May 31, 1966 R. J. TILL 3,253,799

REEL FOR EXTENDING AND RETRACTING A FLEXIBLE CABLE ACTUATOR

Filed March 16, 1962 2 Sheets-Sheet 1

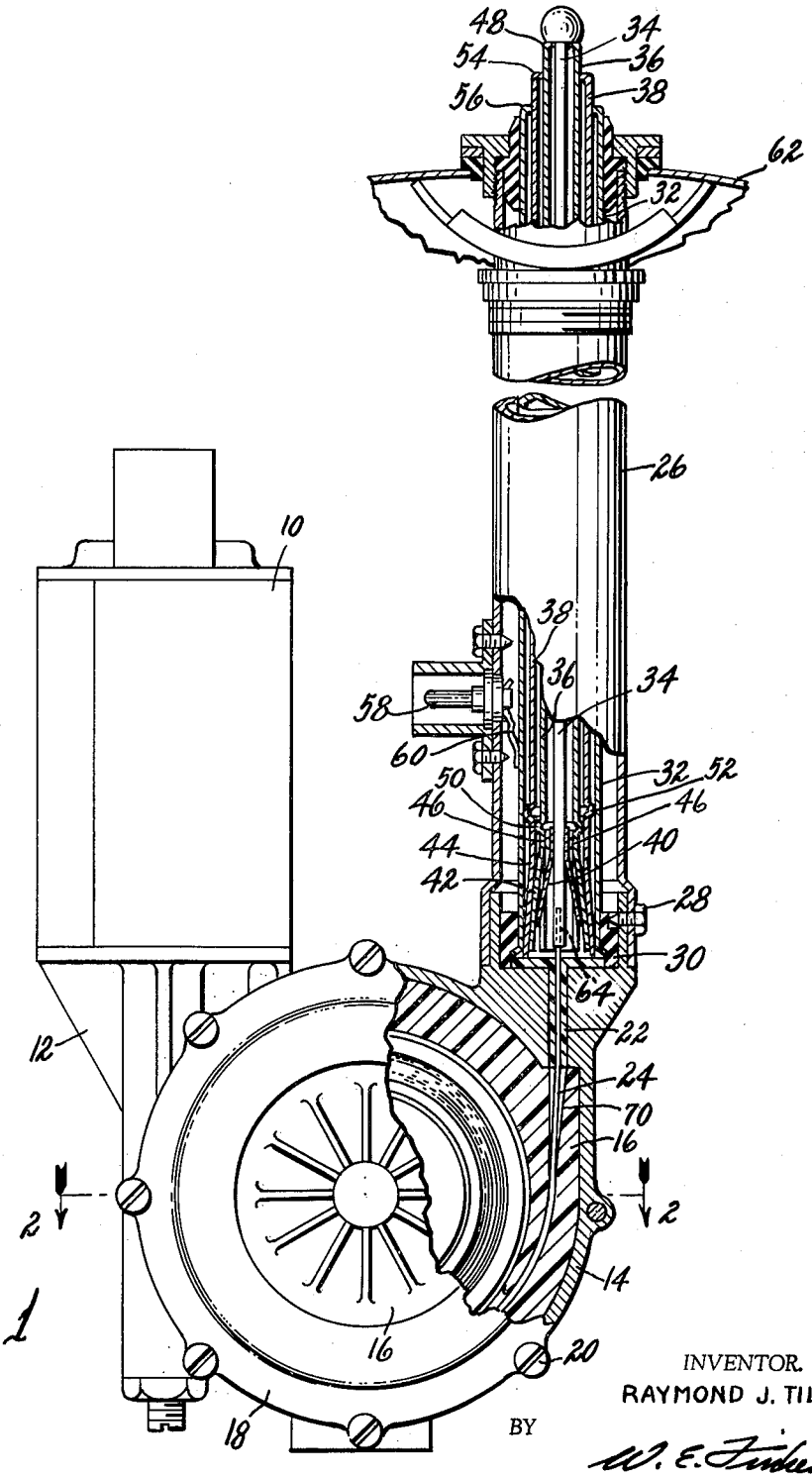


Fig. 1

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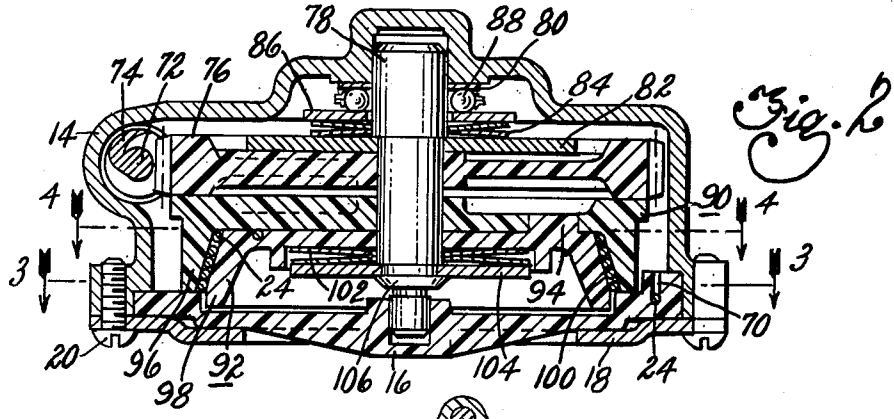


Fig. 2

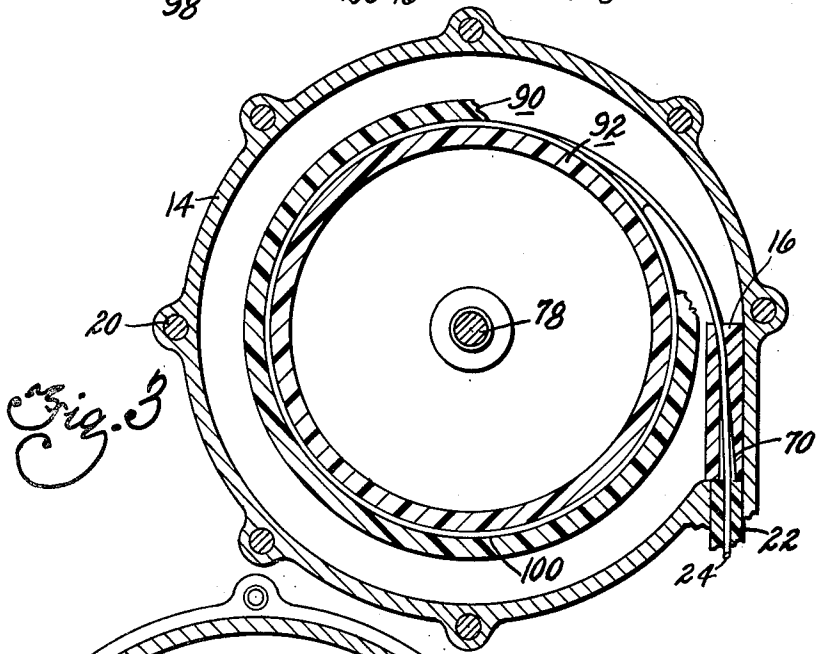


Fig. 3

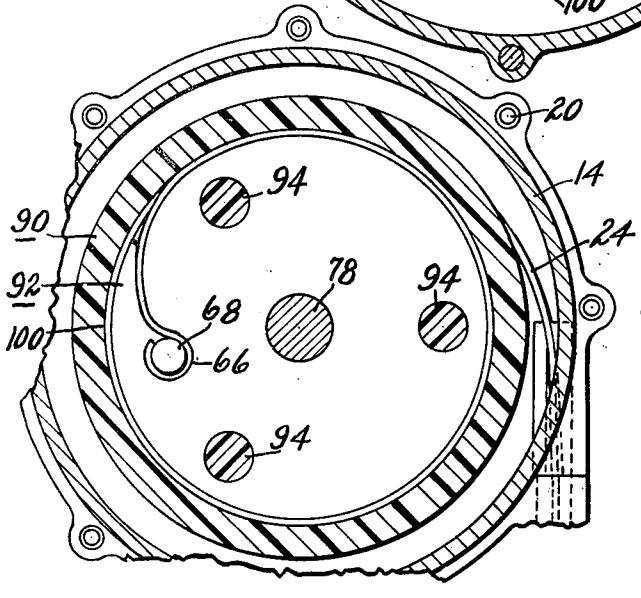


Fig. 4

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REEL FOR EXTENDING AND RETRACTING A FLEXIBLE CABLE ACTUATOR

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3 Claims. (Cl. 242—77)

This invention pertains to antenna actuators, and particularly to an improved power operated reel-type antenna actuator.

Heretofore, numerous actuators for extensible and retractable vehicle antennas have been devised wherein the actuating element comprises a flexible wire, or cable, which, when the antenna sections are fully retracted, is wound on a reel. The present invention is directed primarily to an improved reel assembly for use with extensible and retractable antennas, and while it is specifically shown in connection with a power operated antenna assembly, it will be readily apparent that the improved reel assembly can also be used with a manual input, in the form of a rotary crank or other suitable device. Accordingly, among my objects are the provision of an improved reel assembly for an antenna actuator; the further provision of a reel assembly for an antenna actuator embodying a cone-shaped slot wherein the cable is wound in a single layer; and the still further provision of a multiple-section extensible and retractable antenna assembly including a power operated reel for actuating the same.

The forementioned and other objects are accomplished in the present invention by utilizing a two-part reel comprising telescopically arranged parts having radially spaced conical surfaces which define a cone-shaped, or tapered, slot such that jamming of the cable is precluded. Specifically, the improved reel assembly is shown in combination with an extensible and retractable vehicle antenna comprising a center rod section and a plurality of telescopically arranged movable tube sections, all of the sections being electrically connected. The lower end of the center rod is attached to one end of a flexible cable, the other end of which is attached to a reel assembly. The reel comprises a pair of drum members having telescopically arranged conical surfaces which define a tapered, or cone-shaped, groove between the outer diameter of the inner member and the inner diameter of the outer member. The reel assembly is rotatably mounted on a shaft, and a gear capable of being driven by a reverse electric motor is also journalled on the shaft. The reel assembly can be driven from the gear through Belleville spring clutch means, which clutch means slip when the motor operated gear is driven with the antenna fully retracted or extended, or when the antenna is manually operated.

Extension of the antenna is accomplished by unwinding the reel, and retraction is accomplished by winding the reel. During extending movement, the cable reacts against the outer diameter of the cone-shaped slot to provide the requisite driving force, and during retracting the cable winds on the inner diameter of the reel assembly and is thus forced into a single layer so as to prevent jamming.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings, wherein a preferred form of the present invention is clearly shown and wherein similar numerals depict similar parts throughout the several views.

In the drawings:

FIGURE 1 is a fragmentary view, partly in section and partly in elevation, with certain parts broken away, of the improved antenna actuator assembly.

FIGURE 2 is an enlarged sectional view taken along line 2—2 of FIGURE 1, depicting the improved reel assembly.

FIGURES 3 and 4 are fragmentary sectional views taken along lines 3—3 and 4—4 of FIGURE 2.

With particular reference to FIGURE 1, the improved power operated antenna assembly includes a reversible direct current electric motor **10** having an end cap **12** which is integral with a part of a reel housing **14**. The reel housing **14** has an open side which is closed by a cover **16** suitably attached thereto by a mounting ring **18** and a plurality of screws **20**. Since the housing **14** is composed of die cast metal, a bushing **22** of insulating material is inserted in a tangential opening therein for guiding a flexible cable **24**. A stationary antenna housing **26** is attached to the housing **14** by a screw **28**, a second bushing **30** of insulating material being arranged between the housing **14** and an inner stationary antenna tube **32**. The antenna comprises a movable center rod **34** and movable tube sections **36** and **38**, as well as the stationary tube section **32**, the tube sections **32**, **36** and **38** and the rod **34** being electrically interconnected.

Thus, the rod **34** has a pair of spring fingers **40** attached to its lower end which engage the tube section **36**; the tube section **36** has a pair of integral spring fingers **42** which engage the tubular section **38**; and the tube section **38** has a pair of integral spring fingers **44** which engage the tube **32**. The spring fingers **40** are attached to the rod **34** by spot welds **46** constituting a stop, or shoulder, engageable with the inwardly flanged ends **48** at the outer end of the tube section **36**. The tube sections **36** and **38** are formed with integral beads, or shoulders, **50** and **52**, respectively, likewise adapted to engage the flanged ends **54** and **56** of the tube sections **38** and **32**, respectively. An antenna terminal **58** is electrically connected by a wire **60** to the tube **32**, and is suitably insulated from the antenna housing **26**. As seen in FIGURE 1, the antenna sections are adapted to project through an aperture in a vehicle body **62** and are suitably insulated therefrom.

The outer end **64** of the flexible cable **24** is spot welded, or otherwise suitably connected, to the inner end of the rod **34**. As seen in FIGURE 4, the inner end **66** of the cable **24** is anchored to a post **68** on the reel assembly. The cable **24** is guided by the bushing **22** and a slot **70** in the cover **16**.

Referring particularly to FIGURES 2 and 4, the motor **10** includes an armature shaft **72** having an integral worm **74** in driving engagement with a worm gear **76**. The worm gear **76** is journalled on a shaft **78**, one end of the shaft **78** being journalled in the housing **14** and the other end being journalled in the cover **16**. The shaft **78** receives washer **82**. A pair of Belleville spring washers **84**, a thrust plate **86** and a thrust ball bearing **88** are mounted between flat thrust washers **80** and washer **82**. The Belleville washers **84** act to hold outer drum member **90** under pressure against cover **16** to restrict cable **24** to slot **100**.

The reel assembly comprises an outer drum member **90** and an inner drum member **92**, both of which are journalled on the shaft **78**. The drum members **90** and **92** are drivingly interconnected by mating projections **94** and apertures, and have telescopically arranged radially spaced conical portions **96** and **98** which define a tapered, or cone-shaped, groove **100** therebetween. A second pair of Belleville spring washers **102** and a thrust washer **104** are assembled on the outer side of the reel, the washer **104** being securely staked at **106** to the shaft **78** so as to rotate therewith. The Belleville washers **102** exert pressure between abutting surfaces of outer drum **90** and worm gear **76** constituting a clutch action. A suit-

able lubricant is applied between the abutting surfaces of the worm gear **76** and the outer drum member **90**.

During extension of the several antenna sections, the cable **24** is unwound from the reel assembly, and in so doing the cable **24** reacts against the outer diameter of the tapered slot, or in other words, against the conical surface **96** of the outer drum member **90**. The reaction of the cable **24** against the conical surface **96** produces the requisite driving force to extend the rod section **34** which in turn carries the telescopically movable tubular sections **36** and **38** therewith. During retraction of the antenna, the cable **24** winds on the conical surface **98** of the inner drum member **92** so as to be forced into a single layer, thus pulling the center rod section **34** and the telescopically tubular section **36** and **38** with it. During antenna retraction when the cable **24** is wound on the reel, jamming of the cable is precluded by the tapered slot **100**. The reel assembly stalls when the antenna is fully retracted, while the worm gear **76** can continue to rotate by slipping against the outer drum member **90**.

While the embodiment of the invention as herein disclosed constitutes a preferred form, it is to be understood that other forms might be adopted.

What is claimed is as follows:

1. A reel assembly for actuating an extensible and retractable antenna including, a housing having an opening, a cover attached to said housing for closing said opening, a shaft journalled in said housing and said cover, inner and outer drum members journalled on said shaft and having telescopically arranged, radially spaced conical srufaces defining a conical slot, a flexible cable having one end fixedly attached to said inner drum member and adapted to be wound in a single layer in said conical slot and unwound therefrom, and means for rotating said drum members in either direction.

2. The reel assembly set forth in claim **1** wherein said cover is formed with a groove for guiding said cable.

3. The reel assembly set forth in claim **1** wherein the means for rotating said drum members in either direction includes a worm gear journalled on said shaft, spring means operable to restrict said cable to the groove in the cover, and spring means for establishing a friction drive between said gear and said drum member.

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