Jan. 5, 1937. J. W. SMITH 2,067,164

WINDOW SASH BALANCE

Filed Feb. 12, 1935

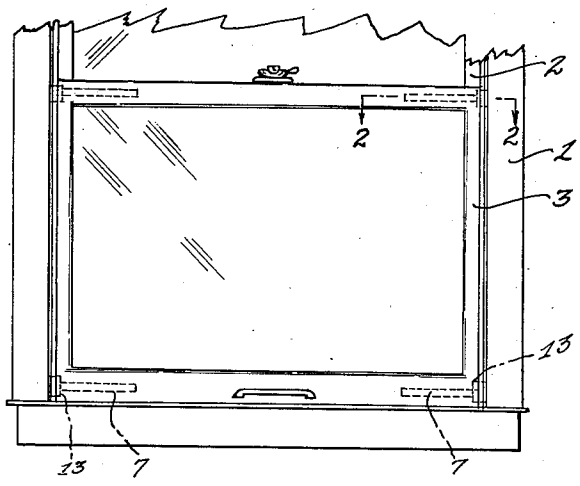


FIG. 1.

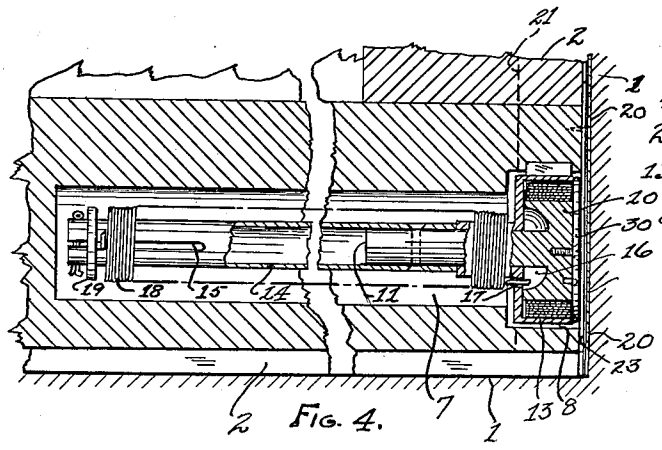


FIG. 4.

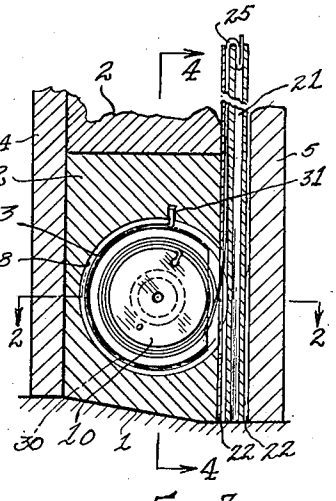


FIG. 3.

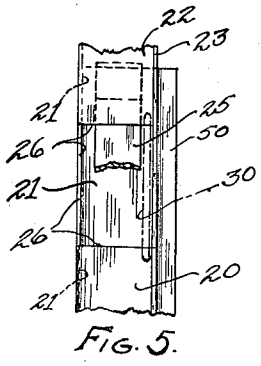


FIG. 5.

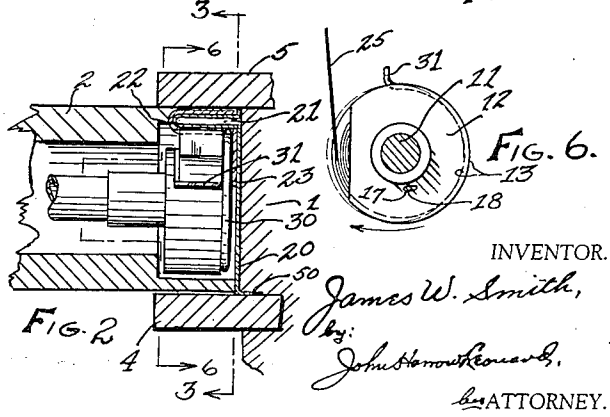


FIG. 2.

FIG. 6.

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Patented Jan. 5, 1937 2,067,164

UNITED STATES PATENT OFFICE

2,067,164

WINDOW SASH BALANCE

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Application February 12, 1935, Serial No. 6,219

10 Claims. (Cl. 16—198)

This invention relates to an improvement in window sash counterbalances and particularly to a simplified and economical spring actuated counterbalance device and mounting therefor so arranged that not only is the sash counterbalanced but also is held by the device in any desired raised or lowered position within the window frame. In United States Letters Patent Nos. 1,839,353 and 1,965,478, issued to me, several window sash balances of the spring actuated type are described, and the present invention includes, with certain new elements, a structure embodying the main operating elements described in the above Letters Patent but mounted in a novel manner so as to more effectively utilize the component parts of the structure, and to effect a new cooperative relationship between the elements and sash.

In spring actuated counterbalances of this general character, considerable difficulty is encountered in retaining the sash in any desired raised or lowered condition to which it is moved, due to the fact that the tension on the spring counterbalance varies with the different positions of the sash. For example, when the window is lowered to its fully closed position, the counterbalance spring is tensioned to a greater degree than when the window is partially or almost wholly raised. A spring strong enough to assure sufficient counterbalancing of the sash when the sash is in the raised positions will be wound or stressed to such a degree when the sash is lowered that it will raise the sash part way from the lowered position. This tendency has been overcome heretofore by providing extraneous accessory equipment or springs so large that the window sash can be retained in the position desired.

One of the objects of the present invention is to provide a small, compact and simple spring actuated counterbalance so constructed and mounted with respect to the window sash and frame parts that reactions of the counterbalance spring create sufficiently high frictional resistances to snub the window sash in the frame and thus retain it in proper position regardless of the pull or stress of the spring.

Another object is to provide a window sash mounting which, by virtue of a self-contained spring counterbalance, is so constructed that the sash may be swung inwardly at the top so as to permit access to the outer face of the window for cleaning while the counterbalancing relation is maintained.

More specific objects are to accomplish the above results without the necessity for accessory extraneous equipment on the window sash and frame combination, and while maintaining a highly efficient weather seal between the sash and the frame.

Another object is to provide a sash and frame, or guide, structure having a self-contained counterbalance, which structure may be readily assembled at the factory site and properly regulated and shipped in condition such that it may be installed readily and quickly where desired.

Other objects and advantages will become apparent from the following specification wherein reference is made to the drawing in which

Fig. 1 is a partial elevation of a window frame and sash structure embodying the principles of the present invention;

Fig. 2 is a fragmentary horizontal sectional view through a portion of the window frame and sash, showing the counterbalance device installed, and is taken on a plane indicated by the line 2—2 of Fig. 1;

Fig. 3 is a fragmentary vertical sectional view taken on a plane indicated by the line 3—3 of Fig. 2, the roller of the pulley being removed for clearness in illustration;

Fig. 4 is a vertical longitudinal sectional view of the sash, frame and counterbalance structure and is taken on a plane indicated by the line 4—4 of Fig. 3; the top sash being moved to the fully lowered position;

Fig. 5 is a fragmentary elevation of the weather strips used in connection with the present illustrative embodiment of the invention;

Fig. 6 is an end elevation of the operating head of the counterbalance device, removed from the sash, and illustrating one operative effect, and is taken on a plane indicated by the line 6—6 of Fig. 2.

Referring to Fig. 1, the invention is shown in connection with a window frame 1, carrying an upper sash 2 and a lower sash 3, the sashes being slidable within the frame to predetermined raised and lowered positions therealong in the usual manner. The sashes may be secured in place by the usual inner stop strips, the blind stops 4, and the outer stop strip or blind stop 5, better illustrated in Figs. 2 and 3, which slidably engage marginal face portions at each end of the sashes with which associated to guide the sashes and retain them in the frame. The frame, sashes, and strips may be castings, wood, sheet metal, or any materials desired.

For the purposes of illustration, the counterbalance device is shown as mounted in the sashes

2 and 3 of the windows, the manner in which they may be mounted in the frame 1 being readily apparent therefrom. Each of the sashes is preferably provided with two such devices, one at each end but since the counterbalance devices and mountings for both sashes and for both ends of each sash, are the same in form and function, except that the ends require corresponding rights and lefts, only one need be described in detail.

For the purposes of illustration, the right hand counterbalance device of the upper sash 2 will be referred to.

Referring to Figs. 2 to 4 inclusive, the sash 2 is provided at its lower portion with a dead end bore 7, which extends from the end of the sash toward the opposite end, a coaxial enlarged counterbore 8 being provided at the open end of the bore 7. The counterbalance device is received within the bore and counterbore with clearance between the device and bore walls, and comprises a rotatable pulley 10 mounted on a suitable shaft 11, with which it may be integral, the shaft, in turn, being rotatably mounted in a housing 12. The housing, in turn, carries a circumferential flange 13 which surrounds the pulley in spaced relation radially and is preferably coaxial therewith, the flange extending only part way around the housing. Mounted on the shaft 11 and fixed against rotation relative thereto is an extension member, which may be in the form of a tube 14. At its end remote from the shaft 11, the tube 14 is provided with a slot 15 which, for ease in assembly, extends to the said remote end of the tube, as illustrated in Fig. 4, and is preferably disposed parallel to the axis of the tube. The pulley 10 is undercut adjacent the housing 12 to provide an annular trough 16 and the housing 12, in turn, is provided with a passage 17 which opens into the trough 16. A coil spring 18 is disposed over the tube 14, one free end of the spring being bent over and received in the passage 17 in the housing 12 for securing that end of the spring thereto for rotation therewith. The opposite end portion of the spring is bent over and received in the slot 15 for securing the end of the spring to the tube 14 for rotation with the tube while permitting the spring end to travel longitudinally thereof. Suitable means such as a washer 19 and cotter pin are provided for preventing the latter end of the spring from moving out of the slot 15 endwise of the tube 14. It is apparent that as the pulley 10 is rotated in one direction, the spring will be wound and stressed, thus providing energy for counterbalancing the weight of the window sash.

Since in most instances, it is desirable that weather stripping be provided between the sash and frame, the practice is followed in the present structure, the weather stripping forming in fact a part of the frame member 1 when so used.

Referring to Figs. 2 and 4, the weather strip, designated 20, is mounted in face to face relation to the abutment face of the frame member 1, a portion of the weather strip being formed into a tongue 21 extending outwardly from the face of the frame toward the sash. Correspondingly, the sash is provided with a longitudinally extending slot which snugly receives the tongue 21 for providing both a weather seal and a guideway for the sash. In the form illustrated, in order to reduce the thickness of the sash required, this slot may be provided by U-shaped metal strip 22 extending along the end of the sash. The strip 22 preferably has a flat flange portion 23 partly overlying and forming part of the face of the end of the sash by which it may be secured to the sash by means of suitable screws or tacks.

In order to operatively connect the pulley 10 to the frame 1 for counterbalancing the sash by the spring, a flexible band 25 may be provided, the band 25 being secured at one end to the pulley and wound thereon, the opposite end of the band 25 being connected to the frame 1 by securing it to the upper end of the weather strip 20 carried thereby, as illustrated in Fig. 3. Thus the band may lie in face to face relation with the tongue 21 of the weather strip so that it is prevented from kinking. As the window is lowered, the band 25 operates to rotate the pulley 10 and stress the spring 18 to provide counterbalancing energy corresponding to the stress of the spring which energy is re-applied through the pulley and band to the frame of the window for effecting the counterbalancing relation of the sash. When the U-shaped strip 22 is utilized, it is necessary to provide therein, adjacent the pulley, a window 26, best illustrated in Fig. 5, through which the band 25 may extend and thus lie snugly between the adjacent walls of the tongue 21 and the groove or strip 22. Carried on the outer end of the pulley 10 is a coaxial roller or flange 30 which protrudes through the window 26 and engages the adjacent face of the tongue 21.

The counterbalance device is mounted in the window sash bores 7 and 8 with the housing 12 lying within the counterbore 8 in the manner illustrated, and is so positioned that the roller 30 may project through the window 26 to effect this engagement. The counterbalance is not secured in fixed position within the bore but is prevented from rotation about the pulley axis by means of a projecting lug or abutment element 31 on the flange 13. The abutment element 31 is received in a suitable recess in the sash with slight clearance. Due to this clearance and that of the bores 7 and 8, the counterbalance is disposed in the sash for substantially floating movement, no other connecting elements than the abutment 31 being provided.

Referring to Fig. 6, it is apparent that with the spring stressed and the abutment 31 holding the housing 12 against rotation about the pulley axis, the stress of the spring 18 applied to the housing and to the pulley which is held against rotation by the band, will tend to swing or pivot the entire counterbalance device about the abutment 31 in the direction indicated by the arrow 33. This action causes a lateral movement of the counterbalance device a sufficient amount to effect engagement of the roller 30 firmly with the tongue 21, thus stopping the lateral movement of the device relative to the frame. The reactionary thrust imparted to the sash by the abutment 31, however, tends to move the window sash in the opposite direction, thus bringing the wall of the U-shaped strip 22 on the opposite side of the tongue 21 from the roller 30 into snug face to face relationship with the opposite face of the tongue 21. This action creates sufficient frictional resistance to snub the window relative to the sash to a sufficient degree to prevent lifting of the window by the spring 18 of the counterbalance.

As a result, regardless of the increased stress of the spring as the sash is lowered, the window will be retained in any raised or lowered position in which set by the operator, as an increase in the stress of the spring likewise increases the reactionary thrusts and snubs the window against

the frame proportionately. It should be noted that the transmission of energy by the pulley is initially tangent to the pulley and along a line offset from the abutment 31 so that the snubbing action is most effective.

It should be noted that the weather strip forms in effect a part of the frame member as well as a guide but in those instances in which the weather stripping is not used, the counterbalance may be arranged to react directly on the blind or other stops of the frame and pinch the window thereagainst. The use of the term "counterbalance" is not to be interpreted to mean that a single device only must effect a complete balanced relation of the sash nor that two devices are necessary for such purpose. Two counterbalances are desirable, however, one at each end of the window as smoother operation of the window is thereby provided. It should be noted, too, that the spring or springs 18 perform two separate and distinct functions, one, the counterbalancing weight of the sash, and the other, the providing of fractional resistance for opposing movement of the sash from any raised or lowered position in which set. The roller 30 necessarily rotates at the same speed as the pulley 10 when rigidly affixed thereto as in the present instance. In such case, since the rotation of the pulley varies depending upon the amount of the band 25 that is wound thereon, the roller tends to lead and lag relative to a normal rolling travel along the weather strip tongue, and consequently of itself offers additional frictional resistance to oppose movement of the window sash.

Obviously, when it is desired to provide a window sash frame with the present counterbalance it is only necessary to drop the counterbalance into the bores 7 and 8, forcing the abutment 31 into a notch or groove provided for the purpose and then pass the end of the band 25 through the window 26 within the groove, which, in the present instance, is formed by the strip 22. The bent over end of the band 25 is then readily engaged with the upper end of the weather strip tongue 21 by sliding the weather strip along the end of the sash from the lower edge of the sash with the tongue in the sash groove. Before insertion of the counterbalance, the spring is tensioned to a degree proper for a fully raised window. As the weather strip is slid along the groove from the lower limit to final position, the spring is caught in the upper end of the strip and is tensioned additionally. The sash may be shipped in this condition and may be readily applied to the frame merely by holding the weather strip in place through the medium of the blind stops. To insure better fastening of the strip by the stops, the strip is preferably provided with a marginal flange 50 which may be engaged between the side margins of the frame slideways and the adjacent blind stop, as shown in connection with the blind stop 4 in Fig. 2. Consequently, the entire assemblage may readily be shipped to the site at which to be used and installed without disassembling or re-assembling any of the parts of the sash and balance structure and with substantially no change or difficult operation in connection with mounting the same in the frame.

Having thus described my invention, I claim:

1. The combination with a window sash member, a frame member mounting the sash member for movement to raised and lowered positions, and means carried by one member and operatively connected to the other for effecting counterbalancing of the sash member, of means operated by the counterbalance means for effecting mutual snubbing relation of said members for opposing movement of the sash member toward said positions.

2. The combination with a window sash member, a frame member mounting the sash member for movement to raised and lowered positions, and a spring actuated counterbalance device carried by one of said members and operatively connected to the other member for effecting counterbalancing of the sash member, of means operated by the energy of the spring of said device when the spring is stressed for opposing movement of the sash member and retaining the sash member in desired raised and lowered positions.

3. The combination with a window sash member, a frame member mounting the sash member for movement to raised and lowered positions, and a spring actuated counterbalance device carried by one of said members and operatively connected to the other member for effecting counterbalancing of the sash member, of means operated by the energy of the spring of said device when the spring is stressed and operatively connected to the members for urging the sash member transversely of its operating path in the frame member to effect mutual frictional resistance between the members to oppose movement of the sash member from the position in which it is set by an operator.

4. In a window sash and frame combination including a sash member and a guide member mounting the sash member for movement therealong to raised and lowered positions, a counterbalance including a rotatable element and a spring for rotating the element in one direction carried by one member, means operatively connecting the said element and other member for rotating said element in the opposite direction and thereby stressing the spring for counterbalancing the sash member, means mounting said device for movement relative to the member by which it is carried, means on the device engageable with the other member consequent upon said movement for moving the members into frictional engagement under pressure exerted by said spring, and said spring, when stressed, moving said device relative to the member in which it is carried.

5. In a window sash and frame combination including a sash member and a guide member mounting the sash member for movement therealong to raised and lowered positions, a counterbalance device including relatively oppositely rotatable elements carried by one of said members, a coil spring connected to said elements for rotating the same in opposite directions when the spring is stressed, means operatively connecting one of said elements to the other of said members for rotating said element consequent upon lowering the sash member in a direction for stressing the spring, means carried by the other element and reacting against one of said members consequent upon the force of the spring applied to said other element for creating a frictional resistance opposing raising of the sash member by the spring.

6. The combination with a window structure including a sash member, a frame member for supporting and guiding the sash member for movement of the latter to raised and lowered positions, one of said members having a longitudinal groove and a tongue on the other member

received in and slidable relatively along said groove as the sash is raised and lowered, and a spring actuated counterbalance carried by one member and operatively connected to the other member for counterbalancing the sash member by stress of the spring, of means operated by the energy of the spring for effecting relative movement of the members to juxtapose wall portions of the groove and tongue for creating sufficient frictional resistance to oppose raising of the sash member by the spring and for effecting a better weather seal.

7. In a window structure including a sash member and a frame member for supporting and guiding the sash member to raised and lowered positions, a rotatable pulley carried by one member and in rolling contact with the other member, means connected with the other member and the pulley to support the sash member in raised positions when the pulley is restrained from rotation, means yieldably urging said pulley against said other member, reactance means for said last mentioned means carried by the pulley carrying member and operated by said last mentioned means for effecting frictional resistance opposing relative movement of said members toward one of said positions.

8. In a window structure including a sash member and a frame member for supporting and guiding the sash member to raised and lowered positions, a longitudinal groove in one of said members, a tongue on the other member slidable along said groove and in snug fitting relation therewith, a rotatable pulley carried by the first member and having a portion protruding into the groove for engaging and rolling along said tongue, means operatively connecting the pulley and tongue carrying member for rotating the pulley consequent upon relative longitudinal movement of said members toward relatively closed position, a spring connected to the pulley and wound thereby consequent upon said movement for counterbalancing the weight of the sash member, and means cooperable with the spring and the pulley carrying member to force the pulley firmly against said tongue by stress of the spring, whereby the members are urged laterally and into stressed frictional engagement.

9. In a window sash and frame structure, a sash member, a frame member mounting said sash member for movement to raised and lowered positions, a pulley supporting element carried by one of said members and mounted thereon for floating movement relative thereto, a pulley rotatably mounted in said element, means operatively connecting the pulley and the other of said members for rotating the pulley upon lowering of the sash member, a spring connected by one end to the pulley and by the other end to said element and wound by the pulley consequent upon lowering of the sash member, means spaced from the pulley axis and connecting the element to the one of said members on which the element is mounted for constraining the element both from rotation by the spring about the pulley axis and constraining the element to said floating movement, whereby, when the spring is wound, the element is urged bodily by the spring in one direction, and means operative consequent upon said bodily movement of the element in said direction for frictionally resisting movement of the sash member along the frame member.

10. In a window structure including a sash member and a frame member for supporting and guiding the sash member to raised and lowered positions, a rotatable pulley carried by one member, a flexible band reeled thereon and connected thereto by one end and connected at the other end to the other member and extending from the pulley substantially longitudinally of the members, whereby on lowering the sash member the pulley is rotated, a spring connected to the pulley and wound thereby consequent upon lowering the sash member, means mounting the pulley on the one of said members by which it is carried for bodily floating movement relative thereto, means cooperating with said spring and movable thereby when the spring is wound for effecting bodily movement of said pulley in one direction, and means carried by the member on which the pulley is mounted and frictionally engageable with said other member consequent upon said movement of the pulley by the spring in said one direction.

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