Sept. 16, 1969 C. M. GILTNER 3,467,329

SELF-ERECTING SPIRAL TUBE DEVICE

Filed Oct. 21, 1965 2 Sheets-Sheet 1

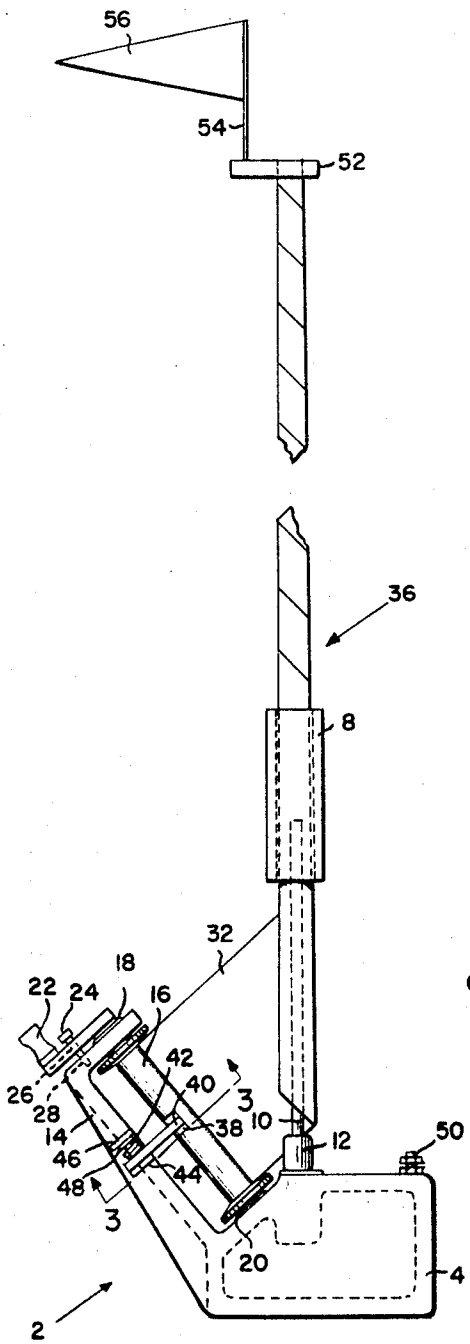


FIG. 1.

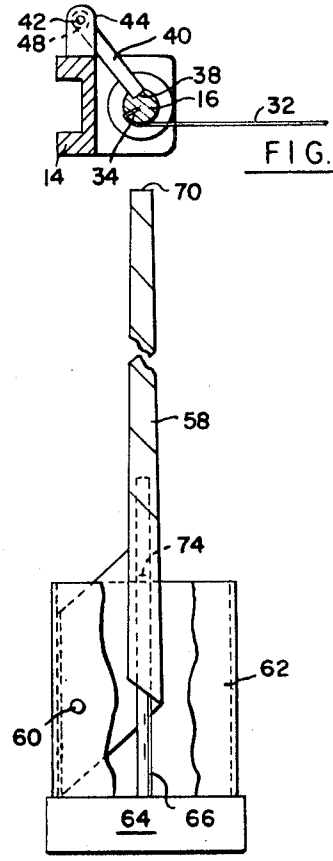


FIG. 3.

FIG. 4.

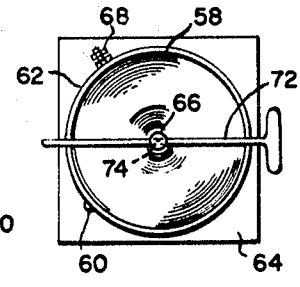


FIG. 5.

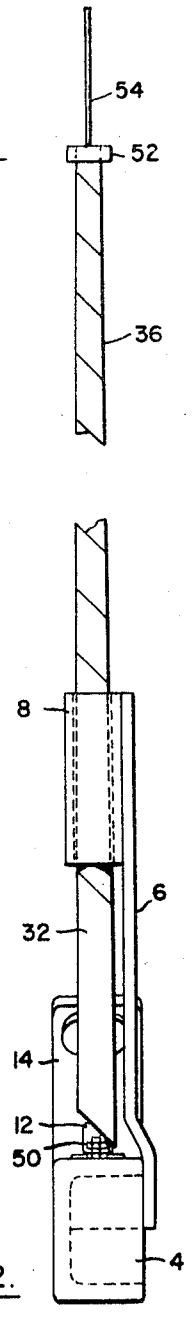


FIG. 2.

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Filed Oct. 21, 1965 2 Sheets-Sheet 2

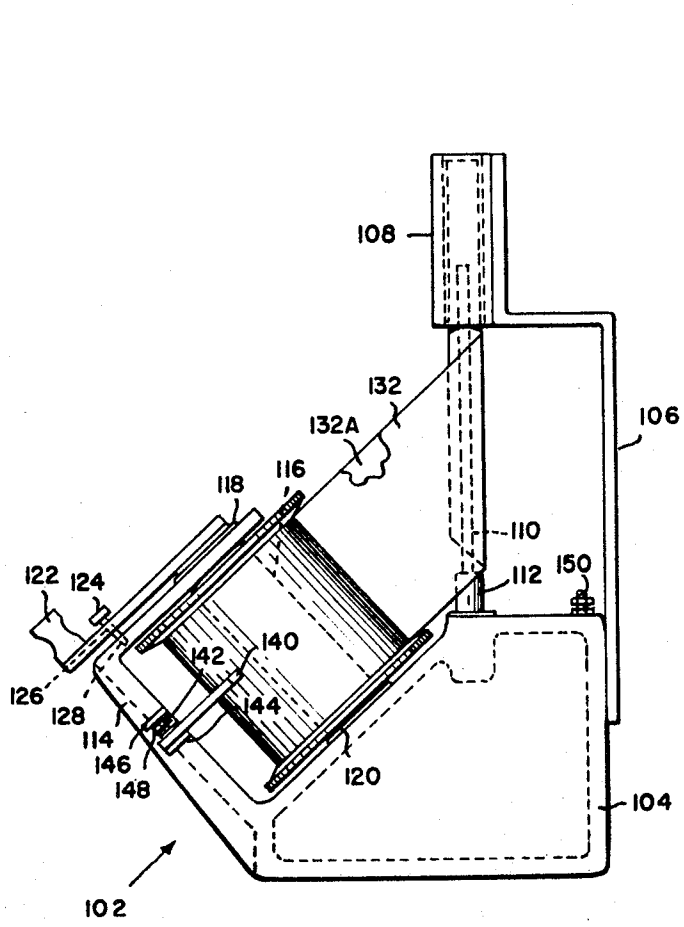


FIG. 7.

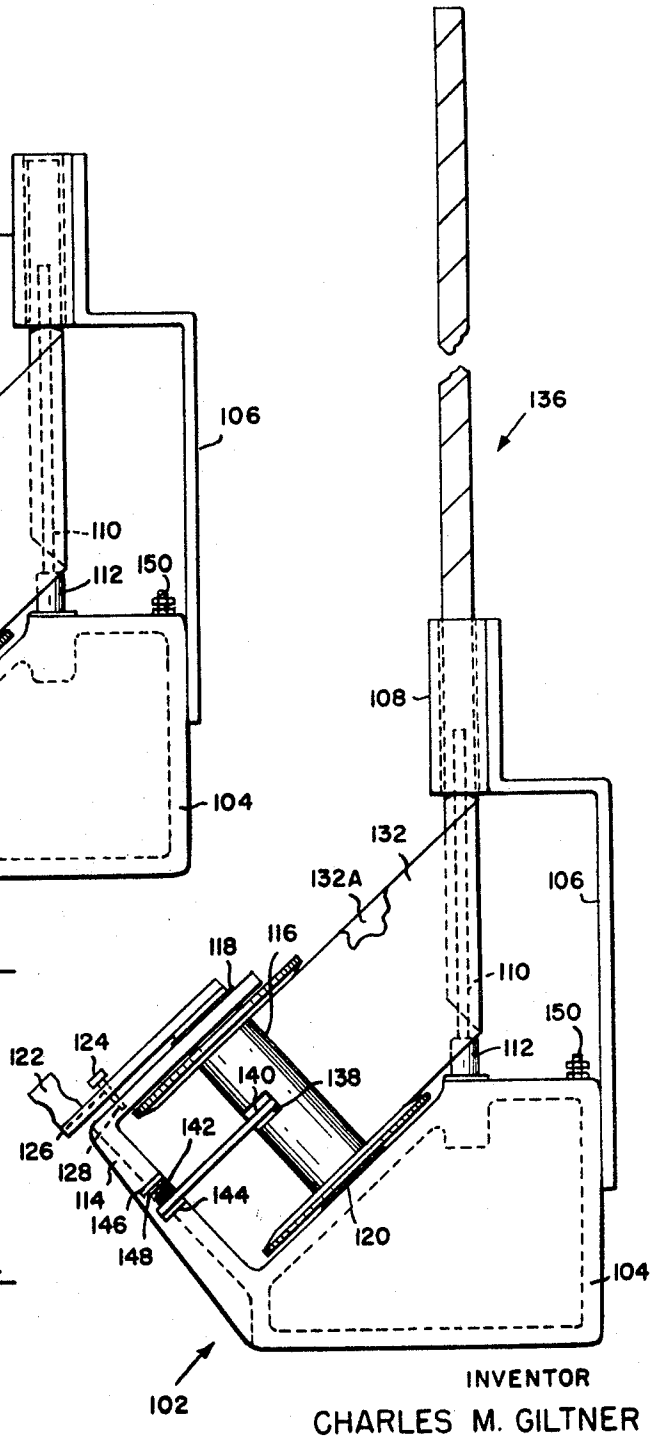


FIG. 6.

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SELF-ERECTING SPIRAL TUBE DEVICE

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ABSTRACT OF THE DISCLOSURE

A self-erecting tube device is formed from a helical ribbon spring having adjacent turns set to tightly coil in overlapping and telescoping engagement, means to releasably retain at least a substantial portion of the spring wound into a cylindrical coil is provided. In a preferred form there is provided means to wind up the spring on a drum to retract the tube and ready it for self-erection.

This invention relates to self-erecting spiral tubes.

There is a substantial need for relatively light and inexpensive self-erecting tubes which when not erected are highly compact and which on erection are relatively long, for example, 25 to 100 feet in length. Further, the tubes must have good lateral and torsional stability.

The tube device of this invention has all of the above discussed desirable features. Further, it is advantageous in that it can be repeatedly extended and retracted. In addition, manufacture is simple within ordinary tolerances.

The tube device of this invention has wide applicability, for example, for use as an antenna with military field radios, emergency radio equipment and radios employed in space. It is also useful as self-erecting supporting structures being useful, for example, for supporting at a remote point a solar panel or a weight for gravity stabilization in space.

The tube device of this invention employs a helical axially extending ribbon spring. The adjacent turns of the spring are set so as to tightly coil in overlapping and telescoping engagement. The spring employed in the invention is similar to the noncumulative force ribbon spring made by the method of U.S. Patent 3,007,239 issued Nov. 7, 1961, with the exception that in lieu of naturally coiling into a cylindrical coil the spring of the invention is set with a helix angle so as to naturally coil into a helical coil which is the extended form of the tube. For simplicity of manufacture each increment of the spring may be set to the same radius although varying radii, such as increasing or decreasing radii, may be used so long as the adjacent coils are in tight contact. The invention provides means to wind at least a substantial portion of the spring into a cylindrical coil to retract the tube into a compact form and ready it for self-erection. Alternatively, the spring can be wound into a cylindrical coil by forcing the outer end towards the inner end with the operator's hands. There is also provided means to releasably retain the spring in the retracted or wound position.

The invention will be clarified by reading the following description in conjunction with the drawings in which:

FIGURE 1 is a front elevation, partially broken away, of a tube device in accordance with the invention;

FIGURE 2 is a right side elevation of the tube device of FIGURE 1, partially broken away;

FIGURE 3 is a section taken on the plane indicated by the line 3—3 in FIGURE 1;

FIGURE 4 is a front elevation, partially broken away, of an alternative embodiment of the tube device of the invention;

FIGURE 5 is a plan view of the tube device of FIGURE 4 showing it in the retracted or wound condition;

FIGURE 6 is a front elevation, partially broken away, of a modified tube device in accordance with the invention in the erected condition; and

FIGURE 7 is a front elevation of the tube device of FIGURE 6 in the retracted condition.

Referring first to FIGURES 1 through 3, a self-erecting tube device 2 in accordance with the invention has a metal base 4 on which is mounted a standard 6 supporting a guide sleeve 8. A guide pin 10 secured to base 4 carries a rotatable guide member 12. Guide pin 10 extends upwardly into guide sleeves 8.

Base 4 has a U-shaped portion 14 in which a drum 16 is rotatably mounted in roller bearings indicated at 18 and 20. A crank and handle 22 is connected to drum 16 for the rotation thereof. Handle 22 can be locked by means of a headed pin 24 which passes through an opening 26 in handle 22 and into an opening 28 in base 4.

A helical ribbon spring 32 having adjacent turns set to tightly coil in overlapping and telescoping engagement has one end secured to drum 16 in slot 34 (FIGURE 3). Spring 32 is adpated to be wound on drum 16 and extends outwardly about guide pin 10 and upwardly through guide sleeve 8 in the form of a helix as indicated at 36 where since the spring is unrestrained it assumes its helical form with adjacent turns overlapping.

Drum 16 is provided with a cut-out portion 38 for the reception of stop member 40 which is of the type normally employed with non-cumulative force spring motors, the stop member being prevented by the spring 32 from entering opening 38 until all of the turns of the spring overlying the opening have been removed from the drum. Stop member 40 is pivotally mounted on a shaft 42 which is fixedly secured to ears 44 and 46. A torsion spring 48 acts to bias stop member 40 downwardly towards drum 16.

A suitable terminal indicated at 50 is secured to base 4 for the connection of a lead when the tube is to be employed as an antenna. A small metal platform 52 is welded to the top portion of spring 32 and carries a staff 54 to which is secured a pennant 56 as illustrative of a support function for tube 2.

Operation

As shown in FIGURES 1 and 2 the tube device 2 of the invention is in its extended or operating position. It is retracted by removing pin 24 and cranking handle 22 so as to wind the ribbon spring 32 onto drum 16 until the platform 52 rests on sleeve 8 at which point pin 24 is reinserted in order to lock handle 22 to base 4. On the removal of pin 24 and the release of handle 22, the spring 32 unwinds upwardly into its helical form rolling off drum 16 until opening 38 is clear permitting latch member 40 to enter opening 38 and stop the rotation of drum 16.

In use the conducting metal base 4 will be mounted in or on an insulating receptacle (not shown) for an antenna application.

Alternative embodiment

A simplified embodiment of the invention is shown in FIGURES 4 and 5. Here a spring 58 identical with spring 32 but longer is pivotally connected as by rivet 60 to a metal ring 62 mounted on a base 64. A guide pin 66 extends upwardly from base 64 through the center of ring 62. A terminal 68 for the connection of a lead for an antenna application is secured to metal ring 62.

Spring 58, in this embodiment, is retracted to a cylindrical wound condition by pushing on the extended end 70 of the spring to collapse it downwardly until it is all contained within ring 62. It will be noted that the outermost wrap of spring 58 pivots about rivet 60. A stop

pin **72** which passes through an opening **74** in guide pin **66** is employed to hold spring **58** in its retracted position. When guide pin **72** is removed, spring **58** extends upwardly into its unrestrained helical extended condition, shown in FIGURE 4.

When it is desired to have additional force for the erection of the tube, the device shown in FIGURES 1 through 3 can be modified so as to reverse wind the spring onto the winding drum. Such an embodiment is shown in FIGURES 6 and 7. Here a self-erecting tube device **102** has a metal base **104** on which is mounted a standard **106** supporting a guide sleeve **108**. A guide pin **110** secured to base **104** carries a rotatable guide member **112**. Guide pin **110** extends upwardly into guide sleeve **108**.

Base **104** has a U-shaped portion **114** in which a drum **116** is rotatably mounted in roller bearings indicated at **118** and **120**. A crank and handle **122** is connected to drum **116** for the rotation thereof and can be locked by means of a headed pin **124** which passes through an opening **126** in handle **122** and into an opening **128** in base **104**.

A helical ribbon spring **132** having adjacent turns set to tightly coil in overlapping and telescoping engagement has one end secured to drum **116** in a slot (not shown) in a manner similar to that employed for securing a spring **32** to drum **16** with the sole exception that the spring **132** as will be seen in FIGURE 6 is positioned so as to be reversely wound onto drum **116**. Spring **132** extends outwardly about guide pin **110** and upwardly through guide sleeve **108** in the form of a helix as indicated at **136** where since the spring is unrestrained it assumes its helical form with adjacent turns overlapping. Drum **116** is provided with a cut-out portion **138** for the reception of a stop member **140**. Stop member **140** is pivotally mounted on shaft **142** which is fixedly secured to ears **144** and **146**. A torsion spring **148** acts to bias stop member **148** downwardly towards drum **116**. A suitable terminal indicated at **150** is secured to base **104** for the connection of a lead for an antenna application.

As best seen in FIGURE 6 spring **132** is provided with an insulating coating **132A** which may be any flexible insulating coating of low electrical conductivity, for example, a synthetic resin such as a fluorocarbon resin such as polytetrafluoroethylene and chlorotrifluoroethylene, a polyester resin, a polyalkylene resin such as polyethylene and polypropylene or a vinyl resin such as polyvinylchloride or vinyl organosol. Such an insulating coating improves the property of the tube device when employed as an antenna particularly in connection with use of high frequencies.

Except for the reverse winding of the spring the operation of the device described immediately above is the same as for the device of FIGURES 1 through 3 and hence will not be further detailed here.

It will be understood that the above discussed embodiments are merely by way of illustration and are not intended to be limiting.

What is claimed is:

1. A self-erecting tube device comprising:
- a helical ribbon spring having adjacent turns set to tightly coil in overlapping and telescoping engagement,
- a guide sleeve for an extended portion of the spring,
- a guide pin coaxial with the guide sleeve and extending below the sleeve,
- a drum for winding up the spring,
- means to rotate the drum, and
- means to releasably secure the drum against rotation.

2. A tube device in accordance with claim **1** in which the spring is reverse wound on the drum.

3. A tube device in accordance with claim **1** having stop means to stop the rotation of the drum when the device is erected.

4. A tube device comprising:
- a helical continuous ribbon spring biased to an axially extended position with adjacent turns coiled tightly in overlapping and telescoping engagement in said position,
- a base,
- means to secure the outermost turn of the spring to the base, and
- means engagable with said spring to releasably retain at least a substantial portion of the spring wound into a substantially cylindrical coil for storage adjacent said base, said spring in the storage position having a bias holding contiguous turns in contact in said coil.

5. A tube device comprising:
- a helical continuous ribbon spring biased to an axially extended position with adjacent turns coiled tightly in overlapping and telescoping engagement in said position,
- a base including a hollow container for the spring when coiled into a substantially cylindrical coil for storage,
- means to pivotally secure the outermost turn of the spring to the base, and
- means engagable with said spring to releasably retain the spring when wound into a cylindrical coil for storage within said container, said spring in the storage position having a bias holding contiguous turns in contact in said coil.

6. A tube device comprising:
- a helical continuous ribbon spring biased to an axially extended position with adjacent turns coiled tightly in overlapping and telescoping engagement in said position,
- a base including a hollow container for the spring when coiled into a substantially cylindrical coil for storage,
- said container being substantially coaxial with the erected spring,
- means to pivotally secure the outermost turn of the spring to the base, and
- means engagable with said spring to releasably retain the spring when wound into a cylindrical coil for storage within said container, said spring in the storage position having a bias holding contiguous turns in contact in said coil.

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U.S. Cl. X.R.

52—108; 248—188.8