Dec. 28, 1954 E. W. F. RYDELL 2,698,173

AWNING WINDOW HARDWARE

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FIG 1

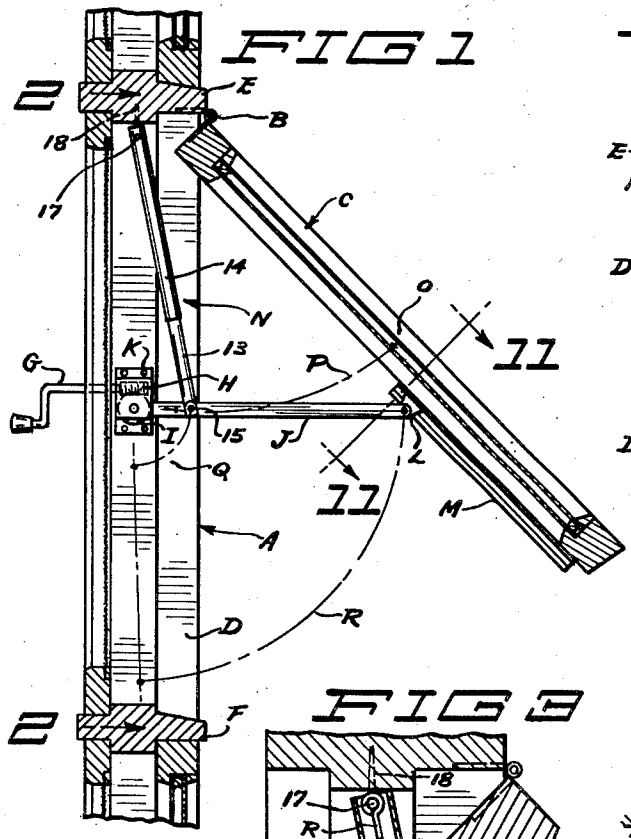


FIG 2

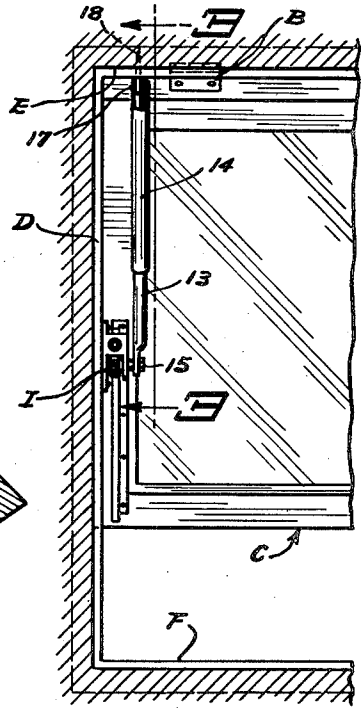


FIG 3

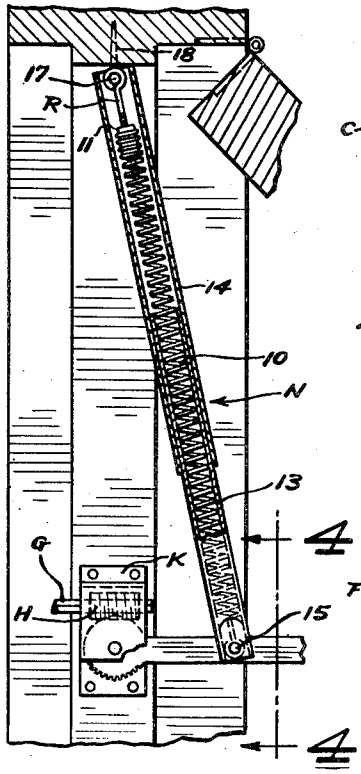


FIG 4

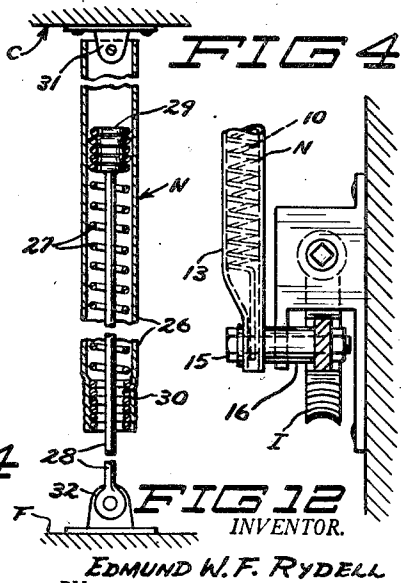


FIG 5

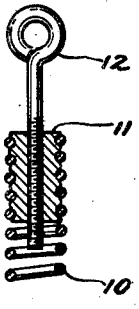


FIG 12

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FIG 6

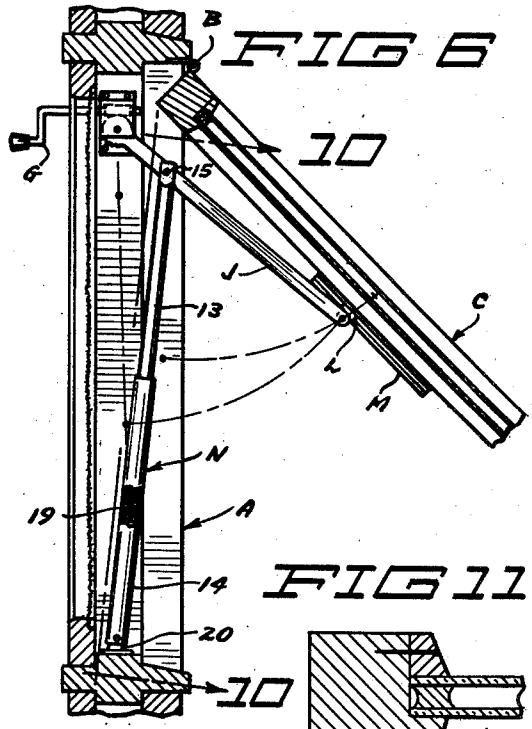


FIG 7

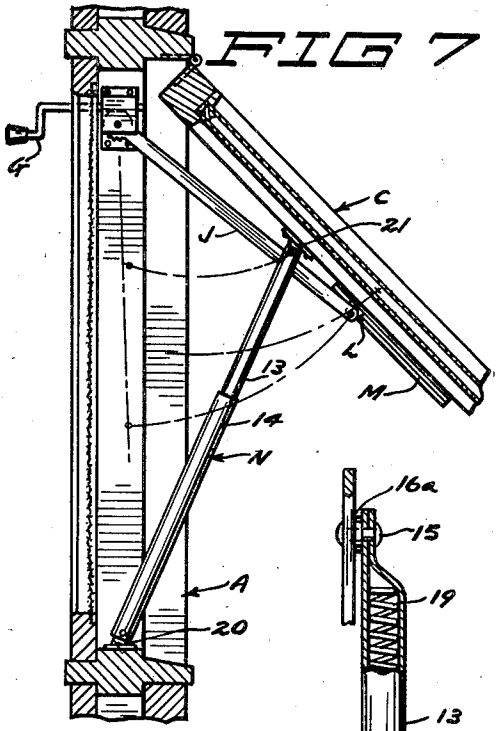


FIG 11

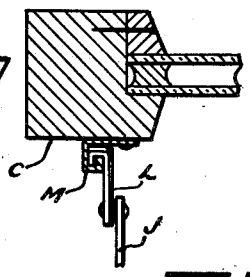


FIG 9

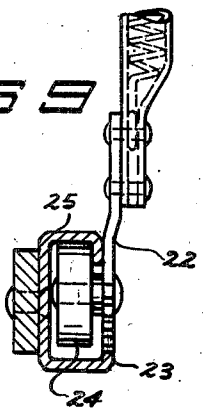


FIG 8

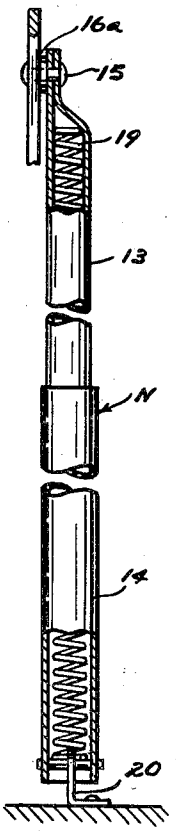


FIG 10

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AWNING WINDOW HARDWARE

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Application September 20, 1952, Serial No. 310,629

3 Claims. (Cl. 268—109)

This invention relates generally to improvements in windows of the well-known awning type and more specifically to the hardware for opening, closing, and locking these types of windows.

The primary object of my invention is to provide a method of opening, closing, and locking awning type windows by means of a worm and gear assembly operated by means of a crank which extends into the room and projects through a hole in the screen frame which, in this type of window, is placed toward the inside of the house. This method of opening the window does away with the necessity of opening the screen and holding it open each time the window is to be operated. A further object of my invention is to provide a sash balancing system, so that in operating the window it is not necessary to lift the weight of the window by means of the crank but only necessary to provide the force necessary to overcome friction and inertia. A further and very important reason for the need for such a balancing system lies in the fact that, without it, the sash has a very marked tendency to jiggle and chatter in closing; this tendency is impossible to overcome in any other way.

These and other more detailed and specific objects will be disclosed in the course of the following specification, reference being had to the accompanying drawings, in which—

Fig. 1 is a typical vertical section through an awning type window, showing the window in the extended position with the operating hardware of my invention installed.

Fig. 2 is an elevation on line **2—2** in Fig. 1 of the window from the inside of the house, the window shown in the extended position, with the hardware of my invention installed.

Fig. 3 is an enlarged section on line **3—3** in Fig. 2 through the window, showing only the operating hardware, and disclosing the internal construction of the balancing system by means of a cutaway view.

Fig. 4 is a section taken on line **4—4** in Fig. 3 and indicates the method of connecting the balancing system and the operator arm.

Fig. 5 is a fragmentary section through the balancing system showing an adjustment method which is incorporated in the balancing system.

Fig. 6 is a section through the window showing another or second modification of this invention, involving the substitution of a compression type balancing system.

Fig. 7 is a section through the window showing a third modification of the invention, involving a compression type balancing system mounted directly on the sash, and having no connection with the operating arm.

Fig. 8 discloses the fourth modification of the invention, which employs a gear mechanism mounted on the operator arm for the purpose of providing a moving connecting point.

Fig. 9 is a section taken on line **9—9** in Fig. 8, which shows the aforementioned gear mechanism and roller bearing.

Fig. 10 is a detail elevation and section showing the construction of the compression type balance system of Fig. 6.

Fig. 11 is a section at **11—11** in Fig. 1, showing the method of attaching the operating mechanism to the sash.

Fig. 12 is a sectional detail of a further modified balance device.

Referring now more particularly and by reference characters to the drawing, A designates generally the frame of

an awning type window, arranged in a building wall or in conjunction with other awning windows as shown above and below in Fig. 1. Hinged at the top with ordinary butt hinges B is the awning type sash C. The frame contains the usual side jambs D, head jamb E, and sill F. The awning window is standard in every respect, and requires no modifications or changes to accept the operating hardware of my invention.

Referring again to the drawing with respect to the operating hardware, G represents a crank which is inserted into a worm gear H which engages and drives a spur gear I which is formed on the end of the operating arm J. The worm gear and the spur gear are housed, borne, and fastened to the frame by means of the housing K. The opposite end of the operator arm is fastened with a swivel connection to the shoe L, which slides in a track M as the window is raised or lowered. The balancing system N is connected to the operating arm at one end and the head jamb at the other end.

The balancing system N consists of the following parts: a tension spring of the proper tension and length **10**, having a hook bent on one end and having the plain coil of the spring at the other; this latter end is screwed onto an adjustment socket **11** having a threaded concentric hole which engages an adjustment rod **12**, which is threaded for the adjustment socket at one end and bent to form a hook at the other end. The spring is housed within two close-fitting tubes **13** and **14** which telescope easily one within the other. The lower end of the lower tube is flattened and apertured as shown in Fig. 4, and fastened to the operator arm by means of a screw **15** and a spacer **16**, the screw fitting into a threaded opening in the operator arm. A small pin **17** passes through the upper end of the upper tube, through the hook at the upper end of the adjustment rod **12**, and also through the eye of a common threaded screw eye or eye hook **18**, and then through the opposite side of the tube. The entire top end of the assembly is held together by this pin, which is secured by enlarging or upsetting the ends.

In installing the operating hardware, the operating mechanism comprising the gear system and the operator arm are installed first. This is done by mounting the housing K on the side jamb D with wood screws through holes which are provided. Next the track is installed on the sash with wood screws; the shoe L being slipped into the track before the screws are inserted. Finally the balancing system is installed, the top end being attached first, screwing the threaded end of the screw eye into the head jamb by twisting the upper tube. The lower connection is made last, by forcibly extending the spring **10**, and inserting the screw **15** with the spacer **16** while the system is held in this position. If the window is not in satisfactory balance upon completion of the installation, it is only necessary to remove the screw **15** at the bottom, twist the lower tube several times to either increase or decrease the tension as the case may be, and reassemble the unit. Twisting the lower tube in this fashion will cause the adjustment rod **12** to move in or out of the adjustment socket **11**, thus effectively lengthening or shortening the spring, which will increase or decrease its tension.

This operating hardware as described heretofore provides a method of opening and closing an awning type window by means which truly anticipates the problems involved. At the time when the window is nearly shut or completely shut, the force of gravity contributes little or no horizontal component of force, and the balancing system counteracts with little or no upward force on the sash, although the spring is under full tension. As the window opens and the force of gravity becomes increasingly stronger, a measure of this increase is the amount by which the center of gravity O of the sash is raised as it moves along the path P in Fig. 1, the balancing system counteracts with ever increasing force as its point of application moves away from dead center along the path Q. Thus, except for slight inequalities to be taken up later, the sash is always in balance.

It will be noted that, in this first modification of my invention the path of the center of gravity of the sash and the path R of point of pressure of the shoe L are not identical nor concentric, and in fact diverge quite widely as the sash is lowered, this being hereinafter referred to as

the "divergence effect." Because of this divergence of these paths, the operator arm gains in leverage over the force of gravity as the sash is lowered, with the result that exactly constant force is not what is required in order to perfectly balance the unit.

It will also be noted that, as the operator arm J descends in closing the window, the spring **10** of the balance system elongates by the amount of the radius of the path Q in Fig. 1. This elongation of the spring, hereinafter referred to as the "elongation effect," causes the tension of the spring to increase as the window is closed. The divergence effect and the elongation effect do not work to cancel each other but their effect is cumulative instead. The result is that the system has rather more than necessary balancing action at the closed or nearly closed positions, but has somewhat insufficient balancing action at the extreme open positions. These theoretical considerations are borne out by working models, which exhibit slight tendencies toward chattering at each extremity of operation, together with the condition of requiring more force at the crank to raise the window the last few degrees. The resultant operating hardware is nevertheless one which is far superior to any of the other known types which do not attempt to balance the window, but is also one in which there is some room for further improvement.

In order to avoid, insofar as possible, the deleterious results of the aforementioned divergence and elongation effects, the second modification of my invention shown in Fig. 6 has been developed. The operating arm assembly comprising the gears, housing, arm, shoe, and track are not changed in any way and are represented by the same reference characters but in this case they are mounted as high as possible on the side jamb. This results in making the paths of the center of gravity of the sash and the point of pressure of the operating arm as nearly coincident as possible, thus largely minimizing the divergence effect. The only other change is in the construction and location of the balancing system, which in this case employs a compression spring **19** rather than a tension spring. In other respects the spring construction (Fig. 10) is very similar to that of the tension spring system and similar reference numerals are used. The balance system in this case can be nearly as long as the height of the sash, which helps to minimize the elongation effect. It will be seen that the elongation (and proportional loss of power) will be very slight in comparison to the total length of the spring. The balancing system is connected to the sill at its bottom end by means of an angle bracket **20** and wood screws, and is connected to the operating arm by means of a screw or rivet **15** in the same fashion as the tension type spring. The spacer **16** is not needed as there is no necessity for the balancing system to clear the housing in closing, as in the case of the tension spring and a small washer **16a** is substituted for the spacer. Since the divergence effect and elongation effect are largely minimized in this construction, this modification results in a system which will effectively balance the window in any position. A further object of this modification is to provide a method whereby the window may be opened further than was possible by previous methods; a maximum approaching 90 degrees was desired. This object of the invention is fully accomplished by the foregoing modification.

A further modification of the balancing system is illustrated in Fig. 7, in which case the same type of compression spring is used as in the foregoing modification. The lower end of the balancing system is attached to the sill as before, but the upper end is attached at **21** to the sash itself rather than to any part of the operating mechanism. This has the advantage that any type of awning window operator may then be used to operate the window. Such operators will then work far better and easier than ever before as they are no longer called upon to lift the weight of the window, but only to overcome friction and inertia. The conventional gear operator heretofore described may, of course, be used; this is illustrated in Fig. 7. In this case the top end of the balancing system is secured to the sash by means of an angle plate and screws at **21** referred to above and similar to the bottom end. In this case the elongation effect is largely minimized, and the window is in almost perfect balance over the entire operating distance. This modification also allows for opening the window to an angle approaching 90 degrees. Since the balancer attaches at a point quite close to the top of the window, a large amount of upward thrust is developed

at the hinges B, and quite a heavy spring is required to effectively balance the window. In view of these facts, a conservative policy would be to provide two such balances, one to be installed on each side of the window, and each carrying half the total load. Such balances could also be installed in suitable rebates on each side of the window, being built into the sides of the window so that when the window is closed, the balances are hidden. This adaptation of the modification is not shown, being so similar as to require no illustration. This modification would also work very well with a hand operated window, as the window would remain in any position to which it was set.

A still further modification of my invention relates to the basic design shown in Fig. 1, but makes the very important addition of providing a moving connection for the joint between the operator arm and the balancing system. This results in still another method of compensating for the divergence effect and the elongation effect. How this is accomplished is shown in Fig. 8. A rack and pinion arrangement is substituted for the fixed connection **15** between arm and balancing system of Fig. 1, resulting in a connection which moves progressively outward (increasing the radius of the path Q Fig. 1) so that the effective leverage of the balancing system upon the operator arm is increased as the window is opened, offsetting the losses in power due to the divergence effect and the elongation effect. The details of construction may be seen in Fig. 9, which is a section taken on Fig. 8. It may be seen that the pinion **22** is made an integral part of the balancing system, being firmly riveted or otherwise secured thereto. The teeth of the pinion mesh with the teeth of a rack **23** and are kept in contact by means of a roller **24** whose axis is the axis of the pinion, and which rides in a channel **25** which is formed as a part of the rack. The rack in turn is solidly riveted or secured on the operator arm. In operation, the rack moves approximately 80 degrees with respect to the pinion as the window is opened; this motion causes the pinion **22** to move outward on the rack in a direction favorable to maintaining the window in perfect balance. Proper selection of the radius of the roller **24** and the pinion can establish any desired amount of travel of the connection point. It should be noted that the rack and pinion assembly fit into the space previously taken up by the spacer **16**. It should be further noted that this modification can be designed to provide a degree of opening angle nearly equal to that provided by the other modifications, since the operator mechanism can be moved up further on the side jamb and a shorter tension spring be used, resulting in a greater opening angle obtainable. The additional elongation effect introduced by using a shorter spring will be somewhat reduced by the lesser divergence effect, but can be wholly offset by a properly designed rack and pinion as illustrated.

It would be possible and perhaps desirable to make the compression type balance by employing a tension spring, thus doing away with the more expensive compression spring. Such a balance system may be made, as seen in Fig. 12, by employing an outer tube **26** to serve as a housing, a tension spring **27** of suitable length and tension which would fit within the outer tube, and an inner rod **28** which would fit inside the coils of the spring. This rod is fastened at one end at **29** of the spring, extends the length of the spring and protrudes some distance beyond the other end of the spring. The housing tube **26** is fastened to the spring at **30** at the opposite end from where the rod is fastened, completely houses the spring and extends some distance beyond the spring. End connections are similar to those used on the other types and are here shown as brackets **31** and **32** to the sash C and sill F. Such a balance system provides compressive force although utilizing a tension spring.

It is to be noted that the effectiveness of the invention (tensile balancing system) is not in the least affected if the tubes which form the housing for the spring in the balancing system are removed. The only purpose of the housing in this case is for appearance, and it is intended that the basic design come within the spirit and scope of the appended claims whether or not the housing tubes are employed to cover the spring.

It is understood that suitable modifications may be made in the structure as disclosed, provided such modifications come within the spirit and scope of the appended claims. Having now therefore fully illustrated and described my invention, what I claim to be new and desire to protect by Letters Patent is:

1. For operating an awning type of window having a sash hinged at its upper edge in a frame and which is opened by swinging the lower edge of the sash outward and upward, operating hardware comprising in combination, an operating arm pivoted to one side of the frame and swingable about said pivot in the same plane as the window hinges, means slidably and pivotally connecting the arm to the sash and operative to open and close the sash upon movement of the arm about its pivot, a coil spring attached at one end to the frame and means movably attaching the other end to the arm for biasing the window toward its open position, and means operative as the arm swings to shift said spring attaching means along the arm and increase the biasing effect of the spring as the window moves toward its open position.

2. For operating an awning type of window having a sash hinged at its upper edge in a frame and which is opened by swinging the lower edge of the sash outward and upward, operating hardware comprising in combination, an operating arm pivoted to one side of the frame and means for swinging the arm inward and outward at its end, means operatively connecting the swinging end of the arm to the sash for opening and closing the same, and a balancing mechanism for biasing the sash upward and outward as it is opened and closed, said mechanism consisting of a spring connected at one end to the frame and a tube enclosing the spring and connected to its other end, means connecting the tube to the arm for movement lengthwise thereof, and cooperating gear and rack teeth on the arm and tube for moving the connection of the spring along the arm as the arm swings to various angles with respect to the tube and thereby compensatingly adjusting the effect of the spring according to the position of the sash.

3. For operating an awning type of window having a sash hinged at its upper edge in a frame and which is opened by swinging the lower edge of the sash outward and upward, operating hardware comprising in combination, an operating arm pivoted to one side of the frame and swingable about said pivot in the same plane as the window hinges, means slidably and pivotally connecting the arm to the sash and operative to open and close the sash upon movement of the arm about its pivot, a coil spring attached at one end to the frame, and means attached to the arm and to the other end of the spring and effective to increase the leverage with which the spring acts upon the arm as the window moves toward its open position.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
1,647,262	Blaski	Nov. 1, 1927
1,727,723	Mathauer	Sept. 10, 1929
1,748,662	Stewart	Feb. 25, 1930
1,751,993	Goldsmith et al.	Mar. 25, 1930
1,839,966	Howard	Jan. 5, 1932
2,184,341	Ferris	Dec. 26, 1939
2,397,754	Sawyer	Apr. 2, 1946
2,554,922	Rappl	May 29, 1951

FOREIGN PATENTS

Number	Country	Date
3,531	Great Britain	Aug. 31, 1880