The invention will be better understood from the following more detailed specification, when considered in conjunction with the accompanying drawings in which:

FIG. 1 is an elevational isometric view, partly fragmentary, of horizontal sliding window structure in accordance with a preferred embodiment of the invention, viewed from the exterior, or "street" side; FIG. 2 is a fragmentary sectional view of the window of FIG. 1, with the section plane horizontal and taken along line 2—2 of FIG. 1. FIG. 2 illustrates the sliding window of FIG. 1 latched in closed position and also illustrates interlock of the sashes; FIG. 3 is a fragmentary sectional view, with the section plane vertical and taken along line 3—3 of FIG. 2, and illustrating the sliding sash in closed position; FIG. 4 is a view similar to that of FIG. 3, but illustrating the sliding sash in an open position; FIG. 5 is a partly sectional isometric view, with the section taken along line 5—5 of FIG. 2, and illustrating the sliding sash in closed position; FIG. 6 is a view similar to that of FIG. 5, but illustrating the sliding sash in an open position; FIG. 7, illustrating the sliding sash in closed position, and FIG. 8, in open position, are enlarged and fragmentary versions of FIGS. 3 and 4 respectively, and illustrate the lower left corner of the sliding sash in greater detail; FIGS. 7A and 8A are sectional views, with the section vertical and taken along lines 7A—7A of FIG. 7 and 8A—8A of FIG. 8 respectively; FIG. 9 is a fragmentary isometric elevational view, partly in section, of a vertical sliding window in accordance with a preferred embodiment of the invention viewed from the "room" side; FIG. 10 is a fragmentary sectional view with the section plane vertical and taken along lines 10—10 of FIG. 9; FIG. 11 is a fragmentary sectional view with the section plane vertical and taken along line 11—11 of FIG. 9 or FIG. 12, and FIG. 12 is a fragmentary sectional view, with the section plane horizontal and taken along line 12—12 of FIG. 11.

In the following description, reference numerals on occasion are suffixed with letters to indicate relative location of a particular part, and also to indicate that there exists a symmetrical part. The suffix letters used herein, and the locations identified by them, are as follows: L, left; R, right; U, upper; D, lower; F, front; B, back (rear). The description on occasion is presented explicitly for a "left" member, and is to be construed as equally applicable to the right member by substituting "R" for "L." Specific differences will be pointed out explicitly. In this manner needless repetition of identical verbiage is avoided.

Referring to FIGS. 1—5, and more specifically to FIGS. 1 and 2, the illustrated horizontal sliding window structure comprises frame structure which is generally rectangular in overall outline and includes lower or sill frame structure 20D, upper frame or header structure 20U, left and right structure 22L and 22R. These parts are intended to be anchored or embedded in building structure, and are so shown in FIG. 2. These frame members, as well as those of the sash members described hereinafter, are made preferably of thin-walled aluminum because of its light weight. This is in furtherance of the objective of ease of sliding. If desired, other suitable conventional window frame material may be employed. The four frame structures may be formed by extrusion separately and joined together by suitable means such as screws upon installation. The assembly practice is conventional. For this reason the illustration of FIG. 1 is simplified to present these parts as integral.

Proceeding from front to rear in FIG. 1, and referring
also to FIGS. 5 and 6, the sill frame structure 20D comprises vertical lip-like member 24 to whose upper end is joined sill member 25 which is generally horizontally disposed but preferably inclined, rising from front to rear so as to permit water drainage. Joined to the sill member 25 towards its rear is a vertically dependent panel 26, which is longer than lip 24. The members 24, 25, and 26 thus form, in cross section, an inverted L, this shape, as well as well as the cross section of the remainder of structure 20D is especially suitable for permanent embedding or anchoring to building structure, by cementing for example. The same consideration applies to the peripheral parts of the remaining frame structures 20U, 22L, and 22R.

Joined to the rear end of sill member 25 is a step which includes vertical strip-like member 27, followed by horizontal panel 28. In the illustration of FIG. 1, the strip 27 is set back with respect to member 26; in the illustration of FIGS. 5 and 6 by way of alternative, elements 26 and 27 are continuous. As may best be shown in FIGS. 5 and 6, the horizontal panel member 23 is in itself stepped, having a thicker front portion 29, and a somewhat thinner rear portion 30, the latter being joined at its rear extremity with a vertical member 31. The members 30 and 31 thus appear in cross section generally as a T, and the members 27, 28, and 31 as an inverted U.

Upward of the member 30, the member 31 forms a bulge 32 inwardly. The bulge engages, in the closed position (FIG. 5), a wool pile weather strip 33 which is inserted in a channel-like recess of the confronting side of the lower rail 34 of the sliding sash 35 to provide a wind seal. In the open position (FIG. 6) the wool pile strip 33 rises to above the bulge 32.

A resilient type weather strip, made preferably of vinyl or like, is inserted in a conforming recess in the horizontal panel member 28 (FIG. 6). As illustrated, this weather strip is made of a horizontal portion 36, which is firmly seated within its recess and a wedge-like part 37 which rises upwardly and outwardly. In the closed position (FIG. 5), the weather strip 37 engages the underside of the lower rail 34 of the sliding sash 35 to provide a weather tight seal. In the open position (FIG. 6) the weather strip 37 is disengaged.

As may best be seen in FIG. 8A, upstanding from the panels 28, 36 is a track 38 on which a notched nylon block 39L rides. As will be described more fully hereinafter the block 39L and a symmetrical block 39R are disposed in a channel of the lower sash rail and ride on track 38. In FIG. 7A, the sliding sash has dropped into closed position, the track 38 is partially traversed. At the same time, the weather strips 33 and 37 have been brought into engagement as previously described.

Referring to FIGS. 1 and 4, the rail 36 is shown to be notched downwardly at its right extremity at 40R. As may best be shown in FIGS. 3 and 7, a similar notch 40L is provided in the rail 28, spaced from the notch 40R by the width of the sliding sash 35. As may best be seen in FIGS. 3, 7, and 7A the nylon block 39L has dropped into its notch 40L, and the same is true of the corresponding members 39R and 40R. As a result, the sliding sash is in closed position shown in FIG. 3. In FIGS. 4, 8, and 8A the blocks 39 ride atop rap 36 at normal height. Thus, any random position for the sliding sash, in which the blocks 39 have not dropped into notches 40, is an open position. If desired, further pairs of notches, similarly spaced, may be provided on rail 28 to afford selectable open positions of known location, rather than random open positions. It should be noted that the notch 40R is not necessarily a "half-notch" in capitalization of the word "notch." This is to afford play in both the left and right direction at notch 40L, in closing and opening the sliding sash 35.

The header structure 20U is generally similar to but simpler than the sill structure 20D. As may best be seen in FIGS. 5 and 6, the configuration of the structure 20U is symmetrical with respect to the plane of the window pane, and is composed of vertical panel members 42B and 42F which are joined towards their upper ends by a horizontal panel member 43 to form an inverted U. The panels 42B and 42F extend upwardly beyond the member 43 so as to form with the latter a channel. The panels 42B and 42F are provided with inward bulges 44F and 44B respectively which, in the closed position, engage wool pile weather strips 45F and 45B of the upper rail of the sliding sash, in a manner similar to engagement of bulge 32 and weather strip 33. In the open position (FIG. 6), the latter weather strips are seen to have risen above the bulges 44F and 44B. As may best be seen in FIG. 1, the vertical panel 42F is joined at its upper end by a horizontal panel 46, which extends frontwardly of member 42F. Joined to the panel 46 is dependent frame structure member 47. In the illustrated embodiment, the members 42F, 46, and 47 constitute frame structure for the fixed "light" 48, which frame structure will be discussed in greater detail subsequently.

Considering the structure of the sliding window, as may best be shown in FIGS. 5 and 6, the pane 35 at its top and bottom is received within generally U-shaped recesses formed in the upper and lower frame members 50U and 50D respectively, which are illustrated as being vertically serrated, also known as a vinyl glazing channel. Taking the upper frame member 50U as exemplary also for the lower frame 50D, the frame structure is bifurcated above the vinyl glazing channel 56 so as to form interior channel 58 which has a cross-section approximately that of a major arc of a circle. Channels such as 58 wherever shown are utilized to receive machine screws for fastening purposes, such as screw 59 (FIG. 8), which is used to secure the left frame member 55L to the lower frame member 55D.

Still considering the upper frame structure 55U (FIG. 5) above the gasket 56, exteriorly it is of semi-circular shape, and finally terminates in spaced rail members 60F and 60B, which are of C-shape in cross-section and receive the respective wool pile weather strips 45F and 45B. In regard to the corresponding rail member 61F of the lower frame 55D, it is similarly C-shaped. It does not receive any wool pile weather strip; this is unnecessary in view of the fact that the rail 61F engages the vinyl weather strip 37 for sealing purposes. The channel 61F is nevertheless formed as shown to render the upper and lower frame members uniform and interchangeable for simplified extrusion.

As may be seen from FIG. 2, the left and right frame members 55L and 55R are similar to the upper frame member 55U just described, except in the following respects. Typically also for the right member 55R the rail members 64F and 64R are joined at their ends by a closing member 65L for neatness in appearance. Wool pile weather strips are provided on both sides of the right member 65R but only on the left side of the left member 65L as are necessary for wind seal.

The joining member 65L is formed to a hook or latch at its front end so as to engage a mating, wedge-like projection of the middle jamb 68 of the fixed "light" 48 described herein in greater detail subsequently. The arrangement is such that the meeting rail 65L engages the middle jamb 68 in the closed position of window 25. At the same time a latch 70, which is affixed to the right frame member 65R, is in position to be latched to a flange light extension 72R of the right frame or jamb structure 22R. This extension 72R is specially shaped so as to engage the conforming right end part of the latch 70 to permit locking of the fixed light.

The left frame or jamb structure 22L is symmetrical to the right jamb 22R, and the remainder of the description of the jambis will be given with reference to the left jamb. The left jamb is seen to be provided with a longi-
tudinal extending flange part 76L, which bears against the building structure 77L, to the front of the latter and projects laterally to both sides of the structure 77L. The rear flange member 72L extends from the interior side of the building structure 77L laterally inwardly. The building structure 77L is wider to the rear of the flange 72L, so that the resulting shoulder permits seating of the jamb 22L. The flange members 72L and 76L are joined, short of their right ends, by a bridging member 80L, which provides rigidity to the unitary assembly. The flanges 72L and 76L are approximately co-extensive at their right ends. The former terminates in latch-receiving lip 81L, although in the illustration of FIG. 2 it is not intended to receive a latch. In the position of lip 81L is in the interest of manufacturing economy, and also in the interest of symmetrical appearance of the channel structure when viewed from the room side.

The member 76L is joined at its right end to a member 82L, which extends frontally of member 76L and is in turn joined at its front end by a laterally outwardly extending member 83L which is approximately co-extensive with flange member 72L. The member 82L, which serves to secure the fixed "light" 48 is provided at about its middle point and on its exterior side with a screw receiving channel 85L, which is utilized to join the jamb 22L to the upper and lower frame members 20U and 20D by means of screws (not shown).

The member 82L is provided to its right with additional structure to support the fixed "light" 48, and this structure is symmetrical with respect to the structure provided for a corresponding member 82M of the middle jamb structure 68. The parts of the latter are identified by the same reference numerals as those of member 82L except for substitution of the suffix M for L. The member 82L is provided towards its rear with a rib-like projection 86L, which serves together with member 82L proper to receive a wedge-like structure 87L, which in outline is an isosceles right triangle with legs running in front-rear and left-right directions. The pane 48 is seated between the latter leg and a co-extensive flange light member 88L, which fills the residual gap between the members 87L. The pane 48 is actually seated within gasket material 89L, which fills the residual gap between the members 87L and 88L.

The middle jamb structure 68 is formed to a shape of two similar rectangles, one offset to the right and to the rear of the other with overlapping parts omitted. The member 82M constitutes one of the longer sides of the front rectangle.

To resume the description of the sliding sash, referring first to FIGS. 1, 3, 4, 7, and 8, it is seen that the four frame members are mitered. In assembling the sliding sash in manufacture, the upper and lower frame members 55U and 55D are fastened to the side members 65R and 65L by means of fastening screw pairs 59R and 59L, as shown in FIG. 1 extend from the side frame member 65R into the screw receiving channels 59 (FIG. 5).

It will be recalled that the upper and lower frame members 55U and 55D are channeled. As may best be seen in FIGS. 1, 3, 4, 7, 7A, 8, and 8A, the notched nylon blocks 39R and 39L are situated within the channel of the lower rail 55U, substantially wholly in it, and their exterior sides are substantially flush with the frame sides 65R and 65L. This configuration is particularly advantageous for the following reasons. It permits fastening of the blocks in a simple operation that is simultaneously with the fastening of the side frames 65R and 65L by means of the fastening screw pairs 59R and 59L previously mentioned. The screws are of the self-threading type so that prethreading of the receiving channels is unnecessary. Also, the location of the blocks wholly within the receiving channel and flush with the frame sides contributes to attractive appearance. It should be recognized that the just described location of the blocks 40 is preferred, but is not absolutely necessary for purposes of the invention. In particular, the blocks could be disposed farther inwardly, that is closer together and spaced apart from the respective frame sides. This would entail spacing the notches 49 in the track 38 at a like distance. The blocks are made preferably of nylon, as this is resistant to wear, but similar suitable materials may be substituted. If desired, a single block may be used, located on the vertical center lines of the sliding sash and of sufficient width to afford stability, particularly in the open position. The cooperating track would be located appropriately for engagement with the single block in the closed position of the sliding window. The riders 39L and 39R are illustrated literally in block shape, it should be understood that this configuration is not absolutely necessary for purposes of the invention, and this fact should be borne in mind in construing the claims.

The horizontal sliding window has been described with one sliding sash and one fixed sash. The window could obviously be constructed "double-hung" simply by making a fixed light 48 a substantial duplicate of the sliding sash 35, coupled with a duplication of the track 38 with its notches 49, and of the vinyl strip 37. In regard to the latter, vinyl is the preferred material, but it will be appreciated that other suitable resilient weather stripping material may be substituted. The weather strip material for elements 33 and 45 has been designated as wool pile; if desired, they may be made of other weather strip material, for example a resilient material such as is used for the weather strip 37. Here too, the equivalence should be borne in mind in the construction of the claims.

The vertical sliding window illustrated in FIGS. 9-12 is basically alike to the horizontal sliding window but rotated by 90°. Note that the vertical sliding window is illustrated as viewed from the room side. It is therefore unnecessary to refer to each and every element of the vertical sliding window in detail; these may be recognized by reference numerals previously used for conjunction with the sliding window. The track 38 is shown on the right side of FIGS. 9 and 10, and includes notches here designated as 40U and 40D. The nylon blocks 39 are obscured from view by the right jamb member 22R.

The remainder of the sill structure (FIG. 9) has not been rotated, but is retained as the lower part 20D, and as such includes the ledge member 25 and saddle member 28 which has embedded therein the resilient weather strip 37 for the purposes previously mentioned for the horizontal sliding window.

In the case of the horizontal sliding window the sash was maintained in open or closed position by gravity action. Since such action is not available for the vertical sliding window, there are provided at the left corners of the vertical sliding sash a pair of resilient members 96U and 96D, which are fastened to the outsides of respective upper and lower frame members 65U and 65D. The resilient or spring leaf material 96 are symmetrical, and the description of the upper member 96U is sufficient for both. Referring also to FIGS. 11 and 12 the member 96U is made of a relatively thin strip of resilient material, and has an initial planar configuration as in flush with the upper frame member 65U. It is fastened to the latter by means of the fastening screw 59U which serves also to fasten together the frame member 65U to the left frame member 65L.

The spring member 96U extends laterally of the frame member 65L and then is formed to the shape of an S so as to engage the frame member 65L and also the left jamb member 43L.

The leaf springs 96U and 96D are formed with sufficient stiffness so as to maintain the sliding sash 35 in position for either the closed position, or any of the random open positions. As in the case of the horizontal sliding window, further notched pairs, similar to and spaced the same as the notched members 40U and 40D
may be provided to afford selectable open positions. In regard to the requirement of pairs of notches 40 in track 38, it should be borne in mind that an intermediate notch, such as the illustrated notch 49U is already paired with the notch 48D but could be paired with an additional notch, spaced the height of the sliding sash upward from the notch 49U. Thus these notches could constitute two pairs—the same applies to the horizontal sliding window—and this should be borne in mind in construing the claims.

For purposes of latching the vertical sliding sash (FIG. 9) a member 98 of arcuate cross-section is formed integrally on the lower frame member 40D, i.e. substantially co-extensive with it longitudinally, and extends frontwardly from it. The cooperating latch 99 is mounted on the lower frame structure 65D of the sliding sash.

The modifications recited for the horizontal sliding window are similarly applicable to the vertical sliding window. The provision of plural pairs of notches in the track 38 has already been mentioned; further, the construction of a double-hung window is accomplished by a similar duplication of the sliding sash 35 for the fixed light 48, together with provision of the associated track 38, notches 40, and blocks 39.

The described window structure meets fully the objectives of the invention stated in the introductory part of the specification. A working embodiment, conforming to the disclosure, was subjected to tests of required pull force to operate the sash and for air infiltration. United States Federal Housing Authority standards are 10 pounds of pull force, maximum, and 0.75 cubic feet per minute per foot of perimeter air infiltration, maximum. A sash in accordance with this disclosure required only 4 pounds of pull force and experienced 0.41 cubic feet per minute per foot of perimeter air infiltration.

The invention has been described by reference to two presently preferred embodiments thereof, and modifications of the basic embodiments have been indicated. Further modifications may occur to those skilled in the art, and it is intended that such modifications as fall within the true spirit and scope of the invention and following claims be embraced within the invention.

What is claimed is:

1. A sliding sash having horizontal and vertical frame members arranged in the shape of a rectangle, for mounting in a receiving structure which is a sill member, an upper horizontal header member, and two vertical jamb members, also arranged in the shape of a rectangle, at least two of the three last-mentioned members being channeled, each channel being formed of a front surface, a rear surface parallel to the front surface, and an end surface joining the parallel surfaces, each parallel surface for sealing engagement of a corresponding oriented surface of the sash frame member when said sash is mounted in said receiving structure and is in closed position, said correspondingly oriented surfaces carrying weather strip means and said parallel surfaces having bulges adapted to engage in said closed position, their respective weather strip means to provide the sealing engagement, the sash member being stepped so as to form a vertical surface having a forward bulge, the rear side of the lower horizontal sash frame member carrying weather strip means adapted to engage in said closed position, at least one of those sash frame members which in said closed position is to engage a cooperating receiv-
spective weather strip means to provide the sealing engagement, the sill member having attached to its horizontally extending resilient weather strip means that is depressible by the underside of the lower horizontal sash frame member in said closed position for weather sealing, said sill member being stepped so as to form towards its rear a vertical surface having a forward bulge, the rear side of the lower horizontal sash frame member carrying weather strip means adapted to engage sealingly said forward bulge in said closed position, at least the first of the vertical sash frame members being channeled and its cooperating vertical jamb member having a track that is disposed for projecting into the last-adverted-to channel, a pair of blocks secured to, and disposed substantially wholly within, and respectively substantially at the ends of the latter channel, said blocks being notched for reception within the notches of said track to afford sliding movement on said track for said sash, said track having at least two tooth-gap-like notches that are spaced apart from one another substantially the same distance as said blocks, and are located such that when said blocks drop into them, said sash is in said closed position, and resilient means attached to the second of the vertical sash frame members and arranged for compressive engagement of the channel of its cooperating jamb member, for urging said blocks against said track to maintain said sash in open and closed positions.

4. A sash according to claim 1, wherein the jamb structure is arranged to support a second sash having a frame member meeting with the otherwise free frame member of the sliding sash, provided with mutually interlocking weather seal means on the two meeting frame members.

5. A sash according to claim 2, wherein the jamb structure is arranged to support a second sash having a frame member meeting with the otherwise free frame member of the sliding sash, provided with mutually interlocking weather seal means on the two meeting frame members.

6. A sash according to claim 3, wherein the jamb structure is arranged to support a second sash having a frame member meeting with the otherwise free frame member of the sliding sash, provided with mutually interlocking weather seal means on the two meeting frame members.

7. A sash according to claim 1 wherein the jamb structure and track is made of aluminum.

8. A sash according to claim 1 wherein the blocks are made of nylon.

9. A sash according to claim 1 wherein the resilient weather strip means is made of vinyl.

10. A sash according to claim 1 wherein the bulge-engaging weather strip means is made of wool pile.

11. A sash according to claim 1 wherein the track is provided with at least one further pair of tooth-gap-like notches that are spaced from one another substantially the same distance as the aforesaid track notches, each further notch pair when receiving the blocks affording a selectable open sash position.

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