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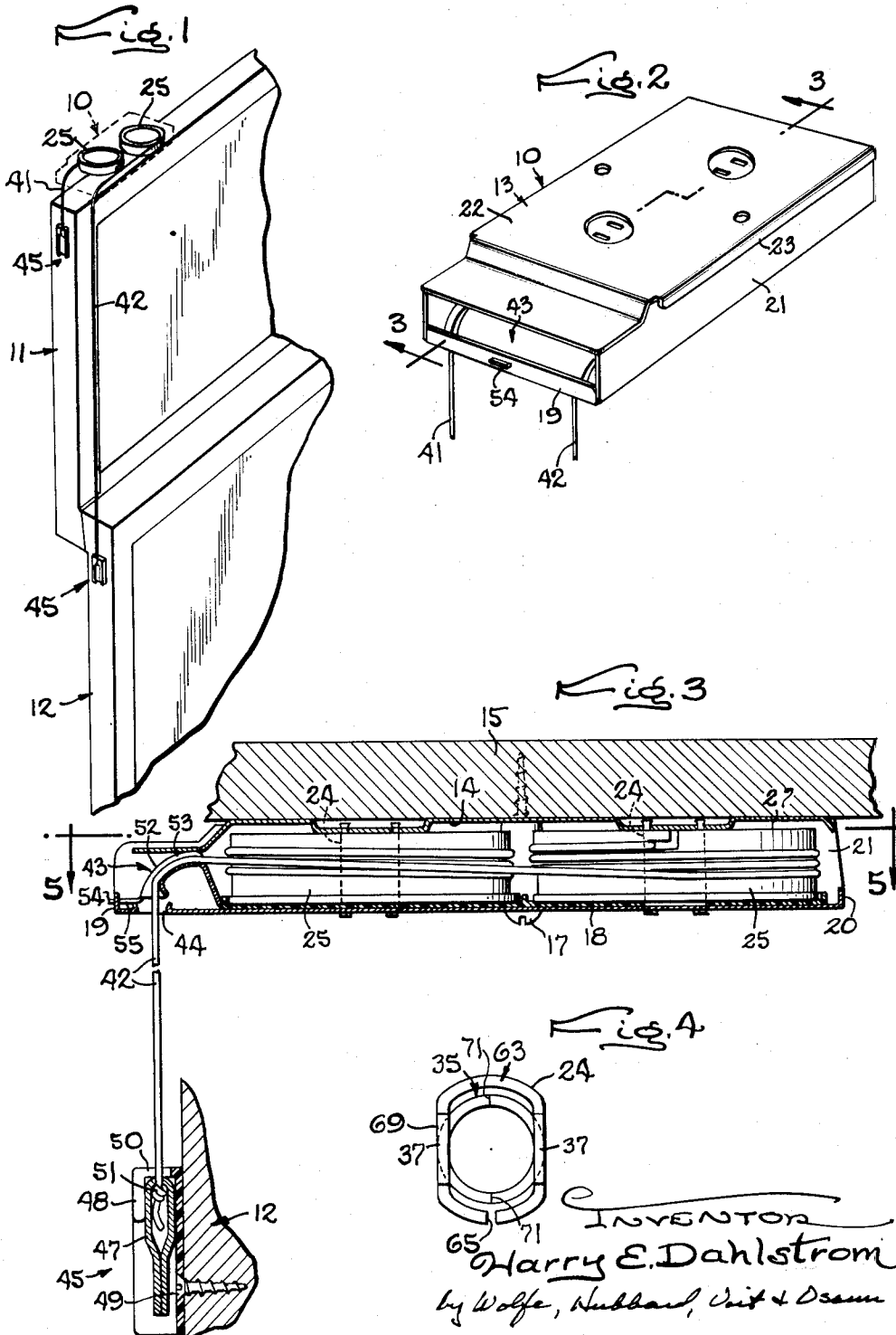
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DEVICE FOR COUNTERBALANCING WINDOW SASHES

Filed April 17, 1962

3 Sheets-Sheet 1



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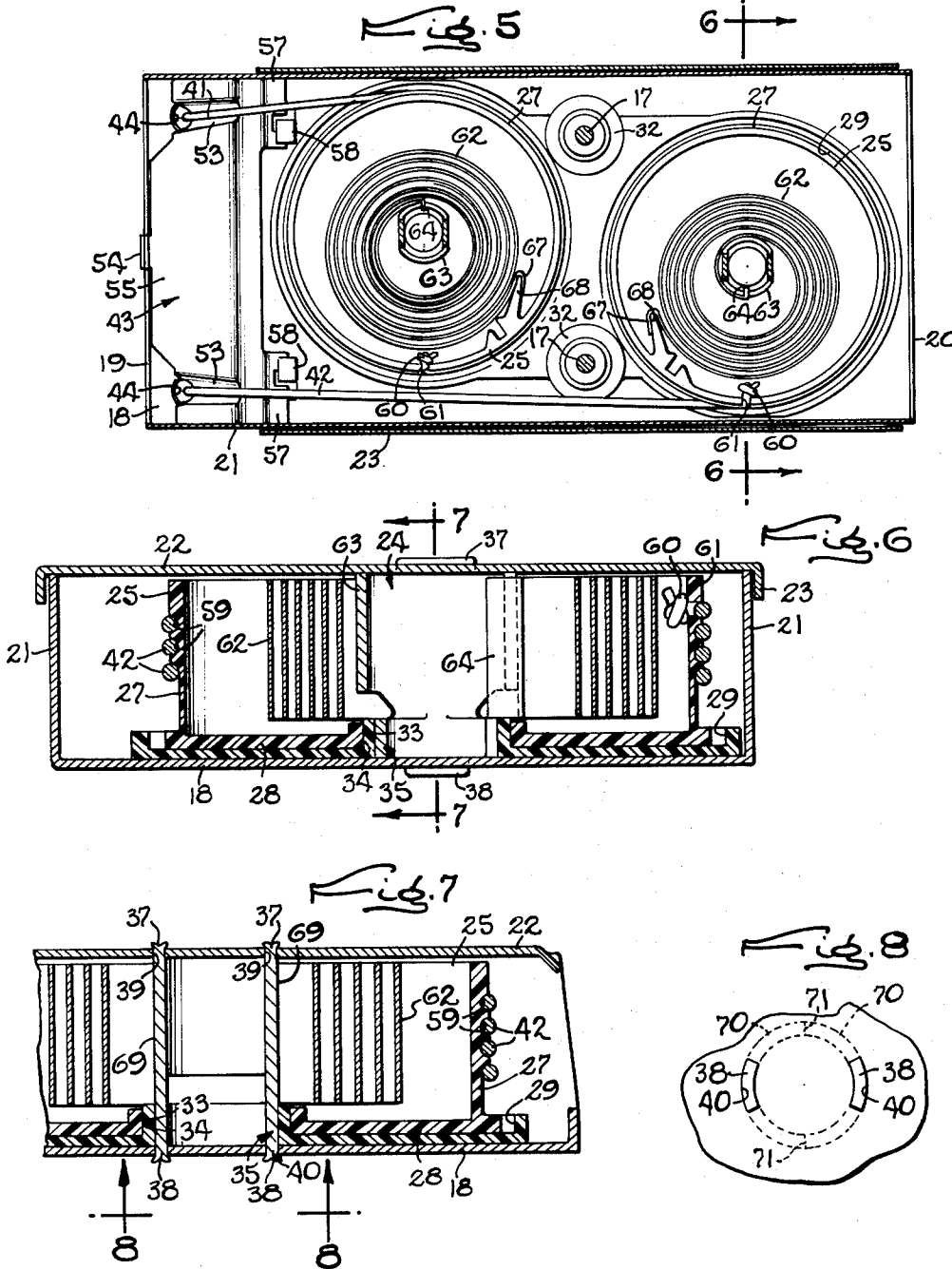
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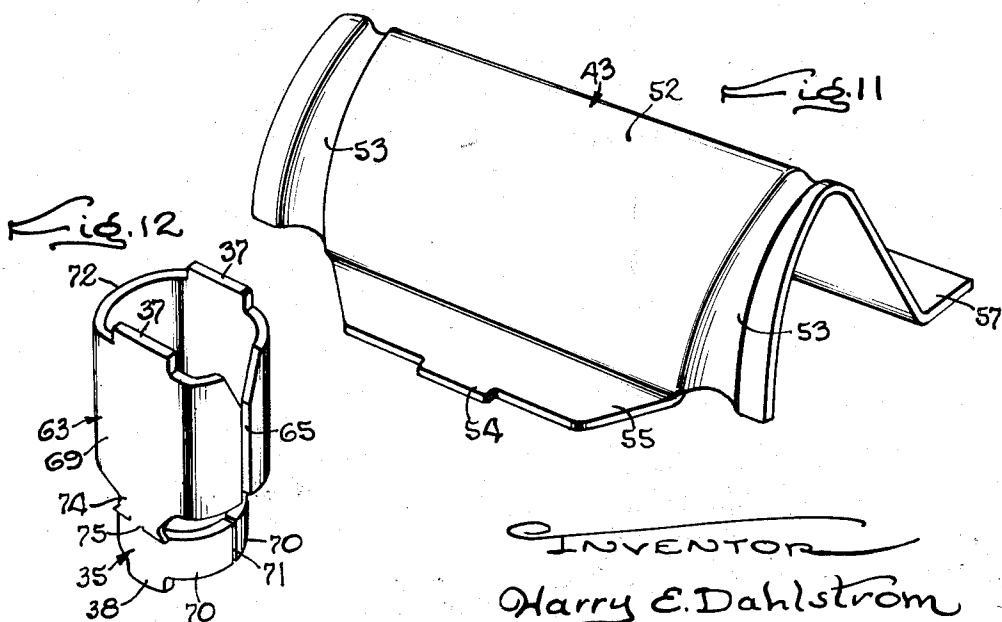
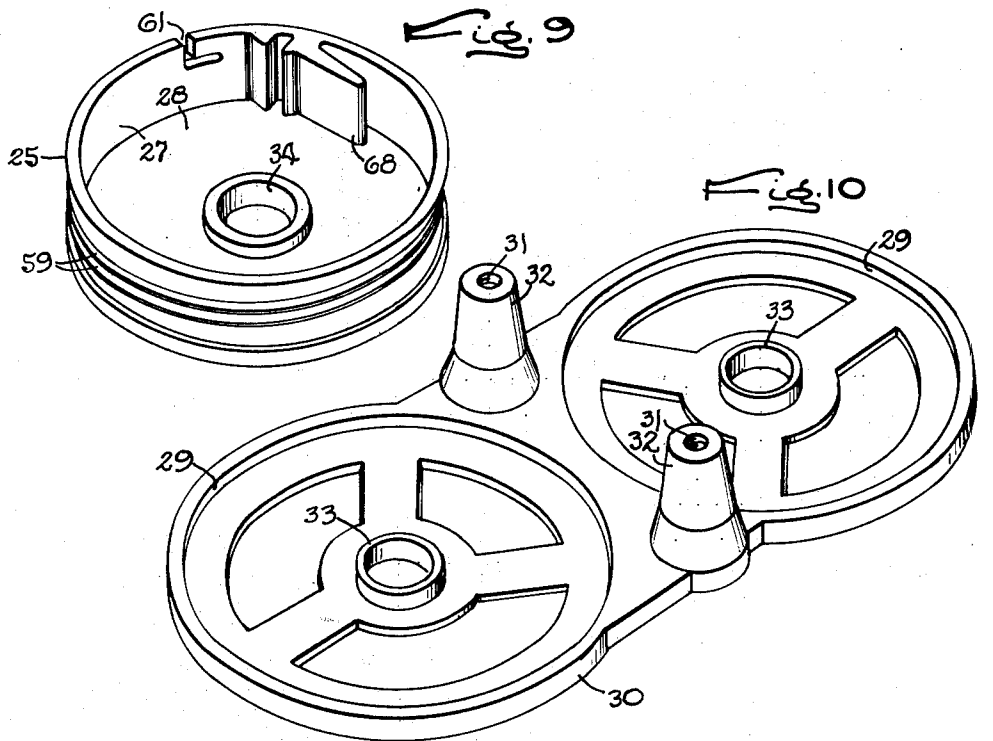
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DEVICE FOR COUNTERBALANCING WINDOW SASHES

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DEVICE FOR COUNTERBALANCING WINDOW SASHES

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7 Claims. (Cl. 16-198)

This invention relates to a device for counterbalancing window sashes slidable vertically in a frame, and more particularly, to a counterbalancer of the type including a drum journaled on an axle in a case and mountable 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 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 exert an upward force on the sash sufficient to offset the weight of the sash.

The primary object of the present invention is to provide in a counterbalancer of the above character an inexpensive axle which prevents the spring from working in between the drum and the axle and binding therein during service use of the counterbalancer.

A related object is to provide a novel axle of the above character which also makes it possible to assemble the counterbalancer in a simple and inexpensive operation.

A more specific object is to provide a tubular sheet metal axle having one diameter for journaling the drum in the case and a body of larger diameter around which the spring is wrapped and by which the inner turns of the spring are spaced radially outwardly from the drum bearing in all conditions of the spring, the axle also having at least one straight and continuous section in a plane paralleling its axis to strengthen the axle so that it is capable of withstanding substantial axial compressive forces applied during assembly to deform tabs projecting from each end of the axle and into aligned slots in the case.

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 embodying the novel features of the present invention.

FIG. 2 is an enlarged perspective view of the counterbalancer.

FIG. 3 is an enlarged fragmentary sectional view taken along the lines 3-3 of FIG. 2 and showing part of the frame header on which the counterbalancer is mounted.

FIG. 4 is a plan view of the drum axle.

FIG. 5 is a fragmentary sectional view taken along the lines 5-5 of FIG. 3.

FIG. 6 is a fragmentary sectional view taken along the lines 6-6 of FIG. 5.

FIG. 7 is a fragmentary sectional view taken along the lines 7-7 of FIG. 6.

FIG. 8 is a fragmentary view taken along the lines 8-8 of FIG. 7.

FIG. 9 is a perspective view of the drum.

FIG. 10 is a perspective view of the bearing in which the drum is mounted in the case.

FIG. 11 is a perspective view of the cord guide.

FIG. 12 is a perspective view of the axle.

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 (not shown) 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 is slidable upwardly to open the window adjacent the sill. To counterbalance the sashes, the device 10 exerts an upward force on the sashes sufficient, in cooperation with

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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 13 mounted adjacent the top of the frame in a socket 14 (FIG. 3) recessed into the underside of the frame header 15 at one end of the header and held in place by screws 17 projected through the case and driven into the header. Preferably, the case is of sheet metal construction and includes a rectangular bottom wall 178, two narrow end flanges 19 and 20, and two narrow side walls 21, the side and end walls being bent upwardly from the four edges of the bottom wall 18. Forming the remaining side of the case is a generally rectangular sheet metal cover 22 formed with side flanges 23 (FIGS. 2, 5 and 6) depending therefrom to lie against the opposite sides 21 of the case.

Journalled in the case on two tubular axles 24 are two drums 25 which comprise hollow cylinders 27 each having one end wall 28 and an open upper end. The lower end of each drum is seated in a shallow cylindrical recess 29 in a bearing 30 (see FIG. 10) which preferably is molded of suitable plastic such as Delrin. This bearing lies on the bottom wall 18 of the case and is held in place therein by the screws 17 which extend through holes 31 in columns 32 molded integrally with the bearing and upstanding therefrom between the recesses 29 to terminate closely adjacent the cover 22. A pair of cylindrical flanges 33 (FIGS. 6, 7 and 10) concentric with the recesses 29 project upwardly from the bearing and telescope into flanged center holes 34 in the lower end walls 28 of the drums.

The axles 24 span the bottom wall 18 and the cover 22 and are formed with cylindrical bearing portions 35 adjacent their lower ends telescoping snugly into the bearing flanges 33. Tabs 37 and 38 on the upper and lower ends of the axles project through slots 39 and 40 in the bottom wall and the cover respectively to hold the axles in place. Thus, the drums turn about the axles on the plastic flanges 33 which constitute anti-friction bearings for the drums.

As shown in FIGS. 1 and 3, two cords 41 and 42 are wound around the drums 25 with the free end portions of the cords extending horizontally off the drums and passing over a guide 43 (see FIG. 11) and downwardly through a pair of spaced holes 44 (FIGS. 3 and 5) in the bottom wall 18 adjacent one end 19 of the case. These cords extend downwardly alongside the respective sashes 11 and 12 and their free ends are fastened to the sides of the sashes by suitable means such as fasteners 45 (FIGS. 1 and 3) each including a U-shaped clip 47 disposed within a casing 48, the casing being fastened to the sash by a screw 49 driven into the sash through a hole in the side wall of the casing. The cord extends downwardly into the clip through a notch 50 in the top wall of the casing and through a registering hole in the upper end of the clip and its free end is knotted at 51 to prevent the cord from pulling out of the clip.

The guide 43 comprises a sheet metal insert (see FIG. 11) including a portion 52 of arcuate cross-section curving upwardly and inwardly from the holes 44 and formed with two spaced grooves 53 for guiding the cords into alignment with the peripheries of the drums. A tab 54 formed on a flat horizontal flange 55 on one side of the arcuate portion and lying against the bottom wall 18 projects through a slot in the end flange 19, and two spaced tabs 57 (FIG. 5) on the other side of the arcuate portion are held against the bottom wall by tabs 58 upstanding from the bottom wall and bent over the tabs 57.

To control the winding of the cords 41 and 42 onto the drums 25, the outer periphery of each drum is formed with a helical groove 59 which guides the associated cord

evenly onto the drum. Each cord is knotted at 60 (FIG. 5) and the knotted end inserted in a notch 61 in the free edge of the drum. Preferably, the cords are wound onto the drums in opposite directions to strip off the latter along opposite sides of the case. The drums may be offset slightly toward the sides as shown in FIG. 5 to avoid interference by the drum closest to the end 19 with the cord 42.

With the foregoing arrangement, turning of each drum in a direction to wind up the associated cord places the cord under tension to urge the sash upwardly. To urge the drums in the appropriate directions, elongated flat springs 62 are wrapped spirally around the upper or body portions 63 of the axles 24 and are fastened at their inner ends to the axles and at their outer ends to the drums, the springs being wrapped around the two drums in opposite directions so that unwinding of the cords as the sashes are lowered winds up the springs. Herein, the inner ends 64 (FIGS. 5 and 6) of the springs are bent inwardly and inserted in axially extending slots 65 in the axle bodies (see FIG. 4) and the outer ends 67 (FIG. 5) are bent around fingers 68 integral with the inner peripheries of the drums.

In accordance with the present invention, the drum axles 24 are constructed in a novel manner to prevent the springs 62 from working in between the drum bearings 34 and the axle bearings 35 and binding therein and, at the same time, are relatively inexpensive in construction and make it possible to assemble the counterbalancer in a simple and inexpensive operation. To achieve these ends, each axle is of tubular construction and the body 63 thereof is formed with a diameter larger than the diameter of the drum bearing to space the inner turns of the associated spring radially outwardly from the bearing in all conditions of the spring. To facilitate assembly of the counterbalancer, the axle is formed with at least one flat side 69 disposed in a plane paralleling the axis of the axle and intersecting the smaller bearing portion 35 so that the axle includes a straight and continuous section lying in the plane of the tabs 37 and 38.

This section resists axial compressive forces so that the tabs may be deformed as by staking, and is reinforced by the curved portion of the body which prevents buckling of the axle during staking. Thus, despite the difference in diameters, the inexpensive tubular axle has sufficient strength to withstand staking forces.

In this instance, each axle 24 comprises a single piece of sheet metal punched out of flat stock and bent into the shape shown most clearly in FIG. 12. The axle bearing 35 is formed by two semi-cylindrical strips 70 opening toward each other with the adjacent edges of the strips spaced apart to form slots 71 (FIGS. 4, 8, and 12) extending down opposite sides of the bearing.

The body portion 63 comprises another strip which herein is bent to form two flat sides 69 disposed in parallel planes with the outer surfaces of the sides spaced apart a distance equal to the outer diameter of the axle bearing 35 and tangent to the outer diameter. Since the two portions of the axle are of the same thickness, the inner surfaces of the sides 69 are tangent to the inner diameter of the bearing. The rest of the body is of arcuate cross-section and disposed at a diameter substantially greater than the axle bearing diameter and preferably concentric therewith. As shown in FIG. 6, the body diameters also are greater than the diameters of the plastic flanges 33 on which the drums turn.

Herein, the flat sides 69 are integrally joined together across one of the remaining sides of the body by an arcuately curved portion 72, and on the other side, the free edge portions of the body-forming strip curve inwardly and terminate short of each other to define the axially extending slot 65 (FIGS. 4 and 12) for receiving the inner end of the spring and anchoring the latter on the axle.

To facilitate the manufacture of the axles, the flat sides

69 are integrally joined to the axle bearing 35 by two legs 74 (FIG. 12) which extend downwardly from the lower edges of the sides and lie in the planes thereof. The lower ends of these legs are integrally joined to the strips 70 by bands 75 through which the reinforcing sections extend.

A tab 37 is formed on the upper edge of each flat side 69 to lie in the plane of the side, and two tabs 38 are formed on the lower edges of the strips 70 to extend downwardly therefrom, the lower tabs comprising correspondingly curved extensions of the strips and lying substantially in the planes of the sides. Thus, the axle includes two straight and continuous sections on diametrically opposite sides of the axle as shown in FIG. 7, the sections extending from the upper tabs 37 through the flat sides 69 and the bands 75, and finally through the segments of the strips 70 and lower tabs 38 included in the planes of the sides. Further, these two continuous sections are reinforced by the integral arcuate portion 72 which braces them against buckling.

With the axles formed in this manner, the counterbalancer may be assembled by positioning the plastic bearing 30 on the bottom wall 18 of the case, seating the drums 25 in the recesses 29, and inserting the axle bearings 35 in the plastic flanges 33 with the lower tabs 38 projecting through the slots 40 in the bottom wall 18 of the case. Then, the cover 22 is placed over the top of the case with the upper tabs 37 of the axles projecting through the slots 39 therein and, simply by staking the outer ends of the tabs 37 and 38 as shown in FIG. 7, the entire assembly may be held together.

Although axles constructed as described above are tubular and are formed with two different diameters, they are strong enough to withstand substantial axial forces. In service use, the springs 62 are always spaced radially outwardly from the drum flange 34 and cannot work into the drum bearing. Accordingly, bothersome jamming of the counterbalancer in service use is eliminated.

I claim as my invention:

1. A device for counterbalancing a window slidable up and down in a frame, said device including, in combination, a case mountable adjacent the top of the frame and having two spaced walls, one of said walls being formed by a cover loosely mounted on said case, a tubular axle spanning said walls, one end portion of said axle comprising a tubular cylindrical bearing portion of predetermined diameter and the other end portion comprising a tubular body having two flat sides disposed in planes paralleling the axis of said bearing portion and spaced apart a distance equal to said predetermined diameter, said sides being tangent to said outside diameter and the rest of said body being arcuate in cross-section and disposed at a diameter greater than said predetermined diameter and concentric therewith, a drum disposed within said case and journaled on said bearing portion to rotate about said axle, an elongated flat spring spirally wrapped around said body and fast at one end on said axle and at the other end on said drum whereby turning of the drum in one direction winds up said spring to urge the drum back in the other direction, said body spacing said spring radially outwardly from said bearing portion to prevent the spring from binding between said drum and the bearing, and tabs projecting axially from the opposite ends of said axle and disposed in said planes, said walls having slots therein aligned with and receiving said tabs, and said bearing portion being integrally joined to said flat sides whereby the latter cooperate with the segments of said bearing portion included in said planes to form two straight and continuous sections extending the full length of the axle to brace the latter against buckling under compressive forces applied against the projecting ends of said tabs to deform the latter whereby the tabs hold the axle in the case and said cover in a fixed position relative to the axle and the rest of the case.

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2. A device for counterbalancing a window slidable up and down in a frame, said device including, in combination, a case mountable adjacent the top of the frame and having two spaced walls, a tubular axle spanning said walls, one end portion of said axle comprising a tubular cylindrical bearing portion of predetermined outside diameter and the other end portion comprising a tubular body having two flat sides disposed in planes paralleling the axis of said bearing portion and spaced apart a distance equal to said predetermined diameter, said sides being tangent to said outside diameter and the rest of said body being arcuate in cross-section and disposed at a diameter greater than said predetermined diameter and concentric therewith, a drum disposed within said case and journaled on said bearing portion to rotate about said axle, an elongated flat spring spirally wrapped around said body and fast at one end on said axle and at the other end on said drum whereby turning of the drum in one direction winds up said spring to urge the drum back in the other direction, said body spacing said spring radially outwardly from said bearing portion to prevent the spring from binding between said drum and the bearing portion, and tabs projecting axially from the opposite ends of said axle in each of said planes, said walls having slots therein aligned with and receiving said tabs, and said bearing portion being integrally joined to said flat sides whereby the latter cooperate with the segments of said bearing portion included in said planes to form two straight and continuous sections extending the full length of the axle to brace the latter against buckling under compressive forces applied against the projecting ends of said tabs to deform the latter thereby to hold the axle in the case and said walls in fixed positions relative to the axle.

3. A device as defined in claim 2 in which said body is joined to said bearing portion by two legs disposed in said planes and integral with both the bearing portion and the body.

4. A device for counterbalancing a window slidable up and down in a frame, said device including, in combination, a case mountable adjacent the top of the frame and having two spaced walls, a tubular axle spanning said walls, one end portion of said axle comprising a tubular cylindrical bearing portion of predetermined diameter and the other end portion comprising a tubular body having at least one flat side disposed in a plane paralleling the axis of said bearing portion and intersecting the latter, the rest of said body being arcuate in cross-section and disposed at a diameter greater than said predetermined diameter, a drum disposed within said case and journaled on said bearing portion to rotate about said axle, an elongated flat spring wrapped around said body and fast at one end on said axle and at the other end on said drum whereby turning of the drum in one direction winds up said spring to urge the drum back in the other direction, said body spacing said spring radially outwardly from said bearing portion to prevent the spring from binding between said drum and the bearing, and tabs projecting axially from the opposite ends of said axle and disposed in said plane, said walls having slots therein aligned with and receiving said tabs, and said bearing portion being integrally joined

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to said flat side whereby the latter cooperates with the segment of said bearing portion included in said plane to form a straight and continuous section extending the full length of the axle to brace the latter against buckling under compressive forces applied against the projecting ends of said tabs to deform the latter thereby to hold the axle in the case and said walls in fixed positions relative to the axle.

5. A device as defined in claim 4 including an anti-friction bearing telescoping snugly with said bearing portion and having an outside diameter telescoping with said drum to journal the latter on said bearing portion, said outside diameter being less than the diameter of the arcuate section of said body.

6. A device for counterbalancing a window slidable up and down in a frame, said device including, in combination, a case mountable adjacent the top of the frame and having two spaced walls, a tubular axle spanning and secured to said walls, said axle having a tubular cylindrical bearing portion of predetermined diameter adjacent one end and a tubular body portion adjacent the other end, a drum disposed within said case and journaled on said bearing portion to rotate about said axle, and an elongated flat spring spirally wrapped around said body and fast at one end on said axle and at the other end on said drum whereby turning of the drum in one direction winds up said spring to urge the drum back in the other direction, said body having arcuate sections disposed at a diameter greater than said predetermined diameter to space said spring radially outwardly from said bearing portion and prevent binding of the spring between said drum and the bearing portion, and said axle being formed with at least one straight and continuous section paralleling the axis of the axle and extending the full length of the latter to give the axle sufficient strength to resist substantial axial compressive forces.

7. A device for counterbalancing a window slidable up and down in a frame, said device including, in combination, a case mountable adjacent the top of the frame and having two spaced walls, an axle spanning and secured to said walls and formed adjacent one end with a cylindrical bearing portion of predetermined diameter, the other end portion of said axle having a diameter greater than said predetermined diameter, a drum disposed within said case and journaled on said bearing portion to rotate about said axle, and an elongated spring wrapped around said other end portion with one of its ends fast on said axle and the other end fast on said drum whereby turning of the axle in one direction winds up said spring to urge the drum back in the other direction, said other end portion spacing said spring radially outwardly from said bearing portion to prevent the spring from binding between said drum and said bearing portion.

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