Sept. 2, 1952 E. E. FOSTER 2,609,191

SPRING COUNTERBALANCE

Filed Feb. 16, 1948 2 SHEETS—SHEET 1

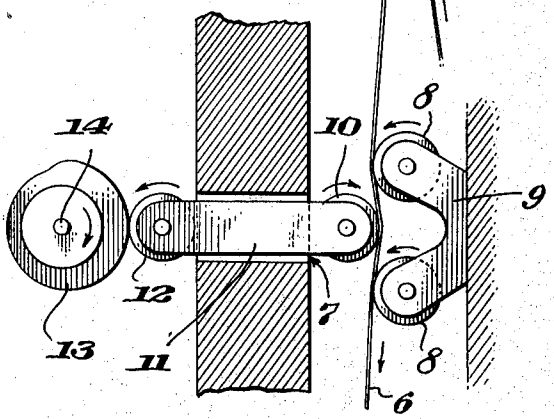


Fig. 1.

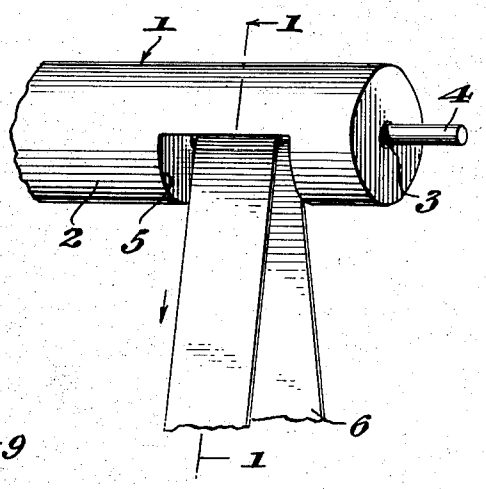
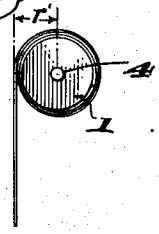


Fig. 2.



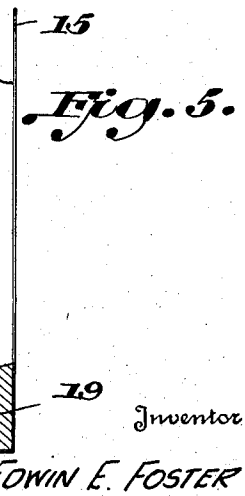


Fig. 5.

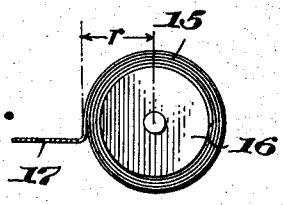
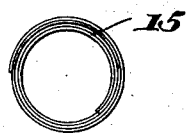


Fig. 4.

Fig. 3.



Inventor

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By Young, Emery & Thompson

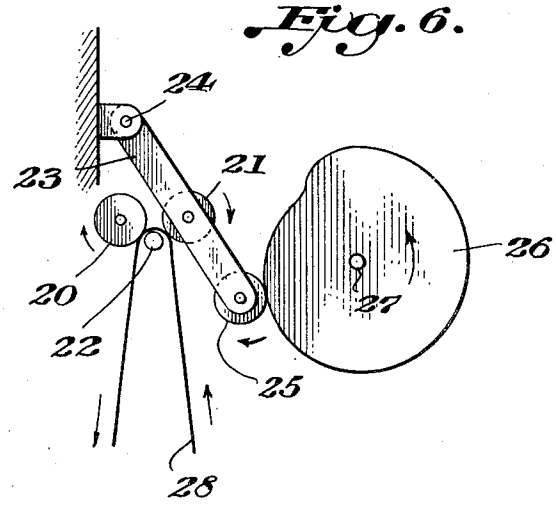
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Fig. 6.



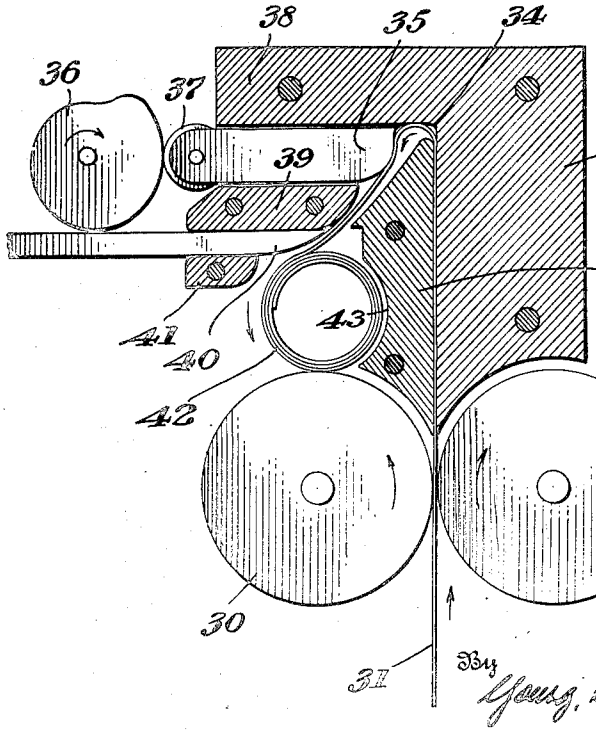


Fig. 7.

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2,609,191

SPRING COUNTERBALANCE

Edwin E. Foster, Austin, Tex., assignor, by mesne assignments, to Eastern Metals Research Co. Inc., New York, N. Y., a corporation of New York

Application February 16, 1948, Serial No. 8,599

4 Claims. (Cl. 267—1)

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This invention relates to a coiled ribbon spring which is an improvement over the springs shown in my copending application Serial No. 744,809, filed April 30, 1947.

It is an object of this invention to produce a spring ribbon for a counterbalance in which a tempered band of uniform width and thickness has a non-uniform set throughout its entire length. A further object resides in a counterbalance spring for windows, doors and the like in which the spring is wound on a drum and the spring is in the form of a ribbon having a non-uniform set throughout its entire length from one end to the other.

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

Figure 1 is a cross section of a device for placing a set in the spring,

Fig. 2 is a perspective view of a die,

Fig. 3 is a side view of a coiled spring,

Fig. 4 is a side view of a coiled spring and drum,

Fig. 5 is a diagrammatic view in side elevation of a spring attached to a window,

Fig. 6 is a side view of a modified device for placing a set in the spring ribbon, and

Fig. 7 is a sectional view of a further modified device for placing a set in the spring ribbon.

The die 1, Figs. 1 and 2, is composed of a cylindrical body member 2 having a central or axial hole 3 in which is removably inserted a rod 4. A cut-out segment or portion 5 in the body member 2 accommodates the spring ribbon or band 6 to be treated and run through the body member and over the rod 4. From the device of Fig. 1 the band 6 passes through a tension setting device 7, Fig. 1, consisting of two spaced and fixed rollers 8 mounted in a bracket 9 and an adjustable roller 10. This roller is movable toward and away from the rollers 8 and is mounted to slide to the right or left in a frame 11. A roller 12 is mounted on the end opposite to that of roller 10 and the roller 12 contacts a cam 13 rotatably mounted on a shaft 14.

Fig. 3 shows the spring 15 coiled upon itself and Fig. 4 shows the spring 15 coiled on a drum 16 and provided with a straight section 17 with the latter of which the spring 15 is secured to the bottom corner 18 of a window by means of a screw 19, Fig. 5.

Fig. 6 shows a device in which a stationary roller 20 cooperates with a stationary abutment 22 and a movable and adjustable roller 21. The roller 21 is mounted in an arm 23 pivoted at one end 24 and having a roller 25 at the other end.

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This roller 25 cooperates and contacts a cam 26 mounted on a shaft 27. The spring 28 passes through the device in the direction of the arrows and the rollers 20, 21, 25 and cam 26 rotate in the direction of the arrows while the spring 28 passes through the device during its treatment.

In Fig. 7 a pair of feed rollers 29 and 30 move and force the spring 31 along guide plates 32 and 33 whereby the spring 31 is given a coiling set in the die cavity 34 and adjustable slide member 35 movable by means of a cam 36. The slide member 35 is provided with a roller 37 to contact the cam 36 and this member moves between plates 38 and 39. A cut off knife 40 slides between the plate 39 and a further fixed plate 41. As seen in Fig. 7 the spring ribbon coils up at 42 aided by a curved contour 43 in the guide plate 33.

The apparatus of Fig. 7 operates by rotation of rollers 29 and 30 in the direction of the arrows whereby the band 31 is forced by guides 32 and 33 into the die cavity 34. In this cavity 34 the band 31 is coiled with a uniform change in the tension by the adjustment of the slide member 35 as governed by the cam 36.

In Figs. 3 and 4, the inside coil, that is the one that contacts the drum 16, assumes its normal curvature fitting snugly around the drum. Each additional coil that is wrapped around the first coil is under more and more strain, because the normal curvature to which they are attempting to return would be a smaller coil than the first one near the drum.

In Figs. 4 and 5 the radius r in Fig. 4 is greater than the radius r' in Fig. 5 by the difference in the number of coils remaining on the drum times the thickness of the ribbon.

As the spring is unwound from the drum the active portion of the coil acts around a shorter lever arm r' and needs to be weaker than when it was acting about the larger arm r.

I claim as my invention:

1. A spring device comprising a tightly coiled, spirally wound spring having an inner end and an outer end, means supporting said spring for rotation about its axis, whereby a force sufficient to straighten said spring and exerted on the outer end of said spring will cause said spring to rotate bodily and unwind, said spring being of uniform width and thickness and being formed with a uniformly decreasing normal radius of curvature, when unstressed from its inner end to its outer end to neutralize the variable of the shortening lever arm as the spring is unwound,

whereby the effective tension of the spring throughout its length will be constant.

2. A tempered spring ribbon of uniform width and thickness coiled on itself in a tightly wound spiral and having a gradually decreasing normal radius of curvature when unstressed from its inner end to its outer end to offset the variable of the shortening leverage as the ribbon is uncoiled whereby its effective tension during coiling and uncoiling will be constant.

3. A spring comprising: a plurality of spirally wound convolutions of spring metal, at least a portion of the spring having outermost and innermost convolutions characterized in that the radius of curvature of the outermost convolution of said portion, when in repose, does not exceed the radius of curvature of the innermost convolution of said portion, when in repose, and the successive convolutions of said portion have, when in repose, a progressively decreasing radius of curvature starting from the inner limit of the innermost convolution.

4. A spring comprising: a plurality of spirally wound convolutions of spring metal, at least a portion of the spring having outermost and innermost convolutions characterized in that the radius of curvature of the outermost convolution of said portion, when in repose, does not exceed the radius of curvature of the innermost convolution of said portion, when in repose, and the successive convolutions of said portion have, when in repose, a progressively increasing radius of curvature from the outer limit of the outermost convolution to the inner limit of the innermost convolution.

EDWIN E. FOSTER.

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