The present invention relates to a window construction and more particularly to a window assembly having two pairs of vertically alidable glass panes for use in cold climate.

The general object of the present invention resides in the provision of a window assembly of the character described having a novel hanging system which permits an improved indirect ventilation of the room by the manipulation of a single glass pane, manipulation of two glass panes being required only for full opening of the window.

Yet another object of the present invention resides in the provision of a window assembly of the character described in which it is only necessary to manipulate the inner lower glass pane to open or close the window, thereby avoiding the need of reaching the outer pair of glass panes.

Another object of the present invention resides in the provision of a window assembly of the character described in which all the glass panes are easily removable for repainting, cleaning or storing.

Still another object of the present invention resides in the provision of a window assembly of simple construction and in which the several glass panes are all counterbalanced, thereby eliminating counterweights, springs and the like.

Yet another object of the invention resides in the provision of a window assembly of the character described in which the glass panes are sashless thereby providing for maximum visibility.

Other objects of the present invention reside in the provision of improved means for locking the glass panes in closed position and novel means for adjustably ventilating the dead air space between the inner and outer pairs of glass panes.

The foregoing and other important objects of the present invention will become more apparent during the following disclosure and by referring to the drawings in which:

FIGURE 1 is a perspective view of a window assembly in accordance with the invention;

FIGURE 2 is a plan section of the window assembly;

FIGURE 3 is a cross-section of the window assembly in which the glass panes are all in closed position;

FIGURE 4 is a cross-section taken through a jamb of the window frame and showing the suspension system;

FIGURE 5 and 5a are partial sections of two spaced portions of a jamb and partial elevation of a window glass pane and showing the locking device for blocking the glass panes in closed position;

FIGURE 6 is a cross-section of a guide track in the jamb;

FIGURE 7 is a cross-section of the guide members for the cables of the suspension system at the top end of a jamb;

FIGURE 8 is a perspective view of the lower glass pane supporting block;

FIGURE 9 is a perspective view of the supporting block for the upper glass panes;

FIGURE 10 is a perspective view of one piece of the guide member shown in FIGURE 7; and

FIGURE 11 is enlarged partial cross-section of a pair of glass panes showing the structure of their mutually engaging cover strips in accordance with a modified embodiment.

Referring now more particularly to the drawings in which like reference characters indicate like elements throughout, reference numeral 1 indicates the window frame consisting of a lintel 2, jams 3 and a sill 4, and which is preferably made of wood. The outside faces of the frame may be provided with longitudinally extending grooves (not shown) for connection of adjacent window frames to one and another by means of keys or for securing within a window opening.

The inside face of the lintel 2 is provided with two longitudinally extending spaced parallel grooves in which are disposed and tightly fitted channel members 5, preferably made of plastic, for receiving in sealing engagement the U-shaped cover strip 6 fitted over the top edge of the outer and inner top glass panes 7 and 8, as shown in FIGURE 3. The lower edges of the top glass panes 7 and 8 are provided with U-shaped cover strips 9 provided with an upwardly inclined sealing lip 10 which is adapted to abut against the downwardly inclined lip 11 of the U-shaped cover strip 12 fitted over the top edge of the bottom outer and inner glass panes 13 and 14 respectively, in the closed position of the window, as shown in FIGURE 3. FIGURE 11 shows a modified embodiment of the cover strips in which lips 10 and 11 depend from the outer corners of the cover strips 9 and 12 respectively so as to be wider and thus more flexible for better sealing of the two glass panes.

The lower marginal portion of each lower glass pane 13 and 14 is fitted with a combined sealing and handle member 15. The members 15 have a U-shaped cross-section and are made of rigid plastic with a right angle inwardly directed handle portion 16 at the top of the inside leg thereof. The U-shaped member is fitted on the lower marginal portion of each glass pane with the interposition of a flexible packing strip 17. The lower portion of each member 15 is provided with a flexible tubular sealing member 18 adapted to directly engage the top inclined face of a plastic cover member 43 resting on sill 4. Cover member 43 has legs 44 at its outer marginal portion which maintain member 43 spaced above the top face of sill 4 in order to define a chamber therewith. The inner marginal portion 45 of member 43 is formed to engage a step 46 made in sill 4. Member 43 forms a channel 47 spaced inwardly of and parallel to the abutting zone for sealing member 18 of glass pane 13. Channel 47 has inward lips guiding slider elements 48 which serve to adjustably open slots 49 made in the bottom of channels 47. Thus the dead air space between the two closed glass panes can be ventilated through slots 49 and notches 50 made in legs 44, in order to prevent the formation of excessive humidity within said dead air space.

As shown in FIGURE 2, the side edge of the glass panes 7, 8, 13 and 14 directly engage and are slidably within guiding tracks 19 and 20 tightly fitted within vertical grooves made in the inside face of the jams 3 of the window frame 1. The right hand guiding track 19 consists simply of two channel members having their bottom in direct contact with the side edges of the glass panes, said channel members having inwardly turned lips 21 directly engaging the inner and outer faces of each glass pane. The left hand guiding track 20 also consists of two channel members but which are deeper than those at the right hand side of the opening of the window and in which are disposed rigid strips 22 in direct contact with the side edges of the glass panes and urged against the same by means of leaf springs 23 secured in the bottom of the channel members and applied against strips 22. There is preferably two or more leaf springs 23 along the height of the window. By pushing the glass panes laterally against strips 22 and leaf springs 23, it is possible to disengage the opposite side edge of the glass panes from
the guiding tracks 19 to thereby remove the glass panes from the window frame.

In accordance with an essential feature of the present invention, the glass panes are mutually counterbalanced and interconnected in the following manner.

The lower inner glass pane 14 is counter balanced by and moves in unison with the upper outer glass pane 7 while the lower outer glass pane 13 is counter balanced by and moves in unison with the upper inner glass pane 8. The lower corners of the lower glass panes 13 and 14 fit within a groove 24 made in a support block 25 shown in FIGURE 8 while the lower corners of the upper glass panes 7 and 8 fit within a groove 26 made within a support block 27 shown in FIGURE 9. The rear face of the blocks of FIGURES 8 and 9 are provided with laterally opening vertically extending grooves 20 and 29 respectively for receiving the lips 21 of the guiding tracks 19 and 20 such that the support blocks 25 and 27 are guided for vertical movement along said guiding tracks.

On each side of the window assembly, the lower support block 25 of the lower inner glass pane 14 is connected to the upper support block 27 of the upper outer glass pane 7 by means of a flexible cable 30 as shown in FIGURE 4 which is anchored or welded at its ends within a hole made in said support blocks as shown in FIGURE 9 and which runs within the channel shaped guiding tracks 19 or 20 with which the blocks are associated. At the top end of each jamb, the cable 30 is guided in a curved path by passing through a curved groove 31 made in a plastic guiding member 32 and registering with the guiding tracks. The upper support blocks 27 of the upper inner glass pane 8 are connected to the lower support blocks 25 of the lower outer glass panes 13 by means of a cable 33 passing through the associated channel shaped guiding tracks 19 or 20 and guided in a curved path at the top of the window frame by engaging a curved groove 34 made in a guiding member 35. The guiding members 32 and 35 are made of nylon or other suitable plastic and consists of flat somewhat semi circular members as shown in FIGURE 10, secured side by side with their faces provided with respective guiding grooves 31 and 34, in mutual contact, see also FIGURE 7. The cables 30 and 33 are preferably steel cables and may be covered with a plastic sheathing. These cables freely slide within the guiding members 32 and 35 due to the relatively large radius of curvature of the grooves 31 and 34.

The window assembly of the present invention is provided with means for locking the glass panes in closed position. These means are shown in FIGURES 1, 3, 5 and 5a and comprise a vertically disposed cam member 36 secured at its upper end on a transverse rod 37 extending through one jamb and pivoted therein. There is one cam 36 associated with each of the lower glass panes 13 and 14, and these cam members 36 can enter the associated guiding tracks for these glass panes, they are disposed in notches 38 made in the jamb. A control rod 40 is pivoted at 41 to the inner leg of cam 36 freely extends in a groove 39 made in the jamb whereby a downward movement of rod 40 will cause cams 36 to project through a slot 42 made in the bottom of the associated guiding tracks so as to engage the top corner of the lower glass panes 13 or 14. The two cam members 36 for glass panes 13 and 14 are rigidly secured to the cross rod 37 so that by pulling down on control rod 40 the inner cam member and the outer cam member will be pivoted outwardly to engage and lock the glass panes. As shown in FIGURE 5a, the lower end of control rod 40 is bent twice at right angles and passes through an inverted L-shaped opening made in a face plate 52 to be secured to a slide actuator button 53. Upward and then lateral movement of button 53 causes the bent portion of rod 40 to engage the horizontal leg of opening 51 to thereby maintain rod 40 in upper limit position and consequently to retract the cam members 36 into glass pane releasing position.

The window assembly of the present invention is used and operates as follows:

In the closed locked position of the window panes as shown in FIGURE 1, the locking cam members 36 engage the top edge of the inner and outer lower glass panes 13 and 14 as shown in FIGURE 5. Thus the lower glass panes cannot be moved downwardly due to their connection to the lower glass panes by the cables 30. To open the window, the button 53 is moved upwardly and locked in its upper position to clear the lower inner glass pane and the latter is lifted by its handle 16. Lifting of the lower inner glass panes will cause downward movement of the outer top glass pane 7 under its own weight. Thus automatically, the window is opened to the exterior by the simple manipulation of the lower inner glass pane and indirect ventilation results, that is, air will enter through the top of the window, then circulate between the two pairs of glass panes and enter the room underneath the lifted lower inner glass pane.

If desired, indirect ventilation can be produced with the air entering underneath the lift outer lower glass pane 14 circulating upwards between the pairs of glass panes to enter the room over the lowered top inner glass pane 8. To attain this result, it is necessary to first lift the lower inner glass pane 14 to have access to the outer lower glass pane 13 and the latter is lifted whereby the inner upper glass pane 8 is automatically lowered and then the inner lower glass pane 14 is lowered again into closed position.

Moreover, direct ventilation can be obtained through both the top and bottom of the window by raising the two lower glass panes which automatically lower the two upper glass panes.

To remove the glass panes from the window frame, the lower inner glass pane 14 is partially lifted, then its support blocks 25 are held stationary while further lifting the lower inner glass pane 14 to disengage the latter from the grooves 24 of blocks 25. Then the glass pane is pressed laterally against the strip 22 and springs 23 in the left hand guiding track 20, to thereby clear the right hand guiding track 19 whereby the glass pane can be easily removed for cleaning, storing repair or the like. The same procedure is repeated in succession for the inner top glass pane 8, the outer lower glass pane 13 and the outer upper glass pane 7.

All the guiding tracks, handle elements and sealing strips are preferably made of a vinyl plastic such as the vinyl manufactured under the trade name "Grom" by B. F. Goodrich Company. This is a weather resistant and long lasting material.

If necessary, the means may be provided at the support blocks 25 or 27 to adjust the effective length of the cables 30 and 33. However this has not been found necessary in practice due to the dimensional stability of steel cables and also to the play afforded by the relatively deep channel members in the lintel.

From the foregoing, it will be clear that the window construction of the present invention forms a double hung window, and that manipulation of the lower inner glass pane is sufficient to open the window to let air in the room, contrary to conventional arrangements of double window assemblies in which it is necessary to manipulate both the inner and outer window units to provide for air circulation.

While a preferred embodiment in accordance with the present invention has been illustrated and described, it is understood that various modifications may be resorted to without departing from the spirit and scope of the appended claims.

What we claim is:

1. In a window construction having a window frame and an inner pair and an outer pair of vertically slideable glass panes in engagement with guiding tracks in the
jambs of said window frame, a suspension system for said glass panes comprising for each jamb and for each guiding track support blocks having upwardly opening grooves made therein removably receiving the lower corners of said glass panes, said blocks being in guided and slidable engagement with said guiding tracks first flexible cable means connected at their ends to said blocks and supporting in counterbalancing manner the lower glass pane of the inner pair and the top glass pane of the outer pair, and second flexible cable means connected at their ends to said blocks and supporting in counterbalancing manner the top glass pane of the inner pair and the lower glass pane to the outer pair, and guiding members at the top of said jambs engaging said cable means for guiding the same in a curved path.

2. In a window construction as claimed in claim 1, wherein said guiding tracks include channel members for directly receiving the side edges of said glass panes, said channel members having inwardly directed lips engageable with the faces of said glass panes, said support blocks having vertical lateral grooves for slidably receiving said lips which retain said support blocks in slidable engagement.

3. In a window construction as claimed in claim 1 wherein said guiding members consist of two flat elements facing and in contact with each other, each contacting face having a curved groove offset with respect to the groove of the other flat element, said curved grooves slidably receiving said first and second cable means along separate paths, said grooves being in register with the respective guide tracks of said glass panes.

4. In a window construction as claimed in claim 1, wherein said window frame has a sill, a sill covering member spacedly disposed on said sill and adapted to abut the lower glass panes in the closed position of said panes, said covering member having a ventilating slot made therein in the zone between said lower inner and outer glass panes, and means for adjustably closing and opening said slot.

References Cited in the file of this patent

UNITED STATES PATENTS

2,084,715 Verhagen June 22, 1937
2,120,359 Hartmann June 14, 1938
2,373,762 Krehbiel Apr. 17, 1945
2,503,606 Anderson Apr. 11, 1950
2,597,539 Smart May 20, 1952
2,601,476 Weatherstone June 24, 1952
2,807,838 Perry Oct. 1, 1957
2,896,248 Gillespie July 28, 1959
2,950,756 Moloney Aug. 30, 1960
2,987,758 Osten June 13, 1961