

Dec. 23, 1952

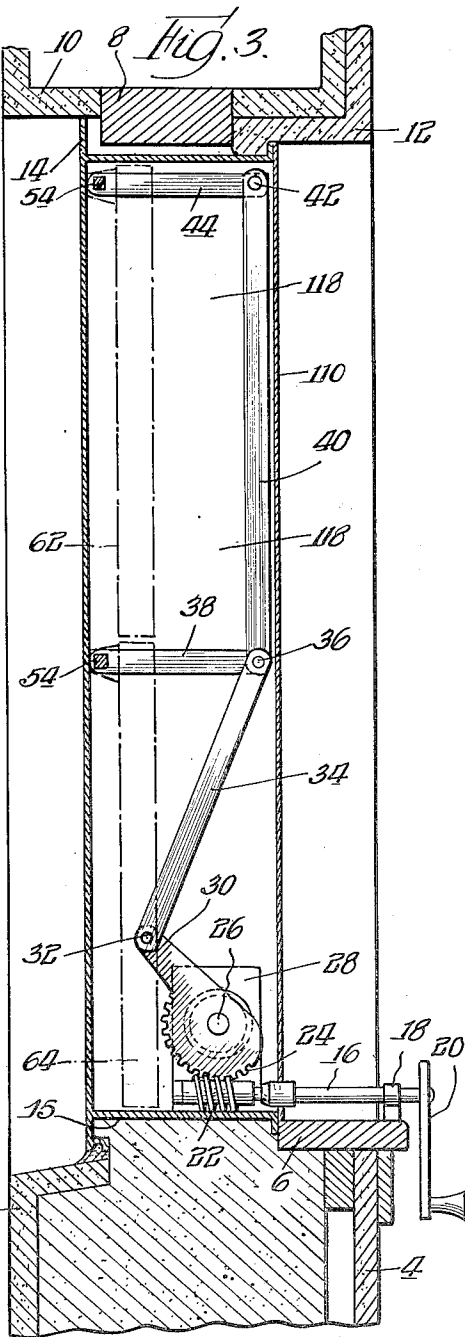
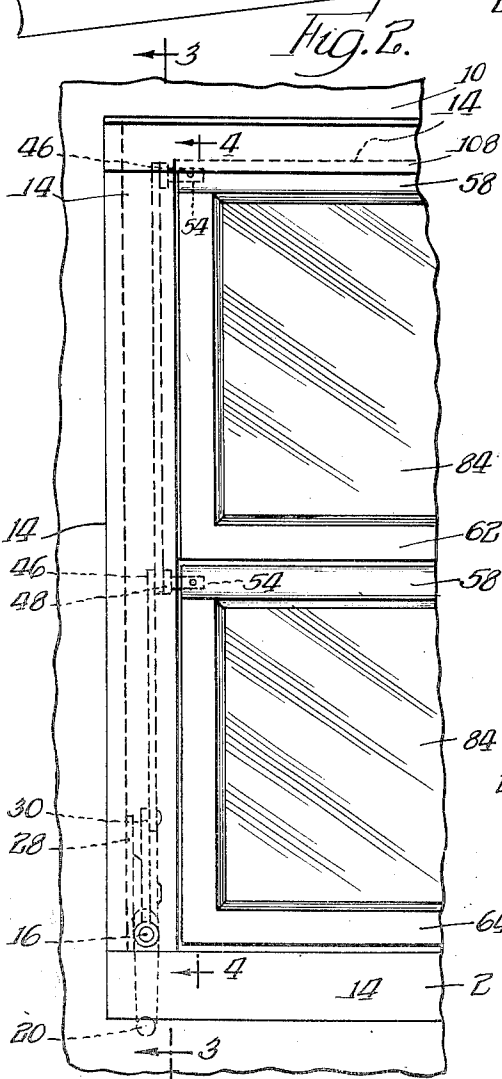
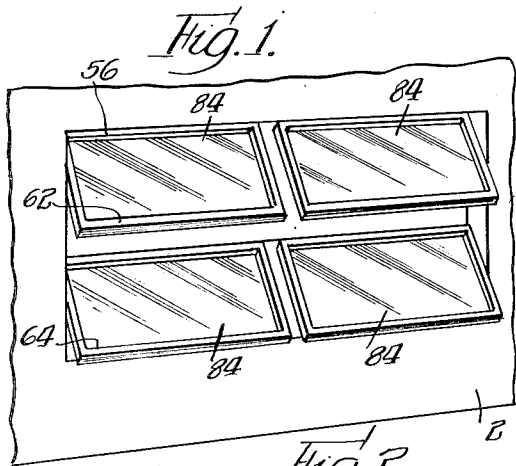
H. W. THOMAS

2,622,672

AWNING TYPE WINDOW

Filed Dec. 5, 1945

4 Sheets-Sheet 1



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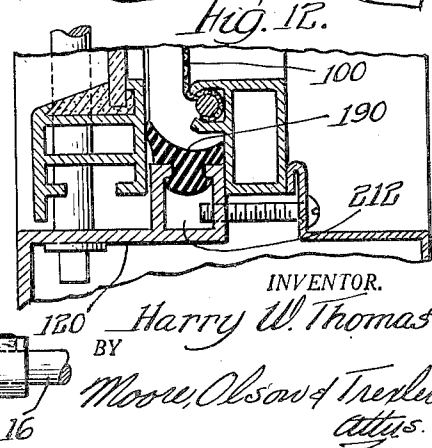
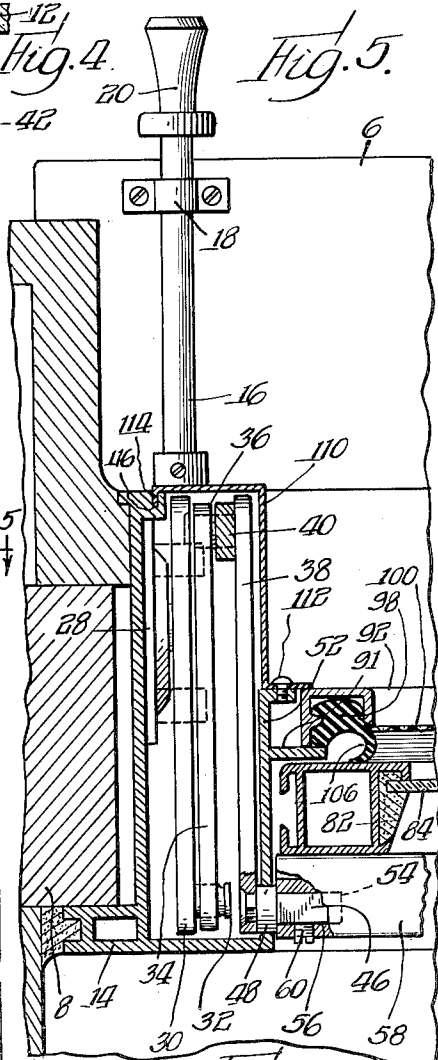
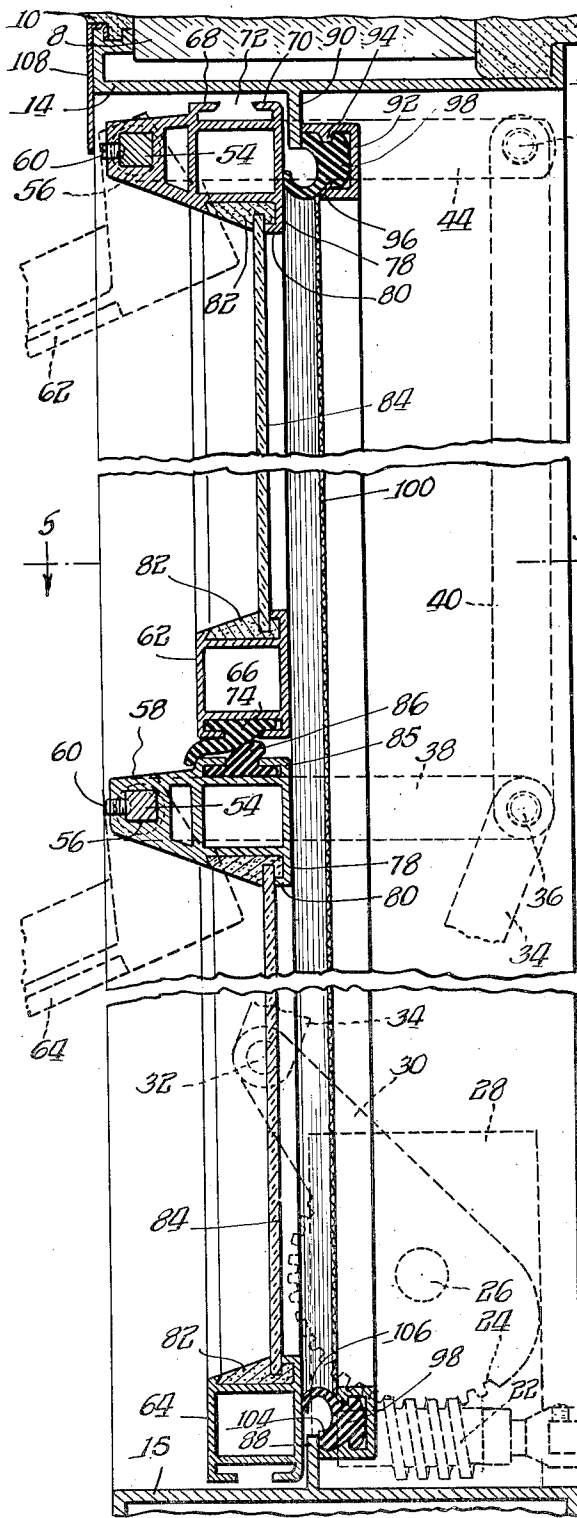
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H. W. THOMAS
AWNING TYPE WINDOW

2,622,672

Filed Dec. 5, 1945

4 Sheets-Sheet 2



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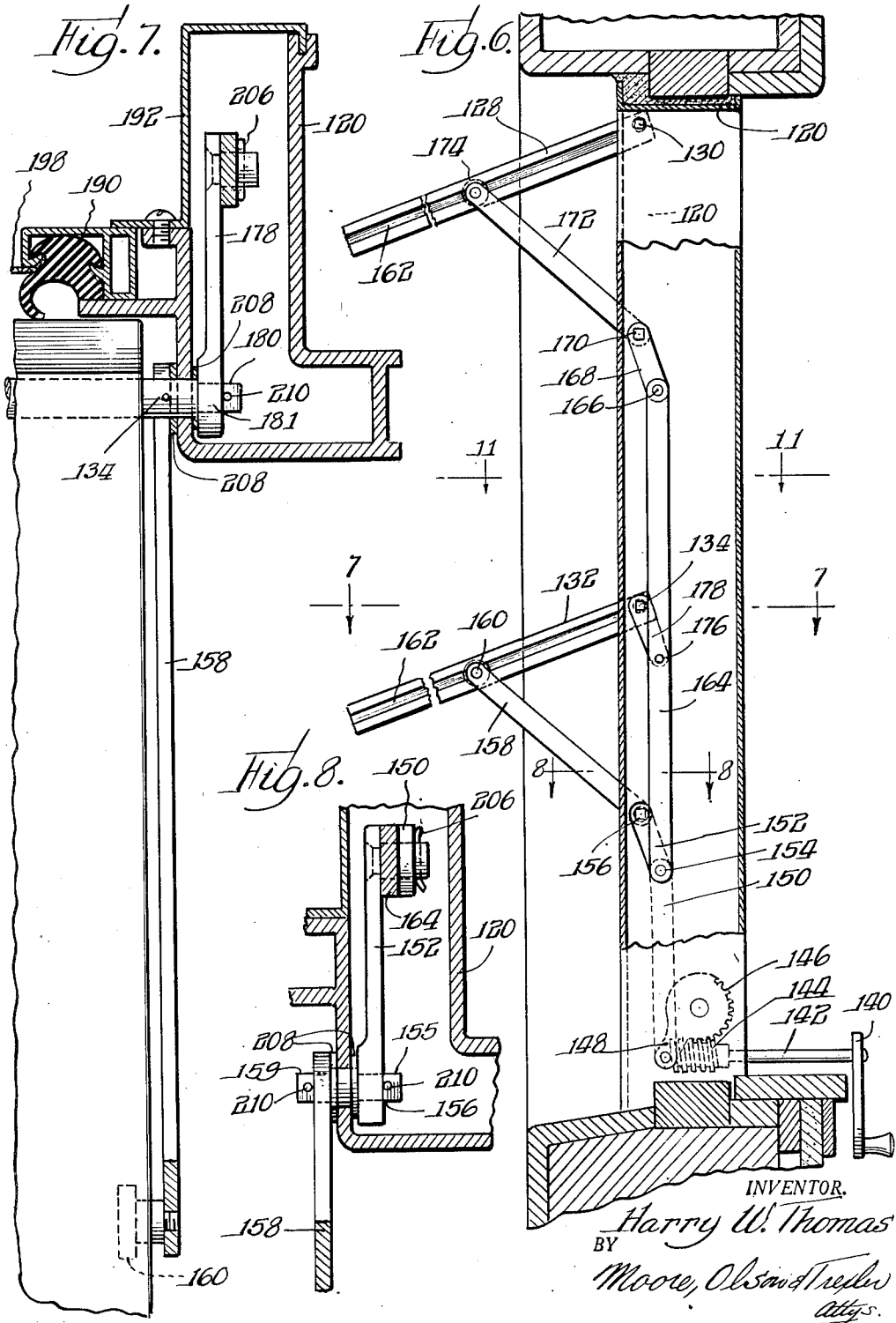
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H. W. THOMAS
AWNING TYPE WINDOW

2,622,672

Filed Dec. 5, 1945

4 Sheets-Sheet 3



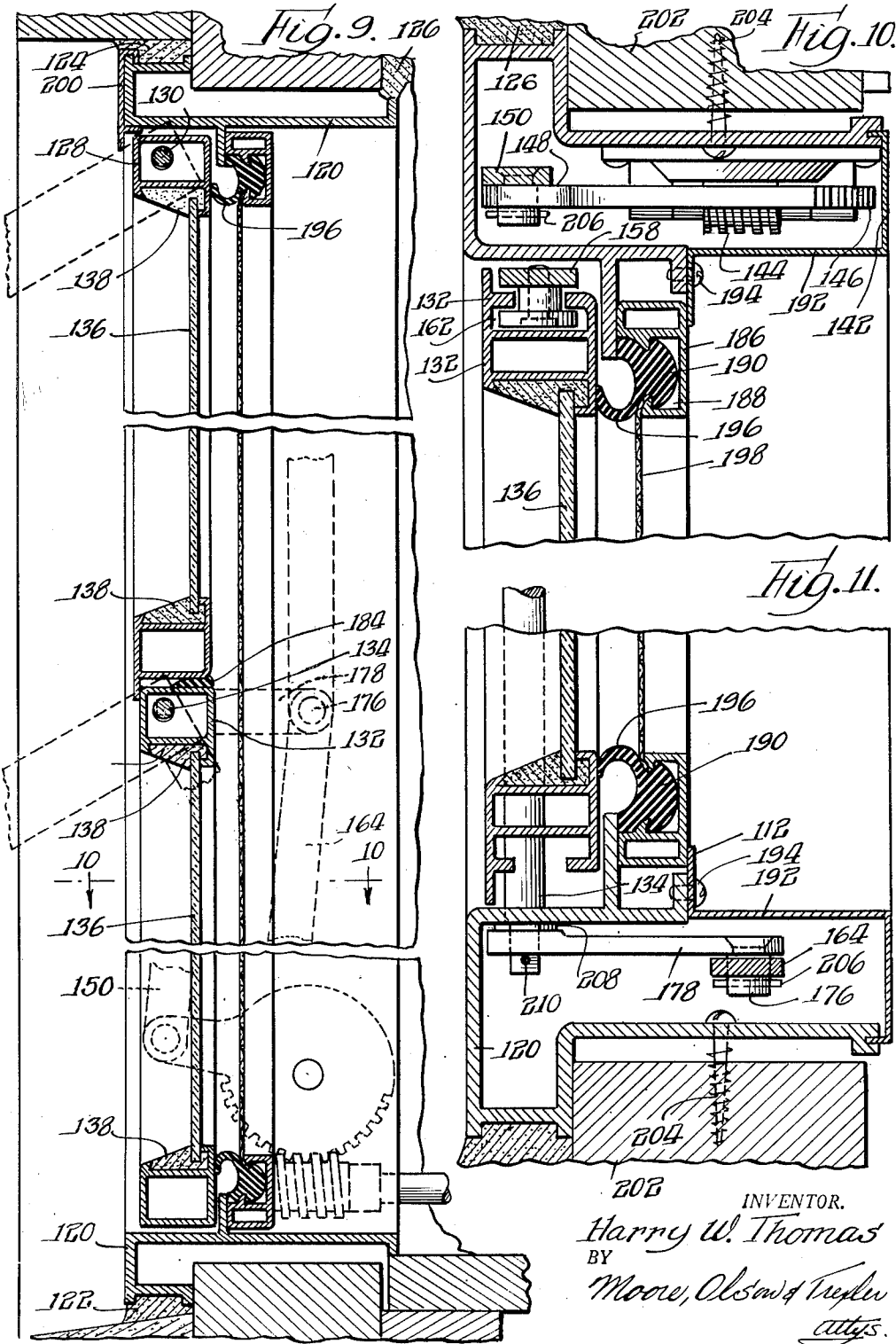
Dec. 23, 1952

H. W. THOMAS
AWNING TYPE WINDOW

2,622,672

Filed Dec. 5, 1945

4 Sheets-Sheet 4



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UNITED STATES PATENT OFFICE

2,622,672

AWNING TYPE WINDOW

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Application December 5, 1945, Serial No. 632,900

9 Claims. (Cl. 160-40)

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This invention relates to window structures, particularly of the so-called awning window type, and to mechanism for operating the same.

In warm climates ordinary window sashes are not particularly adapted to provide the maximum free circulation of air, both in inclement weather as well as on sunshiny days.

According to this invention there is provided an awning type window which can be opened to an angle of seventy degrees from the vertical to assure maximum ventilation. The positioning of the window sash is such that it acts as an awning, preventing the beating in of rain. The operating mechanism is entirely concealed but easily accessible for adjustments. The construction of the invention is such that insect screens are easily applied and removed when window cleaning is necessary. The construction further is such as to provide an automatic lock for each of the window openings when the windows are closed.

Among the other objects of the present invention are to provide an awning type window and sash and hardware construction designed so that the sash can be installed or removed from a window frame without having to remove substantially any of the surrounding members of the jamb or sill; to provide an awning type window of preferably metallic construction wherein the metallic window frame is provided with spaced vertically extending hollow stiles forming housings in which at least a portion of the operating means may be housed for simultaneously operating a plurality of metallic sashes disposed in vertically superimposed relation within the window frame and shiftable on horizontal pivots located adjacent the top rails of each of the sashes and wherein operating means preferably comprising a worm gear and worm, are mounted on one of the inner walls of one of the metallic stiles whereby the worm gear and worm and the linkage mechanism interconnecting it to each of the sash rails are readily accessible for installation and repair simply by removing a detachable wall member of said stile in which the worm gear and worm are mounted.

Yet another object of the invention resides in providing an awning type window comprising a metallic frame member embodying two spaced apart vertically hollow stiles and a bottom sill member providing a lower horizontal imperforate sill surface presenting a substantially unobstructed horizontal sill free of operating mechanism and wherein sash operating means including a worm gear and interconnected worm are

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mounted on one of the lower wall portions of one of the hollow stiles substantially at the base thereof and within the vertical projection of the stile walls, there being linkage mechanism disposed in said hollow stile and detachably interconnecting to at least one of the ends of each of the horizontally swingable metallic sash members which metallic sashes being pivoted at their opposite ends to the adjacent metallic stile walls to swing in horizontal axis into closed position substantially to a common plane and to swing outwardly simultaneously in open position, said hollow stile having an opening extending substantially throughout its vertical dimensions whereby said worm and gear mechanism and the linkage connections between the worm and gear mechanism and said sash rails are exposed and wherein there is a detachable stile wall adapted to close the opening in said stile whereby to completely house the operating mechanism within the stile while rendering the same substantially accessible for repair, installation or replacement.

Yet another object of the invention resides in providing an awning type window comprising a metallic frame of rectangular formation and providing one or more vertical hollow stiles forming one or more of the side members of the frame and a substantially horizontally disposed bottom sill, there being a plurality of vertically disposed metallic sashes mounted in said frame between the vertical stiles thereof, each of the upper rails of each sash having means horizontally pivotally disposed within the confines of the upper sash rail and pivoted to said stiles whereby the said sashes are disposed in vertical superimposed position and to close into a common vertical plane, and to provide a power actuator for simultaneously swinging said sashes to open and closed position comprising a turnable operator wherein the operator is mounted within a stile and wherein means is provided for interconnecting the actuator with each end of each sash adjacent to the top rail thereof, said means including linkage mechanism disposed in vertically arranged relation within at least one of said vertical hollow stiles of the window frame and including at least one horizontally disposed shaft interconnecting said operator and certain of said linkage mechanism for simultaneously actuating the opposed rails of each sash, said transmission shaft being horizontally disposed and lying between the spaced vertical stiles of the window frame and being completely hidden and in a manner to leave the upper surface of the sill unobstructed.

Yet another object of the invention resides in

the construction and arrangement of the upper rail of each horizontally pivoted sash and its connections with the power operated mechanism for simultaneously opening and closing the plurality of the disposed sashes which are arranged in vertically disposed position between the vertical stiles of the window frame and which open and close in a single vertical plane, each upper rail of a sash including a construction and arrangement whereby such upper rail forms a rigidifying strut to facilitate the pivotal swinging of the said window frame about said upper sash as a horizontal axis.

Yet another object of the invention resides in the construction of an awning type window comprising a series of sashes arranged to be horizontally pivoted to swing about separate horizontal axes to closed position in a common vertical plane with respect to a metallic window frame wherein the upper rail of each sash is provided with a strut-like rigidifying extension adapted rigidly to receive therein a pivotal member which is power turned at one end by a suitable linkage mechanism whereby effectively to pivotally swing the sash from one or, if desired, from both of its ends.

Yet another object of the invention resides in providing each upper rail, of a vertically disposed series of metallic sashes of an awning window of the type wherein the plurality of sashes close in a vertically extended plane, disposed between metallic stiles of the window frame and wherein each upper rail of each such sash is hollow and receives therethrough a turnable shaft which shaft has linkage mechanism connecting at one end only thereof to power mechanism disposed in a hollow stile of the window frame for power operating said shaft from one end only thereof and wherein said shaft passes through the hollow sash and at its opposite end beyond the side rail of said sash is provided with linkage connections to certain other of the sashes whereby to insure the simultaneous operation of all the said sashes from the common power source.

Yet another object of the invention is to provide a construction as just set forth, a power operating mechanism comprising a worm and gear device wherein the turnable gear is journaled on one of the vertical walls of the hollow stile of the metallic window frame and wherein suitable linkage mechanism is connected therefrom to the power transmission shaft which passes through the hollow upper rail of the window sash.

Still other objects are to provide an awning type window wherein the window sashes are constructed to receive yieldable weatherstripping between the upper and lower windows to seal the joint therebetween; to provide an awning type of window wherein an improved power operating connection is provided between the window sash and the adjacent frame at one side only for swinging the sash to open or closed position; to provide an awning type window associated with a screen disposed rearwardly thereof wherein the sash for the screen is provided with suitable resilient weatherstripping which not only seals the screen to the surrounding window frame but likewise to the upper and lower sashes of the two window sections that are positioned in front of the screen; to provide an improved type of lever linkage mechanism for operating simultaneously the two or more window sashes of an awning type window; to provide an improved construction of awning type window wherein the window sash is

formed of metal pieces of uniform cross section suitably joined together at the corners to provide a rectangular frame to receive a pane of glass or the like, and wherein said cross sectional shapes are provided with grooved portions not only to receive putty and the like to retain the pane in position, but wherein they are provided with additional oppositely extending grooves to receive flexible weatherstripping so that when two of such sash members are in adjacent, spaced apart relation, the weatherstripping of each sash will contact and provide a flexible sealed joint therebetween; to provide in a window structure, in combination with a window frame having a head, opposed spaced side jambs and a sill, opposed, spaced pairs of hinge members mounted on the frame between the head and sill, a plurality of sashes mounted in the space between the side jambs and between the head and sill of the frame, spaced pairs of hinge elements carried by each sash for connection with the respective pairs of hinge members on the frame, at least one of said hinge elements including a slidable pin hingedly connecting hinge elements on the frame and sash, said pair being slidable in a straight line movement relative to a longitudinal axis of the frame member of a sash to disconnect said pivotal hinge connection between said end of the sash and an adjacent portion of the frame, an arm operatively connected to a pivotally mounted sash and having a free end projecting rearwardly of the side jambs of the frame, a shaft mounted on the frame, a crank arm on said shaft, a plurality of operating rods within the spaced side jambs of the frame and connecting a plurality of operating arms, and manually operated gearing means carried by the frame and operative to move the sashes in unison; to provide these and other objects of invention, as will be apparent from a perusal of the following specification when taken in connection with the accompanying drawings, wherein:

Fig. 1 is a perspective view of the front of an awning type window installation;

Fig. 2 is a front view of a portion of an installation;

Fig. 3 is a vertical section taken on the line 3—3 of Fig. 2;

Fig. 4 is a vertical section taken on the line 4—4 of Fig. 2;

Fig. 5 is a plan sectional view taken on the line 5—5 of Fig. 4;

Fig. 6 is a sectional elevation of a window installation showing another embodiment of this invention.

Fig. 7 is a sectional view of an enlarged scale taken along the line 7—7 of Fig. 6.

Fig. 8 is a sectional view on an enlarged scale taken along the line 8—8 of Fig. 6.

Fig. 9 is a sectional elevation of the window installation shown in Figs. 7 and 8 taken on a larger scale showing further details of construction.

Fig. 10 is a sectional view taken on the line 10—10 of Fig. 9 and shown on a still larger scale and showing the lower sash and the power operating connections.

Fig. 11 is a partial plan sectional view through the upper sash and the transmission shaft for the lower sash as seen when taken along line 11—11 in Fig. 6, but with the windows in a closed position.

Fig. 12 is a fragmentary sectional view, similar to Fig. 11, of a modified form of construction

in which a different arrangement of the weatherstripping is employed.

Referring now to the drawings in detail, the improved awning type window comprises any type of outer masonry sill member 2 and an inside frame member 4 adapted to receive an inside window sill 6. In addition there is a top frame member 8 and a front and back masonry construction 10 and 12 associated with said frame member, all to provide a rectangular opening to receive a rectangular metallic window frame 14 which is adapted to fit or be positioned in the masonry as shown in Figs. 2 and 3 and 4. As shown in Fig. 3, on one side, preferably the left side as shown in Fig. 2, of the metallic window frame 14, the same is formed hollow to provide a housing or compartment where the mechanism for raising and lowering the sashes is housed, so that it cannot be seen from the outside or from the inside. The lower horizontal portion 15 provides an imperforate sill against which the lower sash of the window closes. This sill is substantially horizontal and is substantially free of obstructions entirely thereacross whereby a clear and unobstructed view is insured. Projecting rearwardly inwardly from the housing at the lower corner thereof is a shaft 16 operating in a bearing 18 affixed to the sill 6. The inner end of the shaft 16 carries a handle 20 for turning the same. The shaft 16 has on its opposite end a worm 22 gearing with a toothed sector 24 on a shaft 26 mounted on plates 28 disposed in the side jambs of the frame or housing. The sector 24 has an arm 30 pivotally connected as at 32 with a lever 34. This lever in turn is pivotally connected at 36 with a shorter lever 38, and the pivot 38 in turn connects with another longer lever 40 which is pivotally connected as at 42 with another shorter lever 44. The levers 38 and 44, as shown in Fig. 3, carry at their inner ends a short pin 46. As shown in Figure 5, this pin has a round portion 48 turnable in a bearing of the stationary frame member 52, and also has a squared portion 54 adapted to slide endwise into a square-shaped socket 56 in a rigid lateral extension or projection 58, either cast integrally with one of the shiftable sash members which are preferably metallic hereinafter to be described or suitably integrally joined thereto. The pin 46 may be assembled by moving it endwise so that its squared end 54 slides into the socket 56, and its round portion 48 slides into the bearing in the frame member 52. Thus, the sash is connected to the window frame for pivotal movement about the axis of the pin 46, which axis extends in substantially the same horizontal plane as the upper rail of the sash, as shown in Fig. 4. The sash may be disassembled from the window frame by moving or sliding the pin 46 axially outwardly from the socket 56. If desired a set screw 60 may be used to restrain the square shaft against endwise disconnection from its square socket 56 in the sash projection 58. Upon suitable shifting movement of the levers 38 and 44 the two sash members 62 and 64, the same being the upper and lower sashes, will be shifted to the dotted lines shown in Fig. 4 or will be shifted from the dotted line position to the closed position. The sash operating mechanism is thus disposed at one side only of each window sash and simultaneously operates all the sashes equal distances in opening and closing operation. The other end of the top rail of the sash may be suitably pivotally mounted to the window frame to permit this opening and closing operation.

Removal of the sash from the frame may be effected by endwise withdrawal of the pin 46 and withdrawing the bearing 48 and the pin 46 endwise from the circular stationary bearing in which the round bearing 48 is turnable. This disconnection may be accomplished only from the inside or inboard side of the window, due to the fact that the window frame 14 always prevents access to the pivot pin 46 from the outer or front side of the window.

Each window sash is composed of a preferably metallic frame of identical section except for the projections 58 which are cast integrally with or fastened to the upper rails of each window. The rails are formed of the cross sectional shape shown at 62 in Figure 4 and include a central hollow portion 66 and two upper inwardly extending flanges 68 and 70 forming a narrow pocket 72 therebetween, which pocket is wider inside of the flanges 68 and 70 than at the mouth between the flanges, whereby to receive and hold a weatherstripping 74 of preferably resilient material of the general shape shown at 74 in Fig. 4. The opposite wall of the sash includes an integral, downwardly extending wall 78 and a relatively short flange or toe 80 to provide a pocket 82 to receive putty and other glazing material. The window pane 84 is shown as securely held in position by the toe 80 and the putty 82 in the pockets. It will be noted that the upper rail 85 of the lower window sash is likewise configured of the same cross section to receive a resilient weatherstripping 86 which in association with the weatherstripping 74 is adapted to seal the junction of the two swingable window sashes when in closed position as shown in Fig. 4.

Immediately to the rear of the window sashes as in their closed position, the metallic frame member 14 at the bottom is provided with an upstanding, relatively short wall or partition 88 to provide a stop for the inner position of the lower window sash, and a weatherstrip is also provided to prevent moisture from entering to the rear of the sash from the outside. The upper frame 15, see Fig. 4, is provided with a similarly formed, downwardly extending flange 90 which accomplishes a similar function. There is also a side flange on either side of the frame as shown at 91 in the Fig. 5. These side frames 91 in each instance provide a means for positioning the screen frame 92. This screen frame is shown as comprising a hollow, square-like cross section having an inwardly extending lug 94 and an oppositely extending lip 96, which are adapted to receive and hold therebetween a screen weatherstripping 98. This screen weatherstripping being of flexible material, in cooperation with the lip 96 is adapted to clinch the screen 100 firmly in position between the top and the bottom and side screen frame portions 92. This weatherstripping 98 which thus entirely surrounds the screen frame 92 has one portion 104 which yieldingly contacts the rear wall of the frames 88 and has an additional spaced portion 106 which yieldingly contacts the back of the lower frame of the lower window sash. This weatherstripping 98 forms a weatherstripping completely around all four sides of the screen and the portion 104 contacts at all places the rear wall of the sashes of the various window panes.

Thus when the two window sashes shown in Fig. 4 are closed, the weatherstripping 74 and 86 seals the horizontal joint therebetween and the weatherstripping portions 106 and 104 seal

against the rear face of the sashes of the windows and against the rear faces of the flanges 88 and 90, completely around the margins of the windows.

In addition to the foregoing, the front wall of the frame 14 is provided with a depending guard 108 which prevents the entrance of moisture into the space between the upper window sash and the frame member 14.

In addition there is a cover plate 110 which is attached at 112 to the side frame 52 and has a laterally turned in flange 114 which fits into a groove 116 of the main frame 14 to form a vertical compartment 118 wherein the operating mechanism is enclosed, so as to be hidden from both inside and out. Removability of the cover 110 permits easy access to the maintenance of the operating mechanism. It will be noted that the removal of the endwise disconnectible hinge pin 46 may be accomplished only from the inside of the window by removing the cover plate 110 to provide access to the pin 46.

Modified construction

Referring now to Figs. 6, 7, 8, 9, 10 and 11, the metallic window frame 120 is fitted in the building opening and caulked at 122, 124, and 126. As shown in Figure 9, a hollow metallic sash 128 is fixedly mounted on a shaft 130 suitably journaled in openings in the frame. Similarly, a low hollow, metallic sash 132 is fixedly mounted on a transmission shaft 134 hereinafter described, likewise journaled in the frame 120. Also as shown in Figure 9, the sashes 128 and 132 are provided with preferably glass panes 136 secured by means of putty or similar glazing material 138.

Means for operating these sashes simultaneously comprises a crank 140 which is secured to a shaft 142 which carries a worm 144 engaging a toothed wheel or sector 146. The wheel or sector 146 is formed with an arm 148 which is pivotally connected to the thus manually shiftable vertical link 150. The vertical link 50 is connected to a linkage mechanism which is partially shown in dotted lines in Fig. 9 and which is identical to the mechanism at the opposite side of the window sash shown in Fig. 6. Thus the link 150 is pivoted to a short link identical to the link 152 by pin 154.

As shown in Figure 8, the other end of link 152 engages one squared end 155 of a shaft or pin 156, which shaft is rotatably journaled in the metallic window frame 120. One end of a link 158 is provided with a square hole which fits over and is thus secured to the opposite or other squared end 159 of the shaft or pin 156 so that links 158 and 152 form in effect a bell crank lever, as can be seen by reference to Fig. 8. The construction is such that both links 152 and 158 will traverse the same angle upon motion of either. The end of link 158 is provided with a roller 160 adapted to engage the sidewalls of the channel 162 formed in the sash 132 as can readily be seen by reference to Figs. 6, 7, and 10. A power link 164 extends between pin 154 on the lower sash linkage and pin 166 on the upper sash linkage. Connected to the upper end of power link 164 by pin 166 is a short link 168 similar to link 152. One end of link 168 is secured to one squared portion of a shaft 170 rotatably journaled in the frame 120 to the other squared portion of which shaft 170 there is fastened one end of a link 172 similar to link 158. The other end of link 172 carries a roller 174 similar to

roller 162 adapted to ride in a groove in the side rails of sash 128 similar to groove 162 in sash 132.

Pivoted to the power operated link 164 by pivot pin 176 there is a short link 178. The other end of link 178 is secured to the squared portion 180 of the transmission shaft 134, see Figure 7. It will be clear that as the link 164 shifts link 158 to sash open position, the transmission shaft 134 will likewise rotate and shift the sash 132 to open position. The transmission shaft 134 like the transmission shaft 130 is secured to both vertical side rails of the sash so that in the lower window there are two forces tending to rotate the window both to open and closed position. The force imparted to the side rail through which the roller 160 acts, is thus transmitted through the shaft 134 to the other side rail of the sash, minimizing lateral warping of the sash. The transmission shaft 134 see Figs. 6 and 9 is connected at its opposite ends with identical links 178 which are in turn pivoted to identical links 164. This linkage is duplicated on both sides or both sides of the window sash except that the operating mechanism and the power link 150 are omitted on the side shown. The transmission shafts insure that the linkage on both sides of the sashes operate in unison. The construction can be seen by reference to Fig. 11 in which power from the transmission shaft 134 is transmitted to the link 178 which is pinned to vertical link 164. The window is operable and may be operated without the use of the short link 178 which is auxiliary to the main opening force exerted through the link 158. It may be omitted as shown in the operating arrangement of the upper sash. The upper shaft 130 of the upper sash 128 is secured for rotation with both vertical or side rails of the sash 128.

Secured to the upper portion of the lower sash 132 there is provided a gasket of rubber or other suitable resilient material 184 against which the lower rail of the upper sash 128 is adapted to seal. An insect screen frame 186 is provided with a peripheral channel portion 188 in which elongated strips of resilient material such as rubber 190 are adapted to be housed as can readily be seen by reference to Figs. 9, 10, and 11. The screen frame is positioned by means of plates 192 held by screws 194 to the metallic window frame 120. The rubber or resilient sealing strips 190 are formed with extensions 196 against which the upper portion of the upper sash, the side portions of both the upper and lower sashes and the lower portion of the lower sash are adapted to seal as can readily be seen by reference to Figs. 9, 10, and 11. The rubber strips are formed with button-like projections 190 adapted to seat in the channel portions 188. Clamped between the screen frame 186 and the resilient strips 190 is the insect screen 198 proper. The entire screen can be readily removed for cleaning the inside of the windows by simply removing the retaining plates 192. When the windows are in closed position, they are sealed around their peripheries by the sealing strips 190 and at their juncture transversely by the sealing strip 184. The mechanism which operates the windows is at once a locking mechanism holding the windows in locked position. The plates 192 which hold the screen frame in position also act as cover plates to conceal the operating hardware as can readily be seen by reference to Figs. 10 and 11. A snap-on shield 200 is secured to the upper portion of the window frame 120 as can be seen by reference to Fig. 9.

The frame is secured to the studding 202 by wood screws 204. Spring clips 206 are used over grooved portions of the pivot pins or shafts to hold the parts in assembled position. Fiber washers 208 are used to provide bearing surfaces and seal against leakage of rain water. The links secured to squared portions of shafts are provided with set pins 210 to hold the parts in assembled position.

Referring now to Fig. 12, and comparing it with Fig. 11, it will be apparent that the weatherstripping 190 is lodged in a channel portion 212 formed in the window frame 123. The sash is adapted to seal against one lip of the weatherstripping in closed position as shown and the screen sash against the other lip of the weatherstrip 190.

It will be seen that the objects of the invention have been accomplished. There is provided an awning type window which can be opened to an angle of seventy degrees from the vertical to assure maximum ventilation. The operating mechanism is entirely concealed but easily accessible for adjustments. Insect screens are easily applied and removed and the weatherstripping at once acts to hold the insect screens in place in the screen frame. The construction is such that when the windows are closed they are automatically locked into place. The cross connection of the side rails of the sash through the transmission shafts and the duplication of the linkage enables the use of operating mechanism on one side without the distortion of the sash in the process of opening and closing windows. If desired, a dual opening action may be exercised by the addition of a simple short link.

It will be understood that certain features and sub-combinations are of utility and may be employed without reference to other features and sub-combinations. This is contemplated by and is within the scope of the claims. It is further obvious that various changes may be made in details within the scope of the claims without departing from the spirit of the invention. It is, therefore, to be understood that this invention is not to be limited to the specific details shown and described.

Having thus described my invention, I claim:

1. A window including in combination a window frame, a pair of sashes adapted to be pivoted adjacent their upper ends to said frame, means secured to each of said sashes adjacent their upper ends and journaled in said window frame for pivotally mounting the sashes to said frame, a pair of short shafts journaled in said window frame, a vertically extending link, means operated inboard of said window for raising and lowering said vertically disposed link, linkage means interconnecting said vertically extending link and said pivot means for turning said pivot means upon movement of the vertical link, a pair of short links pivoted to said vertical link at one of the respective ends of said short links, means for securing the other respective ends of said short links to each of said short shafts for rotation therewith, elongated grooves formed in the side rails of said window sashes, rollers positioned in said elongated grooves, long links rigidly carried by said short shafts at one of the respective ends thereof for rotation therewith, and said long links supporting said rollers at the other respective end thereof.

2. A window as in claim 1 in which the means for pivotally supporting the sashes comprises a pair of transmission shafts, and means for se-

curing said shafts to said sashes for rotation therewith.

3. A window construction comprising a rectangular metal frame including a substantially horizontal lower member forming a sill and a substantially horizontal upper member forming a head frame member, said frame including spaced, hollow vertical stiles, said hollow stiles having inwardly projecting vertically extending side flanges spaced inwardly from the outer faces of the stiles to form vertical abutments for the window sashes, a plurality of metallic window sashes each comprising upper and lower horizontal rails and vertical side rails disposed in rectangular formation, each sash when in closed position extending between the hollow stiles with the vertical side rails of the sashes abutting the vertical side flanges of the hollow stiles, pivot means disposed substantially in a horizontal plane including substantially the longitudinal center line of the upper rail of each sash and journaled in the vertical walls of the hollow stiles between the side flanges and the outer faces of the hollow stiles, an actuator mounted in one of said hollow stiles adjacent the sill and operating linkage within said hollow stile and connecting said actuating means to each of said sashes to swing said sashes on said pivots when said actuating means is operated, said sill and said head frame member having inwardly projecting flanges extending between the walls of the hollow stiles and a screen mounted in said window frame inwardly of said side flanges and said inwardly projecting flanges of the sill member and the head member, there being weatherstripping carried by said screen and abutting all of said flanges and all the rails of the sashes when the sashes are in closed position.

4. A window construction comprising a rectangular metal frame including a substantially horizontal lower member forming a sill, said frame including spaced, vertical stiles one of which is formed with a chamber, said stiles having inwardly projecting vertically extending side flanges spaced inwardly from the outer faces of the stiles to form vertical abutments for the window sashes, a plurality of metallic window sashes each comprising upper and lower horizontal rails and vertical side rails disposed in rectangular formation, each sash when in closed position extending between the stiles with the vertical side rails of the sashes abutting the vertical side flanges of the stiles, a pivot pin operatively connected to one end of one of the sashes and journaled in the wall of the adjacent stile to pivotally mount said end of the window sash, said pivot pin being mounted within the said adjacent wall of the chambered stile for endwise removal therefrom to permit withdrawal of the sash from the frame operating gearing mounted on the frame and operative link connections therefrom to each sash, certain of said operative link connections being mounted in said chamber of one of said stiles.

5. A window construction comprising a rectangular metal frame including a substantially horizontal lower member forming a sill and a substantially horizontal upper member forming a head frame member, said frame including spaced, hollow vertical stiles, said hollow stiles having inwardly projecting vertically extending side flanges spaced inwardly from the outer faces of the stiles to form vertical abutments for the window sashes, a plurality of metallic window sashes each comprising upper and lower hori-

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zontal rails and vertical side rails disposed in rectangular formation, each sash when in closed position extending between the hollow stiles with the vertical side rails of the sashes abutting the vertical side flanges of the hollow stiles, pivot means disposed substantially in a horizontal plane including the longitudinal center line of the upper rail of each sash and journaled in the vertical walls of the hollow stiles between the side flanges and the outer faces of the hollow stiles, an actuator mounted in one of said hollow stiles adjacent the sill and operating linkage within said hollow stile and connecting said actuating means to each of said sashes to swing said sashes on said pivots when said actuating means is operated, said sill and said head frame member having inwardly projecting flanges extending between the walls of the hollow stiles and a screen mounted in said window frame inwardly of said side flanges and said inwardly projecting flanges of the sill member and the head member, there being weatherstripping carried by said screen and abutting all of said flanges and all the rails of the sashes when the sashes are in closed position, and manually operable means controlling withdrawal of the pivot pins to permit removal of the sashes from the metal frame.

6. A window construction comprising a rectangular metal frame including a substantially horizontal lower member forming a sill and a substantially horizontal upper member forming a head frame member, said frame including spaced, hollow vertical stiles, said hollow stiles having inwardly projecting vertically extending side flanges spaced inwardly from the outer faces of the stiles to form vertical abutments for the window sashes, a plurality of metallic window sashes each comprising upper and lower horizontal rails and vertical side rails disposed in rectangular formation, each sash when in closed position extending between the hollow stiles with the vertical side rails of the sashes abutting the vertical side flanges of the hollow stiles, pivot means disposed substantially in a horizontal plane including the longitudinal center line of the upper rail of each sash and journaled in the vertical walls of the hollow stiles between the side flanges and the outer faces of the hollow stiles, an actuator mounted in one of said hollow stiles adjacent the sill and operating linkage within said hollow stile and connecting said actuating means to each of said sashes to swing said sashes on said pivots when said actuating means is operated, said sill and said head frame member having inwardly projecting flanges extending between the walls of the hollow stiles and a screen mounted in said window frame inwardly of said side flanges and said inwardly projecting flanges of the sill member and the head member, there being weatherstripping carried by said screen and abutting all of said flanges and all the rails of the sashes when the sashes are in closed position, manually operable means controlling withdrawal of the pivot pins to permit removal of the sashes from the metal frame, said manually operable means projecting from the pivots through the rail of the sash for manual operation.

7. In a window structure, in combination with a window frame having a head, opposed spaced side jambs and a sill, opposed, spaced pairs of hinge members mounted on the frame between the head and sill, a plurality of sashes mounted in the space between the side jambs and be-

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tween the head and sill of the frame, spaced pairs of hinge elements carried by each sash for connection with the respective pairs of hinge members on the frame, one of said hinge elements including a slidable pin hingedly connecting hinge elements on the frame and sash, said pin being slidable in a straight line movement in a direction parallel to a longitudinal axis of the frame member of a sash to disconnect said pivotal hinge connection between said end of the sash and an adjacent portion of the frame, an arm operatively connected to a pivotally mounted sash and having a free end projecting rearwardly of the side jambs of the frame, a shaft mounted on the frame, a crank arm on said shaft, a plurality of operating rods within the spaced side jambs of the frame and connecting a plurality of operating arms, and manually operated gearing means carried by the frame and operative to move the sashes in unison.

8. A window, including in combination a window frame, a sash, comprising a frame of upper and side rails, a turnable shaft mounted in the upper rail of said sash having rigid extensions projecting from opposite ends thereof and journaled in opposite sides of the window frame, a vertically extending link disposed adjacent one side of the window frame, means operable inboard of said window for raising and lowering said vertical link, a stub shaft rotatably mounted in said one side of the window frame, a short link pivoted to said vertical link, said short link being rigidly secured to said stub shaft for rotation therewith, an elongated groove formed in one side rail of said window sash, a roller positioned in said elongated groove, a long link operatively connected to said stub shaft for rotation therewith, said long link supporting said roller, a second vertical link disposed adjacent the opposite side of said window frame, a second short link rigidly connected to said first mentioned shaft and pivotally connected to said second vertical link, and linkage means connected to said second vertical link and the opposite side rail of the sash, causing actuation of the sash by forces applied to both side rails.

9. A window construction, comprising a rectangular window frame having a substantially horizontal sill and a pair of spaced vertically disposed stiles, at least one of said stiles including spaced vertical side walls and a front wall to provide a hollow chamber accessible only from the inboard side of the window, a plurality of superposed rectangular window sashes, each comprising horizontal upper and lower rails and opposed vertical side rails, said sashes being disposed between said stiles, socket means on an end of each upper rail adjacent said hollow stile, said hollow stile having a plurality of openings in one side wall in alignment with each of said socket means, a plurality of pivot pins each slidably and removably disposed through one of said openings and in engagement with one of said socket means to support pivotally said sashes on said window frame with one end of said pins extending into said hollow chamber, means for preventing relative rotation between said pins and said socket members, linkage means disposed within said hollow chamber, said linkage means being rigidly connected to said extending ends of the pins, whereby upon actuation of the linkage mechanism the pins and their associated sashes are rotated about an axis extending through the upper rails of the sashes, and turnable actuating means disposed within said hollow stile and con-

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nected with said linkage mechanism, said actuating mechanism including a rotatable shaft extending rearwardly out of the hollow stile, said pivot pins, linkage mechanism, and actuating mechanism being accessible only through the open inboard portion of the hollow stile.

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