34. The interior and exterior members 30, 31 have a pair of downwardly directed parallel flanges 37, 38, respectively, which is weathertightly fixed to the lower horizontal transom 2. The exterior member 31 also has an upwardly directed flange 36 as an extension of the front wall 31b.

As shown in Figure 3, each vertical frame member or stile 8 of the window frame 4 comprises a pair of spaced interior and exterior members 30', 31' made of metal such as extruded aluminium and interconnected by a pair of connector bars 32', 32' made of a thermally insulating material. Each of the interior and exterior members 30', 31' has through its full length an elongate hollow cross section defined by four walls 30'a, 30'b, 30'c, 30'd; 31'a, 31'b, 31'c, 31'd. The inner wall 31'd of each exterior member 31' has on its inner side a longitudinal groove 33' extending throughout the length thereof, for a purpose described below. Each exterior member 31' also has

an inwardly directed flange 36' as an extension of the front wall 31'b.

As shown in Figure 2, the upper horizontal piece or top rail 9 of the window sash 5 includes a pair of parallel interior and exterior side walls 40, 41 and an intermediate portion extending between the lower edge of the interior side wall 40 and the upper edge of the exterior side wall 41. The intermediate portion has a pair of parallel horizontal walls 42, 42a of different length and a vertical wall 42b extending between the horizontal walls 42, 42a at their exterior side; such three walls 42, 42a, 42b define, together with a lower portion of the interior side wall 40, an elongate hollow cross section through the full length of the upper horizontal piece 9. The lower horizontal wall 42a has on its under side a longitudinal groove 43, for a purpose described below. The exterior side wall 41 has on its interior side a longitudinal groove 44, for a purpose described below.

Likewise, the lower horizontal frame piece or sill 10 of the window sash 5 includes a pair of parallel interior and exterior side walls 50, 51 and an intermediate portion extending between the upper edge of the interior side wall 50 and the lower edge of the exterior side wall 51. The intermediate portion has a pair of parallel horizontal walls 52, 52a of different length and a vertical wall 52b extending

between the horizontal walls 52, 52a at their exterior side; such three walls 52, 52a, 52b define, together with an upper portion of the interior side wall 50, an elongate hollow cross section through the full length of the lower horizontal piece 10. The upper horizontal wall 52a has on its upper side a longitudinal groove 53, for a purpose described below. The exterior side wall 51 has on its interior side a longitudinal groove 54, for a purpose described below.

10 As shown in Figure 3, each vertical piece or stile 11 of the window sash 5 includes a pair of parallel interior and exterior side walls 70, 71 and an intermediate portion extending between the inner edge of the interior side wall 70 and the outer edge of the exterior side wall 71. The intermediate portion has a pair of parallel inner and outer walls 72, 72a of different length and a lower (as viewed in this Figure) wall 72b extending between the vertical walls 72, 72a at their exterior side; such three walls 72, 72a, 72b define, together with an inner portion of the interior side wall 70, an elongate hollow cross section through the full length of the respective vertical piece 11. The inner wall 72a has on its interior side a longitudinal groove 73, for a purpose described below. The exterior side wall 71 has on its interior side (upper side in this Figure) a longitudinal groove 74, for a purpose described below.

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As shown in Figure 2, a pair of upper and lower interior sealing means or weather strips 60, 61 is co-extensive with and is supported by the upper and lower horizontal pieces 6, 7, respectively, of the window frame 4. The upper weather strip 60 has a base 60a fixedly received in the groove 23 of the exterior member 21, and an interiorly inclined projection 60b extending from the base 60a and terminating in a tapering, outwardly (upwardly) bent end 60c (as viewed in cross section) which resiliently and weathertightly engages with an extension 42'b of the vertical wall 42b of the window sash 5. The lower weather strip 61 has a base 61a fixedly received in the groove 33 of the exterior member 21, and an interiorly inclined projection 61b extending from the base 61a and terminating in a tapering, outwardly (downwardly) bent end 61c (as viewed in cross section) which resiliently and weathertightly engages an extension 52'b of the vertical wall 52b of the window sash 5. The lower weather strip 61 has a plurality of openings 62 (only one being shown) extending vertically through the base 61a and communicating with the groove 33 and the respective apertures 34 in the upper wall 31d, each of the openings 62 opening toward the flange 36.

As shown in Figure 3, a pair of right and left vertical interior sealing means or weather strips 61', 61' is coextensive with and is supported by the right

and left vertical pieces 8, 8, respectively, of the window frame 4. Each vertical weather strip 61' has a base 61'a fixedly received in the groove 33' of the exterior member 31', and an interiorly inclined projection 61'b extending from the base 61'a and terminating in a tapering, outwardly (rightwardly or leftwardly) bent end 61'c (as viewed in cross section) which resiliently and weathertightly engages an extension 72'b of the lower (as viewed in this Figure) wall 72b of the window sash 5.

As shown in Figure 2, the upper periphery of the window pane 12 is pressed on opposite sides by a base portion 64a of an upper horizontal exterior sealing means or weather strip 64 and an upper gasket 66. The base portion 64a is fixedly received in the groove 44 of the upper horizontal piece 9 of the window sash 5, and has a plurality of tongues resiliently engaging the window pane 12. The upper gasket 66 is carried by an upper batten 63, a base portion of which is fixedly received in the groove 43 of the upper horizontal piece 9.

Similarly, the lower periphery of the window pane 12 is pressed on opposite sides by a base portion 65a of a lower horizontal exterior sealing means or weather strip 65 and a lower gasket 66. The base portion 65a is fixedly received in the groove 54 of the lower horizontal piece 10 of the window sash 5,

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and has a plurality of tongues resiliently engaging the window pane 12. The lower gasket 66 is carried by a lower batten 63, a base portion of which is fixedly received in the groove 53 of the lower horizontal piece 10.

As shown in Figure 3, each side periphery of the window pane 12 is pressed on opposite sides by a base portion 67a of a vertical exterior sealing means or weather strip 67 and a vertical gasket 66. The base portion 67a is fixedly received in the groove 74 of the respective vertical piece 11 of the window sash 5, and has a plurality of tongues resiliently engaging the window pane 12. The vertical gasket 66 is carried by a respective vertical batten 63, a base portion of which is fixedly received in the groove 73 of the respective vertical piece 11 of the window sash 5.

Each of the upper and lower horizontal weather strips 64, 65 has a covering portion 64b, 65b extending from the base portion 64a, 65a and terminating in an inwardly (downwardly or upwardly) bent end 64'b, 65'b (as viewed in cross section) fixedly received in a groove 45, 55. Thus the covering portion 64b, 65b of each weather strip 64, 65 substantially completely covers the whole surface of the respective exterior side wall 41, 51. Each weather strip 64, 65 also has a tapering, outwardly (upwardly or downwardly) bent projection 64c, 65c extending from the respective

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covering portion 64b, 65b and engaging an interiorly directed end 24a, 36a (as viewed in cross section) of the respective exterior flange 24, 36 of the window frame 4.

5 Likewise, each vertical weather strip 67 (Figure 3) has a covering portion 67b extending from the base portion 67a and terminating in an inwardly bent end 67'b (as viewed in cross section) fixedly received in a groove 75. Thus, the covering portion
10 67b of each vertical weather strip 67 substantially completely covers the whole surface of the respective exterior side wall 71. Each weather strip 67 also has a tapering, outwardly (upwardly or downwardly) bent projection 67c extending from the respective cover-
15 ing portion 67b and engaging an interiorly directed end 36'a (as viewed in cross section) of the respective exterior flanges 36' of the window frame 4.

On and along its outer edge, each of the four interior side walls 40, 50, 70, 70 of the respective
20 pieces 9, 10, 11, 11 of the window sash 5 carries a weather strip 68 (Figures 2 and 3) of thermally insulating material weathertightly engaging the respective interior member 20, 30, 30', 30' of the window frame 4. Designated at the numeral 69 is a hinge
25 connected with the window frame 4 and window sash 5 for pivotal movement of the window sash 5 with respect to the window frame 4.

Thus, the upper horizontal interior sealing means or weather strip 60 and the upper horizontal exterior sealing means or weather strip 64 define jointly with the upper piece 9 of the window sash 5 and the upper exterior member 21 of the window frame 4, an upper horizontal chamber section A_1 (Figure 2). The lower horizontal interior sealing means or weather strip 61 and the lower horizontal exterior sealing means or weather strip 65 define jointly with the lower piece 10 of the window sash 5 and the lower exterior member 31 of the window frame 4, a lower horizontal chamber section A_2 (Figure 2). Each vertical interior sealing means or weather strip 61' and each vertical exterior sealing means or weather strip 67 define jointly with the respective vertical piece 11 of the window sash 5 and the respective vertical exterior member 31' of the window frame 4, a vertical chamber section A_3 (Figure 3). The two horizontal chamber sections A_1 , A_2 and the two vertical chamber sections A_3 , A_3 constitute an endless or encircling combined chamber. As shown in Figure 2, through the apertures 34, 35 in the lower exterior member 31 of the window frame 4 and the opening 62 in the interior weather strip 61, the combined chamber A_1 , A_2 , A_3 , A_3 is open to the outside air so that the air pressure in the combined chamber is equalized with the air pressure outside, thereby providing improved fluid-proofing. The apertures 34, 35 and the openings 62

jointly constitute a passage means for draining water off the combined chamber by gravity. The passage means also serves as a venting means.

5 With the groove 33 communicating with both the apertures 34, 35 and the openings 62, water which would enter into the groove 33 through the apertures 35, 34 and opening 62 by capillary action is not trapped in the groove 33 but drained therefrom to the outside air by gravity. The weather strip 61 is
10 therefore perfectly prevented from becoming damaged or displaced off the groove 33 by freezing of water in the groove 33.

As the apertures 34 and the groove 33 overlap or communicate with each other, the groove 33 is
15 allowed to be wide enough, without reducing the size of the apertures 34, in such an extent to receive the base 61a of the weather strip 61 more stably in position against displacement.

Given that the outwardly bent projection 64c,
20 65c, 67c of each exterior sealing means or weather strip 64, 65, 67 is only slight resilient; this projection, when heavy wind is applied thereon, bends off the interiorly directed end 24a, 36a, 36'a of the respective extension flange 24, 36, 36' so that the
25 outside air flows into the chamber through such a gap. The air pressure in the chamber is thus equalized with the air pressure outside.

Further, since the projection 60b, 61b, 61'b of each interior sealing means or weather strip 60, 61, 61' is inclined interiorly, it is possible to have its tapering end 60c, 61c, 61'c brought in positive engagement with the extension 42'b, 52'b, 72'b of the wall 42b, 52b, 72b of the window sash 5.

A modified window assembly shown in Figure 4 is substantially identical with the one according to the first embodiment described above, with the exception that an exterior member 31 of a lower window frame piece or sill 7 has on its upper wall 31d a longitudinal groove 33 extending coextensively over the upper wall 31d. The upper wall 31d has a plurality of apertures 34 (only one being shown) opening entirely to the groove 33. With such wider groove 33, the weather strip 60 can be retained more firmly in the groove.

Another modified window assembly shown in Figures 5 and 6 is substantially identical with the one shown in Figure 4 except that an exterior member 31 of a lower window frame piece or sill 7 has a pair of cantilevered upper walls 80, 81 confronting together with a longitudinal slot 82 defined by and between their free edges 80a, 81a. An interior sealing means or weather strip 61 has a plurality of vertical openings or holes 83 (two being shown) extending in register with the slot 82. With this arrangement, at least one aperture 35 can be positioned at random with respect to the slot 82.



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CLAIMS:

1. A window assembly comprising:
 - (a) a rectangular window frame having a groove extending longitudinally along an inside surface thereof;
 - 5 (b) a window sash mounted within said window frame;
 - (c) a pair of interior and exterior sealing means disposed between and coextensive with said window frame and sash for defining
10 jointly therewith an encircling chamber, said interior sealing means being fixedly received in said groove; and
 - (d) passage means, extending from said chamber continuously through said interior sealing means and said window frame to the outside
15 air, for draining water off said chamber by gravity.
2. A window assembly according to claim 1, said window frame including a pair of upper and lower horizontal pieces and a pair of vertical pieces interconnected at their ends to said horizontal pieces, said
20 passage means extending through at least said lower horizontal piece.
3. A window assembly according to claim 2, said
25 passage means including a plurality of apertures extend-



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ing through said lower horizontal piece in communication with said groove, and a plurality of openings extending through said interior sealing means in communication with said groove.

5 4. A window assembly according to claim 3, each of said apertures being in register with one of said openings.

 5. A window assembly according to claim 2, said lower horizontal piece having a substantially hollow
10 rectangular cross section defined by a pair of upper and lower walls and a pair of side walls, said groove extending longitudinally in said upper wall, said passage means including a plurality of first apertures extending through said upper wall and overlapping with
15 said groove, a plurality of openings extending through said interior sealing means in communication with said groove, and a plurality of second apertures extending through said lower wall.

 6. A window assembly according to claim 5, each
20 of said first and second apertures and said openings being in register with one another.

 7. A window assembly according to claim 2, said lower horizontal piece having a substantially hollow rectangular cross section defined by a pair of upper
25 and lower walls and a pair of side walls, said groove extending coextensively along said upper wall, said



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passage means including a plurality of first apertures extending through said upper wall and opening to said groove, a plurality of openings extending through said interior sealing means in communication with said groove,
5 and a plurality of second apertures extending through said lower wall.

8. A window assembly according to claim 7, each of said first and second apertures and said openings being in register with one another.

10 9. A window assembly according to claim 2, said lower horizontal piece having a substantially hollow rectangular cross section defined by a pair of cantilevered upper walls confronting with each other, a lower wall and a pair of side walls, said groove extending
15 coextensively along said cantilevered upper walls, said passage means including a slot defined by and between confronting edges of said upper walls, a plurality of openings extending through said interior sealing means in communication with said groove, and a plurality of
20 apertures extending through said lower wall.

10. A window assembly according to claim 9, said slot, said apertures and said openings being in register with each other.

11. A window assembly according to any one of
25 preceding claims 1 to 10, each of said horizontal and vertical pieces having an interior member, an exterior

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member, and at least one connector made of a thermally insulating material and interconnecting said interior and exterior members, said groove extending in said exterior member.
