Aug. 15, 1967 L. L. ANDERSON 3,335,455

DEVICE FOR COUNTERBALANCING WINDOW SASHES

Filed Jan. 25, 1965

Fig. 1

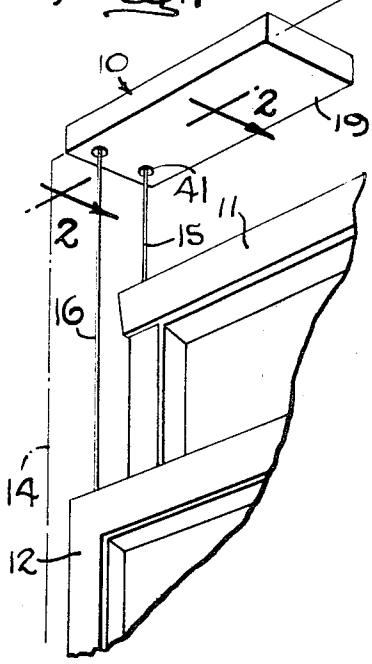


Fig. 2

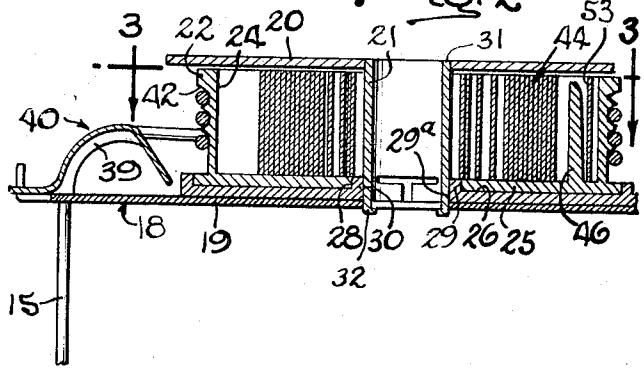


Fig. 3

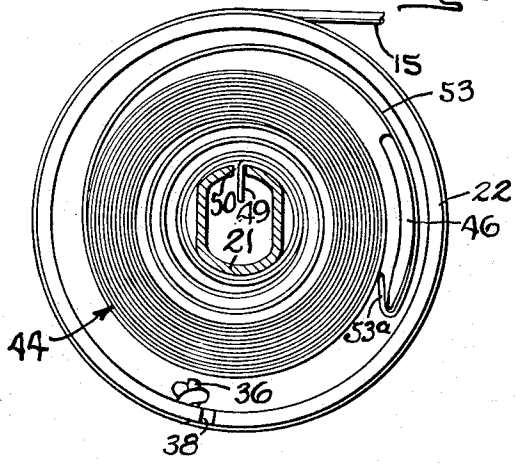


Fig. 5

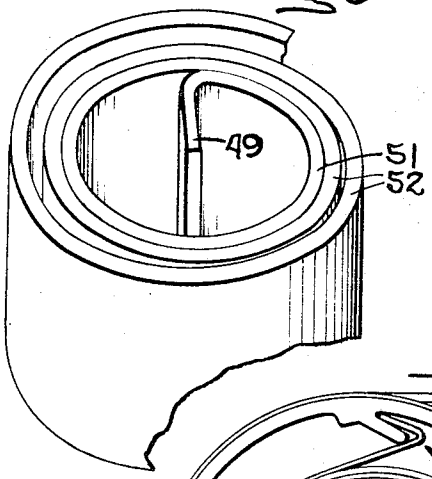


Fig. 4

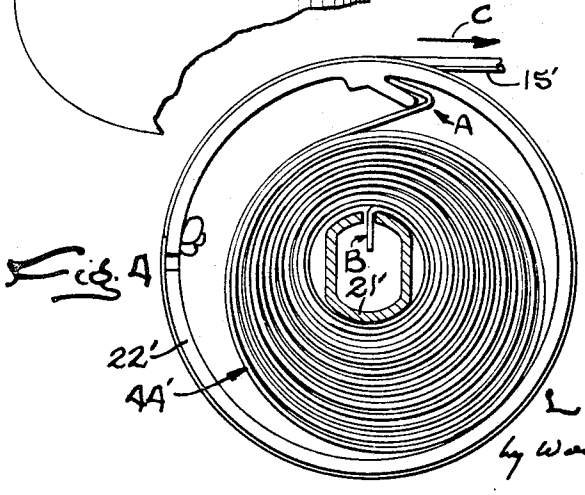
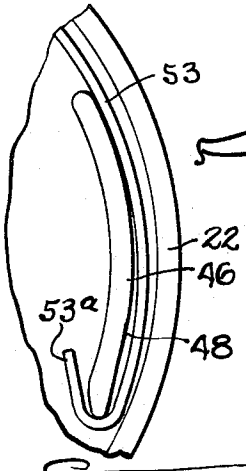


Fig. 6



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DEVICE FOR COUNTERBALANCING WINDOW SASHES

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5 Claims. (Cl. 16—198)

This invention relates to a device for counterbalancing window sashes which slide vertically in a frame, and more particularly, to a counterbalancer of the type including a drum journaled on an axle in a case which is mounted adjacent the top of the frame with a cord wound around the drum and connected to the side of the sash. In such devices, a torsion spring wrapped around the axle acts between the axle and the drum to urge the latter in a direction to apply tension to the cord and thereby exert an upward force on the sash sufficient to offset the weight of the sash.

The primary object of this invention is to provide a novel means of attaching and supporting the spring between the axle and drum to prolong the life and effectiveness of the spring.

Other objects and advantages of the invention will become apparent from the following detailed description taken in connection with the accompanying drawing, in which

FIGURE 1 is a fragmentary perspective view of a window including a counterbalancer of the type which embodies the novel features of the present invention,

FIG. 2 is an enlarged fragmentary sectional view taken along the line 2—2 of FIG. 1,

FIG. 3 is an enlarged fragmentary sectional view taken along the line 3—3 of FIG. 2,

FIG. 4 is an enlarged fragmentary sectional view similar to FIG. 3, taken of a prior device not embodying the subject invention,

FIG. 5 is an enlarged fragmentary view of that portion of the spring immediately adjacent the axle,

FIG. 6 is an enlarged fragmentary view of the drum showing the spring and anchor for fastening the spring to the drum.

As shown in the drawings for purposes of illustration, the invention is embodied in a device **10** for counterbalancing two window sashes **11** and **12** mounted in a conventional frame **14** to slide vertically therein. The upper sash **11** is slidable downwardly in the frame to open the window at the top and the lower sash **12** is slidable upwardly to open the window at the bottom. To counterbalance the sashes, the device **10** exerts an upward force on the sashes through the cords **15** and **16** sufficient, in cooperation with the friction between the sashes and the frame, to offset the weight of the sashes and sustain the latter in selected positions in the frame.

In the present instance, the counterbalancer includes a flat, box-like case **18** mounted adjacent the top of the frame, preferably recessed and held in place by screws (not shown) driven into the frame. The case is of sheet metal construction and includes a bottom wall **19** (see FIG. 2) and a top wall **20** with one of these walls having flanges bent over to form the side walls. Journaled in the case on a tubular axle **21** is a drum **22** comprising a hollow cylinder **24** including a lower end wall **25** and an open upper end. Where, as here, two sashes are mounted in one frame, two such axles and drums are disposed in the case, one for each sash, but only one is shown and described in detail with the understanding that the other is identical.

To rotatably support the drum **22** in the case, a bearing **28**, which preferably is molded of some suitable anti-friction plastic, is supported on the bottom wall **19** of the case. This bearing **28** is held in place by some suitable means such as screws (not shown) extending through the bottom wall **19** and includes an annular recess **26** on which the lower end of the drum rests. A center opening **30** of the drum telescopes over an upstanding cylindrical flange or hub **29** of the bearing to hold the drum concentric about the axle.

The axle **21** spans the bottom wall **19** and the top wall **20** and is formed to telescope snugly into a center opening **29***a* in the hub **29**. Arcuate tabs **31** and **32** on the upper and lower ends of the axle project through the top and bottom walls **19**, **20** respectively, to hold the axle against turning. Thus the drum may rotate about the axle on the hub **29** which constitutes an anti-friction bearing.

As shown in FIGS. 1–3, the cord **15** is wound about the drum and fastened thereto by a knot **36** extending through a slot **38**. The free end of the cord extends horizontally off the drum and passes along a groove **39** of a guide **40**, and downwardly through a hole **41** in the bottom wall **19** adjacent one end of the case. The cord thereafter extends to the sash **11** and is fastened to the side thereof. The guide **40** is preferably made of sheet metal and is supported adjacent the bottom wall and between the side walls, and is held there by some suitable means such as tabs (not shown) formed integrally with the guide and extending through alined openings in these walls.

To control the winding of the cord **15** onto the drum, the outer periphery of the drum is formed with a helical groove **42** which guides the cord evenly onto the drum. With the foregoing arrangement, turning the drum in a direction to wind the cord places the cord under tension to urge the sash upwardly. To urge the drum in this direction, an elongated flat spring **44** is wrapped spirally around the upper portion of the axle **21** with the inner end fastened to the axle and the outer end fastened to the drum. The spring is wrapped about the axle so that unwinding the cord as the sash is lowered winds the spring.

The spring **44** is attached between the drum and axle in a novel manner to hold it concentric about the axle and thus limit sidewise flexing which can lead to breakage of the spring. For a better understanding of such flexing, FIG. 4 illustrates one way in which the spring has been supported in prior art devices. In this illustration, a drum **22′** is journaled about an axle **21′** with a spring **44′** having an end A attached to the drum and end B attached to the axle. The spring is partially wound as is normal in counterbalancing devices, and is therefore urging the drum to turn in the counterclockwise direction to wind the cord **15′**. The force exerted on the drum by the weight of the sash pulling on the cord **15′** is urging the drum to rotate clockwise as indicated by the arrow C. In prior spring devices such as the one illustrated here, the spring in offsetting this force C on the drum to counterbalance the sash is shifted sidewise as illustrated. The direction of shifting of the spring with respect to the axle changes as the drum revolves causing each portion of the spring to flex towards and away from the axle, once per revolution of the drum. This flexing action shortens the useful life of the spring and causes binding of the spring as it winds and unwinds, thus resulting in an uneven or jerking force being exerted on the drum and cord as the sash is raised and lowered.

In accordance with the present invention, the spring **44** is mounted in a novel manner so that it may be anchored securely to the axle **21** and, at the same time, the lateral flexing of the spring is reduced thereby minimizing the possibility of the spring failing, especially adjacent the inner turns **51**, **52** which connect the spring to the axle. Thus, these turns may be annealed or otherwise treated to be nonresilient and permit a firm connection between

the spring and the axle with little chance of the spring breaking at the point where annealing begins since this sidewise flexing of the spring is materially reduced.

To reduce lateral flexing of the spring **44**, the outer end portion **53** of the spring is held generally concentric with the wall **24** of the drum **22**. From this end portion the spring gradually merges into the spiral form. With this arrangement the spring is substantially centered about the axle **21** and remains so as it is wound and unwound. As a result lateral flexing is, for all practical purposes, eliminated and the spring is subjected only to the flexing which results from the winding and unwinding.

In the present instance, the means for holding the outer end portion **53** of the spring **44** concentric with the drum wall **24** comprises an anchor **46** rigidly supported from the end wall **25** of the drum. This anchor extends normal to the end wall and includes a radially outward facing wall **48** extending generally concentric with the drum wall **24**. The outer end **53** of the spring **44** is positioned in abutting relationship to the wall **48** and fastened to the anchor **46** by having the end **53***a* partially bent back on itself in a radially inward direction, with this bent end hooked around the anchor. The spring is thus held in its normal spiral configuration while urging the drum to rotate after being wound. Any force tending to cause sidewise movement of the spring as explained before, is opposed by the wall **48** abutting the spring to thus maintain the spring concentric about the axle. Contact between adjacent turns and flexing of the spring is thus limited

Since such sidewise flexing of the spring is substantially eliminated, it is possible to fasten the spring tightly to the axle without reducing the life of the spring. For this purpose, the inner end **49** is bent normal to the spring to fit into a slot **50** in the axle alined to receive the spring end. To hold the end **49** in the slot **50** as the spring is wound and unwound, the adjacent turn **51** is fitted closely adjacent to the axle to hold the end **49** in the axle slot. Also, adjacent turns **52** may also be so formed for the same purpose. To permit these turns to remain closely adjacent to the axle, since the spring is wound and unwound there is a tendency for the spring to spiral away from the axle, the inner end of the spring is annealed or otherwise treated to lessen the resiliency of the turns **51**, **52**. Thus, the spring is made fast by the inner end fitting into the axle slot and firmly held in place by the adjacent abutting turns which are closely wound about the axle.

The spring **44** is thus supported between the drum **22** and the axle **21** in a manner to be wound when the cord **15** is unwound from the drum periphery to urge the drum to rotate and thereafter wind the cord for counterbalancing the attached sash. During such rotation of the drum, the spring is maintained in a spiral configuration concentric about the axle and sidewise flexing of the spring is held to a minimum. Therefore, the spring winds and unwinds in a smooth and even manner for an effective and smooth operation of the counterbalancing device, with the useful life of the spring shown to be greatly extended.

I claim as my invention:

1. A device for counterbalancing a window sash slidable up and down in a frame, said device including, in combination, a support mountable adjacent the top of the frame, an axle fixed to said support, a drum journaled on said support to rotate about said axle and having a cylindrical wall, a flexible element having one end anchored to said drum and wrapped around the outer surface of said wall, the other end of said element adapted for connection to the window sash, an elongated spring spirally wrapped in a plurality of turns around said axle with the inner end of the spring fixed to said axle and the outer end fixed on said drum whereby turning of the drum in one direction winds the spring which thereafter urges the drum to rotate in the opposite direction, the inner end portion of said spring being nonresilient and wrapped for at least one complete turn closely around said axle, and means

rigid with said drum and concentric with the wall of the drum and about which the outer end of the spring is wrapped inwardly toward the center of the drum, said means being operable to hold the outer end portion of said spring concentric with said drum wall thereby maintaining said spring concentric about said axle.

2. A device for counterbalancing a window sash slidable up and down in a frame, said device including, in combination, a support mountable adjacent the top of the frame, an axle fixed to said support, a drum journaled on said support to rotate about said axle and having a a cylindrical wall, a flexible element having one end anchored to said drum and wrapped around the outer surface of said wall, the other end of said element adapted for connecting to the window sash, an elongated spring spirally wrapped in a plurality of turns around said axle, the spring inner end being bent inwardly, said axle including an opening alined to receive said bent end to prevent the spring from turning about said axle, the outer end of said spring fixed to said drum whereby turning of the drum in one direction winds the spring which thereafter urges the drum to rotate in the opposite direction, the inner end portion of said spring being nonresilient and wrapped for at least one complete turn closely around said axle to hold said bent end in said axle opening, and means rigid with said drum and concentric with respect to the wall thereof and about which the outer end of the spring is wrapped inwardly toward the center of the drum, said means being operable to hold the outer end portion of said spring concentric with said drum wall thereby maintaining said spring concentric about said axle.

3. A device for counterbalancing a window sash slidable up and down in a frame, said device including, in combination, a support mountable adjacent the top of the frame, an axle fixed to said support, a drum journaled on said support to rotate about said axle and having a cylindrical wall, a flexible element having one end anchored to said drum and wrapped around the outer surface of said wall, the other end of said element adapted for connecting to the window sash, an elongated spring spirally wrapped in a plurality of turns around said axle, the spring inner end being bent inwardly, said axle including an opening alined to receive said bent inner end to hold said spring from turning about said axle, an elongated anchor rigidly supported interiorly of and by said drum and having a radially outward facing wall extending concentric to said drum wall, the inner end portion of said spring being nonresilient and wrapped for at least one turn closely around said axle to hold said bent inner end in said axle opening, the outer end portion of the spring being in contact with said anchor wall and having an end portion looped inwardly toward the center of the drum to hold the outer end portion of said spring concentric with said drum wall thereby maintaining said spring concentric about said axle, said spring acting, when said drum is rotated in one direction, to bias the drum for rotation in the opposite direction.

4. A device for counterbalancing a window sash slidable up and down in a frame, said device including, in combination, a support mountable adjacent the top of the frame, an axle fixed to said support, a drum journaled on said support to rotate about said axle and having a cylindrical wall, a flexible element having one end anchored to said drum and wrapped around the outside of said wall, the other end of said element adapted for connecting to the window sash, an elongated spring spirally wrapped in a plurality of turns around said axle, with spring inner end being bent radially inwardly, said axle including an opening to receive said bent end and hold said spring from rotating about said axle, an elongated, arcuate anchor supported from said drum adjacent the outer end of said spring and having a radially outward facing wall extending concentric with but spaced from said drum wall, said spring outer end being fixed to said drum by passage along said outward facing anchored wall and thereafter

being bent around the end of said anchor inwardly toward the center of said drum, the inner end portion of said spring being nonresilient and wrapped for at least one turn closely around said axle to hold said bent end in said axle opening whereby turning of the drum in one direction winds the spring which thereafter urges the drum to rotate in the opposite direction and the anchor wall holds the spring concentric about said axle to prevent sidewise flexing of the spring.

5. A device for counterbalancing a window sash slidable up and down in a frame, said device including, in combination, a support mountable adjacent the top of the frame, an axle fixed to said support, a drum journaled on said support to rotate about said axle and having a cylindrical wall, a flexible element having one end anchored to said drum and wrapped around said wall, the other end of said element adapted for connecting to the window sash, an elongated spring spirally wrapped in a plurality of turns around said axle, with spring inner end being bent radially inwardly, said axle including an opening to receive said bent end and hold said spring from rotating about said axle, an anchor supported from said drum adjacent the outer end of said spring and having a radially outward facing wall extending concentric to said drum wall, said spring outer end being fixed to said drum by

extending along said outward facing anchor wall and thereafter being bent around said anchor, the inner end portion of said spring being annealed to be non-resilient over a plurality of convolutions wrapped closely around said axle to hold said bent end in said axle opening whereby turning of the drum in one direction winds the spring which thereafter urges the drum to rotate in the opposite direction and the anchor wall holds the spring concentric about said axle to prevent sidewise flexing of the spring.

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