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# DOUBLE SLIDING WINDOW

## BACKGROUND OF THE INVENTION

5           The present invention relates to a double sliding window particularly having an indoor side sash removable structure.

          In a conventional art, there are known two types of double sliding window of an indoor side sash removable type (called hereinlater indoor side removable double sliding window or the like for the sake of convenience) including an indoor side drop-down type in which a lower portion of an indoor side sash is dropped down into a lower window frame member, the indoor side sash is inclined towards an inner room side and then an upper portion of the indoor side sash is removed towards the inner room side from an upper window frame, and also including an indoor side swing type in which the indoor side sash is lifted upward so that an upper portion thereof is pushed into the upper window frame member and the lower portion of the indoor side sash is then swung indoor (inner room) side to remove the lower portion of the indoor side sash from the lower window frame member.

          In the indoor side drop-down type of the above two types of the double sliding window, the indoor side

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sash is removable only by constructing the indoor side sash and an outdoor side sash to be slidable and separating mating frame elements of the indoor side and outdoor side sashes from each other in a sash thickness direction. On the other hand, in the indoor side swing type, if a structure of a dew receiving angle member is attached, the indoor side sash is not removable.

For the reasons mentioned above, when windows are fitted or attached to a window frame or the like of a room or building, it is necessary to prepare both these two types of the double sliding windows and to select and use either one of them in accordance with using objects or patterns of the double sliding windows. Thus, it is troublesome and inconvenient to manufacture and reserve both the types of windows.

#### SUMMARY OF THE INVENTION

An object of the present invention is therefore to substantially eliminate defects or drawbacks encountered in the prior art mentioned above and to provide a double sliding window having an improved structure.

This and other objects can be achieved according to the present invention by providing a double sliding window having an indoor side sash removable

structure, in which indoor and outdoor side sashes are fitted to be slidable to a window frame structure composed of an upper frame member, a lower frame member and two vertical frame members so as to provide a rectangular shape in an assembled state, characterized in that when the indoor side sash is lifted upward by a maximum amount, a lower end portion of the indoor side sash is raised upward above the lower frame member and when the indoor side sash is dropped downward, an upper end portion of the indoor side sash is positioned below a lower end portion of the upper frame member, and a dimension of a space between an inner lower rail formed to the lower frame member and an indoor side surface of a lower portion of the outdoor side sash is larger than a thickness side dimension of a lower portion of the indoor side sash.

In a preferred embodiment, each of the indoor side and outdoor side sash is composed of an upper frame element, a lower frame element, a vertical mating frame element and a vertical abutting frame element so as to provide a rectangular shape in an assembled state;

an inner upper horizontal air-tight member, an inner lower horizontal air-tight member and an inner vertical air-tight member are mounted to the upper frame member, the lower frame member and one of the vertical

frame members, respectively, to be continuous so as to be pressed against an indoor side surface of the indoor side sash;

an outer upper horizontal air-tight member, an  
5 outer lower horizontal air-tight member and an outer vertical air-tight member are mounted to the upper frame member, the lower frame member and other one of the vertical frame members, respectively, to be continuous so as to be pressed against an indoor side surface of the  
10 outdoor side sash;

a mating vertical air-tight member is mounted to the mating frame element of the indoor side sash so as to be pressed against an indoor side surface of the mating frame element of the outdoor side sash; and

15 an upper air-tight member is mounted to an upper portion of the mating frame element of the indoor side sash so as to be pressed against the upper frame member, the indoor side surface of the mating frame element of the outdoor side sash, the inner upper  
20 horizontal air-tight member and the outer upper horizontal air-tight member; and

a lower air-tight member is mounted to a lower portion of the mating frame element of the indoor side sash so as to be pressed against the lower frame member,  
25 the indoor side surface of the mating frame element of

the outdoor side sash, the inner lower horizontal air-tight member and the outer lower horizontal air-tight member.

5 In this embodiment, a crescent key is attached to the mating frame element of the indoor side sash, upper and lower sliding members are mounted to the mating frame element of the indoor side sash to be operative in association with an operation of the crescent key, and the upper air-tight member is mounted  
10 to the upper sliding member and the lower air-tight member is mounted to the lower sliding member in a manner that when the crescent key is locked, the upper sliding member is moved upward and the lower sliding member is moved downward so as to create a pressed  
15 condition of the upper and lower air-tight members and when the crescent key is unlocked, the upper sliding member is moved downward and the lower sliding member is moved upward so as to create a separated condition of the upper and lower sliding members.

20 Furthermore, the upper and lower air-tight members have expandable and contractive structure, usually in a contracted state, and an air-pressure supply mechanism is provided in association with the operation of the crescent key in a manner that when the crescent  
25 key is operated to be locked, the air-pressure supply

mechanism operates to supply the air pressure to the upper and lower air-tight members so as to be expanded and when the crescent key is operated to be unlocked, the air-supply mechanism operates to suck the air  
5 pressure from the upper and lower air-tight members so as to be contracted.

According to the characteristic features of the present invention mentioned above, in the primary aspect, when the indoor side sash is lifted or raised upward, the  
10 lower end portion of the indoor side sash is positioned above the lower frame member, and on the other hand, when the indoor side sash is to be dropped downward, the upper end portion of the indoor side sash is positioned below the upper frame member and in this state, the lower  
15 portion of the indoor side sash can be dropped down in the space between the inner lower rail and the lower indoor side surface of the outdoor side sash.

Therefore, the indoor side sash can be inwardly removed by swinging inward the lower portion of the  
20 indoor side sash or swinging inward the upper portion thereof, thus removing the indoor side sash in accordance with the using pattern of the indoor side sash removable double sliding window, and accordingly, only one kind of the double sliding window of this type  
25 may be manufactured and prepared, thus reducing the

manufacturing and maintenance workings.

Furthermore, according to the preferred embodiment of the present invention, the spaces between the indoor side surface of the indoor side sash and the upper frame member, between the indoor side surface of the indoor side sash and the lower frame member and between the indoor side surface of the indoor side sash and one vertical frame member can be made air-tight, and also, the spaces between the indoor side surface of the outdoor side sash and the upper frame member, between the indoor side surface of the outdoor side sash and the lower frame member and between the indoor side surface of the outdoor side sash and the other one vertical frame member can be made air-tight. Furthermore, the spaces between both the mating frame elements of the indoor and outdoor side sashes can be also made air-tight by the mating vertical air-tight member, and the spaces between the mating frame element of the indoor side sash and the upper and lower frame members can be also made air-tight, thus surely realizing the air-tight condition between the indoor and outdoor side sashes and the window frame structure.

Furthermore, in the condition that the crescent key is locked, the spaces between the mating frame elements and the upper and lower frame members can be

made air-tight by the upper and lower air-tight members,  
and on the other hand, in the condition that the crescent  
key is unlocked, the upper air-tight member is separated  
from the upper frame member and the other members, and  
5 the lower air-tight member is separated from the lower  
frame member and the other members, so that the sashes  
can be easily opened or closed with less resistance, thus  
the upper and lower air-tight members being not damaged.

Still furthermore, in the condition of the  
10 crescent key being locked, air is supplied under pressure  
into the upper and lower air-tight members, which are  
then expanded, so that these air-tight members can be  
surely pressed against the upper and lower frame members  
and the other members. On the other hand, in the  
15 condition of the crescent key being unlocked, the air in  
the upper and lower air-tight members can be sucked and  
these air-tight members are hence contracted and then  
separated from the upper and lower frame members and the  
other members, so that the sashes can be easily opened or  
20 closed with less resistance, thus the upper and lower  
air-tight members being not damaged.

The nature and further characteristic features  
of the present invention will be made more clear from  
the following descriptions made with reference to the  
25 accompanying drawings.

# BRIEF DESCRIPTION OF THE DRAWINGS

In the accompanying drawings:

Fig. 1 is a schematic view showing an indoor side sash removable type double sliding window, according to one embodiment of the present invention, viewed from a room side;

Fig. 2 is an elevational section of Fig. 1;

Fig. 3 is a cross sectional view taken along the line III-III in Fig. 1;

Fig. 4 is an elevational view in a state that upper and lower sliding members are moved in directions separating from upper and lower frame members for a window;

Fig. 5 is an elevational view in a state that upper and lower sliding members are moved in directions approaching to upper and lower frame members for a window;

Fig. 6 is a plan view of a portion of the upper sliding member;

Fig. 7 is a bottom view of a portion of the lower sliding member;

Fig. 8 is a view showing a mechanism for moving the upper and lower frame member;

Fig. 9 is a perspective view of the lower sliding members;

Fig. 10 is a view showing a state that air-tight (seal) members provided for the upper and lower sliding members in a contracted state;

Fig. 11 is a view showing a state that  
5 air-tight (seal) members provided for the upper and lower sliding members in an expanded state;

Fig. 12 is an elevational section of an indoor side sash removable type double sliding window, according to another embodiment of the present invention;

10 Fig. 13 is a schematic plan view of a double sliding window structure having four sashes to which the present invention is applicable;

Fig. 14 is an elevational section of an abutting side frame element of an indoor side sash;

15 Fig. 15 is a cross sectional view of the abutting side frame elements of two indoor side sashes;

Fig. 16 is an elevational section of a vertically moving mechanism;

20 Fig. 17 is a developed perspective view of the vertically moving mechanism;

Fig. 18 is a cross sectional view showing an abutting state of the sashes;

Fig. 19 is an elevational section of the vertically moving mechanism for showing the operation  
25 thereof; and

Fig. 20 is an elevational section of the abutting frame element in a pulled state thereof.

#### DESCRIPTION OF THE PREFERRED EMBODIMENTS

5           An indoor side sash removable types double sliding window, according to one embodiment of the present invention, is explained by the following descriptions with reference to the accompanying drawings.

10           First, with reference to Fig. 1, a double sliding window is composed by mounting an indoor side sash 2 and an outdoor side sash 3 to a window frame structure 1 to be slidable in an inplane and horizontal direction thereof. The window frame structure 1 is composed of an upper frame member 4, a lower frame  
15           member 5, one vertical frame member 6 and other vertical frame member 7 in a rectangular shape in assembly.

Each of the indoor and outdoor side sashes 2 and 3 is composed of an upper frame element 10, a lower frame element 11, a vertical mating frame element 12 and  
20           a vertical abutting frame element 13 in a rectangular shape in assembly, and window glasses 14 are fitted in the indoor and outdoor side sashes 2 and 3, respectively.

As shown in Fig. 2, the upper frame member 4 is  
25           formed, at an indoor side portion thereof, with an indoor

side sash guide portion as, for example, an inward recessed portion 20, and also formed, at an outdoor side portion thereof, with an outdoor side sash guide portion as, for example, an outer upper rail 21. The upper frame member 4 has an indoor side suspension piece 22 to which  
5 an inner upper horizontal air-tight member 23 is mounted so as to be directed to the outdoor side and also has an intermediate suspension piece 24 to which an outer upper horizontal air-tight member 25 is mounted so as to be  
10 directed to the indoor side.

The lower frame member 5 has an upper surface structure 29 having a stepped shape composed of an indoor side horizontal plate 26, an intermediate vertical plate 27 and an outdoor side horizontal plate 28. An indoor  
15 side rising (built-up) piece 30, an inner lower rail 31, a horizontal piece 32 and an outer lower rail 33 are integrally formed with the upper surface structure 29 of the lower frame member 5. An inner horizontal air-tight member 34 is mounted to the indoor side rising piece 30  
20 so as to be directed to the indoor side, and an outer lower horizontal air-tight member 35 is mounted to the horizontal piece 32 so as to be directed to the outdoor side.

With reference to Fig. 3, one 6 of the vertical  
25 frame members has an indoor side inward piece 36 to which

an inner vertical air-tight member 37 is mounted so as to be directed to the outdoor side, and the other 7 of the vertical frame members has an intermediate inward piece 38 to which an outer vertical air-tight member 39 is  
5 mounted so as to be directed to the outdoor side. The inner upper horizontal air-tight member 23, the inner lower horizontal air-tight member 34 and the inner vertical air-tight member 37 are formed continuously, and the outer upper horizontal air-tight member 25, the  
10 outer lower air-tight member 35 and the outer vertical air-tight member 35 are formed also continuously.

When the indoor side sash 2 and the outdoor side sash 3 are pulled to the indoor side (room side) in a closed state thereof, the indoor side surfaces of the  
15 respective upper frame elements 10, the lower frame elements 11 and the abutting frame elements 13 thereof are contacted, under pressure, to the respective air-tight members mentioned above. At the same time, a mating vertical air-tight member 40 mounted to the  
20 outdoor side of the mating frame element 12 of the indoor side sash 2 is contacted, under pressure, to the indoor side surface of the mating frame element 12 of the outdoor side sash 3.

A mating portion closing member 41 and a lower  
25 leeward (lee side) plate 42 are mounted, respectively, to

the indoor side horizontal plate 26 (corresponding to a portion between the indoor side rising piece 30 and the inner lower rail 31) and a mating portion of the horizontal piece 32 (corresponding to a portion at which  
5 the mating frame element 12 is positioned at a time when the indoor and outdoor side sashes 2 and 3 are closed) in a manner such that the mating portion closing member 41 is contacted, under pressure, to the inner lower horizontal air-tight member 34. A mating air-tight member  
10 43 and a mating pulling member 44 are mounted to a mating portion, on the indoor side, of the inward recessed portion 20 of the upper frame member 4.

The mating frame element 12 of the indoor side sash 2 has, as shown in Fig. 3, an inner hollow portion  
15 12a having upper and lower portions to which, as shown in Fig. 2, an upper sliding member 50 and a lower sliding member 51 are attached. The upper sliding member 50 is vertically movable between a lower portion shown in Fig. 4 and an upper portion shown in Fig. 5 and is provided  
20 with a fin-shaped outdoor side air-tight member 52 and an upper air-tight member 53 constituting an upper air-tight structure, as shown in Fig. 6.

When the upper sliding member 50 is moved upward, as shown in Figs. 5 and 6, the outdoor side  
25 air-tight member 52 is contacted, under pressure,

respectively, to the intermediate suspension piece 24, the outer upper horizontal air-tight member 25 and the mating pulling member 44 of the upper frame member 4 and the indoor side surface upper portion of the mating frame element 12 of the outdoor side sash 3. The upper air-tight member 53 is contacted, under pressure, to the mating pulling member 44 and the mating air-tight member 43, respectively, and the outdoor side air-tight member 52 of the upper sliding member 50 is also contacted, under pressure, to the mating vertical air-tight member 40.

According to the structure mentioned above, a space between the mating upper portions of the indoor side and outdoor side sashes 2 and 3 and the upper frame member 4 can be surely sealed in air-tight manner. Furthermore, when the upper sliding member 50 is moved downward as shown in Fig. 4, the outdoor side air-tight member 52 and the upper air-tight member 53 are not contacted, under pressure, to the upper frame member 4 and the outdoor side sash 3, respectively, so that any resistance is not caused at a time of opening or closing the indoor side sash 2 and, thus, the respective air-tight members cannot be damaged.

Furthermore, as shown in Fig. 5, when the upper sliding member 50 is moved upward, it is contacted, under

pressure, to the mating pulling member 44, and the upper portion of the indoor side sash 2 is pulled towards the indoor side, so that the air-tight performance can be further improved.

5                   On the other hand, the lower sliding member 51 is vertically movable between the upper position shown in Fig. 4 and the lower position shown in Fig. 5, and as shown in Fig. 7, the lower sliding member 51 is provided with a lower air-tight member 55 and an indoor side  
10                   air-tight member 56 constituting a lower air-tight structure.

                  When the lower sliding member 51 is moved downward, as shown in Figs. 5 and 7, the outdoor side air-tight member 54 is contacted, under pressure, to the  
15                   indoor side lower surface portion, and the lower air-tight member 55 is contacted, under pressure, to the lower leeward plate 42. Then, the indoor side air-tight member 56 is contacted, under pressure, to the inner lower rail 31 and the mating portion closing member 41,  
20                   respectively, and the lower air-tight member 54 of the lower sliding member 51 is hence contacted, under pressure, to the mating vertical air-tight member 40 and the outer lower horizontal air-tight member 35.

                  According to the structure mentioned above, a  
25                   space between the mating lower portions of the indoor

side and outdoor side sashes 2 and 3 and the lower frame member 5 can be surely sealed in air-tight manner. Furthermore, when the lower sliding member 51 is moved upward as shown in Fig. 4, the outdoor side air-tight member 54, the lower air-tight member 55 and the indoor side air-tight member 56 are not contacted, under pressure, to the lower frame member 5 and the outdoor side sash 3, respectively, so that any resistance is not caused at a time of opening or closing the indoor side sash 2 and, thus, the respective air-tight members cannot be damaged.

As mentioned above, according to the structures of the upper and lower sliding members 50 and 51, when the indoor side sash 2 is opened or closed, the sliding members 50 and 51 are moved in directions apart from the upper and lower frame members 4 and 5 thereby to reduce the resistance at the time of opening and closing the indoor side sash 2. For example, when a crescent key (sash fastener) 60, which is attached to the mating frame element of the indoor side sash, is locked, the upper and lower sliding members 50 and 51 are moved in directions to contact the upper and lower frame members 4 and 5, respectively, and on the contrary, when the crescent key 60 is unlocked, the upper and lower sliding members 50 and 51 are moved in directions apart from the

upper and lower frame members 4 and 5.

More concretely, with reference to Fig. 3, a pinion 62 is secured to a rotational shaft 61 of the crescent key 60 and a first rack 63 and a second rack 64 are meshed with the pinion 62. As shown in Fig. 8, the first and second racks 63 and 64 are secured to rods 65, which are then fitted, to be vertically slidable, to holes 66 formed to the upper and lower sliding members 50 and 51 so that the upper and lower sliding members 50 and 51 are movable towards the upper and lower frame member sides by means of spring 67.

According to the structure mentioned above, when the crescent key 60 is locked, the first and second racks 63 and 64 are moved through the engagement with the pinion 62 in the directions of arrows, respectively, and the upper sliding member 50 is pressed against the upper frame member 4 and the lower sliding member 51 is pressed against the lower frame member 5 by means of the rods 65 and the spring 67. When the crescent key 60 is unlocked, the first and second racks 63 and 64 are moved in the direction reverse to the arrow and the upper and lower sliding members 50 and 51 are moved in the direction apart from the upper and lower frame members 4 and 5, respectively, by means of flanged portions 65a of the rods 65.

As shown in Figs. 3 and 9, a water drain hole or holes 68 (or drain port) are formed to the horizontal piece 32 of the lower frame member 5 at portions near the vertical frame member 7 (abutting side portion of the outdoor side sash 3) other than the mating side portion thereof. The water drain hole 68 is closed by a drain valve 69 thereby to prevent rain water from blowing into a room side through the hole 68.

Dewed water on the indoor side surface of the outdoor side sash 3 drops down on the horizontal piece 32 of the lower frame member 5, then drops on the outdoor side horizontal plate 28 through the drain hole 68 and, thereafter, discharged externally through the cutout portion formed to the end portion of the outer lower rail 33.

With reference to Fig. 3, a stopper 80 for the indoor side sash 2 is attached to the inner lower rail 31 of the lower frame member 5 at a vertical frame member 7 side portion. The stopper 80 is slidable along the inner lower rail 31, engaging therewith, and the stopper 80 is removed through a cutout portion 31a formed to the inner lower rail 31 by sliding the stopper along the inner lower rail 31.

The indoor side rising plate 30 of the lower frame member 5 is formed with a mount portion 81 to which

the inner lower horizontal air-tight member 34 is mounted, and the mount portion 81 is formed, at a portion near the vertical frame member 7, with a cutout portion 81a. The inner lower horizontal air-tight member 34  
5 extends to the cutout portion 81a. A portion near the longitudinal end portion of the inner lower horizontal air-tight member 34 is covered by the indoor side sash stopper 80.

According to the structure mentioned above,  
10 the inner lower horizontal air-tight member 34 can be removed or mounted by removing the stopper 80 through the cutout portion 31a thereby to easily exchange the inner lower horizontal air-tight member 34.

With further reference to Fig. 3, a stopper 82  
15 for the outdoor side sash 3 is attached to the outer lower rail 33 of the lower frame member 5 at a vertical frame member 6 side portion. The stopper 82 is slidable along the outer lower rail 33, engaging therewith, and the stopper 82 is removed through a cutout portion 33a  
20 formed to the outer lower rail 33 by sliding the stopper along the outer lower rail 33.

The horizontal piece 32 of the lower frame member 5 is formed with a mount portion 83 to which the outer lower horizontal air-tight member 35 is mounted,  
25 and the mount portion 83 is formed, at a portion near the

vertical frame member 6, with a cutout portion 83a. The outer lower horizontal air-tight member 35 extends to the cutout portion 83a. A portion near the longitudinal end portion of the outer lower horizontal air-tight member 35 is covered by the outdoor side sash stopper 82.

According to the structure mentioned above, the outer lower horizontal air-tight member 35 can be mounted or dismounted by removing the stopper 82 through the cutout portion 33a thereby to easily exchange the outer lower horizontal air-tight member 35.

Another example for making air-tight of a space between the upper and lower mating portions and the upper and lower frame members 4 and 5, respectively, will be described below.

The upper and lower sliding members 50 and 51 are fixed to the positions shown in Fig. 4, and as shown in Figs. 10 and 11, the respective air-tight members, which are contracted in a usual state, are expanded by supplying air under pressure, and the inner portions of the expanded air-tight members are communicated with cylinder chambers 71 of cylinder assemblies 70 by means of hoses 72. The cylinder assemblies 70 have piston rods 73 which are operatively connected to the rods 65 mentioned herein before.

When the crescent key 60 is unlocked, the

cylinder assemblies 70 are operated so as to move forward the piston rods 73 to expand the inner volume of the cylinder chambers 71 and the inner air under pressure of the respective air-tight members are sucked into the cylinder chambers 71, thus providing contracted states of the respective air-tight members. According to such operation, the air-tight members are separated from the upper frame member 4, the lower frame member 5 and so on, respectively.

On the other hand, when the crescent key 60 is locked, as shown in Fig. 11, the piston rods 73 of the cylinder assemblies 70 are moved backward (shrunk) to reduce the inner volumes of the cylinder chambers 71 thereby to supply the air under pressure, to the inner portions of the respective air-tight members, and accordingly, the respective air-tight members are contacted, under pressure, to the upper frame member 4, the lower frame member 5 and so on, respectively.

With reference to Fig. 2, supposing that reference letter "a" denotes an overlapped dimension (amount) of the upper frame member 4 and the upper portion of the indoor side sash 2, reference letter "b" denotes a depth of the inward recessed portion 20 of the upper frame member 4 (a depth to the mating pulling member 44 in Fig. 2), reference numeral "c" denotes an

engaging dimension (amount) of the lower frame member 5  
and the lower portion of the indoor side sash 2 and  
reference numeral "d" denotes a dimension (distance)  
between the upper end surface of the inner lower rail 31  
5 to the upper surface of the lower leeward plate 42,  
these dimensions or distances satisfy equations of  $a < b$ ,  
 $c < d$ ,  $d > a$  and  $b > c$ . Further, reference numeral "e" denotes  
a dimension between the inner lower rail 31 and the  
lower frame element 11 of the outdoor side sash 3 is made  
10 larger than a thickness side dimension "f" of the lower  
frame element 11 of the indoor side sash 2.

According to the relationships between the  
respective dimensions or distances mentioned above, when  
the indoor side sash 2 is lifted upward by hands so that  
15 the upper frame element 10 is forcibly fitted to the  
inward recessed portion 20 of the upper frame member 4,  
the lower frame element 11 is above the inner lower rail  
31. In such positional state, the indoor side sash 2 can  
be removed from the window frame structure by holding  
20 both vertical frame elements of the indoor side sash 2  
with hands and swinging upward the lower portion thereof  
towards the indoor (room) side thereby to remove the  
indoor side sash 2 towards the indoor side from the  
window frame structure.

25 On the other hand, in the structure mentioned

above, the indoor side and outdoor side sashes 2 and 3 are slid in a state that the mating frame element 12 of the indoor side sash 2 is positioned near the vertical frame element 7 other than the abutting frame element 13 of the outdoor side sash 3 and the abutting frame element 13 of the indoor side sash 2 is positioned between the mating frame element 12 of the outdoor side sash 3 and the abutting frame element 13 thereof. Under such positional state, the indoor side sash 2 is lifted upward by hands so that the lower frame element 11 thereof is positioned above the inner lower rail 31, and the lower portion of the indoor side sash 2 is moved outdoor side and the lower portion thereof is dropped down on the horizontal piece 32 (i.e. lower leeward plate 42). According to this operation, the upper portion of the upper frame element 10 takes a position lower than that of the upper frame member 4, and under this state, the upper portion of the indoor side sash 2 is tilted towards the indoor side and then removed from the upper frame member 4 to the indoor (room) side.

That is, according to the structure of the double sliding window (particularly, as indoor side removable double sliding window) of the structure of the present invention mentioned above, it can be usable commonly as indoor side drop-down type and indoor side

swing type double sliding windows as mentioned at the introduction of the present disclosure.

More in detail, as shown in Fig. 2, the maximum lifting amount of the indoor side sash 2 is larger than the engaging dimension of the indoor side sash 2 and the lower frame member 5, the drop-down amount of the lower portion of the indoor side sash 2 is larger than the overlapped dimension of the upper portion of the indoor side sash 2 and the upper frame member 4, and the dimension between the inner lower rail 31 and the indoor side lower portion (indoor side surface of the lower frame element 11) of the outdoor side sash 3 is larger than the lower thickness side dimension of the indoor side sash 2.

Furthermore, as shown in Fig. 12, an inner upper rail 4a may be provided for the upper frame member 4 so as to provide an indoor sash guide portion so that the inner lower horizontal air-tight member 34 is mounted to the lower frame element 11 of the indoor side sash 2, and in this structure, the double sliding window of the present invention can be constructed as indoor side drop-down type and indoor side swing type by constructing the respective constituent elements so as to satisfy the dimensional relationships such as  $a < b$ ,  $c < d$ ,  $d > a$ ,  $b < c$  and  $e < f$  as mentioned before with reference to Fig. 2.

The present invention will be further described about the air-tight performance at mutual abutting portions of the abutting frame elements 13 of the two indoor side sashes 2 with reference to another embodiment of the double sliding window structure having two indoor side sashes 2 and two outdoor side sashes 3 which are fitted to the window frame structure 1.

Referring to Fig. 13, two indoor side sashes 2 and two outdoor side sashes 3 are fitted to the window frame structure 1 such that respective abutting frame elements 13 of both the indoor side sashes 2 are abutted to each other and abutting frame elements 13 of both the outdoor side sashes 3 are abutted against one and the other vertical frame elements 6 and 7. In such sliding window including four sashes, less draw-up (pulling) force will be applied to the abutting portion of the abutting frame elements 13 of both the indoor side sashes 2.

With reference to Fig. 14, a draw-up (pulling) piece 90 is attached to the inward recessed portion 20 of the upper frame member 4 at a portion opposing to the abutting frame element 13 of one of the indoor side sashes 2. Furthermore, as shown in Figs. 14 and 15, an upper sliding member 91 is attached, to be vertically movable, to a portion near the upper portion of a hollow

portion 13a of the abutting frame element 13 of one of the indoor side sashes 2 and a lower sliding element 92 is also attached, to be vertically movable, to a portion near the lower portion thereof. A vertically movable  
5 mechanism 93 is mounted to this abutting frame element 13.

The vertically movable mechanism 93 is, as shown in Figs. 16 and 17, with a rectangular housing 94 mounted to the hollow portion 13a of the abutting frame  
10 element 13, upper and lower rods 95 and 96, an operation member 97 and a link 98.

The rectangular housing 94 has a pair of first opposed plates 99 to which an upper slit 100, a lower slit 101 and an intermediate slit 102 are formed,  
15 respectively. The upper and lower slits 100 and 101 have vertically elongated shapes and the intermediate slit 102 has a horizontally elongated shape, in a shown state. The rectangular housing has a pair of opposed plates 103, one of which is formed with an opening 110 at a vertically  
20 intermediate portion thereof.

The upper rod 95 has an upper end portion to which the upper sliding member 91 is connected and a lower end portion to which a first link 105 is connected by means of a first pin 106, which is fitted to the  
25 upper slit 100 of the housing 94. On the other hand, the

lower rod 96 has a lower end portion to which the lower sliding member 92 is connected and an upper end portion to which a second link 107 is connected by means of a second pin 108, which is fitted to the lower slit 101 of the housing 94.

The first and second links 105 and 107 are connected to each other by means of a third pin 109 thereby to constitute the link 98. The third pin 109 is attached to the operation member 97 and fitted to the intermediate slit 102 of the housing 94. The operation member 97 is fitted to the opening 104 formed to the housing 94 and the opening 110 formed to the opposing surface 13b, i.e. outside surface of the abutting frame element 13 in the inplane direction of the window.

The upper rod 95 and the lower rod 96 are operatively (movably) connected by means of spring 111 so that the upper rod 95 is pulled to be movable downward and the lower rod 96 is pulled to be movable upward thereby to provide the first and second links 105 and 106 in substantially elbowed-shape as shown in Fig. 16 in which the operation member 97 projects over the opposing surface 13b of the abutting frame element 13.

As shown in Fig. 15, a pair of air-tight projection pieces 112 are formed integrally with the opposing surface 13b of one of the abutting frame

elements 13 to be continuous in the longitudinal direction thereof. Further, a pair of projection pieces 113 for moving the operation member 97 are formed integrally with the opposing surface 13b of the other one  
5 of the abutting frame elements 13 to be continuous in the longitudinal direction thereof, and a pair of abutting vertical air-tight members 114 are mounted to the projection pieces 113, respectively.

According to the structure mentioned above,  
10 when the indoor side sash 2 is opened or closed, the operation member 97 is separated from the projection pieces 113, the upper and lower rods 95 and 96 are moved upward and downward, respectively, by means of the spring 111. Therefore, the upper sliding member 91 is separated  
15 from the draw-up piece 90 and the lower sliding member 92 is separated from the inner lower rail 31, so that any large force is not required to open or close the indoor side sash 2.

When the two indoor side sashes 2 are closed,  
20 the projection pieces 113 for movement abut against the operation member 97, which is then moved in the push-in direction in the state shown in Fig. 18, and the first and second links 105 and 106 are moved to positions providing substantially a straight line as shown in Fig.  
25 19, whereby the upper rod 95 is moved upward and the

lower rod 96 is moved downward.

According to the motions mentioned above, as shown in Fig. 20, the upper sliding member 91 abuts against the draw-up piece 90 thereby to pull the upper portion of the abutting frame element 13 towards the indoor (room) side. On the other hand, the lower sliding member 92 abuts against the inner lower rail 31 thereby to pull the lower portion of the abutting frame element 13 towards the indoor side. At the same time, a pair of air-tight projection pieces 112 are contacted under pressure to a pair of abutting vertical air-tight members 114 thereby to create the air-tight condition to the abutting portion.

According to the motions and operations mentioned above, abutting portions of the abutting frame elements 13 of the two indoor side sashes 2 can be surely made air-tight.

Further, with reference to Fig. 13, the air-tight structure of the abutting frame elements 13 of the two indoor side sashes 2 may be applied to an indoor side sash slidable window in which two outdoor side sashes 3 are fixed.

Further, it is self-evident to a person skilled in the art that although the present invention is described hereinbefore with reference to the exemplary

embodiments, it is possible to make various changes, deletions and additions to the disclosed embodiment without departing from the subject and scope of the present invention. Accordingly, it is to be understood  
5 that the present invention is not limited to the described embodiments and includes scopes or its equivalent scope defined by the elements recited in the appended claims.



WHAT IS CLAIMED IS

1. A double sliding window having an indoor side sash removable structure, in which indoor and outdoor side sashes are fitted to be slidable to a window frame structure composed of an upper frame member, a lower frame member and two vertical frame members so as to provide a rectangular shape in an assembled state, characterized in that when the indoor side sash is lifted upward by a maximum amount, a lower end portion of the indoor side sash is raised upward above the lower frame member and when the indoor side sash is dropped downward, an upper end portion of the indoor side sash is positioned below a lower end portion of the upper frame member, and a dimension of a space between an inner lower rail formed to the lower frame member and an indoor side surface of a lower portion of the outdoor side sash is larger than a thickness side dimension of a lower portion of the indoor side sash.

20

2. A double sliding window according to claim 1, wherein each of said indoor side and outdoor side sash is composed of an upper frame element, a lower frame element, vertical mating frame element and a vertical abutting frame element so as to provide a rectangular

25



shape in an assembled state;

an inner upper horizontal air-tight member, an inner lower horizontal air-tight member and an inner vertical air-tight member are mounted to the upper frame member, the lower frame member and one of the vertical frame members, respectively, to be continuous so as to be pressed against an indoor side surface of the indoor side sash;

an outer upper horizontal air-tight member, an outer lower horizontal air-tight member and an outer vertical air-tight member are mounted to the upper frame member, the lower frame member and another one of the vertical frame members, respectively, to be continuous so as to be pressed against an indoor side surface of the outdoor side sash;

a mating vertical air-tight member is mounted to the mating frame element of the indoor side sash so as to be pressed against an indoor side surface of the mating frame element of the outdoor side sash; and

an upper air-tight member is mounted to an upper portion of the mating frame element of the indoor side sash so as to be pressed against the upper frame member, the indoor side surface of the mating frame element of the outdoor side sash, the inner upper horizontal air-tight member and the outer upper



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horizontal air-tight member; and

a lower air-tight member is mounted to a lower portion of the mating frame element of the indoor side sash so as to be pressed against the lower frame member, the indoor side surface of the mating frame element of the outdoor side sash, the inner lower horizontal air-tight member and the outer lower horizontal air-tight member.

3. A double sliding window according to claim 2, a crescent key is attached to the mating frame element of the indoor side sash, upper and lower sliding members are mounted to the mating frame element of the indoor side sash to be operative in association with an operation of the crescent key, and said upper air-tight member is mounted to the upper sliding member and said lower air-tight member is mounted to the lower sliding member in a manner that when the crescent key is locked, the upper sliding member is moved upward and the lower sliding member is moved downward so as to create a pressed condition of the upper and lower air-tight members and when the crescent key is unlocked, the upper sliding member is moved downward and the lower sliding member is moved upward so as to create a separated condition of the upper and lower sliding members.



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4. A double sliding window according to claim 2,  
wherein said upper and lower air-tight members have  
expandable and contractive structure, usually in a  
contracted state, and an air-pressure supply means is  
5 provided in association with the operation of the  
crescent key in a manner that when the crescent key is  
operated to be locked, said air-pressure supply means  
operates to supply the air pressure to the upper and  
lower air-tight members so as to be expanded and when the  
10 crescent key is operated to be unlocked, said air-supply  
means operates to suck the air pressure from the upper  
and lower air-tight members so as to be contracted.