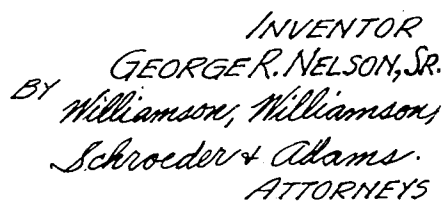


Filed April 7, 1954

SWINGABLE BOOK WINDOW

2 Sheets-Sheet 1



Aug. 16, 1955

G. R. NELSON, SR

2,715,249

SWINGABLE BOOK WINDOW

Filed April 7, 1954

2 Sheets-Sheet 2

FIG. 5

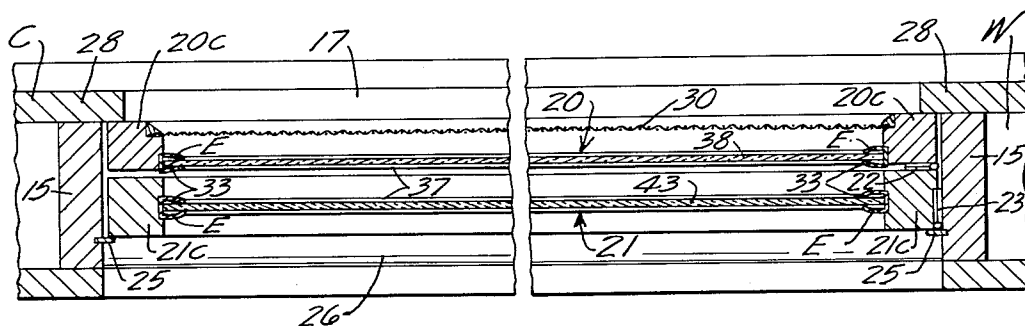


FIG. 6

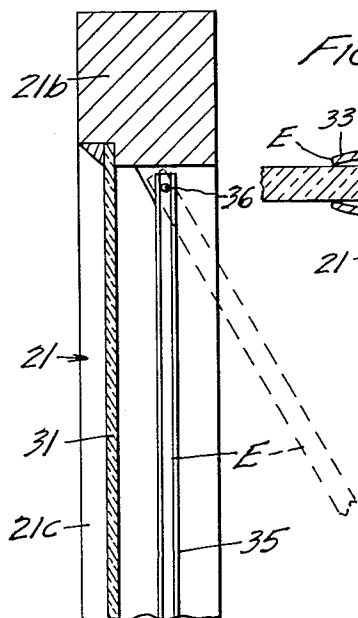


FIG. 10

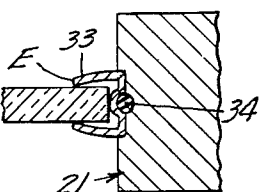


FIG. 7

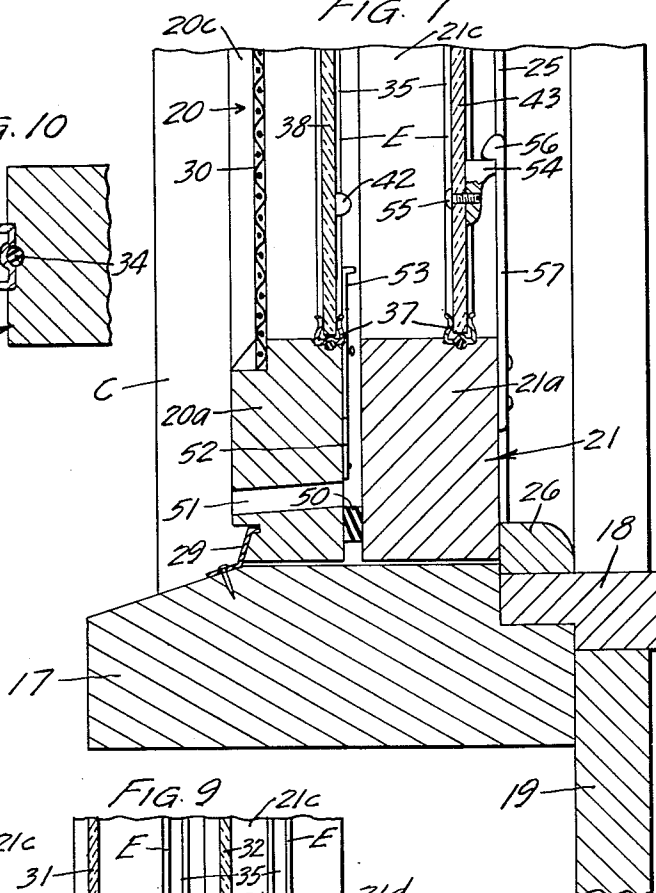


FIG. 8

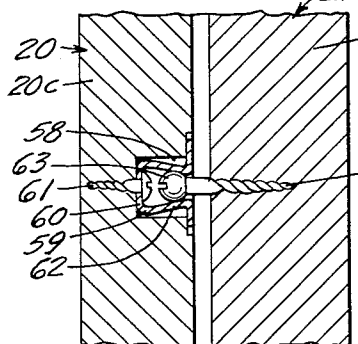
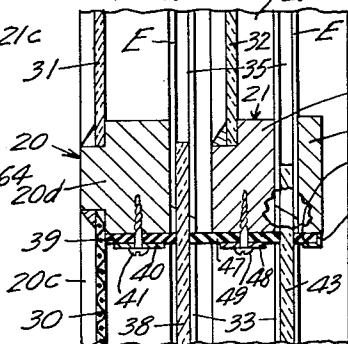


FIG. 9



INVENTOR
GEORGE R. NELSON, SR.
BY *Williamson, Williamson*
Schroeder & Adams
ATTORNEYS

1

2,715,249

SWINGABLE BOOK WINDOW

George R. Nelson, Sr., Almelund, Minn.

Application April 7, 1954, Serial No. 421,577

11 Claims. (Cl. 20—55)

This invention relates to windows, and more specifically to casement windows with self-storing storm windows.

Windows which are swingable in their frame, more commonly known as casement windows, have been used for many years. Many of these windows have used the idea of hinging several windows together to get a self-storing storm window effect in the casement window, but such casement windows lack many of the advantages of windows which have panes which open by vertical shifting. The major advantage of vertically shiftable windows is that they may be opened minutely to obtain only a small amount of draft, whereas swingable casement windows are not readily adapted to be opened just a little bit.

It has been a problem to successfully mount a vertically shiftable windowpane in a casement or swinging window. This is especially true because, as a general rule, vertically shiftable windows are mounted in a vertically shiftable sash. If this were done in a casement window, it would be necessary to have both a swingable sash and a vertically shiftable sash mounted in the swingable sash to hold the pane and to allow it to be shifted vertically. Also, if a screen is to be fixedly attached to the swingable casement window, the side of the pane adjacent to the screen cannot be washed. In order to wash that side of the pane adjacent to the screen, the pane must necessarily be removable.

When a vertically shiftable windowpane is mounted in a swingable casement sash, without a cooperating vertically shifting sash, it is a problem to successfully lock the window so that it cannot be raised from outside the building. Conventional locking means which are generally used in windows which have vertically shiftable sashes cannot be used where only the pane is vertically shiftable and the sash is stationary.

When window sashes are hinged together for swinging relative to one another and are also hinged to the frame for swinging the sashes out of the frame, it is a problem to find an efficient fastener which will hold the individual window sashes together. This is necessary because, when the sashes are swung into the frame, they should not be allowed to separate lest they should jam. On the other hand, the window sashes should be easily separable when they are swung out of the frame. The fastener which locks the window sashes together should not protrude from either of the sashes so that it will interfere with other activities in the immediate area and will not catch in the draperies of the window or the clothing of a person who operates the window.

From the foregoing it can be seen that many problems are involved in making a satisfactory window assembly. It is to the solution of these and other problems that my invention is directed in addition to the innovation of several desirable features to be specifically set forth herein.

An object of my invention is to provide a novel window

2

assembly for self-storing of the storm sash and screen.

Another object of my invention is to provide a novel window assembly arranged to allow ready and easy access to the several parts thereof so that they may be conveniently cleaned and serviced.

5 Still another object of my invention is to provide in a window assembly novel swingably mounted sashes which may be conveniently opened to provide air circulation therethrough by operation of the several parts thereof while the sash remains stationary.

10 Still another object of my invention is to provide improved means for removably mounting a slidably openable pane in a swingably shiftable sash.

A further object of my invention is to provide in my window assembly, novel means for fastening together 15 window sashes which are swingably separable.

A still further object of my invention is to provide for the disposal of condensate collected between the adjacent and swingably mounted window sashes of a window assembly.

20 A further object of my invention is to provide novel means for retaining swingable window sash in the window frame.

A further object of my invention is to provide an improved mechanism for locking an openable window.

25 It is a still further object of my invention to provide novel means for affixing a latch to a windowpane which will preclude removal of the latch from outside of the window.

These and other objects and advantages of my invention will more fully appear from the following description made in connection with the accompanying drawings wherein like reference characters refer to the same parts throughout the several views and in which:

30 Figure 1 is a front elevation of my window assembly;

35 Figure 2 is an elevational view of the outer sash of my window assembly and one side of the inner sash;

Figure 3 is a sectional view taken at 3—3 of Figure 1;

40 Figure 4 is a vertical, sectional view taken at 4—4 in Figure 1;

Figure 5 is a horizontal, sectional view taken at 5—5 in Figure 1;

45 Figure 6 is a partial, sectional view taken at 6—6 in Figure 1;

Figure 7 is a partial, sectional view taken at 7—7 in Figure 1;

50 Figure 8 is a partial, sectional view taken at 8—8 in Figure 1;

Figure 9 is a partial, sectional view taken at 9—9 in Figure 1; and

Figure 10 is a horizontal, cross-sectional view through the vertical side member and channel of one of the sashes taken at 10—10 of Figure 1.

The embodiment of my invention shown in the figures includes a frame F which is mounted in a wall W. The frame has vertical side members 15 and a horizontal top cross member 16 and a horizontal bottom sill 17. On one side of the sill 17 and adjacent its upper surface is mounted a stool 18. An apron 19 extends downwardly from the stool 18 and is affixed to the sill 17. A pair of inner and outer window sashes 20 and 21 are mounted in the frame. The sashes 20 and 21 are parallel and spaced close together. Each of the window sashes 20 and 21 has bottom cross members 20a and 21a respectively and has top cross members 20b and 21b respectively and has vertical side members 20c and 21c, respectively. The inner sash 21 and outer sash 20 are hinged together by suitable means such as hinges 22 which are mounted along and between 60 side rails 20c and 21c on one side of the sashes. Each of the sashes 20 and 21 has a cross rail 20d and 21d respectively, each of which is disposed medially of the

respective sash and horizontally between the vertical side rails thereof. The sashes 20 and 21 are hinged to the frame as by hinges 23 which, as shown, are connected between the side rail 21c of the inner sash 21 and the side member 15 of the frame. Both of the sashes 20 and 21 are supported in the frame by means of hinges 23 and both the sashes are swingable out of the frame and into the room about the pivot of the hinges 23.

Extending around the inside of the frame F, along the side members 15 and the top cross members 16 is a recess 24, best shown in Figures 3 and 4. The recess 24 is adjacent the inside surface of the inner sash 21. Retaining strips 25 are inserted into the recess 24 and engage the inside sash 21 to hold the same from swinging out of the frame and to serve as weather stripping. There is no recess such as recess 24 in the sill 17 or stool 18, but a retaining strip 26 extends between the frame side members 15 and engages the stool 18 and the lower cross member 21a of the inside sash 21. Retaining strip 26 has the same function as strips 25.

Outside of the frame F and the wall W is an outside window casing C which comprises a top cross member 27 and vertical side members 28. The casing C is affixed to the frame F and has its inner edges disposed inwardly of the frame F to serve as stop members for the outer sash 20. The outer sash 20 engages the outer casing C in weather-sealing relationship and is prevented thereby from swinging out of the frame. An impervious window-retaining member 29 is mounted on the sill 17 and extends between the frame side members 15 and engages the lower cross member 20a of the outer sash 20 in weather-sealing relationship. Retaining strip 29 may be made of metal and is somewhat resilient. The lower cross member 20a of the outer sash 20 has a recess in its lower and outer portion into which the retaining strip 29 is inserted.

The window sashes 20 and 21 may be both swung out of the frame simultaneously and then the sashes 20 and 21 may be separated by swinging them about the hinges which interconnect them. When the sashes have been swung back together so as to lie substantially parallel, they may be swung back into the window frame to abut against the outside casing and retaining strip 29. The retaining strips 25 and 26 are then inserted into the recess 24 and retain the window sashes in the frame.

The outer sash 20 has a screen 30 affixed therein below the center cross bar 20d by any suitable means such as putty. The screen 30 covers the entire lower portion of the sash 20.

Windowpanes 31 and 32 are mounted in the upper portions of the sashes 20 and 21, respectively, and above the center cross rails thereof. The windowpanes 31 and 32 cover the entire upper portions of their respective sashes and are affixed in the sashes by any suitable means such as putty.

Each of the window sashes 20 and 21 has channels E which extend vertically along each of the vertical side members of the respective sashes. The channels mounted in the outer sash 20 are positioned adjacent the screen 30 and the pane 31 and inwardly toward the room from each of the same. The channels in the inner sash 21 are positioned similarly on that sash as the other channels are positioned on the outer sash 20.

Each of the channels E has a lower portion 33 which extends from the lower cross member to the center cross rail of the respective sash. The lower portions 33 of each of the channels are fixedly attached to the respective sash, as best shown in Figure 10, and each of the lower portions 33 of the channels has a shallow recess 34 in the bottom surface thereof into which is placed caulking for making a weathertight seal between the channel and the sash. Each of the sashes has a shallow recess along the inside edge thereof and adjacent the lower portions of the channels, also for

receiving the caulking. The interior bottom surfaces of the channels are recessed for receiving the head of the nail which affixes the channels to the sash. The sliding panes held therein will not engage the nail heads.

The channels in each of the sashes each have upper portions 35, each of which extends from the center cross bar of the respective sash to the top cross bar thereof. The upper portion 35 of the channels are pivotally attached to the respective sash at their upper ends, and may be swung out of the sashes about the pivotal connection 36. The upper portion 35 of the channels co-extends with the lower portions 33 of the channels.

A horizontally extending section 37 of channels E lies on the inner edge of the lower cross member of each of the sashes and is fixedly attached thereto. This horizontal section 37 of the channels co-extends with the vertically extended lower portions 33 of the channels. The channels 37 may be perforated to allow discharge of condensate from the interior thereof.

A window pane 38 is mounted in the channels of the outer sash 20 and is vertically slidable therein. In closed position, the windowpane 38 is supported by the lower portions 33 of the channels and by the horizontally extending section 37 of the channels. In this closed position, the windowpane 38 extends upwardly to about the middle of the center across rail 20d of the outer sash 20, and extends slightly into the upper portions 35 of the channels of sash 20. When the windowpane 38 is shifted vertically in the channels, its entire length may be retained in the upper portion 35 of the channels. The thickness of the windowpane 38 relative to the size of the channels in which it slides is such that the channels will grip the windowpane 38 and hold it in any vertical position. The channels are made of a somewhat resilient metal and engage the windowpane 38 in weather-sealing relationship. The pane 38 has a handle 42 affixed thereto adjacent its lower edge.

A window-retaining strip 39 made of a resilient and elastic material such as rubber is mounted on the lower surface of the center cross rails 20d of the outer sash 20. The strip 39 is affixed to the cross rail 20d by any suitable means such as the plate 40 and screw 41 as best shown in Figure 9. The strip 39 engages the outer surface of the windowpane 38 to frictionally hold the pane 38 in any vertical position and to give the pane 38 lateral reinforcement.

When the sashes 20 and 21 are swung out of the frame F and are separated by swinging them apart, the windowpane 38 may be shifted vertically into the upper portions 35 of the channels, and then the upper portions 35 of the channels and the windowpane 38 may then be swung about the pivotal connection 36 out of the sash 20 and the pane 38 may be slidably removed from the sashes. This removing of the pane 38 will be done especially when the pane is to be washed.

A pane 43 is mounted in the lower portion of the sash 21 and in the lower portions 33 of the channels mounted therein. In its closed position, the windowpane 43 is supported by the vertically extending channels 33 and the horizontally extending section 37 of the channels. The pane 43 is of such thickness so as to fit in the channels in weather-sealing relationship and to be retained by the channels in any vertical position. The pane 43 extends upwardly to about the center of the center cross bar 21d of sash 21 and extends slightly into the upper portions 35 of the channels. The pane 43 is vertically shiftable in the channels and may be shifted into the upper portion 35 of the channels with its entire length retained in such upper portions 35.

The upper portions 35 of the channels in inner sash 21 are held laterally against the center cross rail 21d thereof by a check rail 44 which extends between the opposite side rails 21c of the sash. Each of the side rails 21c has a recess 45 in the inside edge adjacent the channels and the center cross rail 21d. The recesses

45 are of such size and configuration as to receive the ends of the check rail 44. The recess in one of the vertical side rails 21c is deeper than the recess in the opposite vertical side rail 21c. The check rail 44 is removably mounted in the recesses 45. The check rail is shifted as far as possible into the deeper of the recesses 45 and the opposite end of the check rail will come out of the respective recess, and thereupon the check rail may be removed from the deeper of the recesses 45. A window-retaining strip 46 made of an elastic and resilient material such as rubber is mounted between the check rail 44 and the windowpane 43. The strip 46 is affixed to the check rail 44 by means of a metal plate 46a and screws and engages the windowpane 43 in weather-sealing relationship. The strip 46 will hold the pane in any vertical position and will give the pane 43 lateral reinforcement. The metal strip 46a will strengthen the check rail.

When the check rail 44 is removed from the sash and from its engagement with the channels of the sash, the windowpane 43 may be shifted vertically into the upper portion 35 of the channels and the upper portions 35 of the channels and the pane 43 may be swung out of the sash 20 about the pivot 36 and thereafter the pane 43 may be slidably removed from the upper portions 35 of the channels.

A window-stabilizing strip 47, made of a resilient and elastic material such as rubber, is affixed to the lower surface of the center cross rail 21d of the sash 21 by any suitable means such as the metal plate 48 and screw 49. Strip 47 engages pane 43 of sash 21 and pane 38 of sash 20 and engages the same to give the panes 38 lateral reinforcement and to hold the panes in any vertical position.

A condensate trough or strip 50 made of an elastic and resilient material such as rubber is mounted between the lower cross members 20a and 21a and is affixed to one of the same and engages the other in water-sealing relationship. The trough 50 extends substantially the entire length of each of the bottom cross members of the sashes and slopes from the extremities thereof toward the center or medial portion of the bottom cross members. The bottom cross members 20a of the sash 20 has a passage 51 extending therethrough which is positioned above the trough 50, but near its lowest point. When condensate is collected in the trough after having run down from between the windows, it will be drained out through the passage 51. A shiftable gate member 52 having a handle 53 affixed thereto is pivotally mounted adjacent the passage 51 for closing the same.

A window handle 54 is mounted on the lower portion of pane 43 of sash 21. The handle 54 also constitutes a latch member and has a substantially flat and horizontal upper surface. Handle 54 has a tapped hole extending horizontally therethrough. The handle 54 is shiftable with the pane 43.

Window handle 54 is affixed to the pane 43 by means of a screw 55 which has a threaded shank and a smooth-surfaced hemispheroidally-shaped head portion with the flat surface thereof affixed to one end of the shank. The shank has a transverse screwdriver slot in the other end thereof. The shank of the screw 55 is matched in size and thread to the tapped hole of handle 54. Windowpane 43 has a screw-receiving hold extending therethrough and coextending with a tapped hole through window handle 54. The shank of screw 55 extends through both of said holes, being threadably connected to the handle 54. The smooth surfaced head of screw 55 is on the side of the pane 43 opposite to that upon which is mounted the handle 54. The screw 55 is tightened in its threadable connection to handle 54 by turning the screw from the screwdriver slot in the shank which is in the tapped hole of handle 54. The screw, not having a screwdriver slot in its head, cannot be removed from that end of the screw.

A hook member 56 having a depending shank 57 is affixed to the sash 21. The shank 57 extends upwardly

from the lower cross member 21a of the sash and the hook member 56 locks over the top surface of the handle 54. The hook member 56 and shank 57 are made of a rigid material but are resiliently laterally shiftable to allow disengagement of the hook from the handle 54. When the windowpane 43 is in closed position, the hook 56 will engage the handle 54 in locking relation and will prevent raising of the windowpane 43 from the other side of the same.

Between the sashes 20 and 21 and on the opposite side from the hinges which interconnect the same, I provide a fastener for retaining the windows in substantially parallel position. As best shown in Figure 8, the vertical side member 20c has a cylindrical recess 58 or cavity therein opening toward the sash 21. The fastener comprising a receiving element 59 or retainer which is made of a thin, resilient material such as spring steel, and has a bottom portion 60 which is connected by suitable means such as screw 61 to the bottom of the recess 58. Connected to the bottom portion 60 of the receiving element 59 are side wall members 62 which extend toward the interior of the recess 58 and slightly inwardly toward the axis of the cylindrical recess 58 to form a restricted exterior neck portion of the receiving element 59 and an enlarged interior chamber. The fastener also comprises an anchoring element or bolt having an enlarged and substantially spherical head portion 63 or bead and a threaded mounting shank 64 for mounting the anchoring element to the sash 21. When the sashes 20 and 21 are in substantially parallel position, the anchoring element will be inserted into the receiving element and the head 63 of the anchoring element is of such size as to be received in the enlarged chamber adjacent the bottom 60 of the receiving element 59. The head 63 will be releasably retained in the receiving element 59 by the restricted neck portion formed by the side walls 62 of the receiving element 59 and will thereby retain the sashes 20 and 21 in substantially parallel and closed position.

It will be seen that I have provided a novel window assembly which includes in its structure both the inner window sash and the outer or storm sash. The storm sash is conveniently and permanently stored in the frame. Servicing of the windows, including washing, can easily and readily be done from inside the room by swinging them into the room and then swinging the inner and outer sashes apart.

It will also be seen that I have provided for the shiftable windowpanes to be directly supported by channels which guide the panes and which are adapted to provide for the ready and easy removal of the panes. The removing of the panes from the outside sash is especially desirable in that a fixed screen is adjacent the pane and precludes washing of the pane. To so support and mount the panes obviates the need for vertically shiftable individual sashes to be mounted in the hinged sash.

It should also be apparent that I have provided novel means for retaining the swingable window sashes in the frame. The outside casing of the window, being shifted inwardly of the frame, obviates the necessity of blind stops in the frame. The removable retaining strips on the inside of the window retain the sashes in the frame and are easily and readily removable to allow the sashes to be swung out of the window.

It should also be observed that I have provided a novel latch mechanism for locking my vertically shiftable pane so that the pane may not be raised and opened from outside the room. The latch mechanism is attached directly to the windowpane, and is locked by means of a hook attached directly to the sash to preclude vertical shifting of the pane. The latch cannot be removed from outside the room to thereby allow raising of the window because a grip cannot be taken on the smooth surfaced screw head which affixes the latch to the windowpane. The screw which affixes the latch to the pane is removable only from the inside of the pane.

It will, of course, be noticed that I have provided novel means for disposing of condensate collected between the sashes. The trough in which the condensate is collected also acts as a spacer to retain the window sashes in spaced relation one to the other.

It will be seen that I have provided, in my window assembly, an improved fastener for retaining the swingable window sashes in close mutual adjacency. The fastener holds the sashes together while they are both in the frame, and when the sashes are swung out of the frame, the fastener is easily separated to allow the window sashes to be swung relative to each other.

It will, of course, be understood that various changes may be made in the form, detail, arrangement and proportion of the parts without departing from the scope of my invention.

What is claimed is:

1. In a window assembly having a frame, the combination of a pair of adjacent window sashes adapted to be mounted in such a frame and being swingably connected together to swing relative to each other, each of said sashes having at least one slidably openable pane mounted therein, and one of said sashes being adapted to be swingably connected to said frame for swinging said sashes out of such a frame.

2. In a window assembly having a frame, the combination of a pair of adjacent window sashes adapted to be mounted in such a frame and being swingably connected together to swing relative to each other, one of said sashes being adapted to be swingably connected to such a frame for swinging said sashes out of the frame, each of said sashes having at least one slidably openable pane mounted therein, the openable pane in one of the sashes being removably mounted.

3. In a window assembly having a frame, the combination including a pair of adjacent window sashes adapted to be mounted in such a frame and being hinged together for swingable separation, one of said sashes being adapted to be swingably connected to such a frame for swinging of said sashes out of the frame, each of said sashes having a slidably openable lower pane and side rails with inside edges, at least one of said sashes having a pair of channels slidably supporting the lower pane, said channels being mounted along the inside edges of the opposite side rails of the corresponding sash and being pivotally attached thereto, whereby when said lower pane and channels are swung out of the sash, the pane may be slidably removed from the channels.

4. The structure recited in claim 3 and said channels having resilient side members for gripping the pane and retaining the same in any vertical position, and said last mentioned sash having a bottom rail which has a channel which is similar to the other channels and is fixedly attached to the inside edge thereof for receiving and supporting the bottom of said lower pane.

5. In a window assembly having a frame, the combination including a pair of adjacent window sashes adapted to be mounted in such a frame and being hinged together to swing relative to each other, one of said sashes being adapted to be swingably connected to such a frame for swinging of said sashes out of the frame, each of said sashes having a slidably openable lower pane and side rails with inside edges, at least one of said sashes having a pair of channels for slidably supporting the lower pane, said channels being mounted along the inside edges of the opposite side rails of the sash, each of said channels having separate, but coextending upper and lower portions, the lower portions of the channels being fixedly attached to the sash, the upper portions of the channels being at least as long as the lower pane and being pivotally attached to the sash, whereby when the lower pane is shifted into the upper portions of said channels and the pane and upper portions of the channels are both swung out of the sash, said lower pane may be slidably removed from the channels.

6. In a window assembly having a frame, the combination including adjacent inner and outer window sashes being adapted to be mounted in such a frame and being swingably connected together to swing relative to each other, one of said sashes being adapted to be hinged to such a frame for swinging the sashes out of the frame, each of said sashes having a slidably openable lower pane and side rails with inside edges, at least one of said sashes having a pair of channels for slidably supporting the lower pane, said channels being mounted along the inside edges of the opposite side rails of the corresponding sash, each of said channels having separate, but coextending upper and lower portions, the lower portions of the channels being fixedly attached to the sash, the upper portions of the channels being at least as long as the lower pane and being pivotally attached to the sash, the inner sash having a check rail extending between its side rails and being removably mounted thereon to form an obstruction to the swinging of the upper portions of said channels, whereby when the check rail is removed from the sash and the lower pane is shifted into the upper portions of the channel, the lower pane and upper portion of the channel may be swung out of the sash and the lower pane may be slidably removed from the channels.

7. The structure recited in claim 6, and the inner sash having a recess in the inside edge of each of the side rails thereof adjacent to the severance between upper and lower portions of the channel and of such configuration to receive the ends of the check rail, the recess in one check rail being deeper than the other recess, and a pane-guiding member mounted on said check rail and frictionally engaging the adjacent slidable pane to retain the same in any vertical position.

8. In a window assembly having a frame, the combination including adjacent inner and outer window sashes being adapted to be mounted in such a frame and being hinged together to swing relative to each other, one of said sashes being adapted to be hinged to such a frame for swinging of said sashes out of the frame, each of said sashes having a slidably openable lower pane and side rails with inside edges, each of said sashes having a pair of channels slidably supporting the lower pane, said channels being mounted along the inside edges of the opposite side rails of the sash, and retarding elements mounted adjacent each of the slidable panes and frictionally engaging the same for retaining the pane in any vertical position.

9. In a window assembly having a frame, the combination including adjacent inner and outer window sashes being adapted to be mounted in such a frame and being hinged together for swingable separation, one of said sashes being adapted to be hinged to such a frame for swinging of said sashes out of the frame, each of said sashes having a slidably openable lower pane and side rails with inside edges, each of said sashes having a pair of channels slidably supporting the lower panes and being mounted along the inside edges of the opposite side rails of the sash, said inner sash having a cross rail, and a retarding element mounted between said sashes on said cross rail and frictionally engaging and retaining the lower pane of the outer sash in any vertical position.

10. In a window assembly, the combination of a frame having an outside casing which has side members and a top member, said members extending inwardly of the frame, inner and outer window sashes mounted within said frame and being hinged together for swingable separation, the inner sash being swingably connected to said frame for swinging the sashes out of the frame, said outer sash engaging the side and top members of the outside casing in weathersealing relationship, and sash-retaining strips removably mounted in the frame, whereby the strips engage the inner sash for holding the same in the frame, and whereby when said strips are removed, the sashes may be swung out of the frame.

11. In a window assembly, the combination including a

window frame having an outside casing which has side members and a top member, said members extending inwardly of the frame, inner and outer window sashes mounted within said frame and hinged together for swingable separation, the outer sash engaging the side and top members of the outside casing in weathersealing relationship, the inner sash being swingably connected to said frame for swinging the sashes out of the frame, said frame also having an elongated recess adjacent to the inner sash and extending substantially around the inside of the frame, and sash-retaining strips removably mounted in the recess and positively engaging the periphery of the inner sash in weathersealing relationship and holding the same in the frame, whereby when said strips are removed, the sashes may be swung out of the frame.

10

15

References Cited in the file of this patent

UNITED STATES PATENTS

391,405 Dibbern et al. ----- Oct. 23, 1888

859,459
894,115
977,712
1,589,874
2,031,875
2,256,097
2,324,139
2,397,803

932,857
65,770
169,184

McCauley ----- July 9, 1907
Case ----- July 21, 1908
Crump ----- Dec. 6, 1910
Ewing ----- June 22, 1926
Dobie ----- Feb. 25, 1936
Mahoney et al. ----- Sept. 16, 1941
Davis ----- July 13, 1943
Murray et al. ----- Apr. 2, 1946

FOREIGN PATENTS

France ----- Dec. 1, 1947
Netherlands ----- May 15, 1950
Austria ----- Oct. 1, 1951