Sept. 2, 1952 E. E. FOSTER 2,609,193

SPRING SASH COUNTERBALANCE

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Fig. 1.

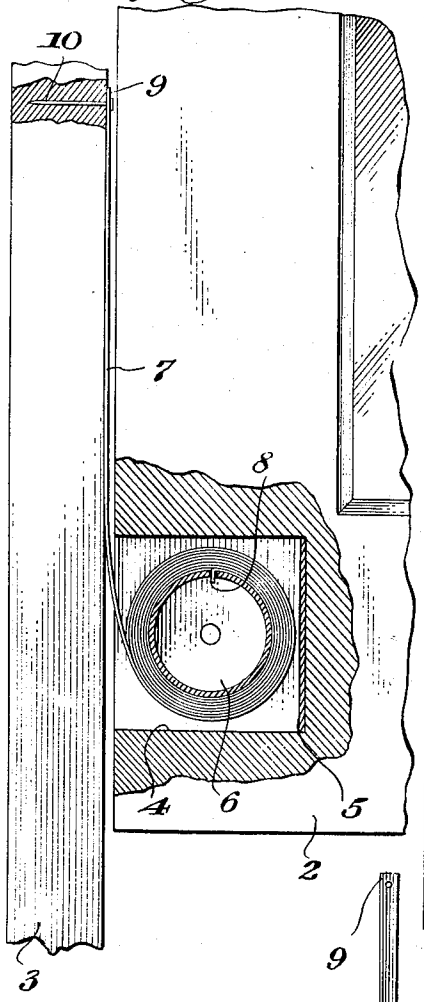


Fig. 2.

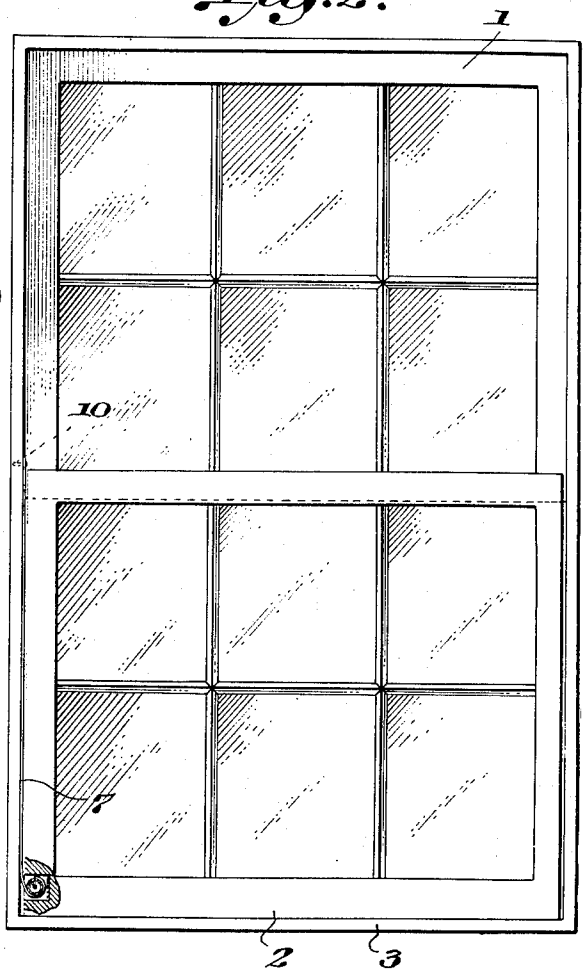
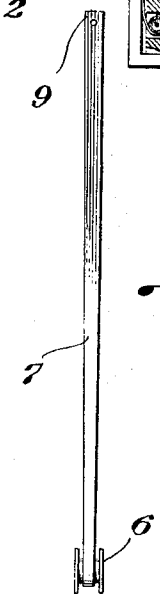


Fig. 5.



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Fig. 3.

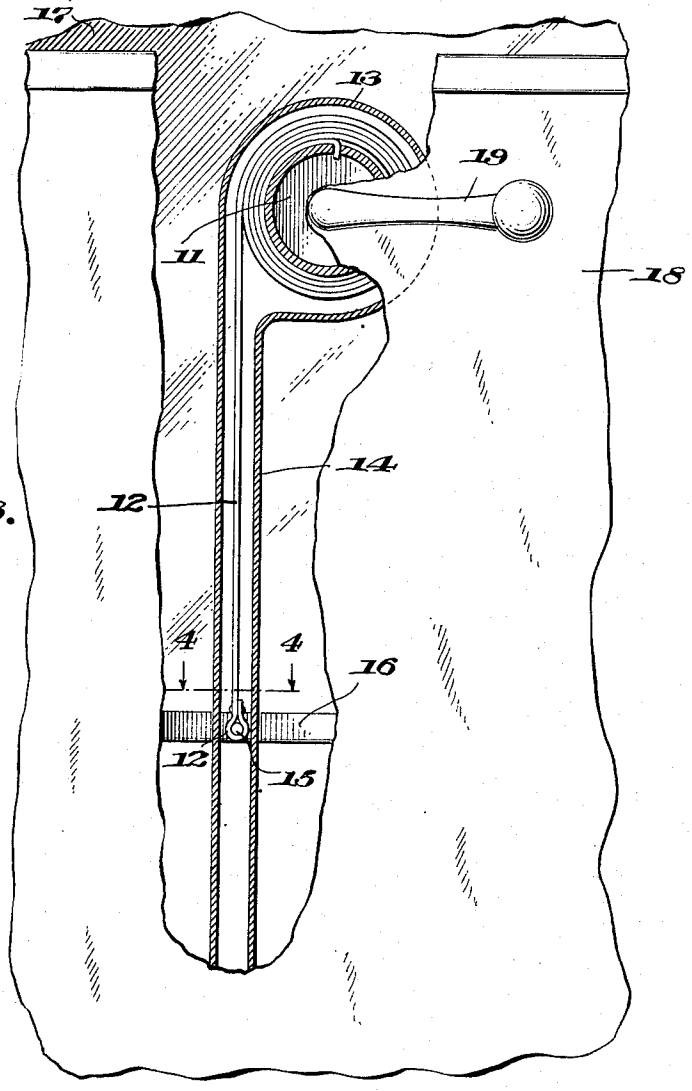
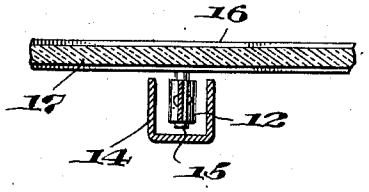


Fig. 4.



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Fig. 6.

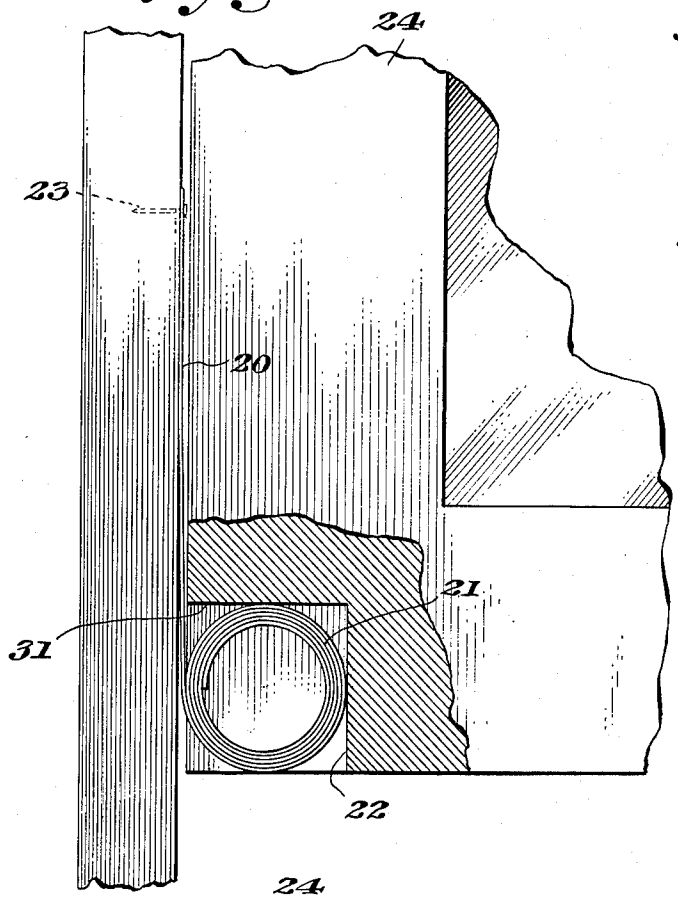


Fig. 9.

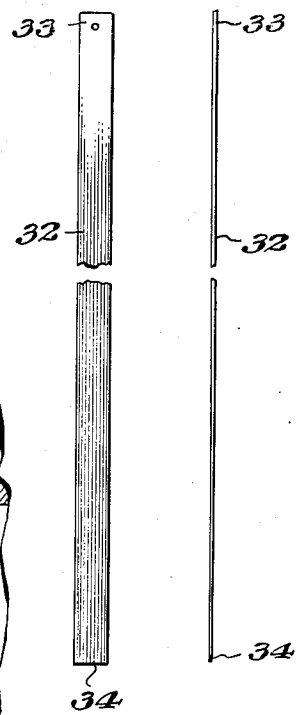


Fig. 10.

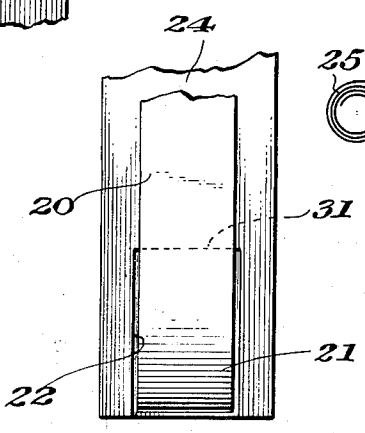


Fig. 7.

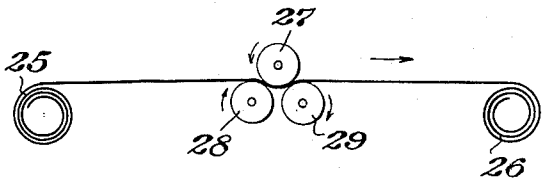


Fig. 8.

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UNITED STATES PATENT OFFICE

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SPRING SASH COUNTERBALANCE

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Application April 30, 1947, Serial No. 744,809

3 Claims. (Cl. 267—1)

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This invention relates to a window or door counter-balance and more particularly to a coiled spring which by its coiling action acts to counter-balance a window sash and the like.

It is an object of the invention to provide a spring ribbon which is tensioned to wind itself into a coil and which acts to counter-balance the window sash. A further object of the invention resides in a tightly wound coil which has one end secured to a spool or center but rotatably mounted in a window sash and the other end secured to a window frame. Another object of the invention resides in the particular construction of the spring ribbon or band which is tapered from one end to the other to thus act as a compensator during the entire coiling or uncoiling action of the spring.

It is therefore an object of the invention to provide a window sash with a tapered ribbon spring to act as a constant counter-balance force for the window sash at all locations of the window. Another object resides in the provision of a spring which is normally tightly wound into a spiral coil and unwinds as a spring.

A still further object resides in a coiled spring mounted to rotate without a spool or shaft in a cut-out portion in the edge of the window stile. Another object resides in a spring with a uniform width and a uniform uncoiling or coiling force throughout all the various coils irrespective of the radii of the coils.

Further objects will be apparent from the following description when considered in connection with the accompanying drawing in which,

Fig. 1 is a side elevation of the lower left portion of a window and a part of the window frame with parts broken away and in section,

Fig. 2 is a front elevation of the complete window and frame with part of a window sash broken away,

Fig. 3 is a side elevation partly in section of a portion of an automobile window with the counter-balance applied thereto,

Fig. 4 is a cross-section taken on line 4—4 of Fig. 3,

Fig. 5 is a side elevation of the spring and its spool in the extended position,

Fig. 6 is a side elevation of the lower left portion of a window and window frame with parts broken away and in section,

Fig. 7 is an end elevation of the window sash of Fig. 6,

Fig. 8 is a diagrammatic view, and

Figs. 9 and 10 are front and side front elevations respectively of a modified spring.

The invention may be applied to any sliding

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window or door but as an example the drawing shows a window with an upper sash 1 and a lower sash 2 slidably mounted in a frame 3. To clearly show the invention the usual guide strips on the frame have been omitted. Each sash has a rectangular cut out portion preferably at each end as at 4 to receive a U-shaped metal frame 5 acting as a bearing for a spool 6. A ribbon spring 7 is secured at one end 8 in a slot in the spool 6 and the other end 9 is secured to the window frame by a nail 10 or any other suitable fastening. The spring 7 is tapered as shown in Fig. 5. As seen from Figs. 1 and 2 the sash balance is practically invisible, that is it cannot be seen when the sash is lowered or in its raised position, except, of course, the tip end of the tape where the nail 10 or screw fastens the spring tape 7 to the frame 3. Either one or two (preferably two) balances are used to a sash, and on unusually heavy sashes additional balances can be installed directly above the one shown, and the steel spring ribbon pinned to the frame with the same screw or nail 10.

Unlike the ordinary clock spring type, which consists of a clock spring within a drum and a cable or ribbon wrapped around the drum, this balance uses a ribbon spring, the normal position of which is a tightly wound coil attached to the center hub or spool 6. The free end 9 of the spring ribbon is unwound and fastened to the frame just above the top of the sash when the sash is down. The spool, which is preferably encased in a square box, or the U-shaped frame 5, is recessed into the lower corner of the stile of the sash.

Figure 2 shows the sash in its extreme closed position and the steel ribbon has been unwound, since the free end is pinned to the frame and the spool is allowed to turn on its axis or pin in the frame. It will be noted in Fig. 5 that the spring ribbon is proportionately wide at the top and gradually tapered to a smaller width at the bottom. This acts as a compensator, since if the ribbon spring were the same width throughout its full length it would become stronger towards the bottom of its stroke, but with the proper amount of taper in the width (or thickness), this spring acts as a perfect balance throughout its entire stroke. The ribbon is preferably fastened to the spool, and this type of spring would, of course, need to be wound in this position while in its annealed condition and tempered while tightly coiled and it can then be transferred to the drum or spool.

It may be found preferable to use a larger spool than the one on which it was originally

formed in order to make the coil fit more snugly. This ribbon, in order not to be overstressed, should be thin gauged, such as 8 to 15 thousandths of an inch. In order to get the proper amount of weight carrying capacity out of the width which will fit into a window stile it is possible to roll more than one ribbon together about the same spool. Or another way to obtain the necessary strength is to add a second spool directly above the first one and let both ribbons lie together and be fastened with the same nail or screw.

This type of counter-balance has much less friction than the ordinary clock spring type. A clock spring has a great deal of friction between the coils in addition to the friction in the axle while the spring of this invention lies together without friction and only has friction in the axle.

It will be clear from the foregoing that the spring according to this invention, is normally tightly wound on its spool and is unwound as a spring. The tapered structure of the spring acts as a compensator, that is, the force of the spring as it winds up and is unwound is the same throughout the entire travel of the window sash.

Figs. 3 and 4 show the counterbalance device applied to an automobile window. The spring 12 similar to the spring 7 of Figs. 1, 2 and 5, is secured at one end to a spool 11 or similar member and this spool and spring is housed in a casing 13 having a U-shaped extension 14. The other end of the spring 12 is secured to a pin 15 which extends out of the U-shaped casing 14 and is secured to a U-shaped bracket or plate 16. This bracket 16 grips or is secured to the window pane 17, and 18 represents the inside layer of fabric or other material which covers the space below the window. A crank handle 19 is secured to the spool 11 so that upon rotating the handle 19 the spool will wind or unwind the spring 12. The extension 14 acts as a guide for the spring 12 to prevent the spring from forming loops or buckling if too much slack occurs between the spool 11 and the pin 15.

The operation of the counterbalance of Figs. 3 and 4 is obvious from the foregoing. The spring 12 is tapered similar to Fig. 5 and the spring is tightly wound in its normal position so that it winds and unwinds with spring force when the crank handle 19 is rotated. Also the pin 15 should preferably be attached at the approximate mid point relative to the width of the window pane 17.

While a number of window constructions have been shown on the drawings and described, it is of course understood that the spring may be used in any structure or device where a counterbalance effect is desired.

It is possible to make the spring in a different manner and still obtain a uniform force for both coiling and uncoiling and in any position of travel of the spring. Thus the spring may have a uniform width but a varying or tapered thickness to accomplish the same result as the spring shown in Fig. 5. This uniform force is accomplished by the tapered width or thickness of the spring or if desired both the width and thickness may be tapered from one end to the other. Actually the force in the spring is due to the coiling and uncoiling into the spiral position and since the radii of the spirals vary there is progressively greater force in the spirals of lesser radii than the ones of greater radii as such spirals coil or uncoil from and into a straight line. For this reason the spring of this invention is tapered to reduce the size of the spring progressively toward the end of the smaller radii coils or spirals which will thus equalize the force throughout the entire operation of the spring.

While the drawing in Figs. 1 and 2 show the coil of the spring in the sash stile it is of course obvious that this coil with its housing may be inserted in the wnidow frame either on the side or at the top.

Figs. 6 and 7 show a spring 20 of uniform width and thickness secured at one end by means of a nail 23 to the window frame and the other end forming a coil 21 bearing against the upper surface 31 of a cut-out portion 22 in the bottom of the window 24. The weight of the window is supported on the increasing or decreasing windings of the coil 21 and due to the natural forces in the spring the coil 21 will remain at all times in its cut-out portion.

Fig. 8 illustrates diagrammatically how a normally spirally coiled tempered spring 25 is treated to transform it into a uniform or constant force spring 26 forcing the spring between rollers 27, 28 and 29 with the parts travelling and rotating in the directions of the arrows. It will be noted that the spring is flattened out and is bent by bulging into the opposite direction in order to provide a coiled spring in which the coiling and uncoiling forces in all the coils are uniform. To explain further it is pointed out that if the coils 25 and 26 were cut diametrically, the semi-circular arcs of coil 25 would all have a different curvature, whereas the arcs of coil 26 would be equal. This is one method of treating the spring.

Figs. 9 and 10 show a spring 32 which has a varying thickness from one end 33 to the other 34, the width being uniform. This spring will operate in the same manner as the spring of Figs. 1 to 5.

I claim as my invention:

1. A normally coiled spring comprising a plurality of convolutions of a ribbon spring lying in a common plane, said convolutions being internally stressed to cause said convolutions to coil up spirally upon each other in tight engagement, said spring being tapered uniformly from its inner end to its outer end, said inner end being of smaller cross-sectional area than its outer end, the taper compensating for differences in the radii of said convolutions of the spring to provide uniform resistance to straightening of every increment of said spring by application of force to the outer end of said spring.

2. The combination with the spring set forth in claim 1 of means supporting said spring for bodily rotation about its axis in response to straightening force applied to the outer end of said spring and the coiling stress of said spring when released.

3. A spring motor comprising a freely rotatable member, a ribbon spring bent and internally stressed to cause it to coil up spirally on said member with all of its coils lying in a common plane and in tight engagement with said member and each other, said spring having every increment thereof along its length bent on progressively longer radii from its inner end to its outer end and being tapered uniformly from one end to the other, the smaller end being adjacent to said member and the longer end being at the outside of the coil, the taper of the spring being related to the radii of curvature of said spirally coiled spring to compensate for the differences in radii and impart uniform resistance to uncoiling and straightening of every increment of said

spring in response to a force applied to the outer end of the spring.

EDWIN E. FOSTER.

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