April 15, 1958 E. L. ANDERSON 2,830,333

WOOD CASEMENT WINDOWS

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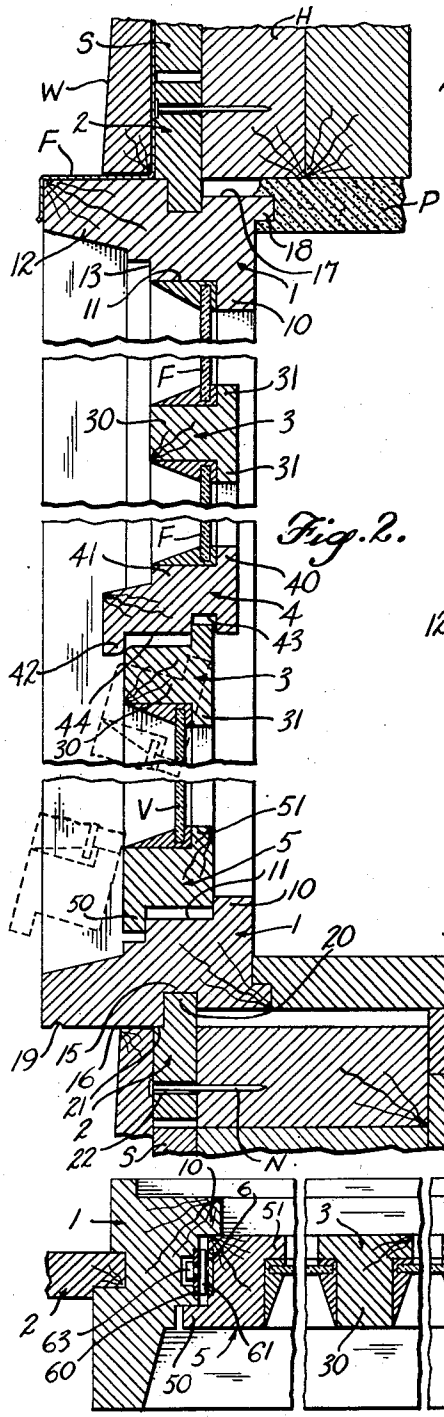


Fig. 2.

Fig. 3.

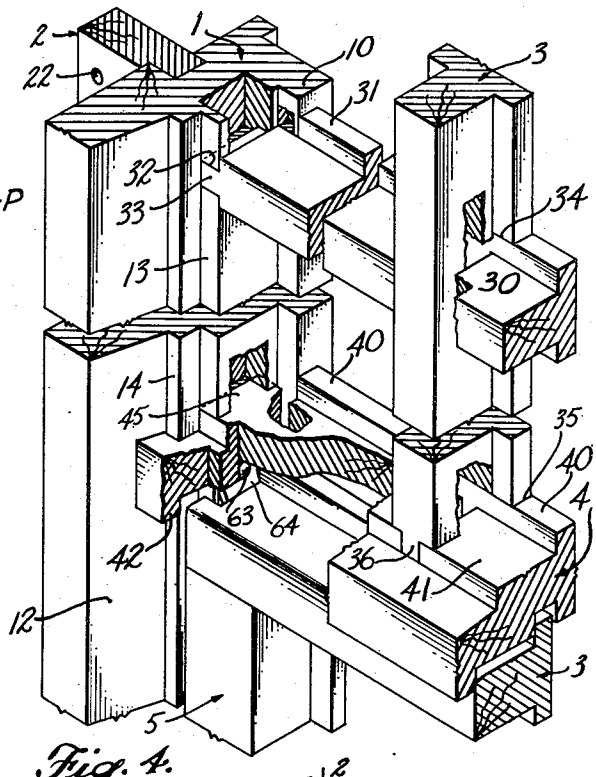


Fig. 4.

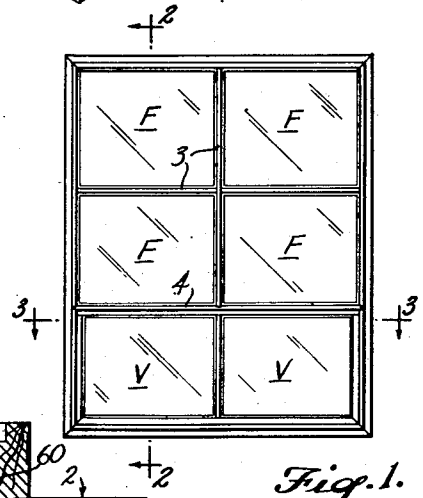


Fig. 1.

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WOOD CASEMENT WINDOWS

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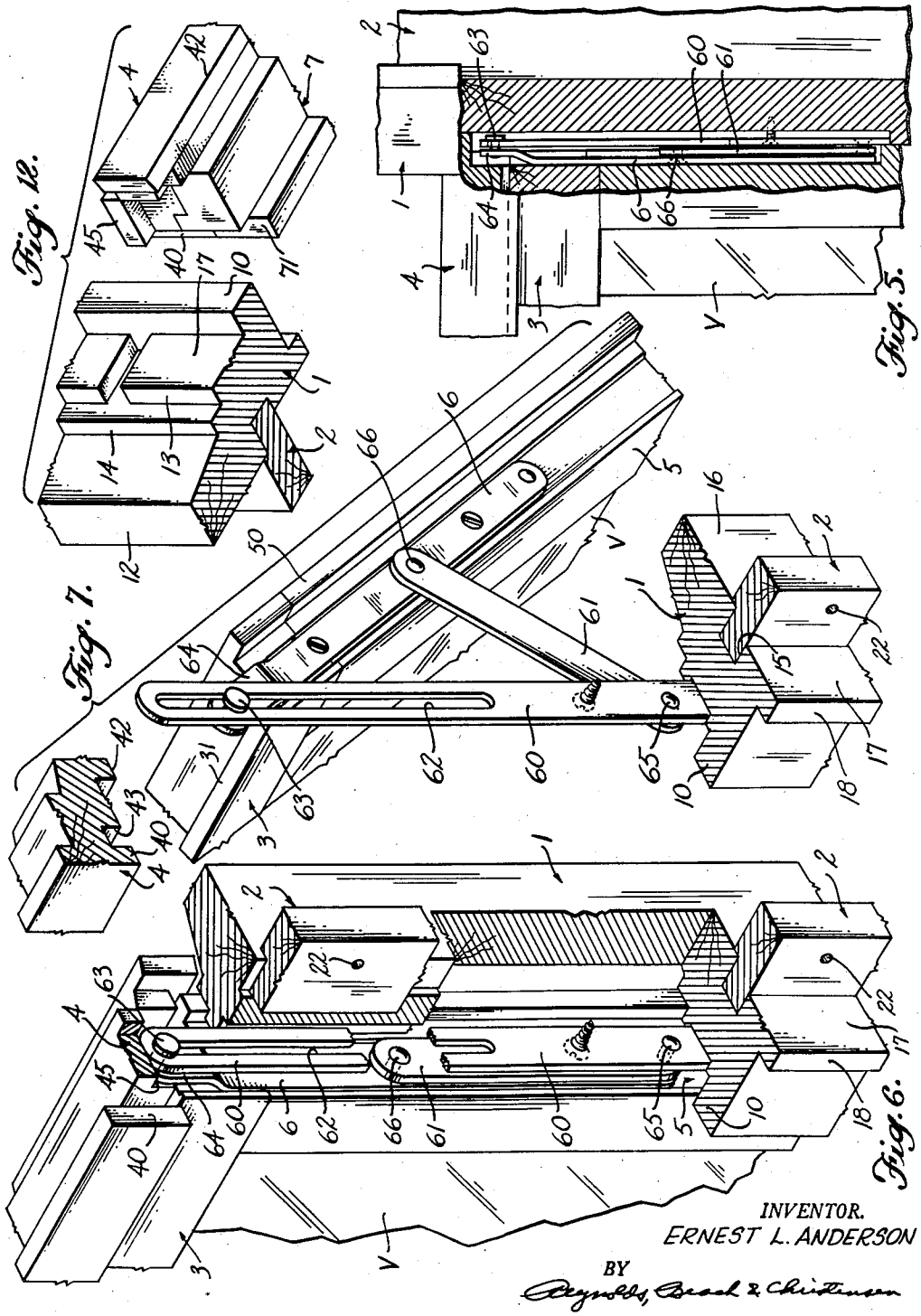


Fig. 12.

Fig. 5.

Fig. 7.

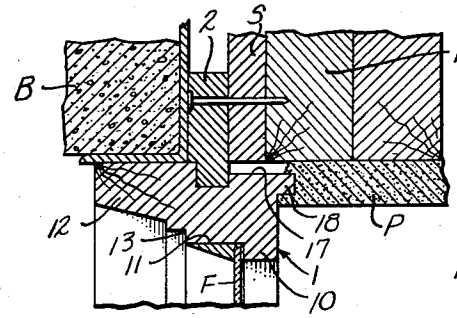
Fig. 6.

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WOOD CASEMENT WINDOWS

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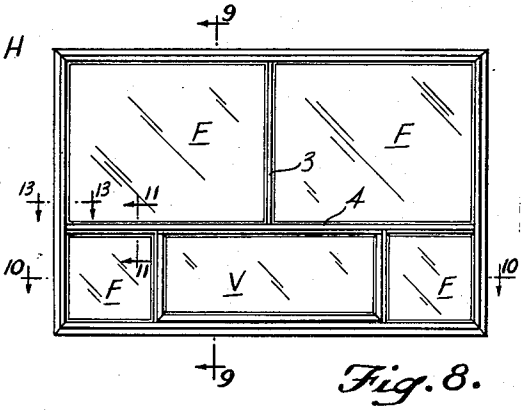


Fig. 8.

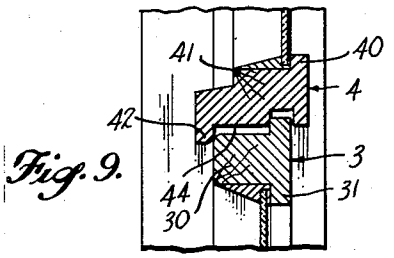
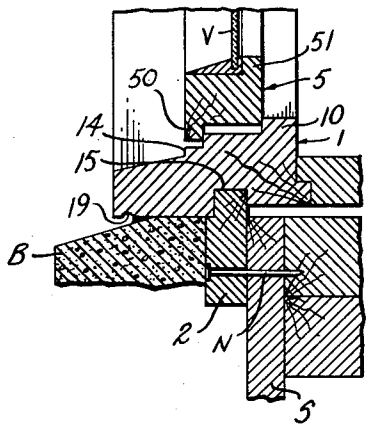


Fig. 9.



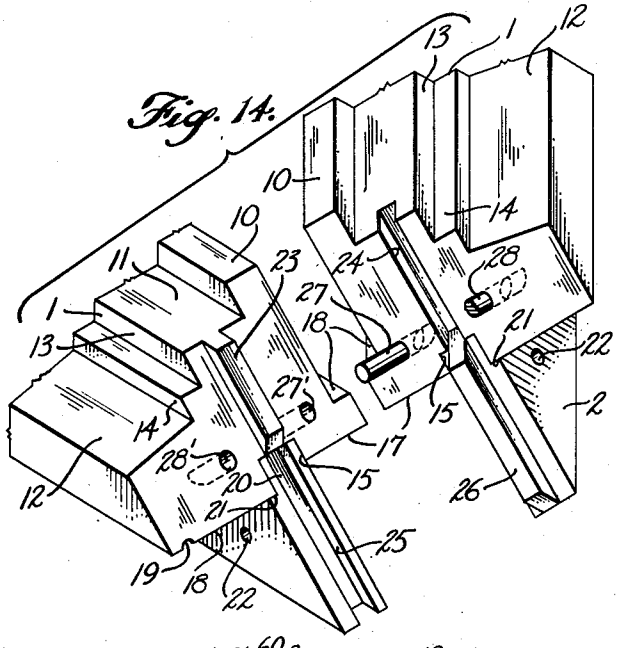
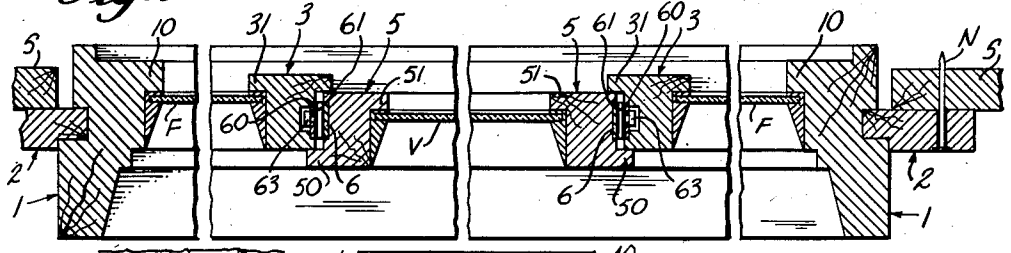


Fig. 14.

Fig. 10.



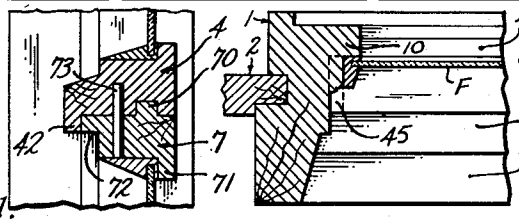


Fig. 13.

Fig. 11.

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WOOD CASEMENT WINDOWS

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Fig. 19.

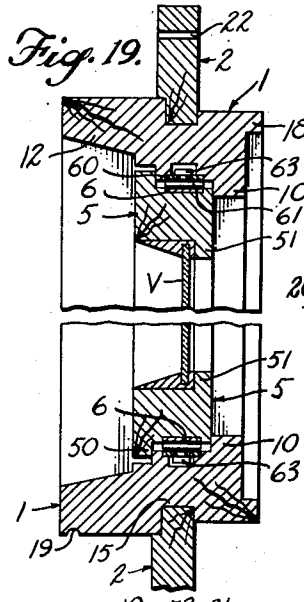


Fig. 18.

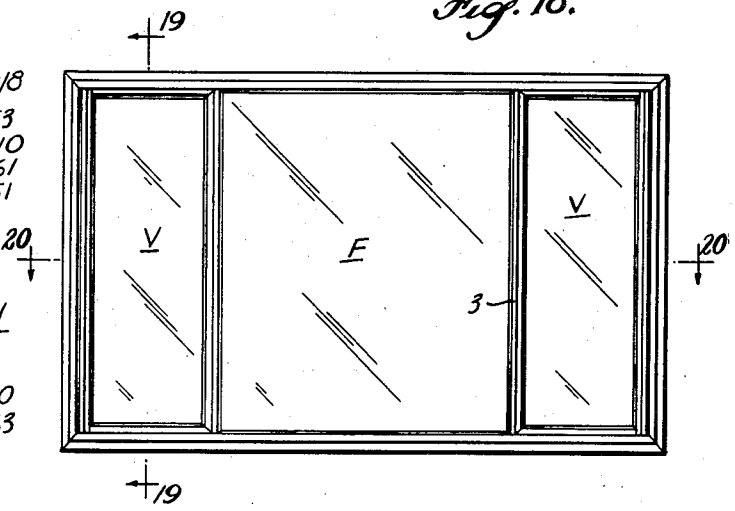
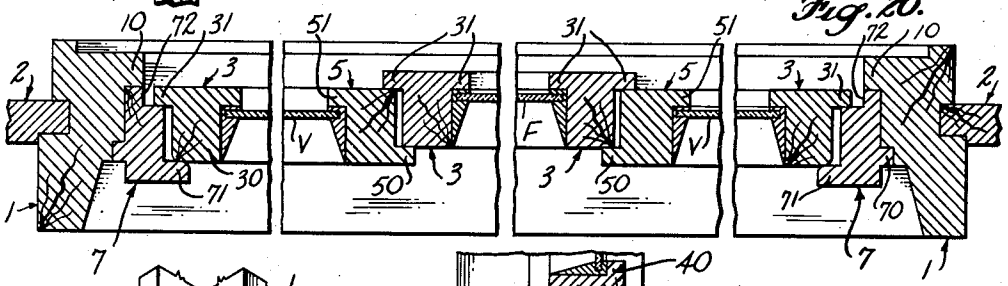


Fig. 20.



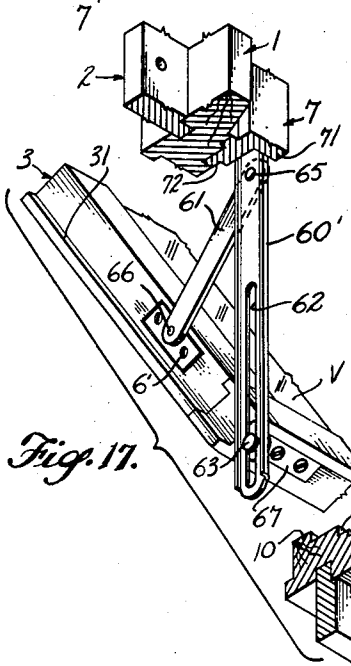


Fig. 17.

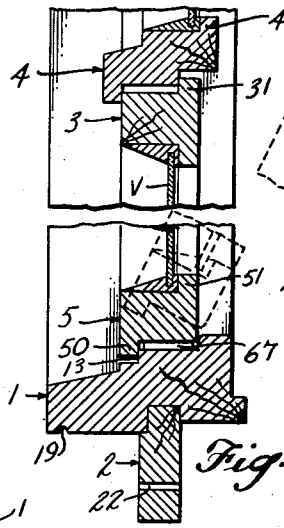


Fig. 15.

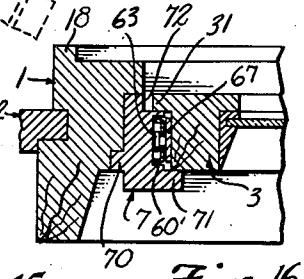


Fig. 16.

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WOOD CASEMENT WINDOWS

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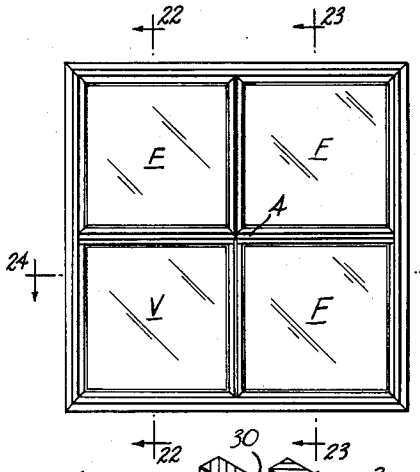


Fig. 21.

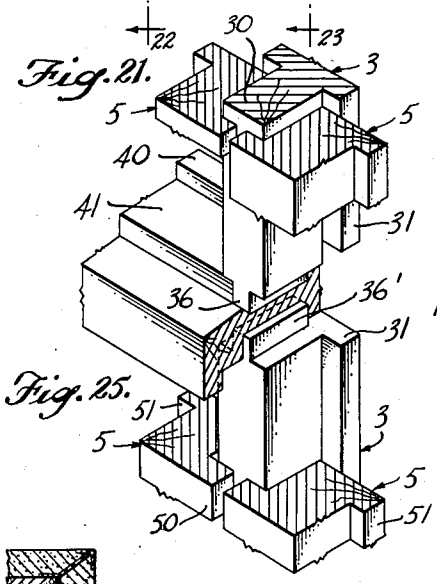


Fig. 25.

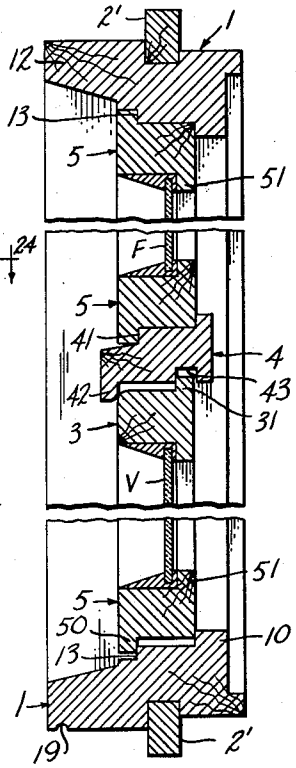


Fig. 22.

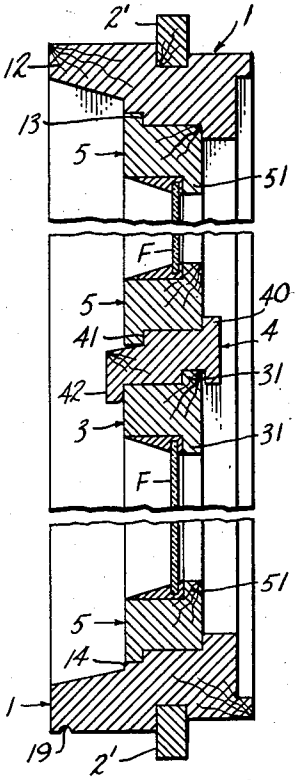


Fig. 23.

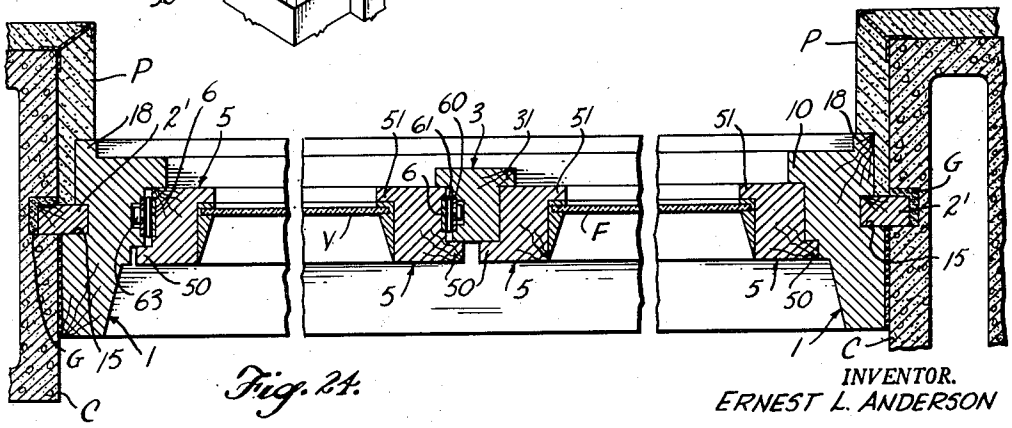


Fig. 24.

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United States Patent Office 2,830,333 Patented Apr. 15, 1958

2,830,333

WOOD CASEMENT WINDOWS

Ernest L. Anderson, Seattle, Wash.

Application December 11, 1951, Serial No. 261,032

2 Claims. (Cl. 20—53)

This invention relates to a construction for wood venting windows, and more particularly to such a window construction which is economical to produce in quantity and to install.

It has been proposed heretofore to prefabricate a wood window sash and frame as an assembled unit with such hardware attached as may be required for movable portions of the window, commonly termed "vents" but more accurately ventilating sashes, so that this window unit would simply be set in place and secured about its edges in an opening formed in a building structure. Various difficulties have been experienced in the manufacture of such window units, however, one resulting from the large number of different molding shapes required in the fabrication of the window.

Another diffiiculty in the design and construction of ventilating sashes for such a window unit has been that of obtaining a proper seal around the edges of such a sash to prevent seepage of air and entrance of water about its edges under all conditions of temperature and humidity, which would tend to cause the wooden parts of the window to shrink or swell. An object of the present invention is to provide a construction which will eliminate this difficulty.

Another advantage of the window structure is that precision formation of the opening in a building structure is not required for the window unit to be fitted properly into the opening, but on the contrary if the window opening is formed in accordance with the nominal dimensions of a window unit ordered within a reasonable over or under tolerance, the window unit will fit sufficiently well to make an entirely satisfactory construction.

A more specific object of the invention is to provide a window construction of the prefabricated type which is well adapted to mass production technique and utilizes a minimum of different molding shapes in its construction. Such shapes may be fitted together in different ways and to form different elements of window units, so that a wide variety of window sizes and styles can be fabricated with a few molding shapes.

Generally similar principles of ventilating sash construction may be utilized whether such sash is hinged to swing about its upper edge, its lower edge, or its side edge, and whether the swinging edge of the ventilating sash moves inward or outward, the interfitting of the parts in each instance being such as to provide a double sealing engagement at each side of the sash, and where the sash swings about an upper or lower edge a protective flange will project downward over the upper edge of the sash to afford a drip arrangement, thus preventing infiltration of water without the necessity of providing an extra element particularly for this purpose. In accomplishing this object a feature of the window is the special hinge mounting for the ventilating sashes which will enable them to seal firmly against the window frame elements surrounding them when they are closed, yet the hinge structure will be entirely concealed when the ventilating sash is closed. Moreover, such hinge structure may be utilized without

modification whether the ventilating sash swings about its upper or its lower edge, or a side edge, and whether the swinging edge of the ventilating sash moves inward or outward from the general plane of the window.

A further feature of the window construction is to extend the muntin bars uninterruptedly from side to side and from top to bottom of the window, except as such continuity must be interrupted by ventilating sash openings, and where muntin bars cross to notch such bars complementally for interfitting without breaking either of the intersecting muntin bars at the point of intersection. Moreover, the design of the muntin, vent and frame bars is such as to afford a strong and rigid construction for the window to carry high wind loads, although the dimensions of the bars in cross section are small to obstruct the glass space as little as possible and to provide a structure of light weight.

A window unit incorporating the features of this invention can be installed in openings in different types of wall structure, such as frame, brick veneer, concrete block, poured concrete, or solid brick construction, with minor or no modification being required.

Also, while, because of the small cross section of the molding elements used in fabricating the window, there is little difference in thickness between the composite framing elements around a ventilating sash and the muntins dividing the fixed lights of the window, an almost completely uniform appearance can be secured in a so-called "sight line" window by utilizing a combination of molding elements useful for other elements of the window also, and without requiring special shapes for muntin bars.

Further objects, advantages and features of the window construction of the present invention will be pointed out in the detailed description of the several representative forms of window shown in the accompanying drawings.

Figure 1 is an exterior elevation of one type of window according to the present invention. Figure 2 is a vertical section through such window taken along line 2—2 of Figure 1, Figure 3 is a horizontal section through the ventilating sash taken on line 3—3 of Figure 1, and Figure 4 is a fragmentary perspective view of molding elements utilized in the fabrication of this window unit prior to glazing and with parts broken away to illustrate principally the construction of joints between various molding members.

Figure 5 is a detail elevation view of a portion of a ventilating sash and frame of the type utilized in the window of Figure 1, for example, with parts broken away to show the hinge installation, and Figure 6 is an enlarged perspective view of the same portion of the window structure with parts broken away to reveal the hinge mechanism with the ventilating sash in closed position.

Figure 7 is a perspective view similar to Figure 6, but with the ventilating sash shown in open position.

Figure 8 is an exterior elevation view of another type of window embodying the principles of the invention, Figure 9 is a vertical sectional view on line 9—9 of Figure 8, and Figure 10 is a horizontal sectional view on line 10—10 of Figure 8. Figure 11 is a fragmentary sectional view through a composite muntin taken at line 11—11 of Figure 8. Figure 12 is a bottom perspective view of the frame bar and meeting rail junction at the swinging edge of the ventilating sash. Figure 13 is a fragmentary sectional view through the window frame of this window, taken on line 13—13 of Figure 8. Figure 14 is a fragmentary exploded perspective view showing a bottom frame member end and a complemental side frame member end, in relationship for assembly and viewed from the exterior of the window.

Figure 15 is a fragmentary vertical sectional view through a window of the type shown in Figure 1, for example, taken on a line such as 2—2 in that figure, but in which the ventilating sash is arranged to have its upper edge swing inwardly instead of its lower edge swinging outwardly. Figure 16 is a fragmentary horizontal sectional view through one side of the frame of such a window comparable to that taken on line 3—3 of Figure 1. Figure 17 is a fragmentary bottom perspective view of a lower corner of such a window with parts broken away to reveal the hinge structure and showing the window in open position.

Figure 18 is an exterior elevation view of another type of window incorporating the principles of the invention, having ventilating sashes at opposite vertical sides. Figure 19 is a vertical sectional view through the window of Figure 18 on the line 19—19 of that figure, and Figure 20 is a horizontal sectional view through the same window taken on line 20—20 of Figure 18.

Figure 21 is an exterior elevation view of still a further type of window according to the present invention, having a single ventilating sash, and Figures 22 and 23 respectively are vertical sectional views through such window on lines 22—22 and 23—23. Figure 24 is a horizontal sectional view through the same window on line 24—24, illustrating a window of this type set in a concrete block wall structure. Figure 25 is a fragmentary perspective view with parts broken away, illustrating the central junction of the muntin bars utilized in the window of Figure 21.

In order to indicate the variety of window types in which the various features of my window construction may be incorporated, the drawings illustrate several typical window installations showing variations in the number of lights used in the window, the location of the ventilating sash, the size of such sash, the hinge point of such sash, and the type of building construction in which the window is installed. It will be appreciated, therefore, that these illustrations are merely by way of example, and the number, location and arrangement of the lights and ventilating sashes may be selected in accordance with the requirements of a particular installation, as desired. Also, the ventilating sashes, while all of the swinging type, may be arranged to swing outward about top or side edges or inward about bottom or side edges, as may be preferred, although ordinarily it will not be desirable for a sash to swing inward about its top edge or outward about its bottom edge. Nevertheless, even these last-mentioned arrangements are possible.

Despite the versatility of window design possible by utilizing the principles of the invention, the construction is well adapted to production technique because of the utilization of only six basic molding shapes. In the window of Figure 1 only five of these shapes are used. This window, which is representative of the most customarily used type, includes four fixed lights F and two lights V in the ventilating sash which is hinged so that its lower edge may swing outward about an axis adjacent to its upper edge, known as an awning type of ventilating sash.

Turning to the detailed construction of the window unit shown in Figure 1, its frame is formed by the wooden frame bar 1, the shape of which bar is the same for all four sides of the window to enable the frame corners to be mitered readily. This frame bar includes an inwardly projecting glass flange portion 10 adjacent to its inner edge, a jamb portion 11, and projecting outwardly from such jamb portion, a molding or trim portion 12. Between the jamb portion and molding portion is a ledge 13, the edge of which serves as a putty guide where fixed lights are set against the glass flange 10, and the outer surface of which is engaged by a ventilating sash bar flange where a ventilating sash is adjacent to the frame. This ledge may also have fitted against it another molding in the case of rather special window construction, as will be explained in conjunction with another representative type of window.

Preferably the ledge 13 is disposed at the inner side of and adjacent to a step 14 between it and the molding 12 proper, the height of such step transversely of the window corresponding to the thickness of the vent bar flange overlapping the ledge as will be explained more fully later.

In the face of the frame bar forming the perimeter of the window unit and generally midway between the outer and inner edges of the frame bar is a groove 15 extending longitudinally of the frame bar. Into this groove fits the edge 20 of the spline 2 disposed in a plane parallel to the window unit and constituting a nailing flange. Preferably the edge portion 20 is somewhat thinner than the thickness of the spline 2 over the major portion of its width to form a shoulder 21 overlapping the portion of the frame bar 1 along one edge of its groove 15, enabling the spline to be located accurately. If the groove 15 is slightly wider than the thickness of the spline edge 20, the spline can be mounted so that its shoulder 21 will seat on the frame bar alongside groove 15 to limit the projection of the spline edge into the groove, and by pressing the stepped side of the spline against the front edge of the groove 15 the spline can be disposed precisely perpendicular to the perimetral surface 16 of the frame bar.

The perimetral surface 17 of the frame bar at the inner side of groove 15 is stepped inward from the outer perimetral surface 16, as shown clearly at the top and bottom of Figure 2, and a rib 18 preferably is provided projecting inward from the inner face of the frame bar and extending along its perimetral edge. The nominal size of the window unit will be measured to the exterior of the perimetral surfaces 16 at opposite sides of the window, but the window unit will be inserted into a window opening only up to the inner face of the splines 2. The extent to which the inner perimetral surface 17 is stepped from the outer perimetral surface 16 represents fitting tolerance between the edges of a window opening formed to receive the window unit and the adjacent portion of such unit to compensate for any unevenness in the cripples at opposite sides of the rough window opening, or in the header H along the top of the window opening, or in the sill plate beneath the window opening. This clearance also allows for errors in measurement of the carpenters forming the rough window opening.

While the spline 2 has been illustrated as an element separate from the frame bar 1, these two parts will in effect form an integral structure because the spline will be secured in the frame groove 15 with waterproof glue of the thermosetting type, such as a phenolformaldehyde resin, which not only will secure the parts firmly together, but render them absolutely watertight. This glue is of the type used in the manufacture of waterproof plywood, for example, which is employed even in boat building. Alternatively, the spline and frame elements can be formed as a single piece.

At intervals along the length of the splines or nailing flanges 2 are drilled holes 22 to receive nails N used to secure the prefabricated window unit to the building structure. Where such a unit is installed in a building of frame construction, the window opening will be framed with a portion of the structural members, such as the cripples and header, not covered by the sheathing S. Such sheathing is of the same thickness as the splines or nailing flanges 2, as illustrated at the top and bottom of Figure 2. After the rough opening has been formed and the window unit secured in place by the nails N, the wall covering W, such as bevel siding, is applied over the sheathing and the nailing flanges. In order to prevent entry of water between the molding portion 12 of the upper frame element and the lower edge of the wall covering, sheet metal flashing F may be installed over the upper side of the window frame and behind the wall

covering, as shown at the top of Figure 2. The interior side of the window opening may then be finished by applying a layer of plaster P to the head and sides of the window opening which may cover the rib **18**. The bottom of the window opening may be finished by fitting a piece of window stool S*t* between the rib **18** on the lower frame bar and the inner wall finish.

Sometimes water is inclined to run from a vertical surface around a corner and along a horizontal surface by capillary attraction, and to prevent such action a small groove **19** may be formed along the under face of the lower frame element adjacent to its outer face, which will form a shape designated a drip to interrupt the capillary flow of water and cause it to drip off the lower frame member.

Within the borders of the window frame unit formed by the frame bars **1** is the structure for supporting edges of the window lights if the window has more than one pane, and for mounting the ventilating sash or sashes if such are incorporated in the window. Between the fixed panes F in the window of Figure 1 are the muntin bars **3** which are of T-section, including a rather thick web portion **30** and relatively thin flange portion **31**. In the installation of these muntin bars it is desirable for each to extend uninterruptedly from one frame bar **1** to another, or from a frame bar to a main division member, such as the meeting rail **4** extending along the upper edge of the ventilating opening at the bottom of the window in Figure 1. Such continuity of the muntins both insures that the muntins in adjacent sections will be in alignment, so that the various fixed window lights will be coplanar, and improves the strength of the window structure to resist wind loads.

The manner in which the muntin bars are connected with the frame bars and meeting rail and arranged at the intersection of two muntin bars is shown best in Figure 4. The ledge **13** of the frame bar is grooved at **32**, and the end of the muntin web is cut to form a tenon **33** to fit endwise into such groove. This groove is cut back only to the outer surface of the glass flange **10**, and the muntin flange **31** is then removed back from the tenon **33** sufficiently so that the end of such flange will abut the edge of the frame bar glass flange **10**. Any wind load on the panes F exerted against the flange **31** will then tend to press the muntin bar inward, which force will be resisted by the bearing of the inner face of the muntin web on the outer face of the glass flange **10**, and the adjacent end of groove **33**.

At the intersection of the horizontal and vertical muntin bars **3**, the flange of one muntin bar is cut out for a distance equal to the width of the flange of the other muntin bar which passes through such groove, and the web of such other muntin bar is grooved and removed back to the flange for a distance equal to the width of the web of the first muntin bar. In the example shown in Figure 4 the flange of the vertical muntin bar is removed to the line **34**, forming a notch in the back of this muntin of a width equal to the width of the flange of the horizontal muntin. Complementally the web **30** of the horizontal muntin bar is cut out for a distance equal to the width of the vertical muntin bar web, forming a notch opening to the front which will receive the web of the vertical muntin bar as shown. Thus the flange of the horizontal muntin bar extends continuously across the window from one frame bar to the other, whereas the web of the vertical muntin extends uninterruptedly from the upper frame bar to the meeting rail **4**. At this meeting rail which incorporates the flange **40** the flange **31** of the vertical muntin bar is cut back to the line **35**, and the step **41** extending along the upper side of the meeting rail is grooved to accommodate a tenon **36** cut on the lower end of the vertical muntin bar web.

As in the joint between the muntin bar end and the frame bar, it will be seen that wind loads on the window vertical muntin are resisted at its lower end by engagement of the inner edge of the web with the meeting rail flange **40**.

For uniformity of appearance it will be noted that the thickness of the meeting rail flange **40** is the same as that of the muntin flange **31**, and the depth of the muntin web **30** is the same as the width of the meeting rail step **41** and of the frame bar jamb portion **11**. Consequently, the outer face of the meeting rail step **41**, the ledge **13** of the frame bar, and the outer edges of the muntins are coplanar, and the inner faces of muntin flanges **31** and of the meeting rail flange **40** are coplanar. While the glass flange **10** of the frame bar **1** may be of the same thickness as the muntin flanges, preferably it is thicker for added strength of such flange and of the frame bar generally.

The meeting rail **4** is used only in a horizontal position as a main division bar of a window above a vent, and in such position is disposed with the step **41** on its upper side. The outer edge of this meeting rail projects beyond the step **14** of the frame bar as shown in Figures 2 and 4, and the junction with the frame bar is similar to that of a horizontal muntin in that bearing against the frame bar glass flange **10** is afforded. Thus, as shown in Figure 4, the flange **40** of the meeting rail is cut back so that its end abuts the edge of the frame bar glass flange **10** while the web of the meeting rail projects beyond its flange and is received in a groove in the frame bar jamb in the manner shown in Figure 4 and in Figure 12.

The front edge of the meeting rail has a rib **42** projecting downwardly to form a drip above the vent. At the base of the meeting rail web and alongside its flange **40** on the underside of the rail is a groove **43** of a width slightly greater than the thickness of the meeting rail flange, and between this groove and the rib **42** is a surface preferably flush with the corresponding edge of the meeting rail flange **40**.

An advantage of the present type of window construction is that the same T-shaped element as used for the muntin bars may be used for at least one marginal element of each ventilating sash as well as for any division elements which may be required. In describing the ventilating sashes, therefore, the T-shaped element will be designated by the same reference numerals as when used as a muntin, even though in that instance it serves the purpose of a vent bar. In a ventilating sash hinged so that its swinging edge moves outward, whether such swinging edge be at the bottom or at either side of the ventilating opening, the marginal member of the sash opposite the swinging edge will be formed by a T-shaped element **3**. The other three vent bars **5** will be of Z-section, in which the outer flange **50** will form a projecting perimetral rib, and the other flange **51** at the inner side of the ventilating sash will form a glass flange. The T-shaped vent bar **3** is disposed with its web **30** projecting outwardly and one edge of its flange **31** will form the glass flange along this edge of the sash. The thickness of the Z-shaped vent bars **5** is the same as the thickness of the T-shaped vent bar **3**, and the flange **31** of this bar is the same thickness as the flanges **51** of the Z-shaped vent bars. All these glass flange elements are therefore disposed in the same plane.

The adjacent vent bars of Z-shape are joined together at the corners by mitered joints, and the Z-shaped vent bars adjacent to opposite ends of the T-shaped vent bar are joined to such T-shaped vent bar by butt pinned or tenoned joints. Since it is desirable for sealing purposes to have the flange of the T-shaped vent bar **3** extend along the full length of its vent side, the ends of the adjacent Z-shaped vent bars will abut the adjacent side of the T-shaped vent bar. At this junction the ends of the adjacent Z-bar members will be stepped to accommodate the full width of the flange **31** on the T-shaped vent bar **3** crossing the ends of such Z-shaped vent bars.

It will be evident from Figures 2 and 3 that the thickness of the Z-shaped vent bar flanges **50** preferably is

equal to the width of the step **14**, but in any event it is important that the width of the jamb **11**, the width of the meeting rail surface **44**, the depth of the T-shaped vent bar web **30**, and the thickness of the Z-shaped frame bar **5** minus the thickness of the flange **50**, all be equal. With these proportions, when the ventilating sash is in closed position the outer surface of the T-shaped vent bar **3** will engage the inner surface of the meeting rail drip rib **42**, and at the perimetral side of such vent bar the outer surface of its flange **31** will abut the outer side of the meeting rail groove **43**, whereas at the other three sides of the ventilating sash the inner surface of the Z-shaped vent bar flanges **50** will abut the frame bar ledges or shoulders **13**, and the inner sides of such Z-shaped vent bars will abut the outer faces of the frame bar glass flanges **16**. Thus a double seal will be effected on all four sides of the sash. Moreover, as shown in Figure 2, the width of the flanges will be such that despite shrinkage and swelling of the vent frame such double sealing contact will be effected at all sides of the ventilating opening, while space is left between the marginal elements of the ventilating sash and the adjacent members of the opening to allow for such shrinkage and swelling without the sash sticking.

In order to insure such double sealing action along the edge of the ventilating sash opposite its swinging edge under all moisture content conditions of the wood, the manner in which the sash is hinged is very important. Thus the axis of sash swing should be in the plane of the window, and, as shown in Figure 3, preferably somewhat nearer the inner surface than the outer surface of the vent bar along the sash edge opposite its swinging edge. In addition, the axis should be preferably somewhat beyond the perimetral surface of the adjacent side of the sash, and certainly not appreciably inwardly of the perimetral surface of such sash side. Such sash pivot axis location can be formed by hinge mechanism which will be completely concealed when the sash is closed.

The details of the hinge structure, its mounting in the window, and its operation are shown principally in Figures 3, 5, 6 and 7. The hinge structure is composed of three principal elements, first a strap **6** which is secured to the sash itself and extends along its edge, second a strap **60** which is secured to the window structure forming the ventilating opening, and third, a link **61** bridging between the two straps **6** and **60**. Strap **60** has in it a slot **62** extending lengthwise of it in which is slidably engaged a headed pivot pin **63** carried by and secured in the end of strap **6** preferably projecting slightly beyond the T-shaped vent bar **3**. The pivot carrying end **64** of this strap may be offset from the remainder of the strap toward strap **60** to provide between such straps a space wide enough to accommodate link **61**. Instead of thus offsetting the strap end **64**, however, the pivot pin **63** may be made longer and provided with a shoulder to engage the side of strap **60** opposite the head of this pin.

The ends of link **61** are connected by pivots **65** and **66**, respectively, to the straps **60** and **6** at locations such that when the two straps and the link are all in overlying registry the pivot pin **63** will be near the end of strap **60** remote from link pivot **65**, and link pivot **66** will be approximately midway between the pin **63** and pivot **65**, although there may be considerable leeway in such location of pivot **66**. As the swinging edge of the ventilating sash moves away from closed position the pin **63** will approach pivot **65** along slot **62**, and the two straps **6** and **60** and the link **61** will assume the triangular relationship illustrated in Figure 7. The longer link **61** is, and the closer pivot **66** is to the pivot pin **63**, the greater will be the angle of swing of the sash for a given movement of pivot pin **63** along slot **62** toward pivot **65**. Conversely, the shorter such link, and the farther pivot **66** is located from the pivot pin **63**, the smaller will be the angle through which the sash swings for a given displacement of pivot pin **63** toward pivot **65**.

As seen in Figure 6, when the ventilating sash is closed all three of the hinge elements **6**, **60** and **61** are disposed in overlying registry and in registry with the frame bar **1** and the side vent bar. Each of these elements is grooved sufficiently to accommodate a portion of the hinge, so that together a sufficient cavity is formed to house the hinge completely. It will be noted that the underside of the meeting rail **4** near its end is grooved to form the recess **45** into which the upper end of the hinge projects. With the ventilating sash in its outwardly swung position of Figure 7, the two straps **6** and **60** may be attached readily by screws to the vent and frame bars respectively.

The axis about which the ventilating sash swings is defined by the line joining the pivots **63** at opposite sides of the sash, and because these pivot pins slide along slots **62** as described, it will be appreciated that the axis of swing shifts continuously and only momentarily assumes any given location with respect to the window unit. Such pivot axis, however, maintains a fixed relationship with respect to the ventilating sash because the pivot pins **63** are carried by the straps **6** secured to this element. The movement of the sash between closed position and a slightly open position is represented by the solid and broken line illustrations in Figure 2. It will be noted that the upper edge of flange **31** of the upper vent bar moves downward and slightly outward from the notch **43**. If the center of pivot pins **63** defining the hinge axis lies precisely in the same horizontal plane as the upper edge of this flange, such flange will not move inward at all and will move outward only a negligible amount. The only appreciable movement of the upper edge of flange **43**, therefore, is a downward and tilting movement as the sash is swung open. On the contrary, as the sash is closed this entire flange will tilt back into a plane parallel to the plane of the window unit, and the upper edge of this flange will be slid upwardly into the notch **43** to abut its outer side. Simultaneously the front face of the upper vent bar will slide upward behind the drip rib **42** to effect a seal against it. Meanwhile, of course, at the other three sides of the sash the spaced inner surfaces of the vent bars and their flanges are moving into double sealing engagement with the outer surface of the glass flange and with the ledge or shoulder **13**, respectively.

It may be noted that if the hinge axis of the ventilating sash were appreciably lower, the first swinging movement of the sash not only would swing the swinging edge of the sash outward, but would swing the upper flange of the upper vent bar inward so that it would come into conflict with the lower edge of the meeting rail flange **40**. Conversely, if the pivot axis were located a substantial distance above the upper sash bar, swinging of the sash would cause interference between both the outer surface of the upper portion of flange **31** and the outer side of groove **43**, and between the outer surface of the upper vent bar and the inner surface of the drip rib **42**. If sufficient clearance were allowed to avoid either type of interference, it would be difficult to effect a tight double seal. Moreover, if the upper edge of the sash swung inward appreciably because of the axis of pivot pin **63** being too low, the flanges of the side Z-shaped vent bars would conflict with the ledges **13** against which they are intended to seat. The location of pivot pins **63** is therefore quite critical.

In Figure 8 a somewhat different style of window unit is illustrated, but this window, like that of Figure 1, incorporates a ventilating sash the lower edge of which swings outward. In this instance, however, the sash does not extend from side to side of the window, but has a fixed light F at each side of it, as well as above it. The junction between the vertical muntin **3** and the upper frame bar of the window, and between such muntin and the meeting rail are the same as in Figure 1, and consequently no further description of them should be required. To accommodate the lower fixed lights, however, a molding shape in addition to the five discussed in connection

with the window of Figure 1 is required. This additional shape is the filler strip 7 shown particularly in Figures 11 and 12.

The filler strip is of greater over-all depth than the muntin bars and vent bars. The upper side of this filler strip has a rib 70 spaced from its inner surface equal to the spacing of the meeting rail groove 43 from the inner surface of the meeting rail 4. Consequently, this rib will fit in and fill such groove and the outer surface of the filler strip will fit behind the drip rib 42 of the meeting rail 4.

The shape of the lower side of the filler strip includes a downwardly projecting glass flange 71 and a step 72 from the extreme outer face of the filler strip, forming a surface flush with the lower edge of the meeting rail drip rib 42. Between the base of this step and the inner surface of the filler strip the depth of such strip is equal to the depth of a muntin bar or a vent bar.

While filler strips 7 secured by pins 73 to the underside of the meeting rail 4 between the frame bars and the muntin bars alongside the vertical sides of the ventilating sash, the outer surface of the glass flange 71 of the filler strip is disposed in the same plane as the outer surface of the frame bar glass flange 10 and the muntin bar glass flange 31, as shown in Figure 10. The small fixed lights F may therefore be secured in place with putty in the conventional fashion against these glass flanges.

The addition of the filter strip 7 somewhat complicates the junction between the combination meeting rail 4 and filler strip 7 and the window frame. Figure 12 is a perspective view of this junction showing how the flange 40 of the meeting rail and the flange 71 of the filler strip are cut back so that their ends butt against the edge of the frame bar glass flange 10. As in the joint between the meeting rail and frame bar previously described, a groove is formed in the jamb of the frame bar to receive a tenon 45 formed on the end of the meeting rail. The remainder of the meeting rail end and of the filler strip end to a depth equal to the width of the frame bar jamb are cut back to abut against the jamb surface. Outwardly of this portion the meeting rail and filler strip project farther to extend across the ledge 13 to abut the step 14. The extreme outer portion of the meeting rail, including the drip rib 42, then extends past this step to abut the side of the molding 12. The horizontal sectional view of Figure 13 shows this joint in plan.

Since all the frame bars of this window unit are alike, as in the window unit of Figure 1, all adjacent bars are mitered at the corners, and in Figure 14 the corner joint for the frame bars, as used both in the window unit of Figure 8 and of Figure 1, is illustrated in an exploded view seen from the outer side of the window. Preferably a complemental stepped tongue-and-groove construction is used to locate the adjoining frame bar ends so that their inner and outer surfaces will be in perfect planar registry. Thus a tongue 23 formed on one mitered end of a frame bar will fit in the groove 24 in the end of the abutting frame bar. Conversely, the end of the spline secured to the first frame bar has a groove 25 to receive the tongue 26 formed on the end of the spline secured to the frame bar having in its end the groove 24.

When the mitered ends of the frame bar and spline assemblies are moved directly together, the tongue 23 will be inserted into the groove 24, and the spline tongue 26 simultaneously will be inserted into the spline groove 25. To insure movement of these miter ends toward each other in a direction perpendicular to the mitered surfaces, the metal pins 27 and 28 are fixed in one of the frame bar ends projecting from it perpendicular to its mitered surface. In the other frame bar end are holes 27′ and 28′ extending perpendicular to the mitered end surface of its end to receive the pins 27 and 28, respectively. These pins serve the triple function of guide pins during assembly, of locating means supplementing the tongue-and-groove structure described and of securing and strengthening means interconnecting the frame ends to form a strong joint.

While the window unit shown in Figure 8 can be installed in building structures of various types, such as the frame construction shown in Figure 2, Figure 9 shows this window unit in a brick veneer type of construction. In this instance the sheathing S extends to the margins of the window opening, covering the header H, the cripples at the side of the window, and the sill plate beneath the window. The splines 2 integral with the frame bars are then secured to the exterior of the sheathing by the nails, after which the brick veneer B is applied around the window, and against the splines or nailing strip or nailing flange 2, so that such brick veneer will be spaced from the sheathing S, in the usual fashion.

While in both the window of Figure 1 and that of Figure 8 the ventilating sashes have been shown hinged to enable their lower edges to swing outward, such sashes may alternatively be designed and hinged to enable their upper edges to swing inwardly. Such a ventilating sash is illustrated in Figures 15, 16 and 17. In this instance the top vent bar 3 again will be of T section, and the bottom vent bar will be of Z section. In this instance, however, the side vent bars will be of T-shaped section instead of Z-shape as in the outwardly opening sashes of Figures 3 and 10.

While the upper vent bar seals against the meeting rail 4 as shown in Figure 15 in the same manner as previously described, except that the lower edge of the flange 40 is removed to enable the upper edge of the window to swing inward, and while the lower Z-shaped vent bar will seal against the glass flange and the ledge 13 as before, special provision must be made for seating of the vent bars along the sides of the sash. Because the sash swings inward provision must be made for inwardly facing ledges which the outer surfaces of the vent bar and its flange at each side of the sash may abut. Such surfaces may be afforded by applying to the frame bar along the ventilating opening frame sides a filler strip 7 of the type previously described in connection with Figures 11 and 12 as being applied to the under side of the meeting rail 4. The rib 70 of this filler strip, as shown in Figure 16, overlaps the ledge 13, and its outer face lies flush with the step 14. Its step 72 affords a space for reception of the vent bar flange 31 and the flange 71 of the filler strip, in the previously described type of installation serving as a glass flange, constitutes a flange for abutment of the outer surface of the vent bar 3. This filler strip may be secured to the frame bar with waterproof glue, such as phenolformaldehyde, in the manner previously described in connection with securing the splines to the frame bars 1, so that the filler strips form integral parts of the frame bars.

As shown in Figures 16 and 17, the hinge again is installed between the window frame as supplemented by the filler strip 7 and the adjacent vent bar. The hinge used is of the same type as that previously described in connection with the outwardly swinging ventilating sashes of the window units shown in Figures 1 and 8, and may be identical in construction, but in this application a somewhat modified hinge structure is disclosed.

Instead of the strap 6 secured to the edge of the ventilating sash in a groove, a short plate 6′ is applied in a recess in the side face of the ventilating sash, so that the link 61 may swing alongside this face and close to it. Such link is pivotally connected to the plate 6′ by the pivot 66 as before. The opposite end of this link is connected by the pivot 65 to a strap 60′ which differs from the strap 60 of the previously described hinge construction by being of channel shape. This entire channel element is then received in a groove in the filler strip 7, as shown in Figure 16. The pivot 63, which slides in slot 62 of this strap, is carried by a separate plate 67 recessed in the lower edge of the vent instead of this pivot

support and the support for pivot 66 being on the same element. The flanges of the channel strap 60' are wide enough to provide a recess for accommodating the head of pivot pin 63, as shown in Figure 16.

Whichever type of hinge structure is used, the pins 63 defining the axis about which the ventilating sash swings again should be substantially along the edge of the sash opposite its swinging edge and may be spaced slightly from the sash, but such spacing should be small. With the hinge axis thus located the sash will swing from its closed position shown in full lines in Figure 15 to the inwardly swung position shown in broken lines, during which movement the lower edge of the sash has not moved either inward or outward appreciably. Such lower edge cannot move outward because the side vent bars, as shown in Figure 16, abut the filler strip 7 at two locations and cannot move outwardly. Moreover, the lower vent bar cannot move inward appreciably because of its abutment with the ledge 13 and glass flange 10 of the frame bar. By locating the pivot axis substantially at the lower edge of the sash, therefore, the lower vent bar will primarily tilt about the lower sash edge and rise to avoid conflicting engagement with the lower frame bar.

In the window of Figures 18, 19 and 20, illustrating a somewhat different type of window unit in which the principles of the present invention may be used, filler strips 7 again are used in conjunction with the frame bars 1 along the vertical sides of the window in the manner described in connection with Fig. 16, even though in this instance the ventilating sashes do not swing inwardly. In this instance the central pane of the window is fixed, while the smaller pane at each side is hinged to swing about its edge adjacent to the vertical frame bar, so that its opposite edge will swing outward, constituting casement ventilating sashes. The horizontal vent bars and swinging edge vent bar in each instance are of Z-shaped section, so that these elements are mitered. The vent bar adjacent to the hinge line is of T-shaped section, being an element 3 as shown in Figure 20.

It will be appreciated that in this instance the hinges will be mounted at top and bottom of the ventilating sash instead of along vertical sides, but the hinges will be interposed between a frame bar of the same type as in Figure 1 and a vent bar of Z-shape as in that figure in each instance. The only difference, therefore, is that in the window of Figure 18 the T-shaped vent bar at the hinged side of the window will cooperate with the filler strip 7 instead of with the meeting rail 4 as shown in Figure 2. The portions of the elements 4 and 7 engaged by the outer side of the T section vent bar and by its flange, however, are comparable, so that again the sash is sealed at two spaced locations on all four sides. Moreover, the action of the casement type ventilating sashes in Figure 18 and Figure 20 will be the same as that of the awning type window of Figure 1, the pivot axis of such casement sashes being located substantially coincident with the sash edge.

In the window of Figure 18 the joints between the frame bars and between the muntins and frame bars are the same as described in connection with the window units of Figures 1 and 8, and consequently no further description of these details should be necessary. Also, the assembly of the frame bars and the splines and the installation of the window unit in a rough opening for different types of building structure is the same as in the other windows discussed and need not be explained in detail.

In Figures 21 to 25, inclusive, still another type of window unit is shown, incorporating the general features of the invention. Again the frame bars on all four sides of the window are alike and are mitered at the corners with a joint like that shown in Figure 14. In this instance, however, as illustrated in Figure 24, the window unit is shown installed in a concrete block window opening. For that reason the splines 2' secured in the grooves 15 of the frame bars 1 are both thinner and narrower than the splines 2 utilized in the windows described above, so that these splines can be received in the grooves G of the concrete blocks C, as shown in Figure 24. Thus these splines would be one-half inch thick instead of three-quarters of an inch, for example, and would be three-quarters of an inch or an inch wide instead of being two inches or two and one-quarter inches wide. Consequently, when the splines are fitted into the concrete block grooves, ample clearance is afforded to set the window squarely in place despite inaccuracies in the laying of concrete blocks, and grout can then be filled in the space between the splines and concrete blocks.

Preferably these special dimension splines are set in the frame bar grooves 15 during the manufacture of the window unit, so that such unit will be adapted specially for concrete wall or concrete block wall construction. It is possible, however, to trim a window unit of the type shown in Figures 1, 8 or 18, for installation in a concrete block wall or a concrete wall by trimming the spline 2 both in width and thickness like the spline 2' of Figures 22, 23 and 24.

It will be noted that the frame bar 1 need not be made specially to receive the smaller spline because this groove is narrower than the portion of the spline 2 projecting beyond the frame bar in the windows of Figures 1 and 8 for example. Particularly in a window to be set in a concrete or concrete block wall, however, it is frequently desirable to have a more sturdy or massive appearance than to obtain a pleasing architectural effect in a window for a frame building wall. Thus the window shown in Figure 21 is what may be called a "sight-line" window.

The massiveness of the window frame and muntin construction could, of course, be secured by using special heavy-section frame and muntin bar stock. The same effect can, however, be obtained by utilizing the same molding shapes as discussed previously in connection with the other windows. Moreover, in such a sight-line window the appearance of the ventilating sash or sashes V will be substantially the same as the fixed lights F by reason of the special frame and muntin assembly structure.

In the four-light window of Figure 21 the horizontal division bar of the window utilizes the meeting rail 4 where a ventilating sash is provided in the lower portion of the window. The upper two fixed lights F are of like construction, but instead of the glass pane being set directly against the glass flanges of the frame bar, meeting rail and muntin, as described previously, the bordering structure of these windows is made more massive by fitting the window glass in a subordinate frame formed of Z-section elements 5. Since these elements are all of the same shape, the corners of this subordinate frame may be mitered. The outer margins of the inner face of these frame elements will then seat against the glass flanges of the frame bar, meeting rail and upright muntin. The perimetral flange of this subordinate frame then seats against the ledge 13 of the frame bar 1 on two sides, the outer surface of the step 41 of the meeting rail and the outer surface of the T-shaped muntin 3. The latter engagement is shown in the upper portion of the perspective view, Figure 25. These subordinate frames for the fixed lights may be secured to the members which they engage with waterproof glue, such as thermosetting phenolformaldehyde, to make a permanent, weatherproof bond.

Not only does this special construction described afford a more massive appearance to the window structure, but the glass pane is set outward by the thickness of the Z-bar flange 51. Consequently, the glass panes in the fixed lights are in precisely the same plane as the glass in the vent V, which further contributes to the uniformity of appearance.

Beneath the meeting rail 4 the subordinate frames have side and bottom elements of Z-shaped section, but the top elements in each instance are formed of a T-shaped

element 3, as shown in Figures 22 and 23. The lower fixed light at the right of Figure 21 will be slightly larger than the ventilating sash at the lower left of this figure, as will be seen by a comparison of Figures 22 and 23. The subordinate frame for the fixed sash will be of a size to fit snugly between the vertical muntin and the vertical frame side at the right, and between the meeting rail at the top and the frame at the bottom. The elements of this subordinate frame may be secured to the main frame members in permanent waterproof fashion like the upper fixed lights by the use of waterproof thermosetting phenol-formaldehyde glue, for example.

The ventilating sash V at the lower left of Figure 21 will, as shown best in Figure 22, have reasonable clearance between its perimeter and the adjacent window frame, meeting rail and muntin elements to prevent sticking of the sash under all humidity conditions. This sash may be supported for outward swinging of its lower edge by hinges mounted one at each vertical side of the ventilating opening frame, as described in connection with the window of Figure 1.

Figure 25 shows in detail the junction between the vertical muntins and the meeting rail. As in the construction of the Figure 1 window shown in Figure 4, the step **41** of the meeting rail is grooved to received a tenon **36** on the lower end of the muntin **3**, and the underside of the meeting rail is grooved transversely from its longitudinal groove **43** outward to receive a tongue **36'** on the upper end of the lower muntin **3**. Again, as in the construction shown in Figure 4, the flange **40** of the meeting rail extends continuously from side to side of the window frame, the flanges **31** of the muntins being cut back so that their ends abut the sides of the meeting rail flange **40**.

After the window has been set in place and the grooves G around the splines **2'** filled with grout, the plaster P may be applied to cover the wall and finish against the inner face of the window frame rib **18**. Other details of construction of this window unit are similar to those utilized in the window units previously described, so that it should not be necessary to repeat that description.

I claim as my invention:

1. In a wooden window structure, the combination of a window frame defining a rectangular ventilating opening and a swinging rectangular ventilating sash adapted to close such opening, said ventilating sash having planar opposite faces and comprising three similar sash edge members each having two sealing surfaces spaced apart transversely of the ventilating sash and both facing in one direction transversely of the ventilating sash, such sealing surfaces of said three similar sash edge members being disposed respectively coplanar in first parallel planes one of which is one face plane of said ventilating sash, and said ventilating sash further comprising a fourth sash edge member parallel to and adjacent to the axis of swing of the ventilating sash, having two sealing surfaces spaced apart transversely of the ventilating sash, facing in the direction transversely of the ventilating sash opposite the direction in which said sealing surfaces of said three similar sash edge members face and disposed respectively in second parallel planes one of which is the opposite face plane of said ventilating sash, and said window frame comprising three members, each having two sealing surfaces spaced apart transversely of the window frame a distance equal to the spacing of said sealing surfaces of said three similar sash edge members, facing in the direction transversely of the window frame opposite that in which said sealing surfaces of said three similar sash edge members face, disposed respectively coplanar in planes parallel to the window frame and coinciding respectively with said first parallel planes when the ventilating sash is closed, and sealingly engageable respectively by said sealing surfaces of said three similar sash edge members when said ventilating sash is closed, and said window frame further comprising a fourth member parallel to and adjacent to the axis of swing of the ventilating sash, having two sealing surfaces spaced apart transversely of the window frame a distance equal to the spacing of said sealing surfaces of said fourth sash edge member, facing in the direction transversely of the window frame opposite that in which said sealing surfaces of said fourth sash edge member face when the ventilating sash is closed, disposed respectively in planes parallel to the window frame and coinciding respectively with said second parallel planes when the ventilating sash is closed, and sealingly engageable respectively by said sealing surfaces of said fourth sash edge member when said ventilating sash is closed.

2. In a wooden window structure, the combination of a window frame defining a rectangular ventilating opening and a swinging rectangular ventilating sash adapted to close such opening, said ventilating sash having planar opposite faces and comprising three similar sash edge members each having two sealing surfaces spaced apart transversely of the ventilating sash and both facing in one direction transversely of the ventilating sash, such sealing surfaces of said three similar sash edge members being disposed respectively coplanar in first parallel planes one of which is one face plane of said ventilating sash, and said ventilating sash further comprising a fourth sash edge member parallel to and adjacent to the axis of swing of the ventilating sash, having a sealing surface facing in the direction transversely of the ventilating sash opposite the direction in which said sealing surfaces of said three similar sash edge members face and disposed in the opposite face plane of said ventilating sash, and said window frame comprising three members, each having two sealing surfaces spaced apart transversely of the window frame a distance equal to the spacing of said sealing surfaces of said three similar sash edge members, facing in the direction transversely of the window frame opposite that in which said sealing surfaces of said three similar sash edge members face, disposed respectively coplanar in planes parallel to the window frame and coinciding respectively with said first parallel planes when the ventilating sash is closed, and sealingly engageable respectively by said sealing surfaces of said three similar sash edge members when said ventilating sash is closed, and said window frame further comprising a fourth member parallel to and adjacent to the axis of swing of the ventilating sash, having a sealing surface facing in the direction transversely of the window frame opposite that in which said sealing surface of said fourth sash edge member faces when the ventilating sash is closed, disposed in a plane parallel to the window frame and coinciding with said opposite face plane of said ventilating sash when the ventilating sash is closed, and sealingly engageable by said sealing surface of said fourth sash edge member when said ventilating sash is closed.

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