March 16, 1954

G. E. KAUFMAN

2,672,304

SPRING DRIVEN REEL

Filed Jan. 28, 1950

3 Sheets-Sheet 1

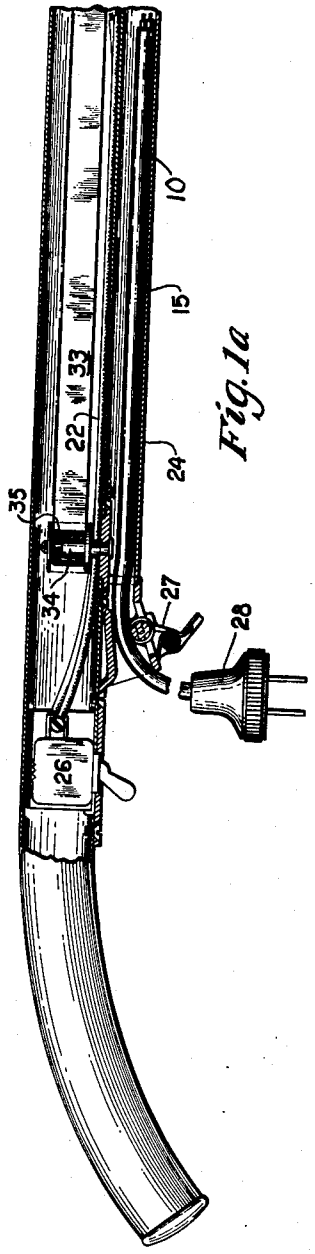


Fig. 1a

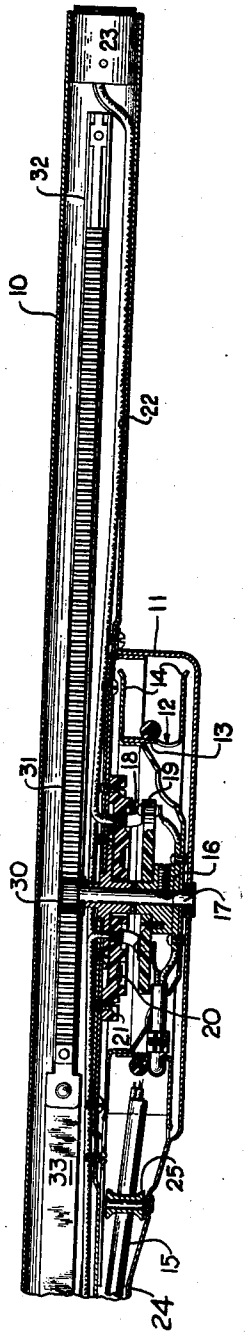


Fig. 1

INVENTOR.
George E. Kaufman
BY
Harry S. Bruaw
ATTORNEY.

March 16, 1954

G. E. KAUFMAN

SPRING DRIVEN REEL

2,672,304

Filed Jan. 28, 1950

3 Sheets-Sheet 2

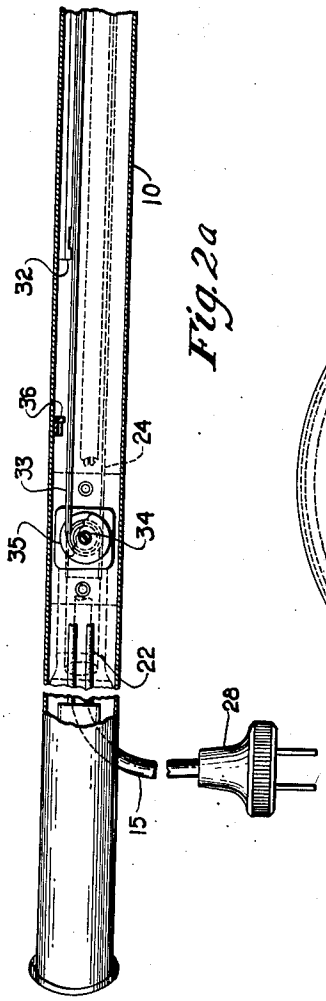


Fig. 2a

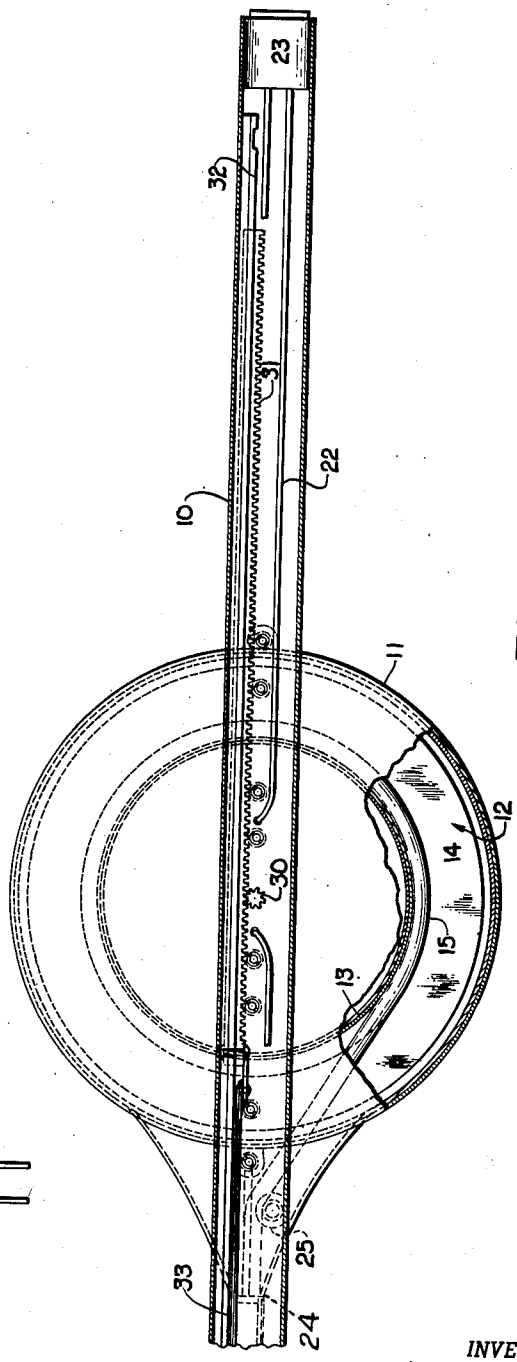


Fig. 2

INVENTOR.
George E. Kaufman
BY
Harry S. Bruess
ATTORNEY.

March 16, 1954

G. E. KAUFMAN

SPRING DRIVEN REEL

2,672,304

Filed Jan. 28, 1950

3 Sheets-Sheet 3

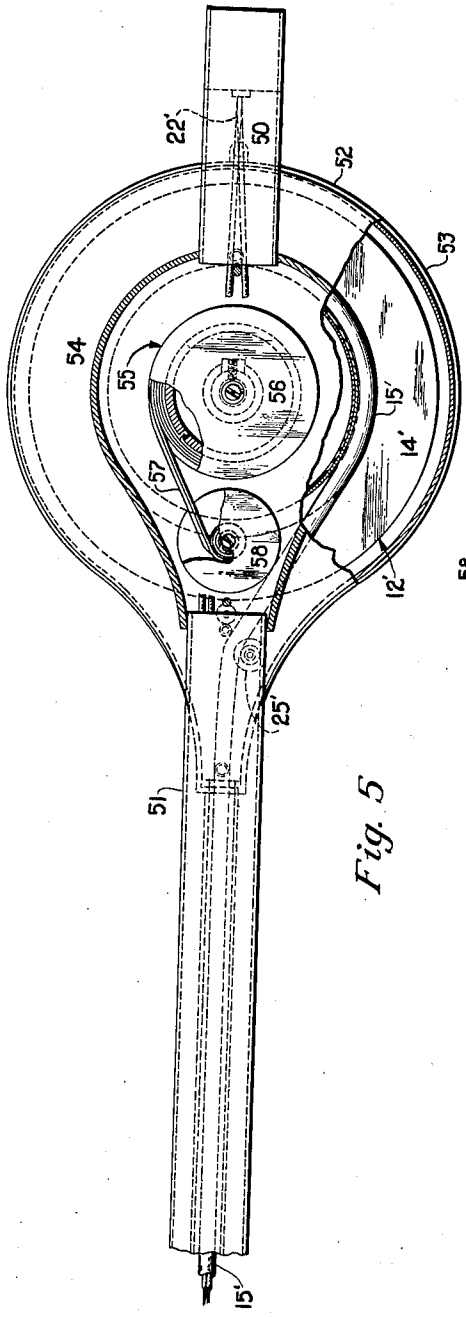


Fig. 5

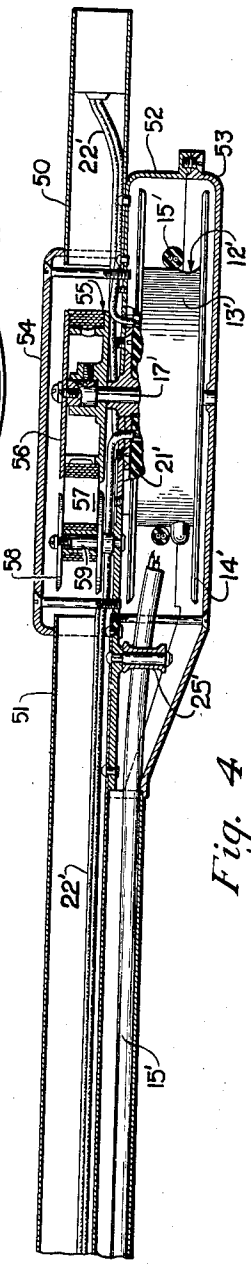


Fig. 4

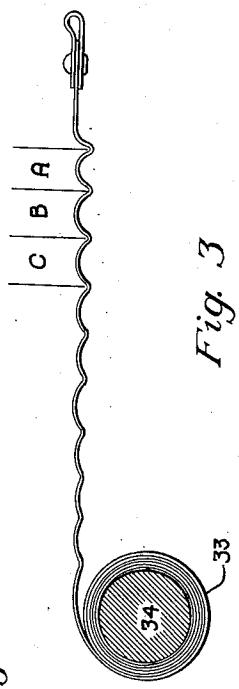


Fig. 3

INVENTOR.
George E. Kaufman
BY
Harry S. Duncan
ATTORNEY.

Patented Mar. 16, 1954

2,672,304

UNITED STATES PATENT OFFICE

2,672,304

SPRING DRIVEN REEL

George E. Kaufman, Canton, Ohio, assignor to The Hoover Company, North Canton, Ohio, a corporation of Ohio

Application January 28, 1950, Serial No. 141,096

15 Claims. (Cl. 242—108)

1

This invention relates to suction cleaners, floor polishers or other such hand manipulated appliances and more particularly to a spring wound cord reel applied thereto whereby the conductor cord is automatically wound and rewound onto a reel associated with the appliance as it is moved away from or toward an outlet socket to which the conductor cord is connected.

In the usual spring wound cord reel the unwinding resistance increases progressively as the cord is unwound. Conversely, the rewinding force decreases progressively as the cord is returned to the reel. The above is exactly the reverse of that desired in hand manipulated appliances. As the ambulatory appliance is moved away from the outlet connection the more cord there is to manipulate. Consequently, the rewinding force or the force necessary to propel the appliance away from the oulet is greatly decreased as the appliance is moved toward the outlet. With ordinary spring wound reels, the force is sometimes not sufficient to completely rewind the cord onto the reel.

The latter, of course, can be remedied by increasing the spring tension but that would also increase the resistance to movement of the appliance away from the outlet as the cord is unwound.

The preferable arrangement would be one in which the resistance to movement of the appliance away from the outlet would be constant or in which such resistance to movement decreases as the cord is unwound.

According to the present invention the above results are carried out by the use of a prestressed spring arranged to resist unwinding movement of the cord and to tend to rewind the cord, in which the prestressing of the spring causes it to resist unwinding movement of the cord with a constant force or to resist such movement with a progressively decreasing force.

According to the broadest aspects of this invention a spring rewound cord reel for an ambulatory appliance is provided in which the resistance to cord unwinding movement is constant or decreases as the appliance is moved away from an outlet and in which the tendency for the cord to rewind is constant or increases as the appliance is moved toward the outlet.

Other objects and advantages of this invention will become apparent as the description proceeds when taken in connection with the accompanying drawing in which:

Figure 1 is a cross-sectional view through the lower end of the handle of an ambulatory appliance showing the cord reel of this invention applied thereto;

2

Fig. 1*a* is a cross sectional view through the upper end of the handle of Fig. 1;

Figure 2 is a view taken at right angles to that of Fig. 1;

Fig. 2*a* is a view taken at right angles to that of Fig. 1*a*;

Figure 3 schematically shows how the prestressed spring acts according to this invention;

Figure 4 is a cross-sectional view of a modification of the invention; and

Figure 5 is a view of the cord reel of Fig. 4 taken at right angles to Fig. 4.

Referring to the drawing, the reference numeral 10 represents the handle of an ambulatory appliance, such as a suction cleaner or floor polisher, and having a flat cylindrical casing 11 suitably secured to the underside thereof. Within the cylindrical casing 11 is a cord reel generally indicated by the reference numeral 12. The reel 12 comprises a cylindrical portion 13, outwardly extending flanges 14 which cooperate to form a space for receiving the conductor cord 15 and a hub 16 which is rotatably mounted within the casing 11 by means of a shaft 17 rigid with the hub portion 16.

The ends of the wires of conductor cord 15 are electrically connected to spring contacts 18 mounted on the upper side of an insulating plate 19 secured to the hub 16. The spring contacts 18 cooperate with slip rings 20 suitably secured to the under face of an insulating plate 21 suitably secured to the back of the casing 11 next to the handle 10. The slip rings 20 are electrically connected to conductor cords 22 leading downwardly to a plug 23 in the bottom end of the handle 10 and to an electric switch 26 in the hand grip end thereof. The plug 23 is adapted to be electrically connected to the motor of an ambulatory appliance such as a suction cleaner, floor polisher or other such appliance. The free end of the cord 15 extends upwardly through a tube 24 secured to the underside of the handle 10 and is guided for movement through the tube and onto the reel 12 by a guide pulley 25.

At the end of the tube 24 is a clamping pawl 27 which will lock the cord against inward movement into the tube 24 until manually released but will permit the cord to be pulled outward freely. A suitable pronged attachment plug 28 is suitably secured to the free end of the cord 15.

The shaft 17 extends into the interior of the handle 10 and has a pinion gear 30 rigidly secured thereto which coacts with the teeth of a rack

bar 31 mounted for reciprocation on the interior of the handle 10 by means of the guide strip 32. The upper end of the rack bar 31 is secured to the end of a flat spring 33 which extends upwardly through the handle 10 and is coiled into a solid coil about a spool 35 free to rotate on a pin 34 secured interiorly to the handle 10 adjacent the upper end of the tube 24. A stop 36 is secured interiorly to the interior of tube 10 to limit upward movement of the rack bar 31.

The spring 33 is prestressed along its length so that as it unwinds from the spool 35, it unwinds in increments and only that increment which is being unwound will resist unwinding movement. The prestressing of the spring 33 is such that as it is unwound it assumes an outwardly bowed camber similar to that of a steel tape as it straightens out.

Operation of Figs. 1 to 3

Fig. 3 shows schematically how the prestressed spring operates. If the spring were to be cut into sections or increments, such as "A," "B," "C," etc., each section or increment would assume its natural curvature. When the spring is coiled about the spool 35, the coil is tight with each coil pressing against the one beneath it so that in order to unwind the spring from the coil only that increment which is being straightened resists the unwinding movement. The natural radius of the increment "A" is less than the radius of increment "B" and the natural radius of increment "B" is less than that of increment "C" and so on, along the length of the spring. It is obvious that it would take a greater force to completely straighten the increment "A" than it would to straighten the increment "B" etc., so that with the spring shown in Fig. 3 the unwinding force decreases as the spring is unwound from the coil. If each increment is prestressed so that the natural free radius of curvature of each increment is the same the unwinding force would be constant for the entire length of the spring.

Another factor to be noted is that when the spring is wound upon a coil of larger diameter than its natural radius of curvature each increment is already partially straightened and thus it will take less force to unwind the spring from a large coil than from a small coil. Thus, where the natural radius of each increment is the same, as the diameter of the coil builds up, when the spring is wound thereon, the force necessary to wind the spring decreases, and as the diameter of the coil decreases, when the spring is unwound from the coil, the force necessary to unwind the spring increases and that is one reason for making the increments at the end of the spring prestressed so as to have smaller natural radius of curvature. By a proper prestressing of the coil along its length and the proper selection of the diameter of the spool 35 the unwinding force can be made constant, increasing or decreasing as desired.

Since the spring is prestressed it tends to return to its natural radius of curvature and therefore tends to rewind itself onto the coil and the rewinding force is the same as that which is required to unwind the spring from the coil.

The upwardly bowed camber which the spring takes as it straightens out is such that once an increment of length has been straightened out and taken its camber, there will be no tendency for that increment to recoil itself, it being only that increment which is being wound upon or unwound from the coil which exerts a force. In other words, when the spring assumes its camber the tendency of that portion of the spring to rewind itself is locked out of action. Thus, by controlling the natural radius of curvature of the increment by prestressing, the force required to unwind the cord 15 from the reel can be made constant or progressively decreasing as desired.

The spring itself and the manner of its prestressing forms no part of the present invention but such springs may be purchased on the open market under the trade name "Neg'ator."

As previously pointed out such prestressed springs exert the greater force when being unwound on a small coil and therefore if the free ends of the spring are wound upon different sized coils the spring will automatically unwind itself from the large coil onto the small one. That feature is taken advantage of in Figs. 4 and 5.

The handle and reel of Figs. 4 and 5 is the same as that of Fig. 1 except the handle 10 is separated at the reel and the two handle sections 50 and 51 are suitably secured to the base 52 of a modified cord reel housing having a removable cover plate 53. A pear shaped housing 54 extends between the handle sections 50 and 51 and is detachably secured to the base portion 52 of the reel housing.

The gear 30 on the end of shaft 17 of Fig. 1 is replaced by a spool generally indicated at 55, having a large diameter drum 56 about which one end of a prestressed spring 57 is wound in a solid coil. The other end of spring 57 is wound about a small diameter spool 58 freely rotatable on a pin 59 secured to the base 52 of the reel housing. The spools 55 and 58 and spring 57 are housed within the pear shaped housing 54.

The end of the spring 57 which is wound on the drum 56 is prestressed the greatest so that the natural radius of curvature of its increments will be less than that of the end wound on spool 58. Thus, as the cord 15 is unwound from the reel the force required will be constant or progressively decreased.

Operation of Figures 4 and 5

In Figs. 4 and 5 the spring 57 is shown substantially all wound upon the large drum 56 and in that position the cord 15 will be substantially unwound. Since the spool 58 is smaller than the drum 56 there will be a greater force tending to wind the spring upon the spool 58 than tending to wind it on the drum 56 and the total force tending to retract the cord will be the difference between those two forces. The drum 56 has been made quite large so that the spring 57 only makes a shallow arc and therefore the force tending to wrap the spring on the drum 56 is small. As the spring unwinds from drum 56 and winds onto spool 58 the diameter of the coil on the drum 56 decreases while the diameter of the coil on the spool 58 increases. If the spring 57 is prestressed the same over its entire length, the force tending to retrieve the cord will be reduced as it winds upon the reel. However, as previously stated the end of the spring wound upon the drum 56 is prestressed to the greatest extent and preferably sufficiently that the retrieving force applied to the cord will increase as the spring is unwound from the drum 56 and wound on the spool 58, in other words, as the cord is retrieved.

From the foregoing it can be seen that this invention provides a cord reel and handle for

an ambulatory appliance such as a suction cleaner or a floor polisher having a spring wound cord reel in which the force required to pull the cord from the reel is constant or decreases as the cord is unwound regardless of the distance of the appliance from the electrical outlet.

While I have shown but two embodiments of my invention it is to be understood that these embodiments are to be taken as illustrative only and not in a limiting sense. I do not wish to be limited to the particular structure shown and described but to include all equivalent variations thereof except as limited by the scope of the claims.

I claim:

1. A handle for an ambulatory appliance comprising, an elongated tube, an electric cord associated therewith, a cord winding spool rotatably mounted on said handle, one end of said cord being attached to said cord winding spool the arrangement being such that the length of said cord is wound upon said cord winding spool when it is rotated in one direction and unwound therefrom when it is rotated in the opposite direction, a second freely rotatable spool carried by said handle in spaced relationship to said cord winding spool, and a thin elongated narrow flat spring having its one end wound in a solid coil about said second spool, means forming a driving connection between the other end of said spring and said cord winding spool so that said spring resists unwinding movement of said cord, said spring being prestressed crosswise in a manner to assume a camber bowed outwardly relative to said second spool as it is unwound from said coil and pre-stressed along its length so as to have a natural arc of smaller radius than said second spool so as to resist being unwound from said second spool and to tend to rewind itself on said second spool whereby said spring will resist unwinding movement of said cord winding spool.

2. A handle according to claim 1 in which the prestressing of said spring is such that as it is unwound from said coil only that portion of length being unwound resists unwinding thereof.

3. A handle according to claim 2 in which the prestressing of said spring is such that as a portion of the length of said spring is unwound from said coil and assumes its camber the prestressed forces in that portion are locked out of action.

4. A handle according to claim 3 in which the prestressing of said spring along its length is such that the resistance to unwinding of said spring from said coil is constant along the length of said spring whereby the resistance to unwinding of said cord is substantially constant and the rewinding forces are substantially constant regardless of the length of cord unwound.

5. A handle according to claim 3 in which the prestressing of said spring along its length is such that the resistance to unwinding of said spring from said coil decreases as it is unwound therefrom whereby the resistance to unwinding of said cord from said cord winding spool decreases as the cord is unwound.

6. In combination, a handle for an ambulatory appliance, an electric cord carried by said handle, a winding reel including a cord winding spool rotatably carried by said handle, said cord being secured to said spool so that the length of said cord will be wound upon and wound from said spool upon rotation thereof in opposite directions, a spring winding spool carried by said handle in spaced relationship to said cord winding spool and having its axis parallel to the axis of said cord winding spool, and a prestressed thin elongated flat narrow spring having one of its ends coiled about said spring winding spool in a solid coil, means forming a driving connection between the other end of said spring and said cord winding spool so that said spring resists unwinding of said cord therefrom and said spring being prestressed along its length so as to have a natural arc of smaller radius than that of said spring winding spool so as to wind upon said spring winding spool and prestressed so as to take a camber bowed outwardly relative to said spring winding spool as it is unwound from said coil.

7. The combination according to claim 6 in which the arrangement is such that the length of the spring assumes a straight portion between said coil and its driving connection to said cord winding spool.

8. In combination, an elongated body, a rotatably mounted cord winding spool carried by said body, an electric cord having one end secured to said spool whereby rotation thereof in one direction will wind said cord thereon and rotation thereof in the opposite direction will unwind said cord therefrom, a second spool mounted on said body for rotation on an axis spaced from and parallel to the axis of said cord winding spool and a flat thin elongated narrow spring having one end wound in a solid coil about said second spool, means forming a driving connection between the other end of said spring and said cord winding spool so that said spring resists unwinding of said cord therefrom, said spring being prestressed crosswise so as to assume a camber bowed outwardly relative to said second spool as it is unwound from said coil and prestressed along its length to have a natural arc of less radius than that of said second spool so as to tend to wind itself into a solid coil on said spool.

9. The combination according to claim 8 in which the prestressing of said spring is such that as the spring is unwound from said coil, straightens out and assumes its camber it will lock out the tendency of the straight portion of said spring to rewind itself upon said coil.

10. A handle for an ambulatory appliance comprising, an elongated tube, a reel secured to said tube intermediate of its ends, a smaller tube secured to the underside of said elongated tube and extending from said reel to adjacent the hand grip end of said elongated tube, said reel including a cord winding spool, an electric cord having one end attached to said spool in such manner that rotation of said spool in one direction will wind the length of said cord thereon and rotation in the opposite direction will unwind said cord therefrom, said cord winding spool having a shaft extending into the interior of said elongated tube, a pinion gear on said shaft interiorly of said elongated tube, a rack bar slidably mounted on the interior of said tube and having teeth in engagement with the teeth of said pinion gear, a second spool on the interior of said elongated tube adjacent the hand grip end thereof and a thin elongated narrow spring having one end wound in a solid coil about said second spool and its other end attached to said rack bar, said spring being prestresed crosswise in such manner as to assume a camber bowed outwardly relative to said second spool as it is unwound from said coil and prestressed along its length so as to have a natural arc of less radius than that of said second spool whereby said spring tends to wind itself into a solid coil about said second spool to resist unwinding of said cord from said cord winding spool

by the force required to unwind each portion of length of said spring from said coil.

11. A handle according to claim 10 in which said spring is prestressed along its length in such a manner that the resistance to unwinding of said cord from said cord winding reel decreases as the cord is unwound.

12. A handle for an ambulatory appliance comprising, a reel casing, tubular handle sections secured to said casing and extending in opposite directions therefrom, a cord winding spool rotatably mounted within said casing and including a drum in alignment with the interior of said handle sections, an electric cord having one of its ends secured to said spool whereby rotation of said spool in one direction will wind the length of said cord onto said spool and rotation in the opposite direction will unwind said cord therefrom, a second spool mounted for free rotation in said casing upon an axis in spaced parallel relationship to the axis of said drum, the diameter of said second spool being smaller than that of said drum, and a thin flat elongated spring having its opposite ends wound in solid coils about said drum and second spool, said spring being prestressed along its length so as to have a natural arc of lesser radius than that of said second spool whereby said spring tends to wind from said drum and onto said second spool so as to resist

unwinding of said cord from said cord winding reel.

13. A handle according to claim 12 in which said spring is prestressed crosswise in such manner as to assume an outward camber relative to said coils as it unwinds from said coils.

14. A handle according to claim 13 in which the prestressing of said spring is such that as each portion of the length thereof is unwound from said coils it straightens out to assume its outward camber whereby the tendency of that portion to rewind itself on said coils is locked out of action.

15. A handle according to claim 12 in which said spring is prestressed in such manner that the resistance to unwinding of said cord remains substantially constant.

GEORGE E. KAUFMAN.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
1,977,546	Fornelius	Oct. 16, 1934

OTHER REFERENCES

Product Engineering, July 1949, The Negative Spring—A Basic New Elastic Member, W. J. Cook and P. C. Clarks, pp. 136–140.