

PATENT SPECIFICATION

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(54) MULTI-GLAZED WINDOW

(71) We, YOSHIDA KOGYO K.K., a corporation duly organised under the laws of Japan and existing at No. 1, Kanda Izumi-cho, Chiyoda-ku, Tokyo, Japan, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to multi-panel units such as multi-glazed sashes for windows and other closure assemblies, and more specifically to improvements for enhancing the soundproofing ability of such multi-panel units.

For soundproofing windows and other closure assembling there have been proposed double or triple-glazed sashes wherein two or three panes of glass are mounted within a common frame parallel to each other and with a relatively large spacing or spacings therebetween. Each glass pane used in such double- or triple-glazed sashes, however, is not so impervious to sound in a relatively high audio frequency range of, for example, 1250 through 4000 hertz as to sound in a low frequency range of 100 through 200 hertz. This soundproofing characteristic of individual glass panes is substantially unaltered even if they are combined in the conventional fashion into double or triple glazing of sashes, so that these prior art multi-glazed sashes are unsatisfactory in their ability to obstruct the passage therethrough of sound of relatively high frequencies.

The present invention seeks to provide an improved multi-panel unit which, in particular embodiments, is effectively soundproofed against a complete range of audio frequencies that must be taken into practical consideration.

According to the invention there is provided a multi-panel unit comprising a frame carrying a unitary glass pane and a compound glass assembly in parallel spaced relation with the unitary glass pane, the compound glass assembly comprising at least two panes of glass in parallel spaced relation and the spacing between the panes of the compound

glass assembly being less than the spacing between the compound glass assembly and the unitary pane, wherein the frame includes sealing means for sealing the spacings between the unitary pane of glass and the compound glass assembly and between the panes of glass of the compound glass assembly, the sealing means comprising an elastic strip extending along and embracing the peripheries of the unitary pane of glass and the compound glass assembly whereby the unitary pane of glass and the compound glass assembly are capable of vibrating independently of each other in response to sound waves of various frequencies impinging thereon.

The invention will now be described in greater detail, by way of example, with reference to the drawings, in which:—

Figure 1 is a fragmentary vertical cross-sectional view of a preferred form of the multi-panel unit in accordance with this invention; and

Figure 2 is a fragmentary vertical cross-sectional view of another preferred form of the multi-panel unit in accordance with this invention.

This invention is based upon the discovery that the compound glass assembly, comprising at least two parallel panes of glass with a sealed spacing of up to about 2 millimeters therebetween, has a highly reliable soundproofing characteristic in a relatively high audio frequency range of from about 2000 to 3150 hertz, although its soundproofing characteristic is not so reliable in a relatively low audio frequency range of from about 125 to 315 hertz. Thus, by combining at least one such compound glass assembly with at least one unitary glass pane in the manner disclosed herein, there can be realised a multi-panel unit which is equally impervious to sound of both high and low frequencies in a practical audio frequency range.

In Figure 1, a multi-panel unit 10 may be considered to correspond to a conventional double-glazed sash. Broadly, the multi-panel unit 10 comprises a generally rectangular frame 11, a unitary pane of glass 12 mounted

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within the frame, and a compound glass assembly 13 also mounted within the frame so as to be in parallel spaced relationship to the unitary glass pane.

5 The compound glass assembly 13 comprises two parallel panes of glass 14 with a small spacing 15 therebetween. This spacing 15 is much less than the spacing 16 between the unitary glass pane 12 and the compound glass assembly 13.

10 In this particular embodiment of the invention, the unitary glass pane 12 has a thickness of 5 millimeters, and each glass pane 14 of the compound glass assembly 13 has a thickness of 3 millimeters. The spacing 15 between the two glass panes 14 of the compound glass assembly is 0.2 millimeter thick, and the spacing 16 between the unitary glass pane 12 and the compound glass assembly 13 is 25 millimeters thick. It has been found that the spacing having a thickness of more than about 2 millimeters between the glass panes 14 of the compound glass assembly 13 gives adverse effects on the soundproofing ability of the unit. Generally, the spacing 15 between the glass panes 14 should be in the range of from about 0.1 to about 2.0 millimeters.

15 The frame 11 of the multi-panel unit 10 comprises strips 17 of rubber or like elastic material extending along and embracing the peripheries of the unitary glass pane 12 and the compound glass assembly 13, and U-sectioned frame members 18 of metal or like rigid material fitted over the respective elastic strips. Preferably, an adhesive should be applied as at 19 between the unitary glass pane 12 and the elastic strips 17 and between the compound glass assembly 13 and the elastic strips 17 to assure airtight sealing of the spacings 15 and 16.

20 The elastic strip 17 has a cavity 20 formed therein for receiving a suitable desiccant. This cavity 20 communicates with the spacing 16 via one or more passages 21 also formed in the elastic strip 17. The cavity 20 serves the additional purpose of permitting easy deformation of the strip 17, as at the time of the assemblage of the glass panes 12 and 14 with the frame 11.

25 The multi-panel unit illustrated in Figure

2 and generally designated 10a therein represents another preferred embodiment of the invention and may be considered to correspond to a conventional triple-glazed sash.

30 The multi-panel unit 10a broadly comprises a generally rectangular frame 11a, first and second unitary panes of glass 12a and 12b mounted within the frame in parallel spaced relationship, and a compound glass assembly 13a also mounted within the frame so as to be located intermediate between the first and the second unitary glass panes in parallel spaced relationship thereto. The compound glass assembly 13a comprises two parallel panes of glass 14a with a small spacing 15a therebetween.

35 In this second embodiment, the first and the second unitary glass panes 12a and 12b each have a thickness of 3 millimeters. The two glass panes 14a of the compound glass assembly 13a also each have a thickness of 3 millimeters and are spaced 0.2 millimeter from each other. The spacing 16a between the first unitary glass pane 12a and the compound glass assembly 13a is 20 millimeters thick, and the spacing 16b between the compound glass assembly 13a and the second unitary glass pane 12b is 30 millimeters thick.

40 The frame 11a of the multi-panel unit 10a also comprises strips 17a of elastic material extending along and embracing the peripheries of the first and the second unitary glass panes 12a and 12b and the compound glass assembly 13a, and U-sectioned rigid frame members 18a fitted over the respective elastic strips. An adhesive is applied as at 19a between the first unitary glass pane 12a and the elastic strips 17a and between the second unitary glass pane 12b and the elastic strips 17a to assure airtight sealing of the spacings 16a and 16b. Cavities 20a and 20b formed in the elastic strip 17a communicate with the spacings 16a and 16b via passages 21a and 21b, respectively.

45 Tabulated below are the soundproofing characteristics of some unitary glass panes of different thicknesses and compound glass assemblies of different types that can be used in the multi-panel unit in accordance with this invention.

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Frequency, Hz	Soundproofing Characteristics, dB				
	Unitary Glass Panes			Compound Glass Assemblies	
	3 mm Thick	5 mm Thick	6 mm Thick	A*	B**
100	12.0	15.0	15.0	22	22
125	14.5	17.0	17.0	19	24
200	17.5	21.5	21.0	21	21
250	18.5	22.0	23.0	21	22
315	21.5	24.5	26.0	21	24
400	21.5	26.0	27.5	24	26
500	22.5	26.0	27.5	24	29
630	23.5	29.0	28.5	27	30
800	26.5	30.0	29.0	28	31
1000	28.5	30.5	31.0	30	32
1250	29.0	31.5	29.5	31	33
1600	29.0	30.0	24.5	32	33
2000	32.0	26.0	24.5	34	33
2500	32.0	26.0	31.5	34	35
3150	30.5	29.0	34.0	34	36
4000	26.0	31.5	37.0	34	30

* A: Two 2-mm thick panes of glass spaced 0.2mm from each other.

** B: Two 3-mm thick panes of glass spaced 0.2mm from each other.

As will be observed from the above table, the soundproofing ability of the 3-millimeter thick unitary glass pane is rather unreliable at frequencies of 3150 hertz and above; that of the 5-millimeter thick unitary glass pane is unreliable at frequencies of 1600 hertz and above; and that of the 6-millimeter thick unitary glass pane is unreliable at frequencies of 1250 hertz and above.

Contrastively, the soundproofing ability of the compound glass assembly designated A in the table is rather unreliable in a frequency range of 125 to 315 hertz, and that of the compound glass assembly B is rather unreliable in a frequency range of 200 to 315 hertz. Although the soundproofing ability of

the compound glass assembly B also becomes unreliable at 4000 hertz, this may be disregarded for practical purposes.

Thus, in the multi-panel units 10 and 10a in accordance with this invention, the unitary glass panes 12, 12a and 12b serve to make the units particularly impervious to relatively low frequency sound, whereas the compound glass assemblies 13 and 13a serve to make the units particularly impervious to relatively high frequency sound. As a consequence, sound waves of various frequencies impinging on the multi-panel units 10 and 10a as indicated by the arrows in the drawings, for example, can be effectively prevented from passage therethrough.

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 5 The unitary glass panes 12, 12a, 12b and the compound glass assemblies 13 and 13a of the multi-panel units 10 and 10a are supported by the strips 17 and 17a of rubber or like elastic material. The unitary glass panes and the compound glass assemblies are therefore capable of vibrating independently in response to sound waves of various frequencies impinging thereon, so that the multi-panel units of this invention are capable of still more efficiently blocking the passage of sound therethrough.

10 Although the multi-panel unit in accordance with this invention has been shown and described in terms of its exemplary forms, it is understood that the invention itself is not to be restricted by the exact details of this disclosure. For example, in the multi-panel unit 10a of Figure 2, either of the first and the second unitary glass panes 12a and 12b may be replaced by a compound glass assembly similar to the one designated 13 or 13a.

WHAT WE CLAIM IS:—

25 1. A multi-panel unit comprising a frame carrying a unitary glass pane and a compound glass assembly in parallel spaced relation with the unitary glass pane, the compound glass assembly comprising at least two panes of glass in parallel spaced relation and the spac-

ing between the panes of the compound glass assembly being less than the spacing between the compound glass assembly and the unitary pane, wherein the frame includes sealing means for sealing the spacings between the unitary pane of glass and the compound glass assembly and between the panes of glass of the compound glass assembly, the sealing means comprising an elastic strip extending along and embracing the peripheries of the unitary pane of glass and the compound glass assembly whereby the unitary pane of glass and the compound glass assembly are capable of vibrating independently of each other in response to sound waves of various frequencies impinging thereon.

2. A multi-panel unit according to claim 1, wherein the spacing between the panes of glass of the compound glass assembly is in the range of from about 0.1 to about 2.0 millimeters.

3. A multi-panel unit according to claim 1 or claim 2, wherein the frame includes rigid members covering the elastic strip.

4. A multi-panel unit substantially as described herein with reference to the drawings.

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WHAT WE CLAIM IS:—

25 1. A multi-panel unit comprising a frame carrying a unitary glass pane and a compound glass assembly in parallel spaced relation with the unitary glass pane, the compound glass assembly comprising at least two panes of 30 glass in parallel spaced relation and the spac-

ing between the panes of the compound glass assembly being less than the spacing between the compound glass assembly and the unitary pane, wherein the frame includes sealing means for sealing the spacings between the 55 35 unitary pane of glass and the compound glass assembly and between the panes of glass of the compound glass assembly, the sealing means comprising an elastic strip extending along and embracing the peripheries of the unitary 40 pane of glass and the compound glass assembly whereby the unitary pane of glass and the compound glass assembly are capable of vibrating independently of each other in response to sound waves of various frequen- 45 cies impinging thereon.

2. A multi-panel unit according to claim 1, wherein the spacing between the panes of glass of the compound glass assembly is in the range of from about 0.1 to about 2.0 50 millimeters.

3. A multi-panel unit according to claim 1 or claim 2, wherein the frame includes rigid members covering the elastic strip.

4. A multi-panel unit substantially as described herein with reference to the drawings. 55

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