July 23, 1940. R. H. BLISS 2,208,889

WINDOW OPERATOR AND LOCK

Filed April 25, 1938 2 Sheets-Sheet 1

Fig. 1

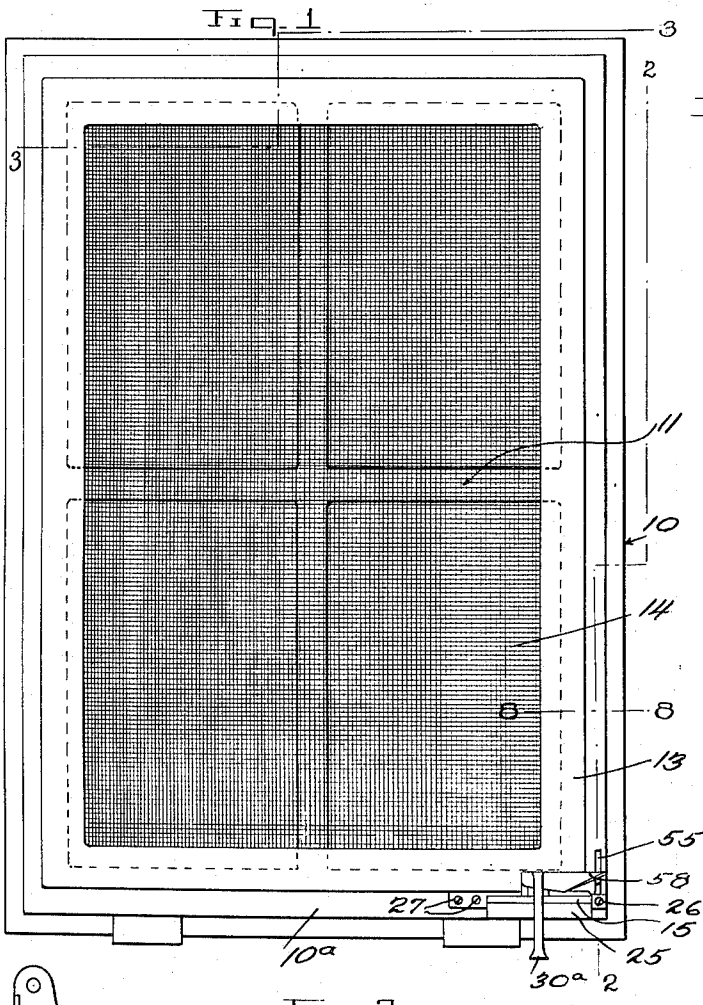


Fig. 2

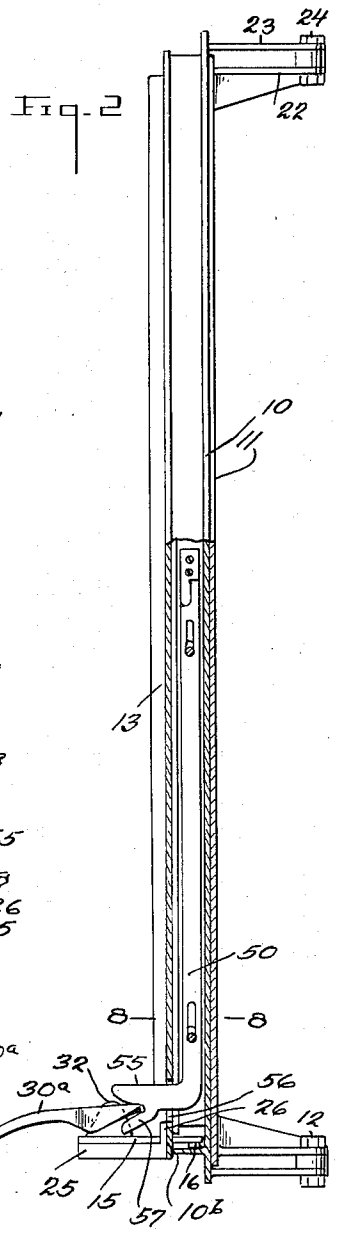


Fig. 3

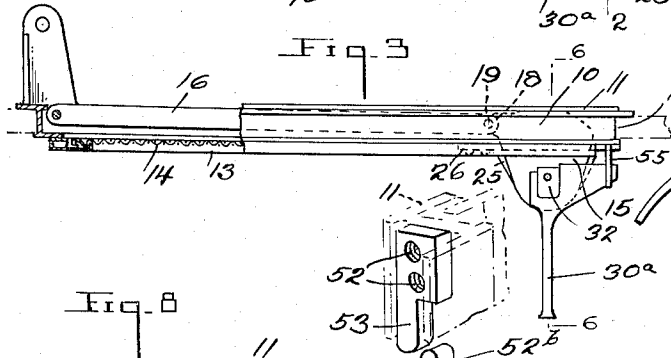
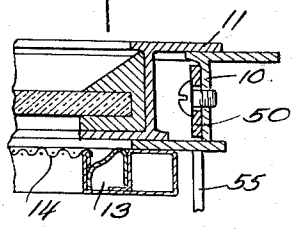


Fig. 8



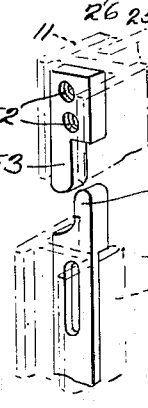


Fig. 9

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Fig. 4

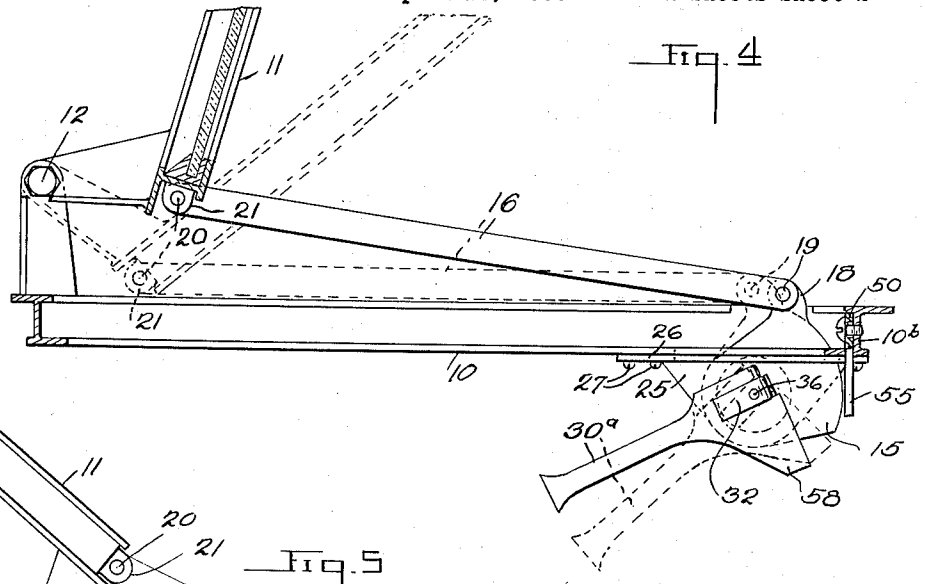


Fig. 5

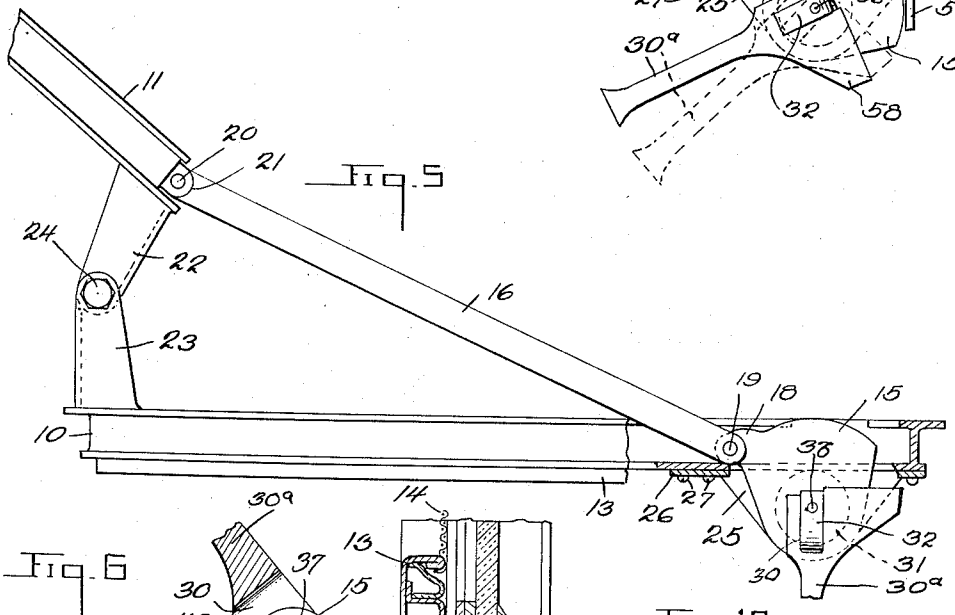


Fig. 6

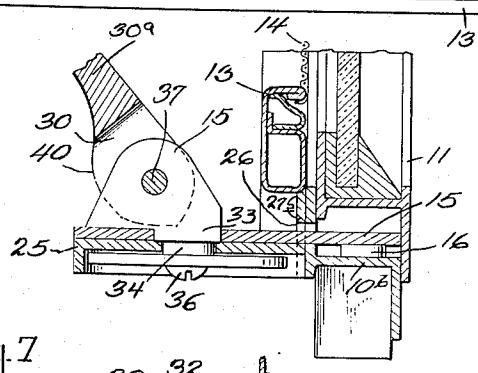


Fig. 10

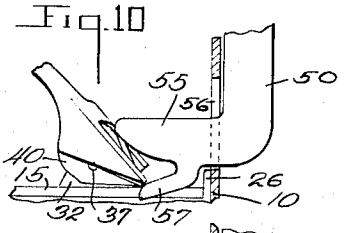


Fig. 7

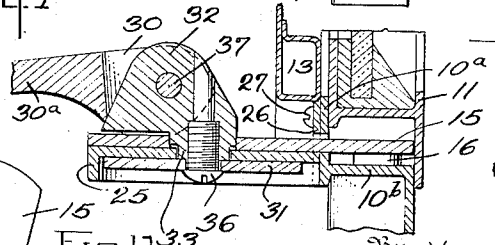
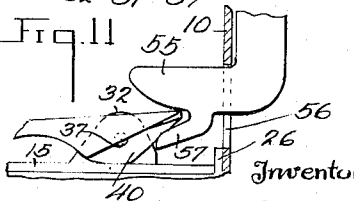


Fig. 11



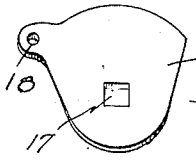


Fig. 12

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UNITED STATES PATENT OFFICE

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WINDOW OPERATOR AND LOCK

Robert H. Bliss, Syracuse, N. Y.

Application April 25, 1938, Serial No. 204,183

10 Claims. (Cl. 268—117)

The present invention relates to window constructions and particularly to windows of the casement type.

The so-called casement window comprises essentially a stationary frame, usually secured within the window opening of a building structure and a laterally displaceable sash, generally pivotally connected to the frame for swinging movement relative thereto, either about a horizontal or a vertical axis. Casement windows may be fabricated of various materials, but are now most commonly made of steel, this material being particularly useful because of its strength, comparatively low cost, and incombustible nature. It is now common practice to supply, in conjunction with not only casement windows fabricated of steel, but also those fabricated of wood or other material, insect screens, the screens completely covering the window openings and being secured to the rear faces of the stationary frames. As it is undesirable to so construct a casement window that it is necessary that the screen be removed each time the sash is to be opened or closed, sash operated means have been designed and have come into use, the purpose of which is to permit manipulation of the sash without requiring removal or displacement of the screen. Such sash operators are commonly mounted upon the frames of the casement windows with which they are used and each includes means for attachment to the free edge of the sash, such means being positioned to the side of the screen adjacent the hinge and being operable from within the room in the wall of which the casement window is mounted. Such operating mechanism may include cranker, irreversible gearing whereby the operator is enabled to open, close or adjust the position of the swinging sash without moving the screen in any manner.

In the general case the sash operating mechanism is so positioned that the force applied thereby to the sash is actually transmitted to the sash at only one point, and not continuously around the free edge of the sash. Usually the operator is connected to the lower cross bar of the swinging sash at the hinge and hence the forces applied to the sash are applied only to this portion of the lower cross bar thereof. The frame of the sash, while relatively stiff, is nevertheless distortable and it is found that, even when the sash is fabricated of steel, when the lower cross bar is pulled into tightly closed position by means of the operator, other portions of the sash, particularly those portions relatively remote from the lower cross bar and from the hinges, do not continuously contact with the frame, and that there is an appreciable gap or aperture between those faces of the sash and frame which are supposed to be in tight contact, thus permitting the passage of air currents, rain and moisture.

It is therefore the customary practice to employ, in addition to sash operators of the type just described, latching means positioned at a point remote from the window operator and hinges and adapted to be manually manipulated after the operator itself has been operated to close the sash as far as possible, to effect complete closure of the sash and bring about a continuous contact between sash and frame around the entire perimeter of the sash, thus completely seating the sash against the frame and preventing the leakage of air or moisture around the same and into the room.

One object of the present invention is to provide an operating mechanism for the swinging sash of a casement window by the use of which alone the sash may be completely closed, full and complete contact of sash and frame being obtained. The sash of a window equipped with the improved operating mechanism may be more rapidly moved to any desired position and may be more widely opened than was heretofore possible with other operating mechanisms and it may be easily locked in any desired position of adjustment. The novel operator has few parts, costs little to make, occupies small space, does not interfere with the customary screen and is attractive in appearance.

A preferred form of the invention comprises a manually operable member mounted on the frame, remote from the axis about which the sash is mounted for swinging movement, at least a portion of the manually operable member being movable toward and away from said axis. An element which is preferably a link connects the movable portion of said member and the sash. The mechanism is so designed and positioned that both pull and thrust may be exerted on the sash to effect its movement in one direction. Such force may be applied immediately adjacent the hinge to open or close the sash, whereby the rapid actuation of the sash is obtained. The manually operable member and connecting element is preferably used in combination with an auxiliary device to apply closing force to the sash, such device being operated by either the manually operable member, an operating handle associated with said device, or by the connecting element. Associated with the mechanism is means for clamping the manually operable member in any

desired position whereby the sash may be fixed in any desired position of adjustment.

The improved operating mechanism makes it possible for the user to obtain full and complete weathering contact of sash and frame, and may be mounted on the room face of the window without requiring piercing of the screen, whereby the complete window structure presents a simple and attractive appearance.

The invention may be embodied in a number of different forms, or modifications, in adapting the same to different types of casement window constructions and to casement windows which are designed and intended to be used at different points in a building structure.

In the accompanying drawings, one form of the invention is illustrated, and will be hereinafter described in detail. It will be appreciated, however, that numerous other embodiments may be readily designed to accomplish specific purposes.

In the drawings:

Figure 1 is an elevation of a casement window structure, viewed from the side thereof which faces the interior of a room with which the window is used;

Figure 2 is a section taken on the line 2—2 of Figure 1, showing an auxiliary mechanism preferably employed;

Figure 3 is a section taken on the line 3—3 of Figure 1, showing the sash in its fully closed position;

Figure 4 is a horizontal section through frame and sash showing the sash in two partially open positions by means of full and dotted lines;

Figure 5 is a view corresponding to Figure 4 but showing the operator with the sash in fully opened position;

Figure 6 is a section taken on the line 6—6 of Figure 3 and showing the operator handle in operating position;

Figure 7 is a similar view but showing the operator handle in clamping position;

Figure 8 is a section taken on line 8—8 of Figure 1;

Figure 9 is a fragmentary view enlarged to show the interengaging portions of the auxiliary mechanism of Figure 2;

Figures 10 and 11 are, respectively, side elevations showing portions of the operating handle and locking rod of the auxiliary locking device, the parts being shown in different positions in the two figures; and

Figure 12 is a perspective view of the operating member of the sash operating mechanism.

While the invention is, as has been previously pointed out, useful in conjunction with windows fabricated of various materials, it is of particular utility when employed in connection with windows of the casement type and fabricated of the well-known lightweight metal bars, such as shown in the drawings, the bars which comprise the main members of the frames, as well as the bars which comprise the main members of the sash, being Z-shaped in cross-section so that, when the sash has been moved to fully closed position it contacts with the frame along two continuous lines extending completely around the window, thereby providing the desired "double weathering" contact. Also, by reason of the use of two Z bars associated as shown in Figure 8, there is a continuous space, rectangular in cross-section, extending completely around the window, two walls of this aperture being defined by adjacent faces of the frame members and the other two walls by adjacent faces of the sash. As this type of construction is well-known, it is deemed unnecessary to describe in detail the exact manner of assembly of the various bars which comprise the window construction.

In the drawings the frame is generally indicated at 10 and the swinging sash at 11. It will be perceived that the sash is connected to the frame by hinges, also of known type so that, in its swinging movements, the sash revolves about a vertical axis indicated at 12, spaced outwardly from the plane of the frame. Permanently or detachably secured to the innermost vertical surface of the frame is a screen frame, indicated at 13, the screen 14 mounted in this frame completely covering the window opening.

The sash operating mechanism which is illustrated by way of example includes a member 15 movably mounted upon the frame preferably at a point remote from the axis of swing 12 of the sash, a connecting element 16 in the nature of a link for transmitting the motion of member 15 to the sash and means for actuating and securing the member 15, and hence actuating and securing the sash 11 to which the member 15 is linked, the actuating and securing means being preferably combined into a single means of simple type such as shown. The operating member 15 comprises a flat plate shown in perspective in Figure 12 which plate is provided with a squared aperture 17 and a projecting lug or finger 18 having therein a circular aperture for the reception of the pivot pin 19 by means of which the finger 18 is pivotally connected to the link 16. The opposite end of the link 16 is connected by a pivot pin 20 to an ear 21 rigid with the sash and the sash and frame are respectively provided with pairs of hinge elements 22 and 23, one pair of which is shown in Figures 4 and 5, which are interconnected by pivot bolts 24 in the usual manner, the axis of swing 12 of the sash being spaced outwardly a substantial distance from the frame.

The plate 15 is disposed in a horizontal plane and lies upon the upper surface of a bracket 25 which is rigid with the frame, either being welded to the frame or attached thereto by suitable securing means. For instance the bracket 25 may be provided with a vertically extending flange 26 attached to the lower frame member by screws or bolts 27. Both bracket, flange 26, and the vertically extending flange 10*a* of the lower frame member 10 are slotted horizontally and the plate 15 projects through these registering slots so as to overlie the horizontal web 10*b* of the lower frame member, the plate being so designed, however, as not to interfere with the closing movement of the sash, as may be readily perceived upon an inspection of Figures 6 and 7.

The actuating and securing means for the plate 15 or movably mounted member of the actuating mechanism comprises a cam member or upper clamping element 30, a disc or lower clamping element 31 and a member 32 connecting these elements 30 and 31. It will be perceived that member 32 has parallel vertical faces and a downward extension, portion 33 of this extension being rectangular in horizontal section and lying within the aperture 17 formed in movable member or plate 15, and a short cylindrical portion 34, truly circular in horizontal section, which lies within a circular aperture formed in the bracket 25. To the lower end of the circular portion 34 is secured, by means of a screw 36, the lower clamping element 31, which is adapted to engage the undersurface of the bracket 25 when slightly

lifted from the position in which it is shown in Figure 6. The cam device **30** is mounted for rocking movement upon a horizontal pin **37** extending through the connecting member **32**, the cam device or upper clamping element having portions disposed on both sides of member **32** provided with aligned apertures to receive the ends of pin **37**. These portions are provided with identical cam surfaces, one of which is indicated at **40**, corresponding portions of these cam surfaces being equidistantly spaced from the axis of pin **37**. The cam surfaces are so shaped that, when the cam device or upper clamping element **30** is moved to the position in which it is shown in Figure 6 the cam surfaces **40** entirely clear the movable member or plate **15**, but when moved into the position shown in Figure 7 the cam surfaces **40** strike the plate **15** simultaneously at an intermediate point in the downward movement of this member and thereafter apply lifting forces to the ends of pin **37** which in turn causes connecting member **32** to be lifted and the lower clamping element **31** drawn into close contact with the bracket or plate **25**.

The design of the clamping means thus described is such that, with the clamping member **30** in raised position as shown in Figure 6 clamping forces are eliminated and the movable member **15** may be freely swung or rotated upon its supporting plate whereas, when the clamping member has been actuated into the position in which it is shown in Figure 7, the cam surfaces **40** bear strongly against the upper surface of the movable plate and the disc **31** is in full contact with the lower surface of the bracket, the plate **15** being thus heavily forced against the upper surface of the bracket and being locked against rotation by reason of its frictional engagement with such bracket surface. The cam surfaces **40** are so shaped that the clamping forces thus applied will remain effective until the upper clamping element **30** is positively actuated, cam surfaces **40** frictionally engaging movable plate **15** in such manner that member **30** cannot change position unless deliberately actuated.

It will be perceived that the upper clamping element **30** has an extension **30***a* in the plane of the connecting member **32** which comprises a manually operable handle by means of which the clamping element may be rocked in a vertical plane into plate clamping or plate releasing position as desired. Handle **30***a* likewise comprises means whereby rotation of the movable member or plate **15** may be effected, and hence actuation of link element **16** and swinging of the sash. As previously described, the squared portion **33** of the downward extension of the connecting member **32** lies within the squared aperture **17** or plate **15** and hence this plate will be rotated whenever member **32** is rotated. The cylindrical portion **34** of the downward extension of the connecting member **32** lies within a circular aperture formed in the bracket at all times and it is therefore about the axis of portion **34** of the connecting member that this member and also the plate **15** are constrained to oscillate or revolve. Hence it is apparent that by the proper manipulation of the handle **30***a* the movable member **15** may be revolved about a stationary axis, for instance from the position in which it is shown in full lines in Figure 4 to the position in which it is shown in full lines in Figure 5, and likewise may be frictionally clamped in either of these positions or in any intermediate position.

When the window is closed the handle **30***a* and other parts of the actuating mechanism will be positioned as shown in Figure 3, the handle being disposed substantially normally to the plane of the window and the link element **16** lying wholly within the space, of substantially rectangular cross-section, defined by the adjacent peripheral members of the sash and frame. With the upper clamping element **30** in the position shown in Figures 2 and 7 the sash will be locked in this position as the member **15** will be tightly clamped by the clamping means described. If the window is to be opened the first move is to lift the handle **30***a* so that the upper clamping element assumes the position in which it is shown in Figure 6, thus releasing the movable member **15**. A force may then be applied horizontally to the handle **30***a* to cause it to swing in a clockwise direction, the plate **15** moving with it and also drawing the link element **16** toward the right, thus exerting a pull upon the edge of the sash adjacent the axis of swing **12** which swings the sash outwardly. Several positions of outward swing of the sash are shown in Figures 4 and 5. When moved to its dotted line position (Figure 4) the actuating handle has caused partial opening of the sash, as shown in dotted lines and when moved to its full line position (same figure) has caused further opening movement of the sash. It will be observed here that the pivot pins **19** and **20** and the axis of swing **12** of the sash are in substantial alignment so that the operating handle **30***a* cannot be moved further in a clockwise direction from the position in which it is shown in Figure 4. The inertia of the sash, however, carries it over this "dead center" position and thereafter, by moving the handle **30***a* in a counterclockwise direction, the link element **16** exerts a thrust upon the sash, the line of thrust being outside the axis of swing **12**, and the sash will eventually be moved to the fully opened position in which it is shown in Figure 5 where the handle **30***a* is again normal to the plane of the window. Further movement of member **15** is prevented by contact of the end of the link **16**, finger **18**, or other stop means, with a stationary member such as the vertical flange of the lower sash member, as indicated in Figure 5. The swinging movement of the sash from its fully closed to its fully opened position is smooth and continuous despite the reversal of movement of the handle **30***a* during the complete outward movement of the sash and the sash is more fully opened by the mechanism described than has heretofore been found possible with any other types of sash actuating mechanisms. Closing movement of the sash is effected as quickly and simply and naturally the sash may be moved to any intermediate position desired. When fully opened, fully closed, or in any intermediate position the movable member or plate **15** may be clamped by the clamping means described and hence the sash firmly held in any position to which it is adjusted. In the closing movement of the sash the mechanism will first exert a pull on such sash by means of the link **16** and, after the sash has moved inwardly beyond the position in which it is shown in full lines in Figure 4 the elements **16** will exert a thrust on the edge of the sash which thrust will increase in magnitude after the sash has passed this dead center position, without increasing the force applied to the handle **30***a* due to the increase in the lever arm of the force acting on the sash. By reason of the fact that the operating member **15** is positioned at a point remote from the axis of swing

12, and link 16 is connected to the sash 11 at a point relatively close to the point of axis of swing of the sash, the speed of movement of the sash opening and closing operations is considerably greater than can be obtained with other types of sash actuating mechanisms previously utilized, a decided advantage. Nevertheless very substantial sash opening and closing forces may be applied, quite sufficient to effect opening and closing of the sash under all possible operating conditions.

While the mechanism as thus far described may be used entirely by itself as a complete sash operating means, and may be relied upon as a lock to hold the sash in closed position, I nevertheless prefer to make use of an additional device for positively locking the sash in closed position and which device is also designed to apply a substantial force to the free edge of the sash to force this edge into tight engagement with the adjacent frame member to prevent the passage of moisture and air between sash and frame members. It has long been appreciated that in the commercial production of metallic casement window constructions, as well as casement window constructions fabricated of wood, that by reason of warping of these members, and for other reasons, tight contact of the free edge of the sash with the cooperating frame member is difficult, if not impossible, to obtain by the means which is relied upon to effect the sash opening and closing movements. Hence it has been customary to provide auxiliary locking devices, entirely independent of the sash actuating means, which function after the sash has been moved to substantially closed position to not only lock the sash in such closed position but to also effect a very slight but nevetheless important final closing movement. My present mechanism includes such a device but it is combined with the sash operating actuating mechanism itself in such manner that this final closing and locking function can be performed by the means provided for sash actuation, thus reducing the number of operations which must be performed in closing and locking the sash and greatly simplifying the construction.

The auxiliary device which I employ includes a locking rod indicated at 50, this locking rod being vertically disposed and lying flat against the inside surface of the web of the vertical frame member which is remote from the axis of swing 12 of the sash. It is provided with slots 51 to receive screws or bolts 52 by means of which it is confined but is nevertheless permitted to move vertically when forces are applied thereto, to a limited extent. The upper end of this locking rod is provided with an extension 52 which functions as a latch bolt and is adapted to be projected upwardly in rear of a catch 53 which is rigidly secured to the free edge of the sash as by means of screws or bolts. The catch engaging face of the projection 52 is formed as a cam surface so that, as the locking rod is raised, a substantial force is applied by the projection 52, against the catch 53, which tends to draw the free edge of the sash tightly against the adjacent frame member. The upper end of the locking rod therefore functions as a latch bolt and camming device. While separate means may be provided for effecting vertical reciprocation of the locking rod 50 at the desired times I preferably make use of the sash actuating mechanism for this purpose. Thus the lower end of the locking rod 50 is provided with a horizontally disposed portion 55 which extends through a slot 56 in the inner flange of the frame member upon which the rod 50 is mounted. The horizontal portion 55 of the locking rod is provided with a downturned arm 57 and this arm defines, together with the end portion of extension 55, a V-shaped notch.

The cam device 30 is provided with a wing 58 which is adapted to move into this notch as the window is closed by actuation of the handle 30a. During the final closing movement of the window the cam device will occupy the position in which it is shown in Figure 10, with the wing 58 just entering the notch in the locking rod. As the cam device is manipulated by the handle 30a into position to clamp the operating member 15 it is rocked from the position in which it is shown in Figure 10 to the position in which it is shown in Figure 11, the upper surface of the wing 58 engaging the lower edge of the portion 55 of the rod 50 and thus applying a lifting force to the rod which causes extension 52 at its upper end to move upwardly and engage catch 53 on the sash, applying a camming force upon this catch as the locking rod moves into final position and forcing the free edge of the sash tightly against the adjacent frame member. The sash is thus locked in closed position.

When it is to be opened the clamping means is of course first manipulated to release the operating plate 15, the handle 30a being lifted in a vertical plane. As the handle 30a is lifted the wing 58 is swung downwardly and after traveling a short angular distance engages the upper edge of the arm 57 of the locking rod. Continued lifting of the handle causes wing 58 to apply a downwardly directed force upon arm 57 and the locking rod 50 is thus positively moved downwardly, withdrawing the latch bolt portion 52 from engagement with catch 53 and releasing the sash for the opening movement which is to follow.

A spring may be employed to urge the locking rod 50 downwardly and the arm 57 dispensed with if desired. It is preferred, however, to positively move the locking rod 50 in both directions. The locking rod may be provided with a plurality of catch engaging elements and the sash with a plurality of catches, if desired, whereby the sash and frame may be positively locked together at more than one point, for instance at points adjacent the upper and lower corners of the sash. Where the sash is of large size this may be important but for sashes of comparatively small size a mechanism such as illustrated may be employed, the sash being locked to the frame at only one point.

The combined sash actuating and locking means, a preferred form of which has been disclosed, is of simple nature, attractive in appearance, inexpensive, and thoroughly efficient in use. It will be quite clear that in adapting it to various types of casement window constructions the design and arrangement of its component elements may be very considerably modified without departure from the invention.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. In a casement window having a hinged sash, means for opening and closing the sash, locking mechanism including a vertically movable element, and a handle for actuating said opening and closing means and said locking mechanism, said handle being pivoted horizon-

tally and having a projection adapted to engage said vertically movable element when the sash is closed.

2. The combination set forth in claim 1 in which clamping means is associated with the handle, actuated by a movement of the handle in a vertical plane, for securing or releasing the opening and closing mechanism.

3. In a window construction, in combination, a frame, a sash, means pivotally mounting the sash upon the frame at one side thereof for swinging movement to and from a substantially co-planar positioned with said frame, and mechanism for swinging the sash, said mechanism comprising a member pivotally mounted on the frame at a point remote from the axis of swing of the sash for rotational movement only in a horizontal plane, and a link pivotally connected directly to said member and to said sash, said link transmitting swinging forces to said sash when the member is operated and being disposed substantially in the plane of the frame and sash when the sash is closed.

4. In a window construction, in combination, a frame, a sash, means pivotally mounting the sash upon the frame at one side thereof for swinging movement about an axis offset from the plane of the frame, and mechanism for swinging the sash, said mechanism comprising a member pivotally mounted on the frame at a point remote from the axis of swing of the sash for rotational movement only in a horizontal plane, a link pivotally connected directly to said member and to said sash, said link transmitting swinging forces to said sash when the member is operated and being disposed substantially in the plane of the frame and sash when the sash is closed, and means for operating said member and holding it in any desired position of adjustment, said last named means including a manually operable lever connected to said member so as to be effective in applying turning forces thereto, said lever being movable relatively to said member, and a clamping device associated with said lever and operable thereby upon said relative movement to clamp said member to the frame in any desired position.

5. The combination with a window frame and sash mounted thereon for swinging movement about an axis offset from the plane of the frame and relatively close to one frame member, of a sash operating and locking mechanism associated therewith, said mechanism including a handle element mounted on the frame at a point adjacent the frame member remote from the axis of swing, said element being rotatable about horizontal and vertical axes, sash locking means associated with said last mentioned frame member, means including a link connecting the handle and sash whereby the sash may be swung by rotation of the handle about one axis, and means on the handle for engaging and operating the sash locking means when the handle is operated about the other axis.

6. The combination with a window frame having parallel vertically disposed side members and top and bottom members, of a sash mounted thereon for swinging movement about an axis offset from the plane of the frame and relatively close to one of said side members, of a sash operating and locking mechanism associated therewith, said mechanism including an element movably supported on the second side member of the frame and adapted to be moved into engagement with the free edge of the sash when the sash is closed to lock the same to the frame, a member movably mounted on the frame at a point closely adjacent said second frame side member, and a link connecting said last mentioned member to the sash at a point closely adjacent the axis of swing, said member being movable about one axis to operate the link to open or close the sash and about another axis to engage and operate the sash locking element when the sash is in closed position.

7. The combination set forth in claim 6 in which said movably mounted member may be rocked about a vertical axis to effect swinging of the sash and about a horizontal axis to effect operation of the sash locking element.

8. The combination set forth in claim 6 in which clamping means is also associated with said movably mounted member whereby the sash may be clamped in any desired position of adjustment.

9. The combination set forth in claim 6 in which the sash locking element has a part engageable by said movably mounted member only when said member has been moved to close the sash.

10. In a window construction, in combination, a frame, a sash, means mounting the sash upon the frame at one side thereof for swinging movement about an axis offset from the plane of the frame to and from a position in which the sash and frame are substantially co-planar, and mechanism for swinging the sash about said axis, said mechanism comprising an operating handle positioned at a point adjacent the opposite side of the frame from the axis of swing of the sash and mounted upon the frame for swinging movement about each of two angularly disposed axes one of which is vertical, a link pivotally connected directly to a portion of said handle and also pivotally connected directly to said sash, said link transmitting swinging forces to said sash when the handle is moved about a vertical axis and being disposed substantially in the plane of the frame and sash when the sash is closed, and means actuated by the movement of the handle about the other axis to clamp the sash operating mechanism to the frame thereby holding the sash against movement in either direction.

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