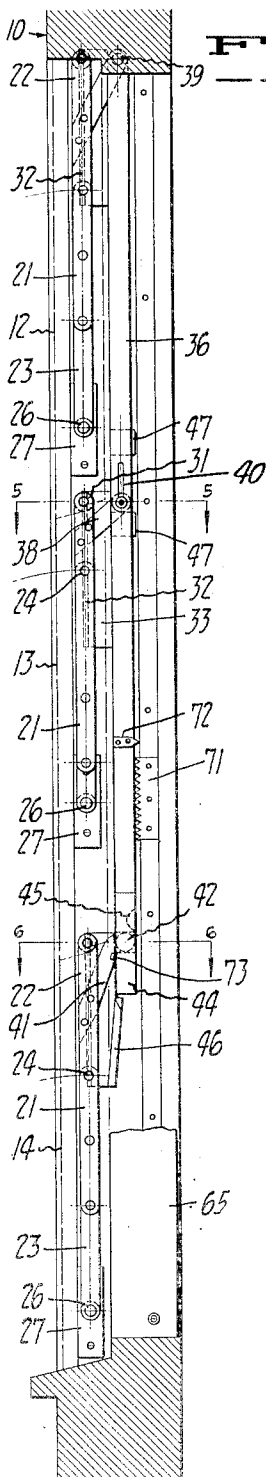
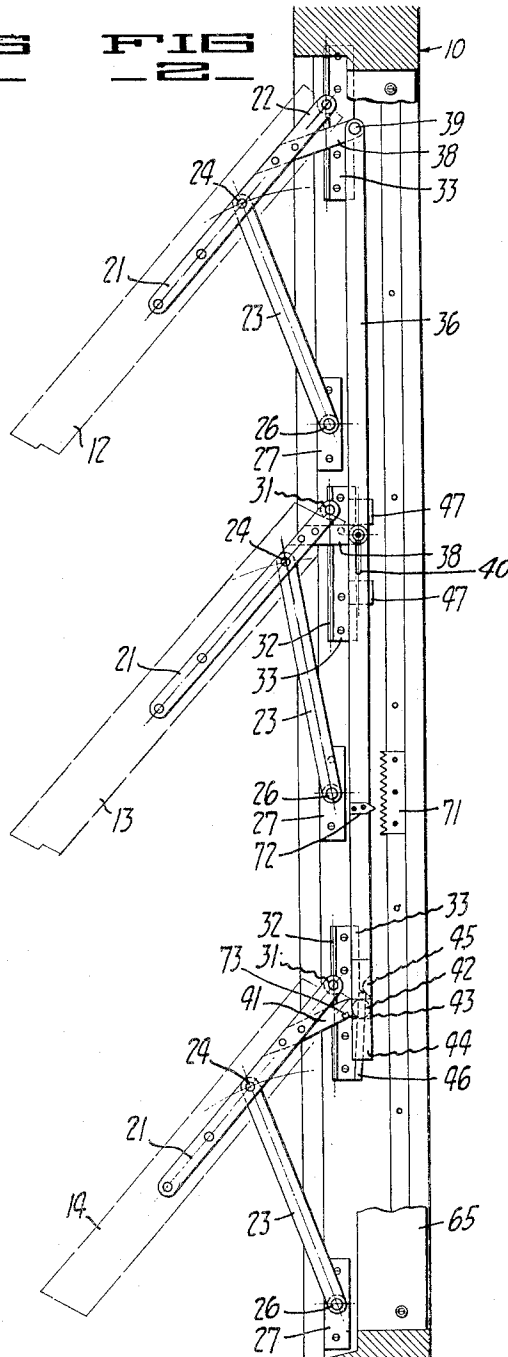


Aug. 4, 1942.

A. G. LARSON  
WINDOW CONSTRUCTION  
Filed July 26, 1940

2,292,133

4 Sheets-Sheet 1



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Aug. 4, 1942.

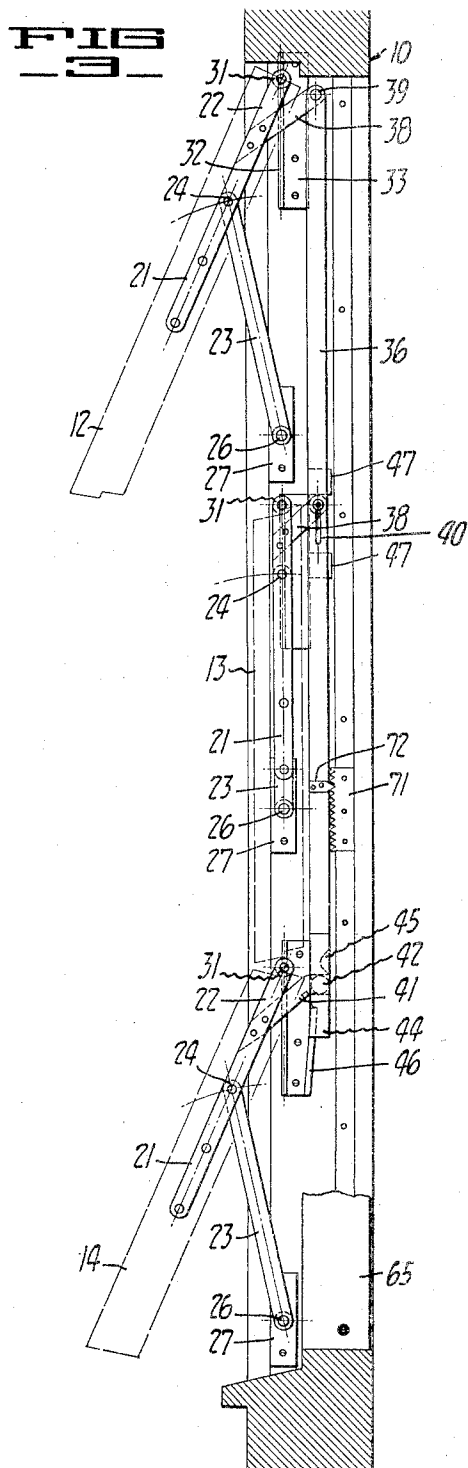
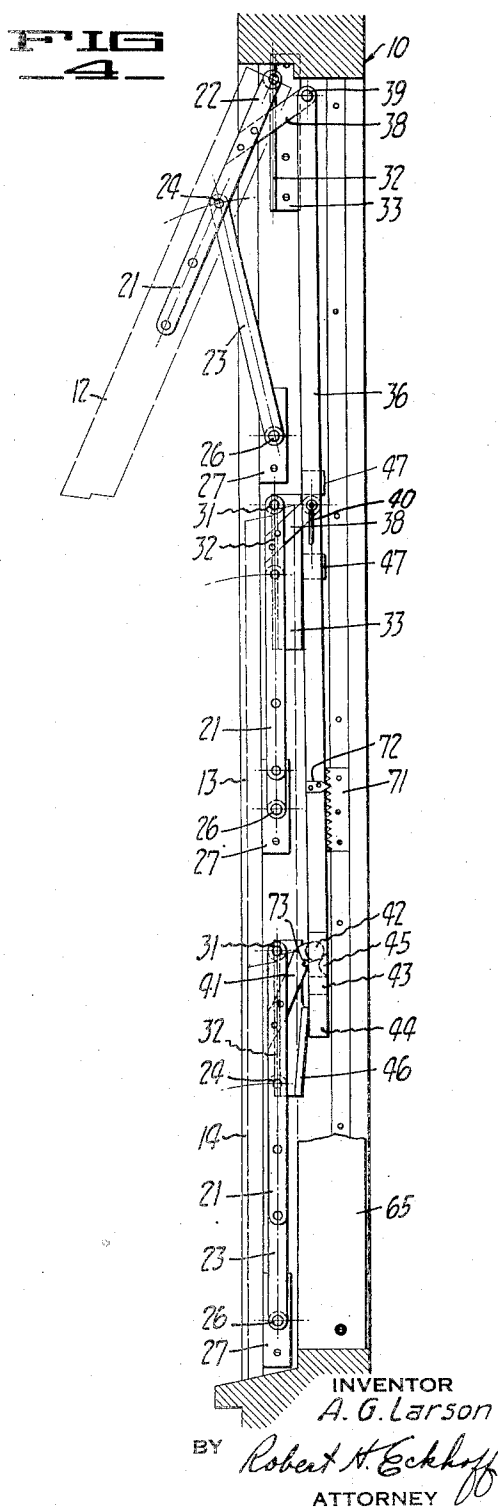
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**2,292,133**

## WINDOW CONSTRUCTION

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4 Sheets--Sheet 2



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WINDOW CONSTRUCTION

Filed July 26, 1940

4 Sheets-Sheet 3

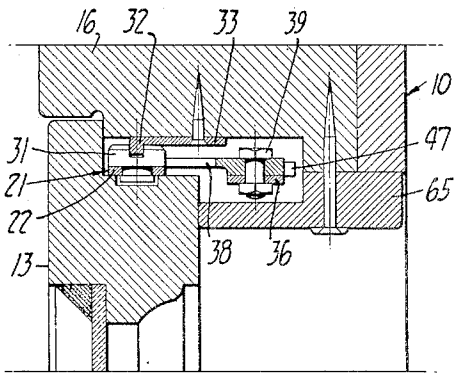


FIG. 12

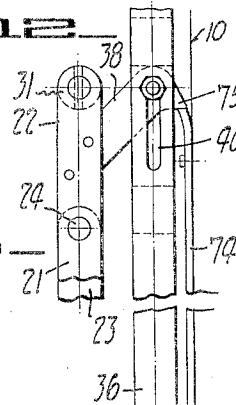


FIG. 5

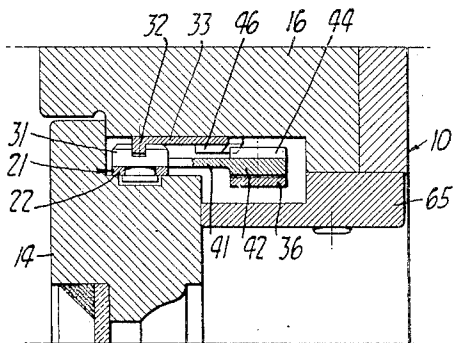


FIG. 6

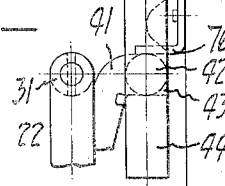
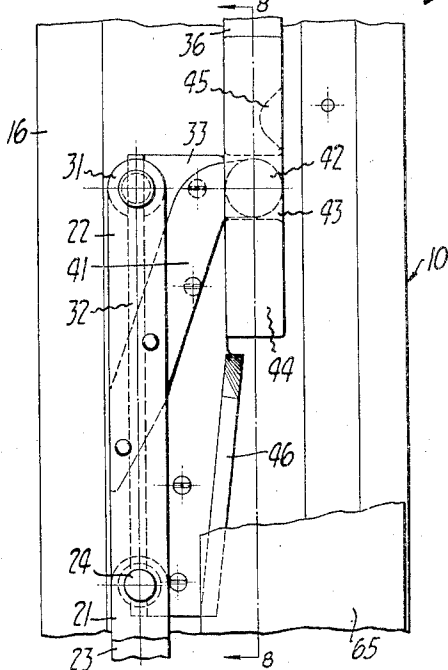
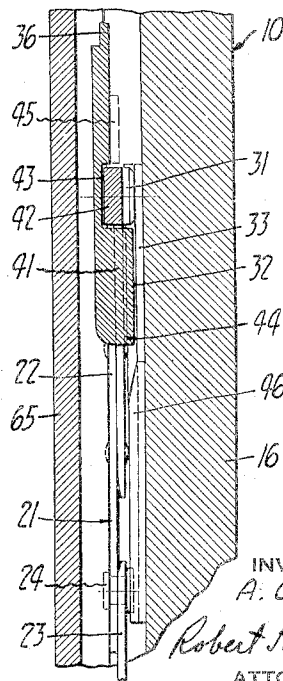


FIG. 8

FIG. 7



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**FIG. 10**

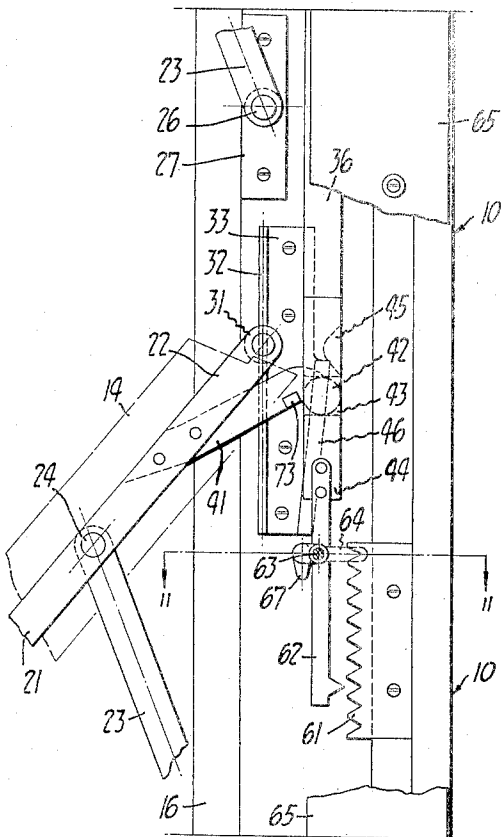


**FIG. 9**

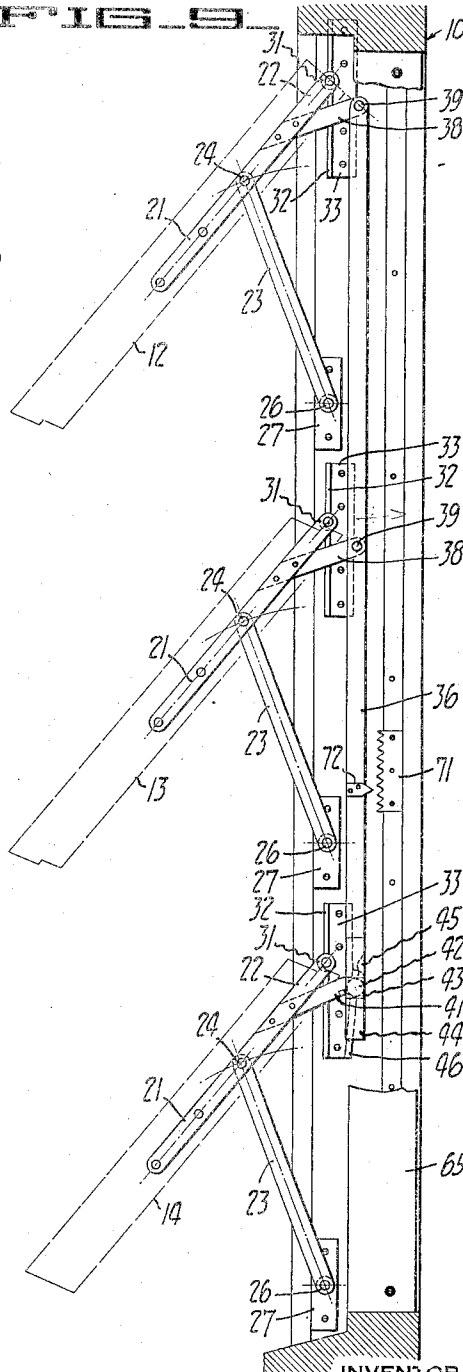
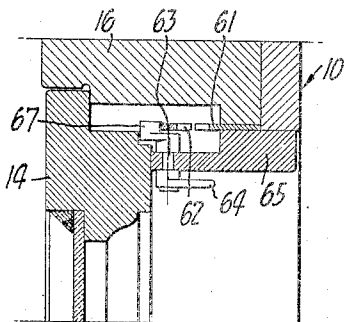


**FIG. 11**



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## UNITED STATES PATENT OFFICE

2,292,133

## WINDOW CONSTRUCTION

Albert G. Larson, Oakland, Calif., assignor to  
Harry Larson

Application July 26, 1940, Serial No. 347,712

10 Claims. (Cl. 20—42)

This invention relates generally to windows of the multiple sash type, in which the sashes are arranged to swing about generally horizontal axes. While not limited in its application, the window disclosed herein is particularly suited for construction of metal, as distinguished from the more common type windows which are usually made of wood.

The invention also relates generally to windows making use of a plurality of sashes carried by a single frame and arranged one above the other. It is further particularly concerned with the mechanism enabling the sashes to be moved between open and closed positions in a selective manner.

It is an object of the invention to provide a window of the above character having an improved automatic mechanism for securing a definite cycle of operation upon manual manipulation of one of the sashes. As will be presently explained, the cycle of operation is such that by manipulating the lower sash, for example, one or more of the plurality of other sashes can be selectively opened or closed. Thus, in a three sash window, for example, it is possible to manipulate the bottom sash to open only the top sash, to open both the top and middle sash, or to open all three sashes, or to leave one or more of the upper sashes in an open or partially open position while the bottom sash is closed.

In connection with the automatic cycle of operation, a further object of the invention is to enable, by operation of a selected sash, a conjoint operation of one or more of the other sashes by manipulation of both of them or independent manipulation of one sash.

Another object of this invention is to provide an improved means for effecting automatic engagement and disengagement of clutch mechanism which in turn enables conjoint operation of all of the sashes by the manipulation of one of them, or an independent manipulation of one or more of the sashes.

The construction of the present invention is further characterized in that the window construction is such that certain present defects in construction are overcome. This defect consists particularly in the manner in which the individual sashes are mounted in the frame.

Another object of the invention is to provide an automatic multiple sash window of simple, reliable, and rugged construction which will not be subject to objectionable wear in usage, and which will perform its desired functions over a long period of time without servicing.

Further objects of the invention will appear, in addition to the foregoing, from the following description in which the present preferred embodiment of the invention is set forth in detail in conjunction with the accompanying drawings.

Referring to the drawings, Figure 1 is a side elevation, partly in section, through a window embodying the construction of the present invention.

Figure 2 is a side elevation partly in section showing the window construction in Figure 1 with the upper sashes moved toward full open position, and with the lower sash partially returned to closed position.

Figures 3 and 4 are side views, partly in section, showing the window in several different operative positions.

Figures 5 and 6 are respectively sections taken along the lines 5—5 and 6—6 of Figure 1.

Figure 7 is a side elevation, partly in section, showing the clutch operating mechanism of the present invention, while Figure 8 is a section taken along the line 8—8 of Figure 7.

Figure 9 is a view similar to Figure 2, but showing a modification of construction.

Figure 10 is a view similar to Figure 7, but showing a sash locking means.

Figure 11 is a cross-sectional view taken along the line 11—11 of Figure 10.

Figure 12 is a fragmentary side elevation illustrating a locking mechanism for a sash when in closed position.

Referring first to Figure 1, my window comprises a suitable frame 10 adapted to be mounted in a weatherproof manner within a suitable supporting structure as the wall of a building. The frame 10 serves to carry a plurality of sashes, 12, 13, and 14 for swinging movement between open and closed positions. The number of swinging sashes provided may vary in accordance with requirements. In some instances, more than three sashes will be required, while in other instances two sashes will suffice.

When two sashes are employed, one sash may be carried independently above the other, or the sashes may be placed a substantial vertical distance apart with an intermediate panel or independently mounted sash. While the type of swinging movement employed may be modified, the movement is preferably of a generally horizontal axis.

While the particular type of frame illustrated is formed of wood, it is to be understood that other materials can be employed, as for example, suitable steel structural members. This will be-

come further apparent hereinafter wherein it is pointed out that the structure may be positioned and operated in any opening provided by suitable framing, such as is provided by oppositely spaced vertical framing members 16. The fit between each sash and the framing is weatherproof; any suitable construction can be employed.

To mount the sashes for the type of swinging movement desired, the side edges of each sash are provided with sash plates 21 suitably secured thereto, and which provide projecting and laterally extending arms or brackets 22. Two supporting arms or links 23 are provided for each sash. The upper end of each link 23 has a pivotal connection 24 with the corresponding sash plate 21, while the lower end of each link 23 has a pivotal connection 26 with a plate 27 secured to each vertical member 16.

In one form of the invention pivotal connection 24 is made with each sash plate at substantially the same point along each sash, as shown in Figure 9. This modification will be first discussed. Another modification (that in Figures 1-4) contemplates attachment of sash plate 21 of the middle sash 13, for example, at a point half way between brackets 22 and pivotal connection 24 on the other sashes. This last construction, in conjunction with other presently described mechanism, enables the top sash to be selectively opened and closed in a normal manner while the lower sashes can be selectively opened and closed, together or separately. The first mentioned construction enables the first sash to control the upper sashes.

#### *Selective movement of upper sashes as a unit by bottom sash*

As to the modification of Figure 9, the arms 22 for each sash are pivotally connected to suitable vertical guide means in each sash so that a vertical sliding movement can occur. Thus, as appears in the drawings, arms 22 are shown as carrying slotted pins 31 traveling on vertical ribs 32 on the side plates 33, each side plate 33 being secured to the vertical side members 16. Any other sliding connection can be employed between the arms 22 and the members 16.

Mounted for a vertical reciprocating movement is a travel bar 36 suitably guided for vertical reciprocating motion. In accordance with this invention, so far as it concerns this modification, each sash 12, 13, and 14 is connected to the travel bar, at least during initial opening movement of the travel bar. Thus, sashes 12 and 13 each include such connecting means as an arm 38 attached to sash plate 21, and extending therefrom for a pivotal attachment to the travel bar as at 39.

The sash 14, that shown as the operating sash for the present disclosure, includes a like arm designated as 41. However, arm 41 carries a boss 42 on the end thereof adapted to ride in a suitable recess 43 in travel bar 36 adjacent the enlarged end 44 of the travel bar. When sash 14 is moved outwardly as in Figure 9, the boss 42 engages the bottom of recess 43 in the travel bar and moves the travel bar 36 on each side of the sash downwardly. This is effective to open the other sashes because of the pivotal connection 39 between arms 38, the sash plate 21 associated therewith, and the travel bar. As this motion continues, the end 44 on the travel bar rides up onto the upwardly extending camming surface of cam member 46 angularly positioned 75

in the line of downward movement of the travel bar. Cam member 46 holds the end of the travel bar raised sufficiently to permit the boss 42 to be moved back out of the recess 43 and back along the travel bar. With the end of the travel bar raised, the lower sash can be selectively returned to its closed position. As the lower sash is returned, the boss 42 comes in contact with a cam 45 to force end 44 off the cam member 46, whereupon it drops down onto the boss 42. In this position, boss 42, upon outward movement of the lower sash, comes into engagement with bottom face of recess 43 positively. The end 44 in the travel bar then lies against the inner side of member 46 so that the lower sash controls and moves the other sashes. The bottom of recess 43 is usually made with a configuration corresponding to that of the boss 42 so that the boss can pull the travel bar into the cam member 46.

With the upper sashes open and the bottom sash closed, it is only necessary, to close all sashes, to move sash 14 outwardly until the boss 42 engages in the recess 43. This can be determined by moving the sash 14 outwardly until outward movement of sashes 12 and 13 is observed. Return movement of sash 14 will then be effective to return sashes 12 and 13.

It is to be noted that the construction of the present invention enables the windows to be moved independently of the pivotal support therefor. Usual awning type windows depend on application of levers to either one or both of these points. Since the force application to the sash in the present window construction is independent of the mounting means for the window, this enables the window construction to be materially stronger, enabling much more leverage to be applied to the window, and enabling the windows to be opened and closed more easily. Further, the automatic cam operating means is not dependent on any spring or other parts. It is therefore easy to manufacture and does not get out of order.

#### *Selective manipulation of intermediate sash*

The window construction of the present invention (Figures 1-6) enables, for example, the top sash in a three sash window to be opened selectively while the lower two sashes are in a closed position. With the same structure it is also practical to open the two upper sashes and close the lower sash, or all three sashes can be opened, the manipulation being effective from the bottommost sash. This mode of operation is secured by attaching link 23 of the sash 13 at a point intermediate the usual pivotal connection 24 and pivotal connection 22, as shown in Figures 1 to 6 inclusive, and by providing on each of the travel bars 36 spaced stops 47. The end of the middle sash arm 38 is not positively connected to the travel member, although it can be located by bolt 39 extending through slot 40 in the travel bar to retain the arm 38 in position. The free end of the arm 38 extends between the stops 47 on the travel bar. The stops 47 are usually spaced apart so that the top and lower sashes can be opened from a closed position, as in Figure 1, to an angle of about 30°, as in Figure 3, before the middle sash is moved, usually a spacing of about one and a half inches is satisfactory. Because of the increased leverage on the middle sash by reason of the moving of the pivotal point 24 of attachment of link 23, the middle sash moves at a higher rate than that of the top or

lower sash until the sashes are open to the same extent, as in Figure 2. It is thus possible to open the top sash, without opening the middle sash, by opening the lower sash only about 30°, the sash then being in the position in which it appears in Figure 3.

With the top sash open, the bottom sash is returned to leave only the top sash open as in Figure 4. To close the top sash, the bottom sash is moved out until its bosses 42 pick up and engage recesses 43 on the travel bars when the sashes can be closed.

Selective opening of the top sash provides a material saving in fuel in winter weather, particularly in cold climates where the diminished window opening provides ample ventilation. At the same time, it enables all windows to be opened fully.

#### *Locking means*

In accordance with this invention, the sashes can be locked in any desired position in which they are placed. This is accomplished, as shown in Figures 10 and 11, by mounting adjacent each travel bar, and preferably also along intermediate portions of the travel bar, a suitable serrated member 61. An engaging member 62 is mounted adjacent each serrated member, and a suitable locking device is provided in the form of a rod 63 carrying a handle 64 and mounted for rotation in the cover member 65. On the other end of the rod is mounted a suitable cam member 67 to force each travel member sideways and bring the engaging member 62 into engagement with the fixed serrated member 61. Because the travel member is more or less flexibly supported, this engagement can take place at a plurality of points along the travel member so that the sash can be locked in an adjusted position. This is of advantage because it prevents a sudden gust of wind from slamming an open sash to shut position and shattering the glass therein, to the possible harm of occupants of the room.

In place of, or in conjunction with the manually manipulated locking means of Figures 10 and 11, the locking means can be automatic in operation and controlled by the selectively operated sash. For example, sashes 12 and 13 in the modification shown in Figures 1-4 can be selectively locked in position by manipulation of sash 14. To accomplish this I preferably provide a notched plate 71 mounted on the side frame while the cooperatively formed tooth 72 is mounted upon travel bar 36. Normally the tooth is not engaged with the plate 71 when the sashes are in closed position, as in Figure 1, but the tooth is above the plate. However, if desired, the length of the plate can be so adjusted that the tooth is in engagement therewith so that sashes 12 and 13 are definitely locked in position until sash 14 has swung outwardly enough to move travel bar 36 to an extent sufficient to disengage the tooth from the notched plate, whereupon the sashes 12 and 13 can be moved into an open position. A cam member 73 is provided upon each arm 41 associated with sash 14, this member being effective to move the travel bar 36 sufficiently towards the right in Figures 1-4 to engage the tooth with the notched plate 71. In Figure 2 the tooth is shown out of engagement with the plate, while in Figure 3 it is partially engaged with the plate, sash 14 being returned toward its closed position. In Figure 4 the tooth is shown in locking engagement with the plate,

sashes 13 and 14 being closed and sash 12 being locked in open position.

When sash 13 is opened, it is of course locked positively against closing, as by a sudden gust of wind, because arm 38 associated therewith is positively engaged with stop 47 on the travel bar, and the travel bar is locked in position and the sash cannot be swung to closed position. When sash 13 is closed, together with sash 12, irrespective of the position of sash 14, sash 13 can be locked in closed position. Referring to Figure 12, a bar member 74 is slideably mounted in any suitable manner. One end 76 thereof is bent over to engage boss 42 while the other end of member 74 is formed to abut an extension 75 on arm 38 of sash 13 and lock the sash against opening movement.

When sash 14 is moved outwardly, member 74 can drop and permit sash 13 to open. If sash 13 is permitted to remain in open position and sash 14 is closed, the member 74 does not engage the extension 75 because travel bar 36 will have been moved sufficiently to the left in Figure 12 to permit member 74 to be lifted, as sash 14 closes, without engaging extension 75.

If desired, the notched plate and tooth can also be applied to a structure of the character shown in Figure 9.

While herein I have shown various of the operating parts as separately provided and mounted upon the framing, it is to be understood that these can be assembled as units. Thus, side plates 33 and plates 27 can, if desired, be provided by a single plate continuous for a given sash structure.

#### *I claim:*

1. In combination, a window frame, at least three sashes for said frame, a pair of guides for each sash positioned in said frame on opposite sides thereof and extending parallel to said frame, a sliding hinge connection between each sash end and one pair of said guides, an arm for each sash hinged on said frame and on a sash at a point intermediate the ends of said sash, a common operating means for said sashes, operating connections extending from said operating means to two of said sashes at a point substantially midway between said sash end and said intermediate point, and another operating connection extending to the other of said sashes including a lost motion connection and being made to said sash at a point about a quarter the distance between said end and said intermediate point measured from said end.

2. In combination, a window frame, a plurality of sashes for said frame, a pair of guides for each sash positioned in said frame on opposite sides thereof and extending parallel to said frame, a sliding hinge connection between each sash end and one pair of said guides, an arm for each sash hinged on said frame and on a sash at a point intermediate the ends of said sash, a common operating means for said sashes including an operating connection extending from said operating means to each sash between said sash end and said intermediate point, one of said operating connections comprising an arm extending from one of said sashes and having a cam surface thereon, said common operating means including a cam fixed on one side of said frame and a movable travel bar interconnecting said sashes and having cam surfaces thereon cooperating with said arm cam surface to permit said arm cam to move said bar down into

open position wherein said bar engages said fixed cam and is moved inwardly by said fixed cam and from which position said arm cam can move without disturbing said bar into a sash closed position.

3. In combination, a window frame, a plurality of sashes for said frame, a pair of guides for each sash positioned in said frame on opposite sides thereof and extending parallel to said frame, each sliding hinge connection between a sash end and one pair of said guides, an arm for each sash hinged on said frame and on a sash at a point intermediate the ends of said sash, a common operating means for said sashes including an operating connection extending from said operating means to each sash between said sash end and said intermediate point, one of said operating connections comprising an arm extending from one of said sashes and having a cam surface thereon, said common operating means including a cam fixed on one side of said frame and a movable travel bar interconnecting said sashes and having cam surfaces thereon cooperating with said arm cam surface to permit said arm cam to move said bar down into open position wherein said bar engages said fixed cam and is moved inwardly by said fixed cam and from which position said arm cam can move without disturbing said bar into a sash closed position and then, upon return to sash open position, reengage said bar positively upon further movement of said cam to move said bar to sash open or sash closed position.

4. In combination, a window frame, a plurality of sashes for said frame, a pair of guides for each sash positioned in said frame on opposite sides thereof and extending parallel to said frame, a sliding hinge connection between each sash end and one pair of said guides, an arm for each sash hinged on said frame and on a sash at a point intermediate the ends of said sash, a common operating means for said sashes including an operating connection extending from said operating means to each sash between said sash end and said intermediate point; said operating means including a travel bar, one operating connection comprising an arm extending from one of said sashes and engaging said bar in an initial position to move said bar back and forth over a path, a cam for releasing said arm from operating engagement with said bar to permit said arm to be returned to said initial position after movement of said bar in one direction along said path, and a cam on said bar engaged by said arm upon said return to move said bar into a position in which said arm reengages said bar positively upon movement of said arm from initial position.

5. In combination, a window frame, a plurality of sashes for said frame, a pair of guides for each sash positioned in said frame on opposite sides thereof and extending parallel to said frame, a sliding hinge connection between each sash end and one pair of said guides, an arm for each sash hinged on said frame and on a sash at a point intermediate the ends of said sash, a common operating means for said sashes including an operating connection extending from said operating means to each sash between said sash end and said intermediate point; said operating means including a travel bar, one operating connection comprising an arm extending from one of said sashes and engaging said bar in an initial position to move said bar back and forth over a path extending longitudinally

of said frame, a cam for releasing said arm from operating engagement with said bar to permit said arm to be returned to said initial position after movement of said bar in one direction along said path, a cam on said bar engaged by said arm upon said return to move said bar into a position in which said arm can reengage said bar positively upon movement of said arm from initial position, and a lock for said bar closed upon movement of said one of said sashes from an open position into closed position.

6. In combination, a window frame, a plurality of sashes for said frame, a guide for each sash positioned in said frame on opposite sides thereof and extending parallel to said frame, a sliding hinge connection between a sash end and a pair of said guides, an arm hinged on said frame and on a sash at a point intermediate the ends of said sash, a common operating means for said sashes, an operating connection extending from said operating means to each sash between said sash end and said intermediate point, and locking means operated by said operating means for locking said operating means against movement to retain the sash in a selected position.

7. In combination, a window frame, at least three sashes for said frame, a pair of guides for each sash positioned in said frame on opposite sides thereof and extending parallel to said frame, a sliding hinge connection between each sash end and one pair of said guides, an arm hinged on said frame and on a sash at a point intermediate the ends of said sash, a common operating means for said sashes, operating connections extending from said operating means to two of said sashes at substantially the same point of connection between said sash end and said intermediate point, and another operating connection including lost motion extending to the other of said sashes and at a point different from said first mentioned point of connection but between said end and said intermediate point.

8. In a multiple sash window, a frame, at least two sashes carried by the frame for swinging movement, means serving to interconnect said sashes for conjoint swinging movement upon manually swinging one of them, said last named means including a vertically moving travel bar disposed on the side of the frame and having a recess therein adjacent the lower end of the travel bar, an operating arm carried by that sash adjacent to an end of said bar and having an end adapted to fit in said recess and move said travel bar, and a cam member secured to said frame to move said lower end in toward said adjacent sash upon continued downward movement of said bar by said adjacent sash to move said operating arm end out of said recess to permit selective closing of said adjacent sash.

9. In a multiple sash window, a frame, at least two sashes carried by the frame for swinging movement, means serving to interconnect said sashes for conjoint swinging movement upon manually swinging one of them, said last named means including a vertically moving travel bar disposed on the side of the frame and having a recess therein adjacent the lower end of the travel bar, an operating arm carried by that sash adjacent to an end of said bar and having an end adapted to fit in said recess and move said travel bar, a cam secured to said frame to move said lower end in toward said adjacent sash upon continued downward movement of

said bar by said adjacent sash to move said operating arm end out of said recess to permit selective closing of said adjacent sash, and a cam member on said bar above said recess and engaged by said arm upon selective closing of said adjacent sash to move said bar out of engagement with said cam member whereby, upon continued opening movement of said adjacent sash, said operating arm engages said recess to permit selective movement of the sashes.

10. In combination, a window frame, a plurality of sashes for said frame, a pair of guides for each sash positioned in said frame on opposite sides thereof and extending parallel to said frame, a sliding hinge connection between a sash end and one pair of said guides, an arm hinged on said frames and on the sash at a point intermediate the ends of the sash to sup-

port the sash for swinging movement in the frame together with said sliding hinge connection, means serving to interconnect said sashes for conjoint swinging movement upon manually swinging one of them, said last named means including a vertically moving travel bar disposed on the side of the frame and having a recess therein adjacent the lower end of the travel bar, an operating arm carried by that sash adjacent to an end of said bar and having an end adapted to fit in said recess and move said travel bar, and a cam member secured to said frame to move said lower end in toward an adjacent sash upon continued downward movement of said bar by said adjacent sash to move said operating arm end out of said recess to permit selective closing of said adjacent sash.

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