

Feb. 12, 1952

R. S. HARTMAN
CLOSURE OPERATING MEANS

2,585,122

Filed Sept. 3, 1948

4 Sheets-Sheet 1

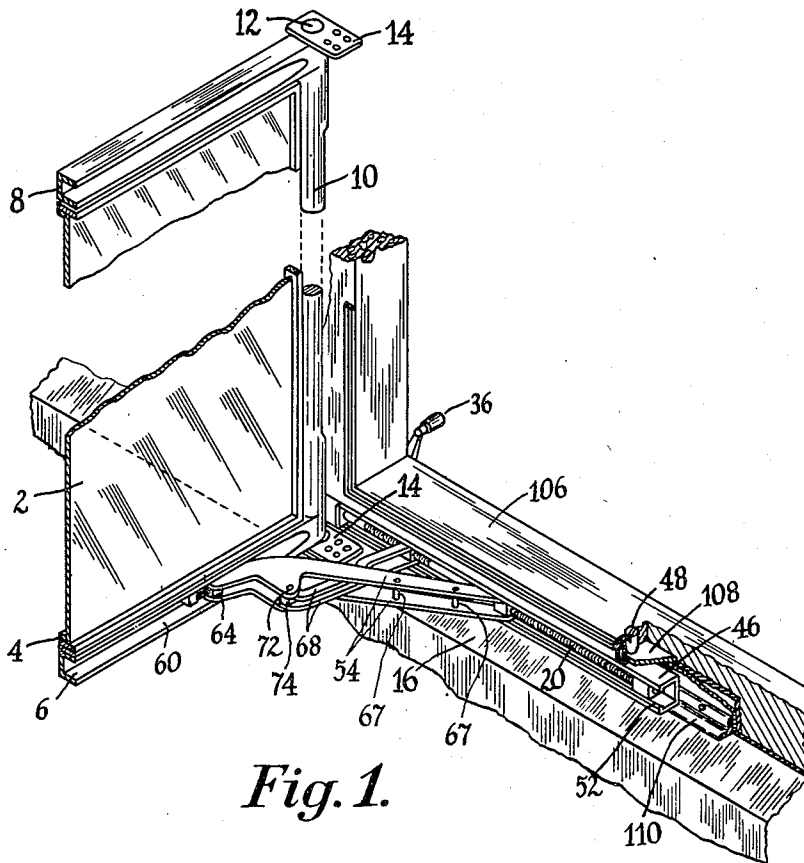


Fig. 1.

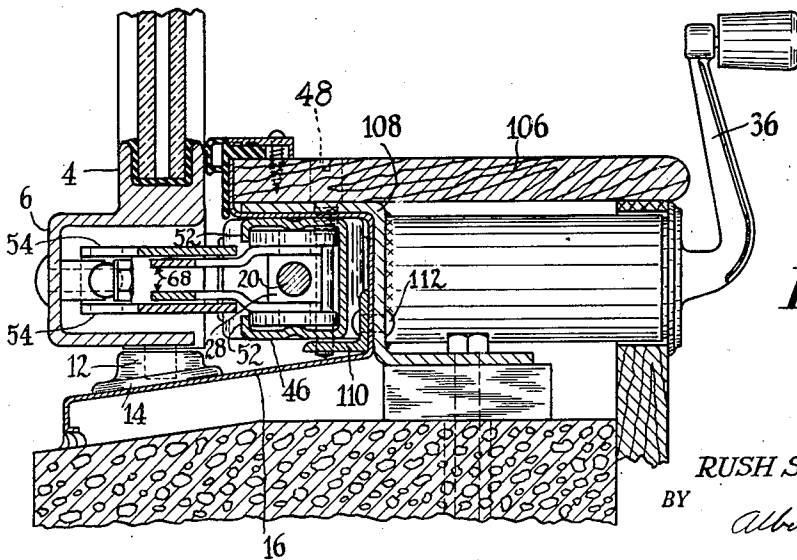


Fig. 4.

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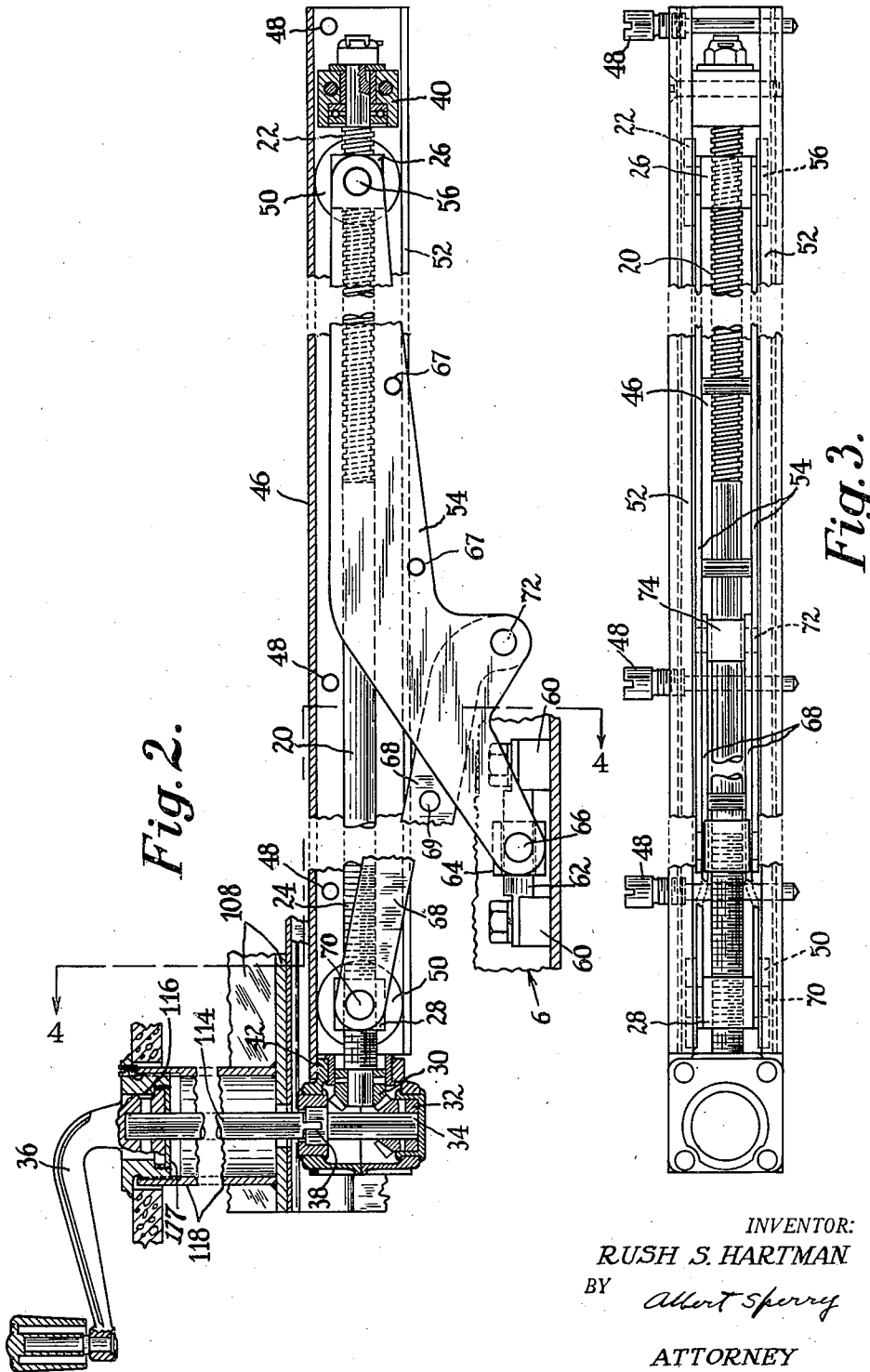
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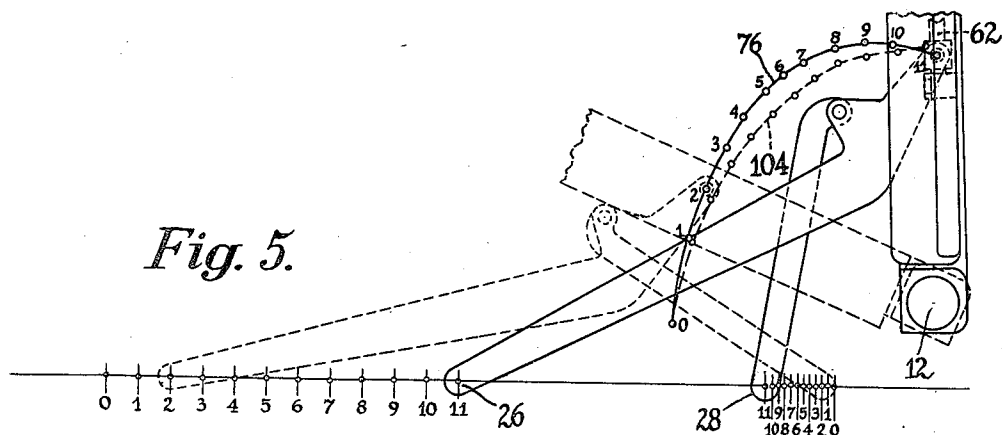
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Filed Sept. 3, 1948

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UNITED STATES PATENT OFFICE

2,585,122

CLOSURE OPERATING MEANS

Rush S. Hartman, Trenton, N. J.

Application September 3, 1948, Serial No. 47,572

11 Claims. (Cl. 268—120)

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My invention relates to mechanism for opening and closing windows, doors, and other closures, and while my invention is particularly useful for actuating relatively large and heavy windows or doors such as those used in modern office buildings, factories, and apartment houses, it is equally useful as operating means for the ordinary casement windows and similar relatively light closures in homes and elsewhere.

Operating mechanisms heretofore provided for opening and closing doors and windows have not generally been suitable for actuating relatively large and heavy windows such as those demanded by modern trends in architecture for office buildings and elsewhere, wherein large and long window areas are provided and double glazing is used for insulating purposes. Even when prior operating means are employed for actuating relatively light weight casement windows, it is frequently impossible to draw the window into firm sealing engagement with the window frame. In either situation the loose connections heretofore provided have permitted the window to rattle and vibrate or even to be torn loose in a high wind.

A further objection to operating mechanisms of the prior art arises from their complicated and expensive construction, especially when designed for use with heavy windows. Thus for example when the mechanism is actuated by means of a crank and gears, it is necessary to use accurately machined parts and heavy constructions to withstand the forces applied thereto. Even then the wear and distortion of elements after short periods of operation often render the parts loose or inoperative. Moreover, when the operating mechanism is connected directly to pivot means about which a window is movable or is connected to the window adjacent the pivot, there is always danger of twisting or distorting the sash so as to prevent proper sealing or even to cause the window glass to break.

In accordance with the present invention, these objections to constructions of the prior art are overcome and novel window or closure operating means are provided which are simple and economical to produce and in which the forces are so applied and distributed that large and heavy windows may be safely opened and closed with a minimum of effort on the part of the operator. Furthermore, strains on the operating means are reduced to a minimum so that inexpensive die cast or pressed gears may be used, and relatively light weight elements may be employed without danger of distortion. The construction is such as to hold the window or closure firmly in place in any po-

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sition to which it may be moved, even when the window is large and is subjected to a high wind.

These advantages are preferably attained by employing a combination of an actuating arm and supporting link which are movable in such relation as to provide a strut or support for the actuating arm in all positions to which it is moved. At the same time the actuating arm is controlled by a threaded shaft which affords a one-way operating connection that eliminates slippage and serves to prevent excessive strains on the gears and other elements of the actuating mechanism when the window is subjected to a high wind.

One of the objects of my invention is to provide a novel type of closure operating mechanism which is simple and economical to produce and which is easy to apply and remove.

Another object of my invention is to provide operating means wherein a minimum of effort is required to open and close a window or other closure.

A further object of my invention is to provide a closure operator with a novel arrangement of an actuating arm and supporting link which serve to impart sufficient strength and rigidity to the construction to permit its use with relatively large and heavy closures.

Another object of the invention is to provide a closure operator which is capable of holding a window in a fixed position and yet serves to prevent excessive strain on the operating means even when the window is large and subjected to high wind pressures.

Another object of the present invention is to provide operating mechanism which may be applied to a window in a manner to eliminate all danger of twisting or distortion of the window and excessive strains on the operating mechanism.

A particular object of the present invention is to provide a closure operating means with a threaded shaft which is rotatable by a crank and gears to move an actuating arm and supporting link in combination so as to support and hold a window firmly in any position to which it may be moved.

These and other objects and features of the present invention will appear from the following description thereof in which reference is made to the figures of the accompanying drawing.

In the drawing:

Fig. 1 is a perspective of a portion of a typical window and operating mechanism embodying my invention;

Fig. 2 is an enlarged plan view of the operating mechanism illustrated in Fig. 1;

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Fig. 3 is a side elevation of the mechanism illustrated in Fig. 2;

Fig. 4 is a vertical sectional view of the construction illustrated in Figs. 2 and 3 taken on the line 4—4 of Fig. 2;

Fig. 5 is a diagrammatic plan view of the construction illustrated in Figs. 1 to 5 indicating different positions to which the window may be moved;

Fig. 6 is a diagrammatic perspective of an alternative form of construction embodying my invention;

Fig. 7 is a diagrammatic plan view similar to Fig. 5 illustrating a further alternative construction embodying my invention;

Fig. 8 is a plan view similar to Fig. 2 illustrating a portion of a modified form of operating means embodying my invention; and

Fig. 9 is a side elevation similar to Fig. 3 showing the construction of Fig. 8.

In that form of my invention illustrated in Figs. 1 to 5, the window glass is indicated at 2 and is mounted in a sash 4. The sash is preferably provided with a lower channel member 6, an upper channel member 8 and a side member 10 which extend along the edges of the sash and have upper and lower pivot members 12 fixedly secured thereto for mounting the window for horizontal movement about a vertical axis. The pivot members engage complementary pivot means on the brackets 14 mounted on the sill member 16 of the window and on the top header member (not shown).

The channel and side members may be part of and fixedly secured to the window sash but in the alternative the window sash may be pivotally mounted on the channel members adjacent the center of its upper and lower edges as shown and described in my copending application Serial No. 521,451, filed February 7, 1944, now abandoned, so that the window may be reversed for cleaning or turned to any desired position to direct air into the room where the window is located.

The operating mechanism of the present invention is employed for moving the window 2 about the pivot means on brackets 14 to any desired position. As shown, the operating mechanism embodies a shaft 20 having threads 22 adjacent the end thereof remote from the pivot means and threads 24 adjacent the end thereof nearest the pivot means. An internally threaded nut or carriage 26 is mounted on shaft 20 and provided with threads complementary to those shown at 22 so that that nut or carriage 26 will move longitudinally of the shaft 20 when the shaft is rotated. A similar internally threaded nut or carriage 28 is in threaded engagement with threads 24 on shaft 20 and is movable along the shaft when the shaft is rotated. The threads 22 as shown in Figs. 2 and 3 are of considerably greater pitch than the threads 24 and are opposite in direction so that rotation of shaft 20 will cause the carriage 26 to travel inward along the shaft 20 a relatively great distance while the carriage 28 is caused to move outward along the shaft 20 a relatively short distance as the shaft is rotated to open the window. The carriages move apart when the shaft is rotated in the opposite direction for closing the window.

The shaft 20 may be rotated by any suitable means. As shown a bevelled gear 30 is secured to the shaft 20 and meshes with a complementary bevelled gear 32 secured to shaft 34. The shaft 34 is rotatable by a crank 36 through the key connection indicated at 38.

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Shaft 20 is mounted for rotation in the end thrust bearing 40 and in bearing 42 which surrounds the bevelled gear 30. Shaft 20 and its bearings are mounted in the channel-shaped housing 46 which is secured to the sill member 16 of the window by threaded pins 48. The carriages 26 and 28 on shaft 20 are provided with rollers 50 which engage the base of the channel 46 and are held within the housing by the intumed edges 52 of the channel. The rollers serve to support the carriages 26 and 28 and the shaft 20 so that forces applied to the carriages 26 and 28 in a direction at right angles to the shaft as seen in Fig. 2 are not transmitted to the shaft 20 but are taken up by the fixed channel member 46. In this way all danger of bending of shaft 20 or binding of the carriages on the shaft is eliminated and the force required to rotate the shaft and actuate the operating mechanism is reduced to a minimum. Moreover, the rollers in effect provide intermediate supports for the shaft at those points where it would otherwise be subjected to the greatest lateral strains. The shaft therefore may be made as long as necessary to insure the required travel of carriages 26 and 28 without weakening the construction.

The carriage 26 serves to move an actuating arm 54 which is pivotally connected at its inner end to carriage 26 by the pivot means 56. The outer end of arm 54 is slidably and pivotally connected to the lower channel member 6 of the window sash. For this purpose the channel member 6 is provided with spaced supports 60 between which a bar 62 extends. A slide block 64 engages bar 62 and carries pivot means 66 to which the outer end of the actuating arm 54 is connected. The actuating arm illustrated consists of spaced parallel strips of metal which are held in spaced relation by the carriage 26 and block 64. Reinforcing studs or connectors 67 also serve to strengthen the metal strips of the actuating arm.

A supporting link 68 is pivotally connected at its inner end to the carriage 28 on shaft 20 by pivot means 70. The outer end of link 68 is pivotally connected to the actuating arm 54 by pivot means 72 at a point near the outer end of the arm. The link 68, like the actuating arm, consists of a pair of spaced metal strips which are held in spaced, parallel relation by the carriage 28 and by a bushing 74 surrounding the pivot means 72. Connecting studs 69 are also provided for reinforcing the metal strips of link 68. The link 68 is movable about pivot 72 within the slot formed by the spaced members of the actuating arm and both the arm 54 and the link 68 are well supported and reinforced so as to resist bending.

With this construction, rotation of crank 36 causes the arm 54 and link 68 to cooperate in moving the window sash about its hinge or pivot means 12. In so moving the actuating arm itself rocks about the pivot means 72 at the outer end of link 68 and is supported intermediate its ends and preferably at a point near the window as shown in Fig. 5. By suitably proportioning the length of the actuating arm and the supporting link and selecting the location of the pivot means and the pitch of the threads on shaft 20, the outer end of the actuating arm may be caused to move through an arc of predetermined form. This arc preferably is nearly concentric with the pivot means or hinge 12 about which the window moves. Thus, for example, as shown in Fig. 5, the pivot means 66 by which the outer end of the actuating arm 54 is connected to the window 2

will move through the arc 76 which is nearly concentric with the pivot 12 of the window. It is then only necessary to provide for very limited relative movement of the pivot means 66 along the window 2 and as a result bar 62 may be short and sturdy.

Further, as shown in Fig. 5, the movement of the carriages 26 and 28 toward each other in response to rotation of crank 36 and shaft 20 causes the actuating arm 54 and supporting link to move from a position in which they form an obtuse angle to positions substantially at right angles to each other. The window sash thereupon is moved about the pivot 12 through successive positions indicated on arc 76 corresponding to successive equal increments of movement of the carriages 26 and 28 along shaft 20. The numbered positions on arc 76 are those to which the pivot means 66 on the outer end of the actuating arm 54 is moved and since this pivot means moves with the window, the numbered positions actually indicate the positions of the window itself. It will be noted from these positions on arc 76 that the movement of the window is greater for each increment of movement of the carriages 26 and 28 during the initial stages of opening the window than in the later stages of movement when the window approaches its fully opened position. The power applied in rotating the crank 36 and shaft 20 is therefore multiplied to a greater extent as the window opens and this increase in power compensates for the increase in load due to the raising of a horizontally pivoted window or the increase in wind pressure on a vertically pivoted window. Therefore the effort required to rotate crank 36 and the strains imposed on the gears and other elements of the operating means are substantially uniform although the load increases materially. Furthermore, the limited forces exerted on the gears renders it possible to use inexpensive die cast or pressed gears so that the machining and cost of the elements of the construction is reduced considerably.

Moreover, as the window approaches a fully opened position in which it extends at 90° from the frame, the link 68 approaches a position at right angles to the arm 54. The support for the actuating arm afforded by supporting link 68 thereby increases as the window opens and when the window is fully opened the arm and link are positioned so as to provide substantially the maximum support and rigidity for the window. This is of particular advantage in opening and closing large windows where wind pressures become a serious factor as the window moves outward from the face of the building. Similarly when a large window is movable about a horizontal axis, as shown in Fig. 6, the weight of the window is largely or entirely supported by the operating means when the window is raised toward a horizontal position. The need for unusual strength and support for the window and for the actuating arm then becomes very critical.

The structure and combination of elements provided thus serve to insure positive movement and positioning of the window. Furthermore the pitch of the threads on shaft 20 is such as to afford a one-way driving connection so that there is no possibility of slipping or counter rotation of the shaft and crank under load. Therefore vibration will not cause the window to change in position and it may be moved to opened or closed position even in a very high wind.

As shown in Fig. 6, the window or closure may

be mounted for pivotal movement about a horizontal axis or hinge. This construction also is typical of those in which two operating means are employed, one of which is located at each side of the window as indicated at 78 and 80. Such operators are preferably actuated by a single crank 82 located in any desired or convenient position and connected to the actuating means through a suitable system of shafts and gears such as the centrally located bevelled gears 84, shafts 85 and corner bevelled gears 86. Both of the operating means thus employed are preferably of the same construction and design and may be of the same type shown in Figs. 1 to 5. Such dual operating mechanism may, of course, be employed on vertically pivoted doors and windows and has the advantage of insuring positive and similar movement of opposite edges of the closure. All danger of twisting or distortion of the window is thereby eliminated so that very large and heavy doors and windows can be moved without danger of injury thereto.

As shown in Fig. 7, the present invention also may be used in moving closures through an arc of approximately 180° or more if desired. In the construction shown, the pivot means 88 for the sash 90 is mounted so that it projects outward from the sash allowing it to clear any wall construction protruding beyond the sash when the window is closed. The actuating arm 92 differs somewhat in shape from that shown in Figs. 1 and 2 but is similarly formed to cooperate with a supporting link 94 in opening and closing a window with the minimum effort and strain on the window and operating means. The pivotal connection 96 between the window 90 and the outer end of the actuating arm 92 is shown in this case to move through an arc 98 which differs in form from arc 76 as shown in Fig. 5. However in each instance the arc is generally concentric with the pivot means about which the window swings and only limited relative movement between the pivotal connection 96 and the window itself is required.

In the further alternative construction shown in Figs. 8 and 9, the inner end of the supporting link 100 is mounted on a fixed pivot 102. The remaining elements of the assembly are similar in construction and operation to those shown and described in connection with Figs. 1 to 5. With this arrangement there is no shifting of the inner end of the supporting link and the location of the outer end of the actuating arm and pivotal connection 66 on successive movements of carriage 26 will be those indicated by the arm 104 of Fig. 5.

It will be apparent from a comparison of the arc 76 and 104 of Fig. 5 and arc 98 of Fig. 7 that the movement of the actuating arm is influenced by the shape and points of pivotal connection of the actuating arm and supporting link and is additionally influenced by the relative movement of carriages 26 and 28. Therefore it is possible to obtain a greater variety of operating movements by varying the pitch and direction of threads 22 and 24 or by omitting one thread altogether, so long as the necessary relative movement of the inner ends of the actuating arm and supporting link is provided. In all such modifications of my invention, powerful and positive operation of the window or closure is assured with operating means which are economical to produce and install and easy to operate.

Each of the forms of my invention described has a further advantage in that the operating

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means is concealed and protected by the sash when the window is closed, thus providing a neat appearance both inside and outside. However, in the event any part should break or stick or should need repair or lubrication, the window sash and operating means may be moved together to an exposed position in which the parts are accessible for work or inspection. Thus as shown in Figs. 3 and 4 the channel member 46 by which the shaft 20 and carriages 26 and 28 are carried is secured in place by threaded pins 48 which extend through the wooden stool 106 of the window sill and into threaded engagement with an angle iron bracket or reinforcing member 108 mounted in the wall adjacent the sill 16 of the window opening. The lower end of pin 48 extends into a complementary opening in the lower bracket 110 secured to bracket 108 by rivets 112 or otherwise. With this construction it is only necessary to remove the pins 48 from the stool 106 and brackets 108 and 110 whereupon the channel member 46 together with shaft 20 and carriages 26 and 28 may be moved with the window as it swings about its pivot means 12. As the window sash is pushed open the key 38 in crank shaft 114 is disengaged from the shaft 34 by which the actuating gear 32 is carried. The whole operating mechanism is thus exposed and may be lubricated, removed or repaired without difficulty.

The form of my invention shown in Fig. 2 also embodies an improved type of support for the crank 36 by which the operating mechanism is actuated. For this purpose the crank 36 is connected to shaft 114 which extends through a sleeve 118. The crank is rotatable in an outer bearing 116 mounted on the sleeve and is held against removal by retainer 117. The sleeve 118 is welded or otherwise mounted to the bracket 108. The shaft and crank are thereby supported directly by sleeve 114 carried by the angle iron bracket 108 that also supports the channel member 46 on which the operating mechanism is mounted. In this way the crank and operating mechanism are supported as a unit, and the crank shaft 114 is held in accurate alignment with shaft 34 to which gear 32 of the operating mechanism is secured. Moreover, looseness or bending of the shaft is prevented since forces applied to the crank are not transmitted to the plaster or other yieldable interior wall structure adjacent the crank. Therefore the wall surface adjacent the crank is not broken or marred by operation of the crank as it is when using those types of closure operating devices heretofore developed in which a crank is used as an actuating means.

These and other features and modifications may be employed and numerous changes may be made in the form, construction and arrangement of the elements employed in the practice of my invention and in applying it to other and various types of closures with which it may be used. In view thereof it should be understood that the particular construction shown in the drawings and described above has been chosen for the purpose of indicating the nature of my invention and typical applications thereof, and is not intended to limit the scope of my invention.

I claim:

1. Mechanism for moving a closure about a pivot into and out of closed position with respect to an opening, comprising an actuating arm having means at the outer end thereof for pivotally

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connecting said arm to a closure, a supporting link having the outer end thereof pivotally connected to said actuating arm intermediate the ends of said arm, a rotatable shaft, means for mounting said shaft adjacent said opening, members mounted on said shaft and pivotally connected to the inner ends of said actuating arm and supporting link, means for rotating said shaft, and interengaging threads on said shaft and members for simultaneously moving both of said members toward and away from each other on rotation of said shaft in opposite directions to move said actuating arm about the outer end of said supporting link as a pivot for moving the closure to opened and closed positions.

2. Mechanism for moving a closure about a pivot into and out of closed position with respect to an opening, comprising an actuating arm having means at the outer end thereof for pivotally connecting said arm to a closure, a supporting link having the outer end thereof pivotally connected to said actuating arm intermediate the ends of said arm, a rotatable shaft, means for mounting said shaft adjacent said opening, members located adjacent said shaft and pivotally connected to the inner ends of said actuating arm and supporting link, means for rotating said shaft, and threads on said shaft engaged by both of said members for simultaneously moving said members toward and away from each other on rotation of the shaft in opposite directions, the pitch of the threads engaged by said members being different.

3. Mechanism for moving a closure about a pivot into and out of closed position with respect to an opening, comprising an actuating arm having means at the outer end thereof for pivotally connecting said arm to a closure, a supporting link having the outer end thereof pivotally connected to said actuating arm intermediate the ends of said arm, a rotatable shaft, means for mounting said shaft adjacent said opening, members located adjacent said shaft and pivotally connected to the inner ends of said actuating arm and supporting link, means for rotating said shaft, and threads on said shaft engaged by both of said members for simultaneously moving said members toward and away from each other on rotation of the shaft in opposite directions, the pitch of the threads engaged by said members being different and opposite in direction.

4. Mechanism for moving a closure about a pivot into and out of closed position with respect to an opening, comprising an actuating arm having means at the outer end thereof for pivotally connecting said arm to a closure, a supporting link having the outer end thereof pivotally connected to said actuating arm, a rotatable shaft, means for mounting said shaft adjacent said opening and at right angles to the pivot about which the closure is movable, members located adjacent said shaft and pivotally connected to the inner ends of said actuating arm and supporting link, means for rotating said shaft, and threads on said shaft engaged by said members for moving said members toward and away from each other on rotation of such shaft in opposite directions, the threads engaged by the member to which the actuating arm is connected having a greater pitch than the thread to which the supporting link is connected.

5. Mechanism for moving a closure about a pivot into and out of closed position with respect to an opening, comprising an actuating arm having means at the outer end thereof for pivotally

connecting said arm to a closure, a supporting link having the outer end thereof pivotally connected to said actuating arm, a rotatable shaft, means for mounting said shaft parallel to a side of said opening and at right angles to the pivot about which the closure is movable, members located adjacent said shaft and pivotally connected to the inner ends of said actuating arm and supporting link, means for rotating said shaft, and threads on said shaft engaged by said members for moving said members toward and away from each other on rotation of such shaft in opposite directions, the threads engaged by the member to which the actuating arm is connected having a greater pitch than the thread to which the supporting link is connected, and said threads being opposite in direction.

6. In combination with a window sash, pivot means about which said sash is movable into and out of position to close an opening and operating mechanism for opening and closing said sash, including a threaded shaft extending at right angles to the pivot means and parallel to a side of said opening, said shaft having two threaded members engaging the same, an actuating arm having its outer end pivotally connected to said sash and its inner end connected to one of said threaded members, a supporting link having its outer end pivotally connected to said actuating arm near the outer end of said arm and having its inner end pivotally connected to the other threaded member and located at a point between the first threaded member and the pivot about which the sash is movable, and means for rotating said shaft to move said threaded members whereby said operating arm will be caused to move about said outer end of said supporting link as a pivot in opening and closing said sash.

7. In combination with a window sash, pivot means about which said sash is movable into and out of position to close an opening, and operating mechanism for opening and closing said sash including a rotatable shaft positioned parallel to a side of said opening and at right angles to said pivot means, said shaft having threads of different pitch near the opposite ends thereof, an actuating arm having its inner end pivotally connected to a member engaging those threads on the shaft which are of greater pitch and having means on the outer end thereof providing a sliding and pivotal connection with said sash, a supporting link having its outer end pivotally

connected to said actuating arm near the outer end of said arm and having its inner end pivotally mounted on a member engaging those threads on the shaft which are of lesser pitch, the latter member being located between the threaded member to which the actuating arm is connected and the pivot about which said sash is movable, and means for rotating said shaft to move said threaded members toward and away from each other and to move the outer end of the actuating arm about said outer end of the link and through an arc generally concentric with the pivot means for said sash.

8. A construction of the character set forth in claim 7 wherein the pitch of the threads on said shaft are opposite in direction.

9. A construction of the character set forth in claim 7 wherein the means for rotating said shaft includes a crank, and said shaft and crank are independently and separably mounted adjacent said window opening.

10. A construction of the character set forth in claim 7 wherein the means for rotating said shaft includes a crank, and said shaft is mounted for rotation in a support, and means for detachably securing said support in position adjacent said window opening.

11. A construction of the character set forth in claim 7 in which there are two operating mechanisms, one located adjacent each of two opposite edges of the window, and common means are provided for rotating the shafts associated with both operating mechanisms.

RUSH S. HARTMAN.

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