May 28, 1963 E. J. WOODHAMS 3,091,005

VERTICALLY SLIDABLE TILTABLE SASH

Filed May 5, 1960 2 Sheets-Sheet 1

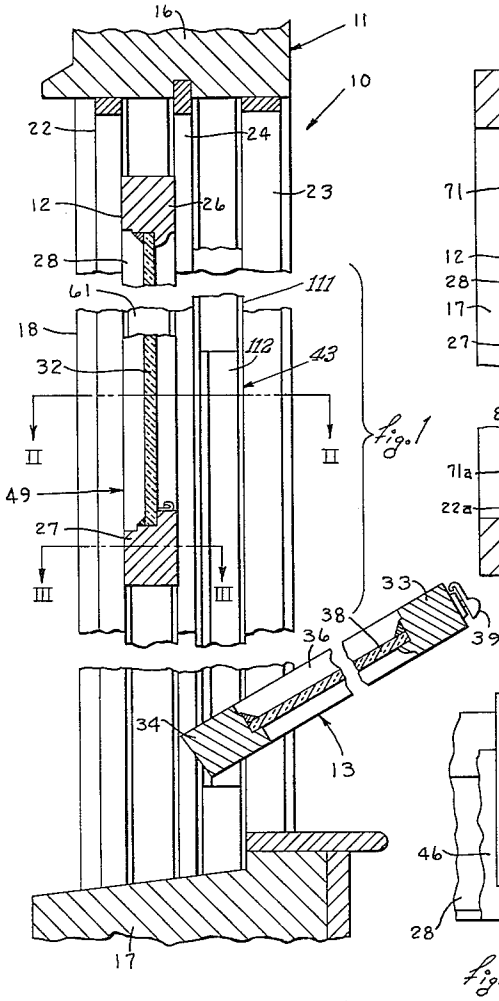


fig. 1

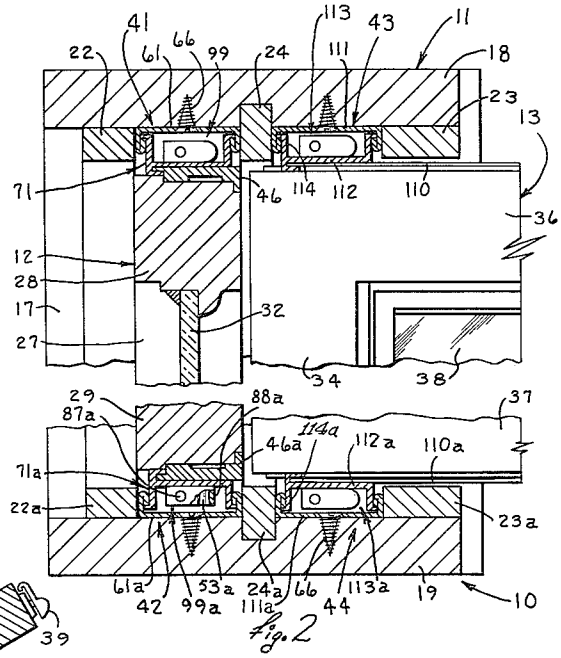


fig. 2

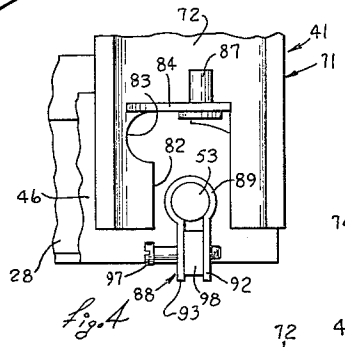


fig. 4

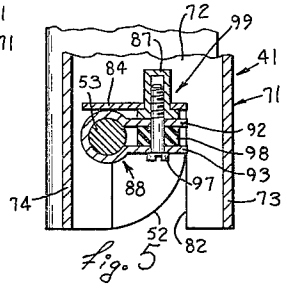


fig. 5

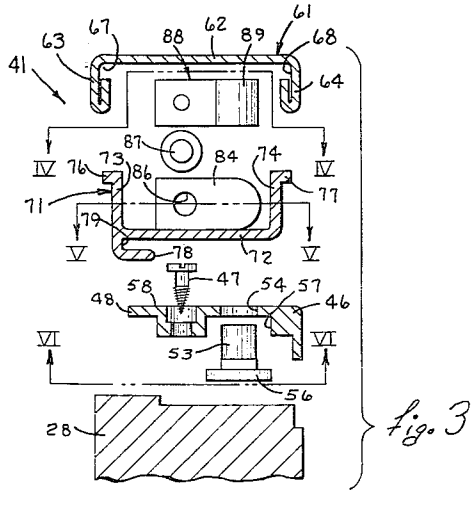


fig. 3

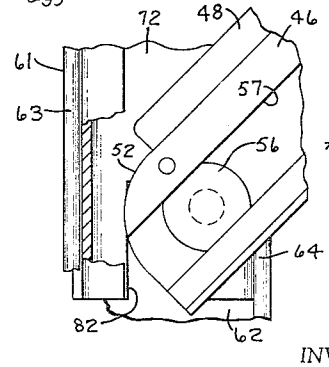


fig. 6

INVENTOR.
EDWARD J. WOODHAMS
BY
Woodhams Blanchard & Flynn
ATTORNEYS

May 28, 1963 E. J. WOODHAMS 3,091,005

VERTICALLY SLIDABLE TILTABLE SASH

Filed May 5, 1960 2 Sheets-Sheet 2

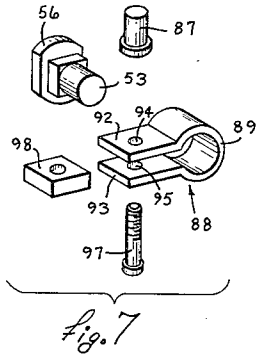


Fig. 7

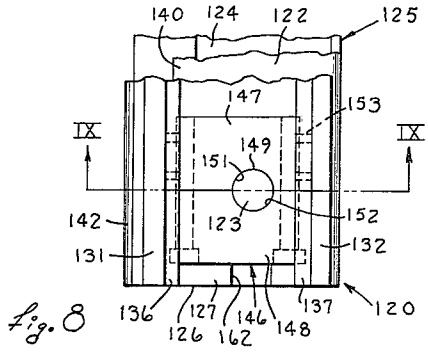


Fig. 8

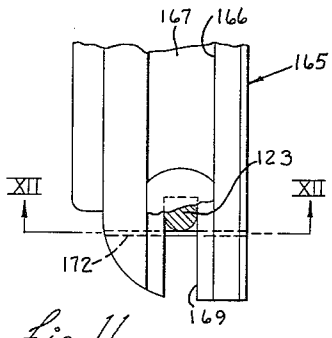


Fig. 11

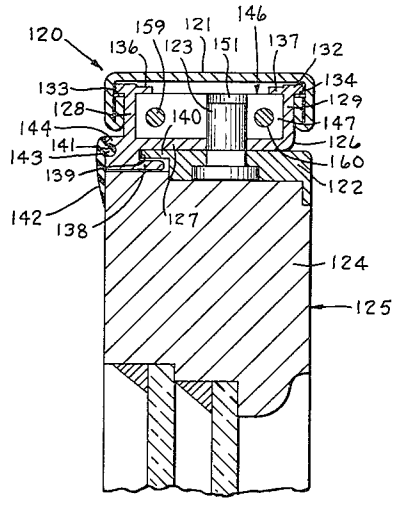


Fig. 9

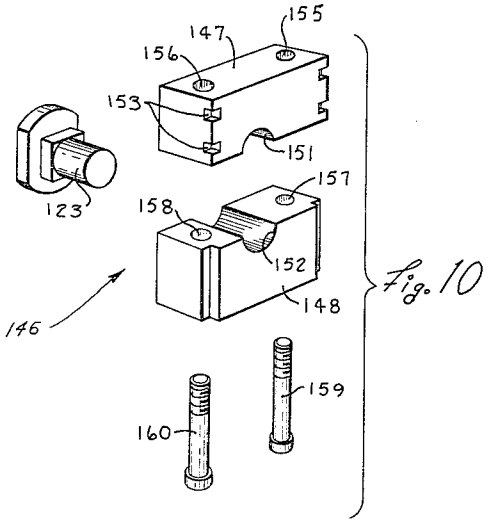


Fig. 10

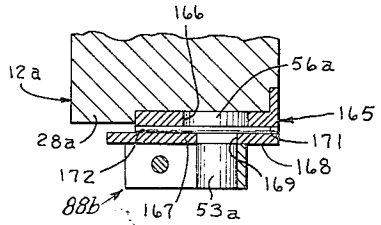


Fig. 12

INVENTOR.
EDWARD J. WOODHAMS

BY
Woodhams, Blanchard and Flynn
ATTORNEYS

United States Patent Office

3,091,005
Patented May 28, 1963

3,091,005

VERTICALLY SLIDABLE TILTABLE SASH

Edward J. Woodhams, Texas Township, Kalamazoo County, Mich., assignor, by mesne assignments, to Michigan Equity Corporation, a corporation of Michigan

Filed May 5, 1960, Ser. No. 27,194
7 Claims. (Cl. 20—49)

This invention relates in general to a double-hung window construction and, more particularly, to a type thereof having sash support structure whereby one or both of the sashes can be supported within the window frame for both sliding and hinged movement with respect to the window frame, and for easy removal of the sashes from the frame.

The basic concept of a double-hung window construction, wherein the sashes can move slidably and pivotably with respect to the window frame in which they are mounted, has been known for many years. However, insofar as I am aware, existing structures of this type have not met with widespread commercial acceptance for several reasons, in spite of their obvious advantages for ventilation and cleaning. For example, one serious objection to this type of window structure stems from the present lack of a satisfactory mechanism for hingedly supporting the sashes within the window frame. Where the hinged movement is around a horizontal axis, as it normally is, the principal problem has been to provide a hinge mechanism which is strong enough to hold the sash in a variety of positions intermediate the vertical and horizontal positions. Moreover, the hinge mechanism should also be easy to install and operate, inexpensive to fabricate, capable of easy adaptation to existing windows, capable of easy adjustment to compensate for wear, shrinkage and the like, and it should not have braces or other projections which are unsightly or which interfere with other objects, such as drapes, located adjacent to the window.

The previous attempts to achieve a satisfactory hinge mechanism for horizontally pivoted windows in a double-hung frame have progressed along several different lines. One arrangement, which pivots the sash inwardly around its lower rail, includes one or two link bars which connect the sash to the window frame at points spaced upwardly from the hinge axis of the sash for the purpose of supporting the sash in a non-vertical position. This type of structure is sufficiently complicated that it must, as a rule, be part of an original window installation or a substantially modified installation. Moreover, the link bars are unsightly and usually restrict the hinged movement of the sash as well as its removal.

In another form of existing structure of this general type, the hinge mechanism is installed between the sash and the window frame about midway between the upper and lower rails so that the torques applied by the sash around the hinge axis are substantially balanced at all positions of the sash, thereby creating a minimum of need for resistance to pivotal movement of the sash around its hinge axis. Obviously, this type of structure raises serious problems where storm or screen sash are involved.

In an effort to avoid the above-mentioned problems, complicated hinge mechanisms have been provided at the opposite ends of the lower rail, but have been found unsatisfactory because they are practically impossible to reach for adjustment purposes and because they are very difficult, hence expensive, to install. In a further effort to overcome these problems, hinge brackets have been mounted upon and between the lower rail of the sash and the window frame so that said hinge brackets extend sidewardly away from the sash, generally on the interior side of the sash. Thus, the hinge mechanism can be easily adjusted, but it can also be easily seen, which is

undesirable, and it creates an interference with drapes, curtains and the like.

In examining various prior known hinge mechanisms for such purposes, it has been noticed that they have consistently relied upon structures wherein the resistance to pivotal movement of the sash with respect to the window frame has been developed by forcing the hinge elements together in a direction parallel with the hinge axis. That is, the frictional resistance has been developed by compressing, in a direction parallel with the hinge axis, the hinge members connected to the sash and the frame. Although many forms of this type of hinge mechanism have been developed, none are known to have been widely utilized.

Accordingly, a primary object of this invention has been the provision of an improved sash support structure whereby a sash can be both slidably and hingedly supported upon a window frame of the double-hung type for trouble-free operation during long periods of frequent use.

A further object of this invention has been the provision of a structure, as aforesaid, in which the hinge mechanism can be quickly and easily adjusted without using special tools, without removing the sash from the window frame and by any person capable of making simple normal adjustments with a screwdriver.

A further object of this invention has been the provision of a structure, as aforesaid, which can be easily adapted to, and installed upon, a double-hung window already in use, and wherein a sash equipped with said structure can be quickly and easily removed from the window frame when desired by a very simple procedure which requires the removal of just two screws.

A further object of this invention has been the provision of a structure, as aforesaid, having a hinge mechanism which is completely hidden from sight, which is completely foolproof in its operation, which is sturdy in structure and which, if necessary, can be easily removed from the window frame.

Other objects and purposes of this invention will become apparent to persons familiar with this type of equipment upon reading the following descriptive material and examining the accompanying drawings, in which:

FIGURE 1 is a broken, vertical cross-sectional view of a double-hung window construction embodying and invention.

FIGURE 2 is a sectional view substantially as taken along the line II—II in FIGURE 1.

FIGURE 3 is an exploded sectional view substantially as taken along the line III—III in FIGURE 1.

FIGURE 4 is a sectional view substantially as taken along the line IV—IV in FIGURE 3 and rotated clockwise 180°.

FIGURE 5 is a sectional view substantially as taken along the line V—V in FIGURE 3 and rotated clockwise 180°.

FIGURE 6 is a sectional view substantially as taken along the line VI—VI in FIGURE 3.

FIGURE 7 is an exploded, perspective view of the hinge mechanism of the invention.

FIGURE 8 is a fragmentary, side elevational view of the outer side of a modified support structure with the guide member removed.

FIGURE 9 is a sectional view taken along the line IX—IX in FIGURE 8, and showing a double-glazed sash.

FIGURE 10 is an exploded perspective view of the modified hinge bracket shown in FIGURE 8.

FIGURE 11 is a fragmentary side elevational view of the inner side of a modified mounting member which supports a trunnion upon the vertical edge of the sash.

FIGURE 12 is a sectional view taken along the line XII—XII in FIGURE 11.

For convenience in description, the terms "upper," "lower," and words of similar import will have reference to the window construction and parts thereof as appearing in FIGURE 1. The terms "interior" and "exterior" will have reference to those sides of the window construction and parts thereof corresponding to the interior and exterior surfaces, respectively, of the wall in which the window construction is installed. The terms "inner," "outer" and words of similar import will have reference to the geometric center of said window construction, the sash support structure of the invention and parts associated therewith.

General Description

The objects and purposes of the invention, including those set forth above, have been met by providing a sash support structure which is particularly adapted for use in a double-hung type of sash and frame structure, wherein the sashes are vertically slidable within the window frame between substantially non-overlapping closed positions and fully overlapping open positions between the header and sill of the window frame. Each sash is also supported for pivotal movement around a horizontal axis preferably extending through, and lengthwise of, the lower rail of each sash. The invention relates primarily to the structure whereby each sash is supported upon the frame so that it can both slide and pivot with respect to the frame.

The sash-supporting structure is comprised of a pair of slide guides mounted upon the vertical jambs of the frame and a pair of slides disposed respectively within the slide guides for vertical movement therealong. The slides are connected to the sash near the lower end of each by a hinge mechanism which is capable of supporting the sash with respect to the frame at various angles ranging from vertical to horizontal. The hinge mechanism includes a trunnion supported upon the sash and a split sleeve mounted upon the slide and into which the trunnion is rotatably received. Easily engageable adjustment means is provided in the hinge mechanism for controlling the force by which the sleeve grips the trunnion and, accordingly, for controlling the resistance of said hinge mechanism to pivotal movement of the sash. The hinge mechanism is designed so that it is substantially completely hidden from view at all times and, moreover, is located at all times completely between the parallel planes defined by the exterior and interior surfaces of the sash when it is in the vertical position.

A modified sash support structure (FIGURE 9) includes a slide member having a resiliently flexible sealing element secured to and extending along the exterior surface thereof for engagement by the adjacent vertical sash element to block the entrance of the atmosphere therebetween. This modification also includes a different hinge bracket supported upon the slide member.

Detailed Construction

The window assembly **10** (FIGURES 1 and 2), which has been selected to illustrate a preferred embodiment of the invention, is comprised of a window frame **11** of the type used to support a pair of double-hung sashes, such as the sashes **12** and **13**. The window frame **11** (FIGURE 1) has a header **16**, a sill **17** and a pair of side jambs **18** and **19**, all of which may be substantially conventional and fabricated from any convenient material such as wood. The jambs **18** and **19** (FIGURE 2) have exterior stops **22** and **22***a*, interior stops **23** and **23***a* and intermediate stops **24** and **24***a*, respectively, which are spaced and parallel in the usual manner for guiding the vertical, sliding movement of the sashes disposed therebetween. In all material respects, the window frame **11** and parts thereof may be completely conventional and of the type presently in wide use for double-hung window installations.

The upper or exterior sash **12** (FIGURES 1 and 2), has an upper rail **26**, a lower or meeting rail **27** and a pair of vertical elements or stiles **28** and **29** in which a closure panel, such as a pane of glass **32**, is mounted. The lower sash **13** (FIGURES 1 and 2) has rails **33** and **34**, stiles **36** and **37** and a closure panel **38**. A conventional sash lock **39** (FIGURE 1) has parts thereof mounted upon the meeting rails **27** and **33** of the sashes **12** and **13**, respectively, whereby the lower sash **13** can be secured to the upper sash whereby both sashes are held against both vertical and tilting movement with respect to the window frame **11**.

As shown in FIGURE 2, the upper sash **12** is mounted upon and within the frame **11** by means of a pair of sash support structures or mechanisms **41** and **42** which may be substantially mirror images of each other and which provide for both vertical sliding and horizontal tilting movement of the sash **12** with respect to the frame **11**. Similar support structures **43** and **44** support the lower sash **13** for vertical sliding and horizontal tilting of said sash **13** with respect to the window frame **11**.

The sash support structure **41** (FIGURES 2, 3 and 4) includes an elongated, rigid mounting member **46** which extends along, and is secured to the outer edge of, the stile **28** by screws **47**. Said mounting member **46** has a lengthwise flange **48** which is spaced from the stile **28** and projects toward, but is spaced from the exterior side **29** of, the sash **12**. The mounting member **46** preferably extends substantially the full length of said stile **28** and has the lower exterior portion thereof (FIGURE 6) cut away to form a curved edge **52** for reasons appearing hereinafter.

A hinge pin or trunnion **53** (FIGURE 3) extends through an opening **54**, which penetrates the mounting member **46** near the lower end thereof substantially concentric with the curved edge **52**. The trunnion **53** has an out-of-round head **56** which is disposed within a lengthwise slot **57** in the inner surface of the mounting member **46**, whereby rotation of said trunnion **53** with respect to the mounting member **46** is positively opposed. The opening **54** and the adjacent portion of the trunnion **53** may also have mating, out-of-round contours for the purpose of further preventing relative rotation therebetween. The free end of the trunnion **53** extends beyond the planar, outer surface **58** of the mounting member **46**, which surface includes the outer side of the flange **48**.

An elongated, rigid and channel-shaped slide guide **61** (FIGURES 1, 2 and 3) has a web **62**, which is disposed against the jamb **18**, and a pair of inwardly extending flanges **63** and **64**, which are snugly disposed adjacent to the exterior stop **22** and intermediate stop **24**, respectively. Said slide guide **61** (FIGURE 1), which preferably extends from the header **16** to the sill **17**, may be secured to said jamb **18** by screws **66**. The flanges **63** and **64** have lengthwise, parallel grooves **67** and **68** in their opposing surfaces, preferably adjacent to the web **62**.

An elongated, rigid slide member **71** (FIGURES 3, 4 and 6), which is substantially channel-shaped and preferably of approximately the same length as the stile **28**, slidably supported upon and within the guide **61** for movement lengthwise thereof. Specifically, the slide member **71** has a web **72** and a pair of outwardly extending flanges **73** and **74** which are slidably disposed adjacent to the flanges **63** and **64**, respectively. The flanges **73** and **74** have lengthwise, sideward projections **76** and **77** adjacent their free edges, which projections extend respectively into the grooves **67** and **68** to guide the lengthwise sliding of the slide **71** with respect to the guide **61** while preventing relative transverse movements thereof.

An elongated flange **78** (FIGURES 3 and 6), having a substantially L-shaped cross section, is integral with and extends along the web **72** adjacent the exterior edge thereof. The flange **78** cooperates with the adjacent portion of the web **72** to define an elongated groove **79** which opens

toward the interior side of the frame **11** and into which the flange **48** on the mounting member **46** is snugly but slidably receivable to form a weather seal.

As shown in FIGURES 4 and 5, the slide member **71** has an upwardly extending notch **82** in its lower end. The notch **82** has near its upper end and one its interior side an arcuate edge **83** with a somewhat larger radius than the radius of the trunnion **53**. A flange **84** (FIGURES 3 and 4), which lies substantially within a plane perpendicular to the lengthwise extent of the slide member **71**, is rigidly secured to the web **72** between the flanges **73** and **74** adjacent to the upper edge of the notch **82**. If desired, the flange **84** and at least the upper portion of the notch **82** may be formed at the same time by bending a portion of the web **72** into a position perpendicular to the lengthwise extent of said slide member. An opening **86** (FIGURE 3) is provided through the flange **84** near its exterior edge for snug reception of an internally threaded sleeve **87**, of a well-known type, which sleeve is rigidly secured to the flange **84**.

A substantially U-shaped hinge member **88** (FIGURES 4, 5 and 7) has a substantially cylindrical bearing portion **89** with integral, substantially parallel flanges **92** and **93** extending therefrom. The inner diameter of the bearing portion **89** is preferably about equal to the diameter of the trunnion **53** when the flanges **92** and **93** are approximately parallel. Said flanges **92** and **93** have coaxial openings **94** and **95** through which a screw **97** is slidably received for threaded reception into the sleeve **87**, whereby the hinge member **88** is secured to the flange **84** with the bearing portion **89** snugly disposed within the arcuate edge **83** of the notch **82**. Under such circumstances, the trunnion **53** can be slidably and rotatably disposed within the bearing portion **89** while the flange **48** is snugly disposed within the groove **79**. A resiliently flexible grommet **98** (FIGURE 7), preferably encircles the screw **97** between the flanges **92** and **93** for resiliently resisting movement of the flanges **92** and **93** toward each other in response to tightening of the screw **97**.

The flange **84** (FIGURE 4), the hinge member **88** and the above-described means securing them together comprise the support bracket **99** which engages the trunnion **53** for the purpose of supporting the sash **12** upon the slide member **71**, hence upon the window frame **11**. The hinge member **88** and trunnion **53** are preferably fabricated from materials which will resist, without seizing, rotation of the trunnion **53** in a selectable amount, depending upon the tightness of the screw **97**. The diameter and length of the trunnion **53**, within the limitations of the disclosed structure, may depend in part upon the amount of engaging surface which is required between the trunnion **53** and the hinge member **88** to control effectively the pivotal movements and positioning of the sash.

The support bracket **99** (FIGURE 2) is preferably constructed and arranged so that the exterior side of the stile **28** will be adjacent the plane defined by the interior surfaces of the exterior stops **22** and **22***a* when the sash **12** is in a substantially vertical position.

The support structure **42** (FIGURE 2) which is preferably a mirror image of the support structure **41**, described above, includes a mounting member **46***a* secured to the stile **29**. A trunnion **53***a* extends from the member **46***a* for reception into a support bracket **99***a* supported upon the lower end of the slide member **71***a*. A slide guide **61***a* is supported upon the jamb **19** between the stops **22***a* and **24***a* for slidably supporting the slide member **71***a*.

The support structures **43** and **44** (FIGURE 2), which support the lower sash **13** upon the frame **11** may be, and preferably are, substantially identical with the support structures **41** and **42**, respectively, described above. Specifically, the support structures **43** and **44**, respectively include mounting members **110** and **110***a*, slide guides **111** and **111***a* and slide members **112** and **112***a*. The slide members **112** and **112***a*, upon which the support brackets **113** and **113***a* are mounted, preferably have shorter flanges **114** and **114***a* than the flanges **73** and **74** on slide member **71**. This arrangement permits pivotal movement of the upper sash **12**, including the mounting members **46** and **46***a* thereon, between the slide members **112** and **112***a* without interference therefrom.

It will be recognized that, by appropriate arrangement of certain parts associated with the support bracket **99** and the trunnion **53**, their positions of mounting can be reversed. That is, the support bracket can be supported upon the mounting member **46** and recessed into the sash stile **28**, whereas the trunnion **53** can be supported upon the web **72** of the slide member **71**.

Operation

As an important feature of this invention, the sash support structures **41** through **44** of the invention can be mounted upon and within a double-hung window frame **11**, either before or after it is installed with substantially equal ease. In both cases, the upper sash **12** will be slightly narrower in width than the lower sash, and both sashes will be slightly narrower than those which are not equipped with the invention. Where the sash support structures **41** to **44** are part of the original window assembly, it may be desirable to provide sashes of slightly reduced sizes. Where the sash support structures are installed on existing windows, the vertical edges of the sashes are trimmed off. Any loss of strength in the stiles, resulting from such trimming, is adequately overcome by the addition of a relatively strong mounting member **46** to said stile. The outer edges of the stiles on each sash are properly notched to receive snugly the mounting members secured thereto.

The slide guide **61** and the slide member **71**, for example, are inserted into the space between the stops **22** and **24** (FIGURE 2) after which the web **62** is secured to the jamb **18** by screws **66**. The trunnion **53** is connected to the mounting member **46** before the mounting member is secured to stile **28**. The hinge member **88** is mounted upon the trunnion **53** with the screw **97** extending through the flanges **92** and **93** and the grommet **98**.

In a similar manner, the slide guide **61***a* and the slide member **71***a* are mounted upon the jamb **19**, and the mounting member **46***a* with its trunnion **53***a* is secured upon the stile **29**.

The slide members **71** and **71***a* are moved upwardly and the sash **12**, with its stiles **28** and **29** in substantially horizontal positions, are moved from the interior side of the frame **11** through the window frame opening until the hinge members supported thereon are disposed between the slide guides **61** and **61***a*. This may require a raising of one side of the sash so that the hinge members and trunnions therein can clear the interior and intermediate stops on said window frame. The sash **12** is then moved upwardly so that the hinge members **88** and **88***a* move upwardly into the notches, such as the notch **82**, in the lower ends of the slide members **71** and **71***a*, until both hinge members assume positions about as shown in FIGURE 5. Thereafter, the screws associated with the hinge members, such as the screw **97** on hinge member **88**, are threadedly engaged with the sleeves **87** and **87***a* and tightened until the trunnions **53** and **53***a* are properly gripped by the hinge members **88** and **88***a*. Because the support bracket **99** and the trunnion **53** are close to the lower edge of the sash **12**, the screw **97** is easily accessible for adjustment when the sash is spaced upwardly from the sill **17**. The sash **12** can be pivoted around the hinge axis provided by its trunnions into the substantially vertical position, as shown in FIGURE 1, for normal double-hung operation.

In a similar manner, the lower sash **13** is mounted upon and between the jambs **18** and **19** by the support mechanisms **43** and **44**. When the sash lock **39** is in

its locked condition, pivotal movement of the sashes **12** and **13** is positively prevented. That is, the connection of the sash lock prevents pivotal movement of the lower sash **13** and, at the same time, prevents vertical movement of both sashes. The intermediate stop along the header **16** prevents pivotal movement of the upper sash **12** while it is held in the raised position by the sash lock **39**. The snug reception of the flange **48** on the mounting member **46** within the groove **79** on the slide member **71** provides an adequate weather seal.

It is seen that, when the sashes **12** and **13** are in their substantially vertical positions, as shown in FIGURE 1 with respect to the sash **12**, the hinge mechanisms, such as the support bracket **99** and trunnion **53** are completely concealed. Moreover, except for the interior edge of the mounting member **46** the entire sash support structure **41**, for example, is also hidden from normal view. Yet, each hinge mechanism can be quickly and easily adjusted simply by raising the sash and using a screw driver.

The modified sash support structure **120** (FIGURE 9) includes a slide guide **121**, which may be substantially identical with the slide guide **61** (FIGURE 3) and which may be mounted upon a window jamb, such as the jamb **18** in FIGURE 2. The modified support structure **120** also includes a mounting member **122** which may be substantially identical to the mounting member **46** and is secured to a vertical sash element **124** on the sash **125**, which may be similar to the sash **12** (FIGURES 1 and 2). A trunnion **123**, which may be substantially identical to the trunnion **53** (FIGURE 7), may be mounted upon and extend through the mounting member **122** in substantially the same manner that the trunnion **53** is mounted upon and extends through the mounting member **46**. The sash **125** to which the mounting member **122** is secured may, as shown in FIGURE 9, be designed for double glazing.

The slide member **126** (FIGURE 9) is similar to the slide member **71**, for example, in that it is channel shaped and has a web **127** with a pair of parallel flanges **128** and **129** integral with and extending from the opposite lengthwise edges of the web **127**. The flanges **128** and **129** have oppositely extending, lengthwise projections **131** and **132** slidably receivable into the grooves **133** and **134** in the slide guide **121**. Said flanges **128** and **129** also have inwardly extending, lengthwise projections **136** and **137** which preferably define a plane substantially parallel with the web **127** and are located adjacent the free edges of the flanges **128** and **129**.

The slide member **126** (FIGURE 9) has an elongated, L-shaped flange **138** which extends inwardly and then interiorly from the web **127** adjacent the exterior edge thereof to define with said web a groove **139** into which the lengthwise flange **140** on the mounting member **122** is snugly and slidably receivable in substantially the same manner that the flange **48** on the mounting member **46** (FIGURES 3) is receivable into the groove **79** on the slide member **71**.

The slide member **126** has a sidewardly extending lengthwise projection **144** extending along and away from the exterior side of the flange **128** adjacent the L-shaped flange **138**. The exterior surface of said projection is preferably about flush with the exterior surface of the sash element **124**. The projection **144** has a lengthwise undercut groove **141** extending along the exterior side thereof.

An elongated, resiliently flexible sealing element **142**, which may be fabricated from any convenient material such as neoprene, plastic or the like, and which is weather resistant, is mounted upon and extends along the slide member **126**. That is, the sealing element **142** has an integral, lengthwise bead **143** which is snugly receivable into the groove **141** for holding the sealing element **142** snugly against the exterior surface of the projection **144**. Said sealing element **142** is relatively flat and is wide enough to extend substantially beyond the L-shaped flange **138** for engagement by the adjacent portion of the exterior surface on the sash element **124**, when said sash element is parallel with the slide member **126**.

The hinge member **146**, which is supported within the slide member **126** near the lower end thereof, is comprised of upper and lower bearing blocks **147** and **148**, which are disposed between the flanges **128** and **129**. Said bearing blocks **147** and **148** have opposing substantially semi-cylindrical grooves **151** and **152** in their adjacent sides which are arranged to define a substantially cylindrical bearing opening or surface **149**. The maximum, radial depth of the recesses **151** and **152** is slightly less than the radius of the trunnion **123** received therein.

The upper bearing block **147** has a pair of recesses **153** (FIGURES 8 and 10) in both vertical edges thereof which are adjacent the inner projections **136** and **137**, respectively. Accordingly, the upper block **147** can be firmly held with respect to the slide member **126** by staking the adjacent portions of the projections **136** and **137** into the recesses **153**. The upper bearing block **147** has a pair of vertical, threaded openings **155** and **156** on opposite sides of the groove **151**.

The lower bearing block **148** (FIGURE 10) has a pair of smooth bore openings **157** and **158** which are axially aligned respectively with the threaded openings **155** and **156**. A pair of screws **159** and **160** are slidably received through the smooth bore openings **157** and **158** for threaded engagement within the threaded openings **155** and **156**. Thus, by tightening the screws **159** and **160**, the lower bearing block **148** is moved upwardly toward the upper bearing block **147**, thereby increasing the force with which the trunnion **123** is gripped between the bearing blocks **147** and **148**. Such increase in gripping force increases the resistance of the blocks to the rotation of the trunnion **123** within the hinge member **146**. The web **127** of the slide member **128** (FIGURE 8) has a recess **162** in its lower end through which the trunnion **123** may be slidably received for the purpose of effecting a mounting of the trunnion **123** within the hinge member **146** when said trunnion is mounted upon the mounting member **122**.

The operation of the modified support structure **120**, as well as the sash slidably and hingedly supported thereby within a window frame, such as the window frame **11** (FIGURE 1), may be substantially the same as that discussed above with respect to support structure **41**. As discussed above, the force with which the trunnion **123** is gripped between the bearing blocks **147** and **148** may be adjusted by turning one or both of the screws **159** and **160**, which are easily reached whenever the sash **125** is in at least a partially raised position so that it is spaced from the sill. Removal of a sash with the mounting member **122** and trunnion **123** thereon can be effected easily by removing both of the screws **159** and **160** so that the lower bearing block **148** can slide with the trunnion **123** through the lower end of the slide member **126**.

Under some circumstances, it may be necessary or desirable to mount the trunnion **53** (FIGURES 4 and 5) upon the slide member **71** before the trunnion is connected to the sash, such as the sash **12***a*, by means of a mounting member **46** (FIGURE 3). This can be accomplished by a modified mounting member **165**, which has a lengthwise groove **166** (FIGURE 12) on its inner face adjacent the sash element **28***a* in a manner substantially similar to the mounting member **46**. The web **167** between the groove **166** and the outer surface **168** of the mounting member **165** has a lengthwise slot **169** which extends through the lower end of the mounting member **165** from a point near thereto. The slot **169** is of cross-sectional dimension substantially equal to the diameter of the shank on the trunnion **53***a* for slidably receiving said shank when the head **56***a* of said trunnion is within the groove **166**.

A pin opening **171** (FIGURE 12) extends transversely through the mounting member **165** substantially parallel

with the outer surface **168** so that it intersects the slot **169** near the upper end thereof. A pin **172** is snugly receivable into the opening **171** so that it passes through the slot **169** at a distance from the upper, closed end thereof substantially equal to the diameter of the shank on the trunnion **53***a*.

Assembly of a sash support structure **41** (FIGURE 2), including the mounting member **165** (FIGURE 12), is effected by first securing the mounting member **165** to a sash **12***a*. The trunnion **53***a* is then inserted into a bearing device, such as the bearing member **88***b* (FIGURE 12), so that the head **56***a* of the trunnion **53***a* is spaced from the bearing member for reception into the groove **166** (FIGURE 11) as the shank moves along the slot **169** in the mounting member **165**. When the trunnion **53** reaches the upper end of the slot, the pin **172** is then inserted into the pin opening **171**. The sash **12***a* is now ready for operation in the manner set forth above with respect to the sash **12**.

Although a particular preferred embodiment of the invention has been disclosed above in detail for illustrative purposes, it will be understood that variations or modifications of such disclosure, which lie within the scope of the appended claims, are fully contemplated.

What is claimed is:

1. In a structure for pivotally and slidably supporting a sash in a window frame having a pair of spaced, substantially parallel jambs, the combination comprising:

An elongated guide member securable to, and substantially parallel with, one of said jambs;

An elongated slide member slidably supported upon and parallel with said guide member, said slide member being substantially shorter than the guide member;

A hinge device mounted upon said slide member adjacent one end thereof, said hinge device having means defining an arcuate gripping surface axially perpendicular to said slide member;

A trunnion rotatably engaged by said gripping surface;

Means supporting said trunnion upon the edge of said sash adjacent said slide member and near said one end thereof, said sash being pivotable with respect to said frame around the axis of said trunnion; and

Mechanism operatively associated with and connected to said hinge device and located radially outwardly of said gripping surface for adjusting the radial pressure between said trunnion and said surface, and thereby controlling the rotational movement of said trunnion with respect to said hinge device, whereby the pivotal movement of said sash is controlled.

2. The structure of claim 1 wherein the means supporting said trunnion upon said sash includes an elongated mounting member secured to and extending along said edge of said sash, said mounting member having a lengthwise groove in the side thereof adjacent to said edge of said sash and the wall of said mounting member between the outer surface thereof and said groove having a lengthwise slot extending from near said one end of said mounting member therethrough, said slot being of less width than said groove and disposed substantially midway between the edges thereof; and

Wherein said trunnion has a shank slidably but snugly receivable into and along said slot into the closed end thereof, and said trunnion has a head slidably and no-rotatably disposable within said groove when said shank is in said slot, whereby said trunnion can be mounted in said hinge device after which said mounting member can be engaged with said trunnion; and

Including means secured to said mounting member for holding said trunnion rotatably within said closed end of said slot.

3. In a structure for pivotally and slidably supporting a sash in a window frame having a pair of spaced, substantially parallel jambs, the combination comprising:

An elongated guide member securable to, and substantially parallel with, one of said jambs;

An elongated slide member slidably supported upon and parallel with said guide member, said slide member being substantially shorter than the guide member;

A hinge device mounted upon said slide member adjacent one end thereof, said hinge device having two portions with opposing concave surfaces defining a substantially cylindrical bearing opening axially perpendicular to said slide member, said portions being movable toward and away from the axis of said opening;

A trunnion rotatably receivable into said bearing opening;

Means supporting said trunnion upon the edge of said sash adjacent said slide member and near said one end thereof, said sash being pivotable with respect to said frame around the axis of said trunnion; and

Mechanism connected to said two portions for effecting said movement thereof and thereby controlling the frictional engagement of said trunnion by said hinge device, whereby said sash is held in angular positions with respect to said guide member.

4. Sash support structure for hingedly and slidably supporting a rectangular sash upon and within a double-hung window frame having a pair of opposed, elongated and substantially parallel surfaces extending along the vertical jambs thereof, comprising:

A pair of similar, elongated and substantially parallel guide members mounted upon and extending lengthwise of said opposing surfaces of the vertical jambs;

A pair of similar, elongated slide members of substantially less length than said guide members slidably supported respectively upon said guide members for movement lengthwise thereof;

A pair of support elements rigidly secured to said slide members adjacent the lower ends thereof;

A pair of hinge members removably mounted upon said support elements, said hinge members having portions defining substantially cylindrical and coaxially alignable bearing openings perpendicular to said slide member;

A pair of elongated mounting members secured to and extending along the opposite vertical edges of the sash to points adjacent the lower rail thereof;

A pair of coaxial trunnions rigidly secured to and extending in opposite directions from said mounting members adjacent said lower rails, said trunnions being rotatably and simultaneously receivable into said bearing openings, whereby vertical movement of the sash effects vertical movement of the slide members, said sash being pivotable with respect to said frame around the axis of said trunnion; and

Adjustment means on said hinge members and said support elements for moving said portions toward and away from the axes of said bearing openings and thereby increasing and decreasing the frictional engagement of the trunnions by the hinge members, whereby said sash is held by engagement between said trunnions, hinge members and support elements, only, in angular positions with respect to said slide members.

5. The structure of claim 4 wherein said support elements are integral flanges on said slide members extending toward their associated guide members;

Wherein each slide member has a slot extending from its support element through the lower end of the slide for reception of the trunnion with the hinge member thereon; and

Wherein each hinge member is substantially U-shaped and includes a resiliently compressible element between the flanges thereof near the free ends thereof.

6. The structure of claim 4 wherein said hinge members are substantially U-shaped; and

Wherein each pair of associated slide and guide members has a pair of opposed, spaced and substantially parallel surfaces between which the support element and hinge member are substantially disposed where-

by said hinge members and said trunnions lie substantially between the planes defined by the interior and exterior surfaces of the sash.

7. The structure of claim 4 wherein each of said hinge member includes a pair of bearing blocks having cooperative, semi-cylindrical surfaces defining a substantially cylindrical opening, one of said blocks in each hinge member being rigidly secured to a slide member near its lower end and the other block being slidably held in said slide member; and

Wherein said adjustment means includes screw means connecting said blocks together.

References Cited in the file of this patent

UNITED STATES PATENTS

1,886,968	Monsch et al.	Nov. 8, 1932
2,126,177	Dennis	Aug. 9, 1938
2,666,235	Kaufman et al.	Jan. 19, 1954
2,778,068	Kaufman et al.	Jan. 22, 1957