Aug. 20, 1963 H. E. WINKELMANN, SR 3,101,134

POWER OPERATED ANTENNA

Filed July 27, 1960 3 Sheets-Sheet 1

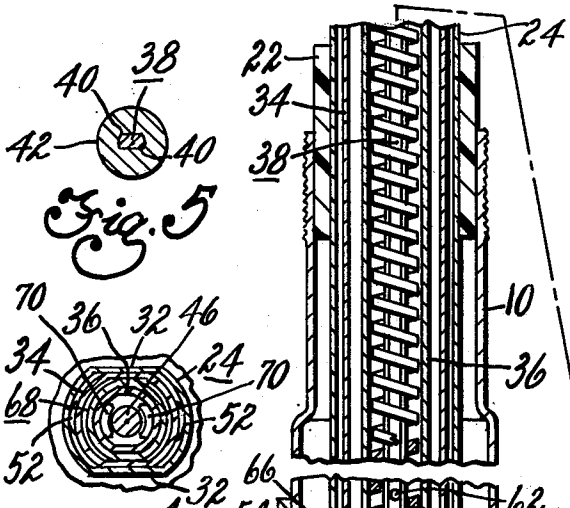


Fig. 5

Fig. 4

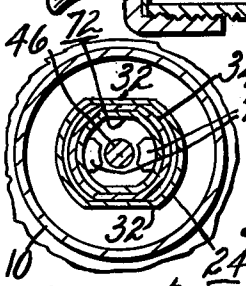
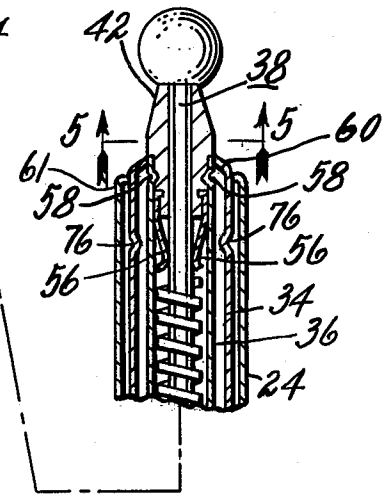


Fig. 3

Fig. 2



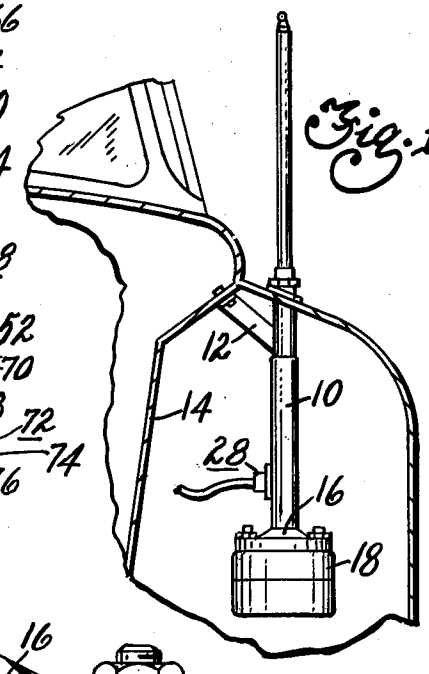


Fig. 1

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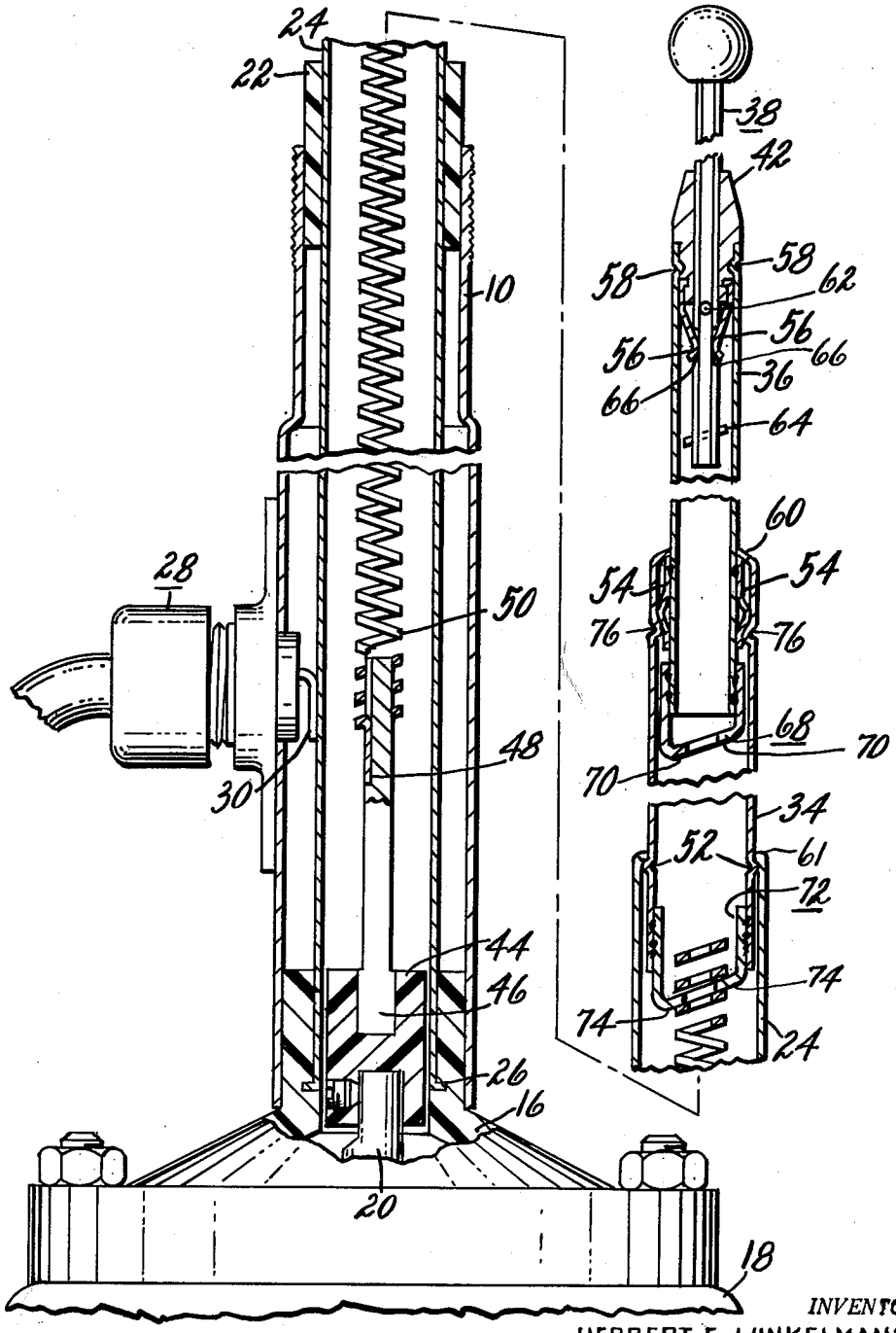


Fig. 6

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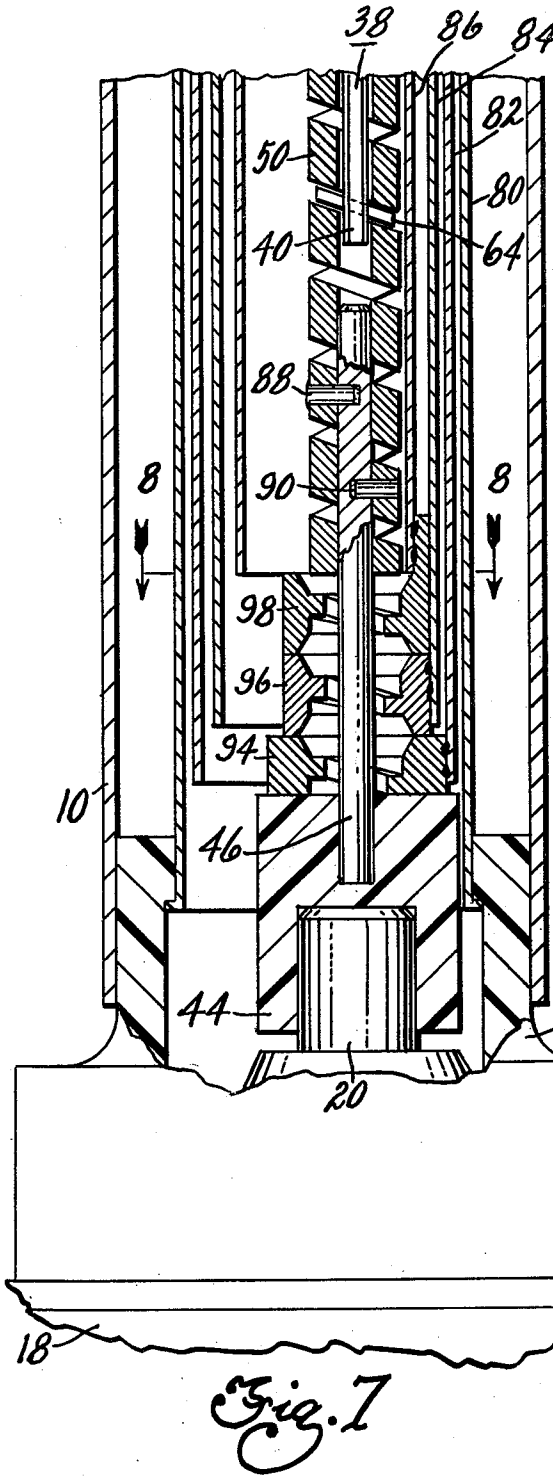


Fig. 7

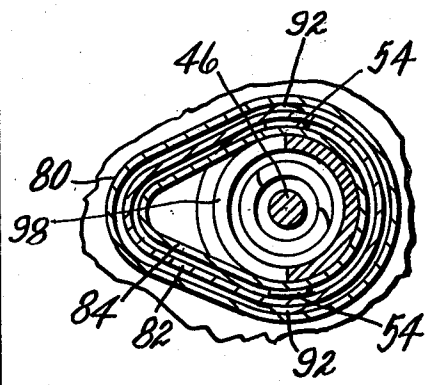


Fig. 8

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3,101,134

POWER OPERATED ANTENNA

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10 Claims. (Cl. 189—26)

This invention pertains to power operated antennas, and particularly to an improved power operated extensible and retractable antenna for motor vehicles.

Power operated antennas for motor vehicles have been used heretofore. This invention relates to an improved multiple section extensible and retractable power antenna driven by a reversible electric motor wherein the several antenna sections have positive driving connections with the electric motor during extension and retraction and include means for retaining the sections in their extended positions. Accordingly, among my objects are the provision of an improved multiple section extensible and retractable power operated antenna; the further provision of a power operated antenna assembly including a plurality of noncircular telescopically arranged sections which are restrained against rotation relative to each other and relative to the antenna housing; the further provision of a power operated antenna including a reversely rotatable lead screw with which the several antenna sections are selectively engageable; and the still further provision of a power operated antenna including means for locking the antenna sections in their fully extended positions.

The aforementioned and other objects are accomplished in the present invention by embodying a separate driver for each antenna section, the drivers being selectively engageable with the reversible motor driven lead screw. Specifically, the power antenna comprises a stationary tubular housing having a plurality of telescopically arranged noncircular tubular antenna sections disposed therein. In one embodiment the tubular antenna sections are of partially circular shape with diametrically opposed flats whereby relative rotation between the several antenna sections is precluded. In a modified embodiment the tubular sections are tear drop in cross section. The antenna housing is suitably connected to a support in the motor vehicle and carries a reversible electric motor, the shaft of which is drivingly connected with a helically wound wire spring constituting a lead screw. The helically wound wire spring is coaxially disposed within the innermost tubular section, and a rod comprising one of the extensible and retractable antenna sections is coaxially disposed within the lead screw. Each of the tubular antenna sections has a driver attached to its inner end constituting a nut for engaging the lead screw. The rod has a diametrically extending drive pin engageable with the lead screw, and a stop pin engageable with the cap of the innermost tubular section. In addition, the rod has a pair of diametrical grooves adapted to be engaged by a spring clip carried by the outer end of the innermost tubular antenna section. The inner ends of the movable tubular antenna sections likewise have springs, or detents, arranged to engage complementary indentations on the antenna section located radially outward therefrom for locking the respective antenna sections in their extended positions.

When the antenna is fully retracted, the drivers of the outer movable tubular antenna sections are disengaged from the lead screw while the drive pin on the rod is engaged with the lead screw. Accordingly, upon rotation of the screw in one direction, the rod will be extended, and when it reaches its fully extended position the stop pin on the rod will engage the cap of the innermost tubular section thereby causing upward movement

of the innermost tubular section so that the driver thereof engages the lead screw prior to disengagement of the drive pin on the rod from the lead screw. During continued rotation of the lead screw, the innermost tubular section will move from the fully retracted position and in so doing will move the next tubular section upwardly so that its driver engages the lead screw. When the outermost movable tubular section is fully extended rotation of the lead screw will be arrested thereby stalling the electric motor.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings, wherein preferred embodiments of the present invention are 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, illustrating the power operated antenna installed in a motor vehicle.

FIGURE 2 is an enlarged fragmentary sectional view of a power antenna constructed according to the first embodiment of this invention.

FIGURES 3, 4 and 5 are sectional views taken along lines 3—3, 4—4 and 5—5, respectively, of FIGURE 2.

FIGURE 6 is a fragmentary view, partly in section and partly in elevation, depicting the power operated antenna of FIGURE 2 in the fully extended position.

FIGURE 7 is a fragmentary view, partly in section and partly in elevation, of a modified power operated antenna.

FIGURE 8 is a sectional view taken along line 8—8 of FIGURE 7.

With particular reference to FIGURES 1 through 5, the power operated antenna comprises a housing **10** suitably attached by a bracket **12** to a body panel **14** of a motor vehicle. Preferably, the greater portion of the housing **10** is disposed within a well of the vehicle so as to be concealed from view. The lower end of the housing **10** is suitably attached to a cup-shaped insulator **16** which supports a reversible electric motor **18** having a shaft **20**. An insulating sleeve **22** is disposed between the housing **10** and the outermost stationary tubular antenna section **24**. The inner end of the fixed tubular section **24** is secured at **26** to the insulator **16**. An antenna lead assembly **28** is suitably attached to and insulated from the housing **10** and includes a spring contact **30** which engages the tubular section **24**.

As seen in FIGURE 4, the antenna section **24** is partially circular in cross section with a pair of diametrically opposed flats **32**, and antenna sections **34**, **36** of complementary cross section are telescopically arranged therein. The innermost movable antenna section comprises a rod **38** likewise having diametrically opposed flats **40**, and extends through a complementary opening in a cap **42** attached to the tubular antenna section **36**. Accordingly, the extensible and retractable antenna sections **34**, **36** and **38** will be restrained against rotation relative to the stationary antenna section **24**.

The motor shaft **20** is drivingly connected to an insulator coupling **44** to which the inner end of a stub shaft **46** is connected. The stub shaft **46** is soldered at **48** to the inner end of a helically wound wire spring **50** constituting a lead screw. The hollow lead screw **50** is coaxially disposed between the tubular antenna section **36** and the rod **38**.

The antenna sections **24**, **34**, **36** and **38** are electrically connected in the following manner. The tubular section **34** is formed with a pair of outwardly extending projections **52** which engage the inner periphery of the tubular section **24**. The tubular section **36** has a pair of diametrically opposed leaf springs **54** having their upper

ends welded thereto, which slidably engage the inner periphery of the tubular section 34. The rod 38 is engaged by a pair of diametrically located spring clips 56 attached to the metallic cap 42 which is in turn secured to the tubular section 36 by a pair of crimped indentations 58. The cap 42 closes the open end of the tubular section 36 and the ends of the sections 34 and 24 are formed with inwardly extending flanges 60 and 61, respectively.

The rod 38 has an obliquely extending stop pin 62 attached thereto and an obliquely arranged drive pin 64 extending therethrough. In addition, the rod 38 has a pair of diametrically located notches 66 disposed between the stop pin 62 and the drive pin 64. The drive pin 64 is adapted to internally drivingly engage the slot formed between the helically wound convolutions of the lead screw 50. Accordingly, during rotation of the lead screw 50 in one direction, the rod 38 will move upwardly, while during rotation of the lead screw 50 in the opposite direction, the rod 38 will move downwardly, as viewed in FIGURE 2.

The tubular section 36 has a sheet metal driver 68 soldered to its inner end. As seen particularly in FIGURE 4, the driver 68 is formed with a pair of obliquely arranged tangs, or fingers, 70 adapted to externally threadedly engage the groove between the convolutions of the lead screw 50. Similarly, the tubular section 34 has a sheet metal driver 72 soldered to its inner end having obliquely arranged fingers, or tangs, 74 adapted to externally threadedly engage the groove between the convolutions of the lead screw 50. In addition, the tubular section 34 is formed with a pair of diametrically located indentations 76 adjacent its upper end.

The antenna is shown in the fully retracted position in FIGURE 2, and in the fully extended position in FIGURE 6. In order to fully extend the antenna, the motor 18 is energized so as to rotate the lead screw 50 in one direction so as to cause upward movement of the rod 38 due to the interaction of the nonrotatable drive pin 64 and the helical groove between the convolutions of the helically wound wire lead screw 50. As the rod 38 moves upwardly, the stop pin 62 will engage the lower end of the cap 42, and the spring clips 56 will engage the notches 66 of the rod to securely lock the rod 38 in the fully extended position. In addition, continued upward movement of the rod 38 due to interengagement of the drive pin 64 and the lead screw will cause upward movement of the tubular section 36. Conjoint movement of the tubular section 36 and the rod 38 will continue until the drive pin 64 becomes disengaged from the lead screw. Prior to the drive pin 64 being disengaged from the lead screw, the driver 68 engages the lead screw so that continued rotation of the lead screw will continue conjoint upward movement of the rod 38 and the tubular section 36. As the tubular section 36 is extended, the spring slips 54 engage the internal indentations 76 on the tubular section 34. The indentations 76 deflect the leaf springs 54, and when the outwardly bulged portions of the leaf spring are located above the beads 76, the intermediate section 36 will be maintained in its extended position.

Continued upward movement of the tubular section 36 will cause the upper ends of the leaf springs to engage the flanged end 60 of the tubular section 34 thereby causing upward movement of the tubular section 34 until the driver 72 engages the lead screw after which the driver 68 leaves the lead screw 50. Thereafter, the three sections 38, 36 and 34 will continue to move upwardly until the projections 52 on the section 34 engage the flanged end 61 of the stationary tubular antenna section 24. The driver 72 remains engaged with the lead screw 50 when the section 34 is fully extended so as to securely hold the three antenna sections in the fully extended position. Moreover, when the projections 52 engage the flanged end 61 of the stationary tubular section 24, rotation of the lead screw 50 will be arrested thereby stalling the motor 18.

In order to retract the antenna, the motor 18 is energized for rotation in the reverse direction whereupon the driver 72 which is in engagement with the lead screw 50 will cause downward movement of the section 34, and prior to disengagement of the driver 72 with the lead screw 50, the driver 68 and the section 36 will be engaged with the lead screw. Consequently, when the section 34 is fully retracted the section 36 will continue its retracting movement through disengagement of the leaf springs 54 with the indentations 76 until such time as the drive pin 64 on the rod 38 re-engages the lead screw. When the section 36 is fully retracted, continued downward movement of the rod section 38 will disengage the spring clips 56 from the detent notches 66 on the rod whereupon the rod 38 will move downwardly to its fully retracted position whereat rotation of the lead screw will again be arrested to stall the motor 18.

Referring to FIGURES 7 and 8, in the modified emment, the antenna includes four movable sections including the rod 38 and three telescopically arranged tubular sections 82, 84 and 86 which are tear drop in cross section. The outer stationary tubular section 80 is likewise tear drop in cross section. Moreover, in the embodiment of FIGURES 7 and 8, the helically wound wire lead screw 50 is connected to the stub shaft 46 by pins 88 and 90. By virtue of the tear drop configuration of the tubular sections 80, 82, 84 and 86, relative rotation between the sections is precluded. The rod section 38 is restrained against rotation by virtue of its diametrically located flats 40 engaging a complementary opening in a cap attached to the innermost movable tubular section 86 in a manner identical to that shown in the first embodiment. Moreover, the tubular sections 84 and 86 have leaf springs 54 secured to their inner ends. In addition, the outermost movable tubular section 82 is formed with a pair of outwardly extending projections 92 which perform the same function as the projections 52 in the embodiment of FIGURES 1 through 6.

In the embodiment of FIGURES 7 and 8, the tubular sections 82, 84 and 86 have drivers in the form of sintered iron nuts 94, 96 and 98 attached to their inner ends for externally threadedly engaging the lead screw 50. Operation of the modified antenna of FIGURES 7 and 8 is identical to that of the embodiment shown in FIGURES 1 through 6 inasmuch as the several extensible and retractable antenna sections are restrained against rotation relative to each other and to the stationary tubular antenna section 80, and the drivers are selectively engageable with and disengageable from the lead screw 50 during extension and retraction.

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

What is claimed is as follows:

1. A power operated antenna including, a stationary outer tubular antenna section, a plurality of electrically connected movable antenna sections telescopically arranged within the outer section and restrained against rotation relative thereto, said plurality of movable antenna sections being extensible beyond and retractable into the outer section, reversible motor means, a lead screw telescopically arranged between two of said movable antenna sections and drivingly connected with said motor means, and a driver on each of said movable antenna sections selectively engageable with and disengageable from said lead screw for extending and retracting said movable antenna sections upon rotation of said lead screw in opposite directions.

2. A power operated antenna including, a stationary outer tubular antenna section, a plurality of movable antenna sections telescopically arranged within the outer section and restrained against rotation relative thereto and electrically connected to each other, a lead screw tele-

scopically arranged between two of said movable antenna sections, reversible motor means drivingly connected with said lead screw, a driver on each of said movable antenna sections selectively engageable with and disengageable from said lead screw for extending and retracting said movable antenna sections upon rotation of said lead screw in opposite directions, and means for maintaining said movable antenna sections in their extended positions.

3. A power operated antenna including, reversible motor means, a hollow lead screw drivingly connected with said motor means, a first movable antenna section extensible beyond and retractable into said lead screw, a plurality of movable tubular antenna sections telescopically arranged radially outward of said lead screw, a stationary tubular antenna section telescopically arranged relative to said plurality of movable antenna sections, said tubular antenna sections having a cross-sectional configuration which precludes relative rotation therebetween, a driver connected to each movable antenna section selectively engageable with and disengageable from said lead screw during extension and retraction thereof, and coacting stop means between said movable antenna sections for selectively engaging and disengaging said drivers with said lead screw during extending and retracting movement thereof.

4. A power operated antenna including, a reversible electric motor, a helically wound wire lead screw drivingly connected with said motor, a movable rod antenna section extensible beyond and retractable into said lead screw, a plurality of tubular movable antenna sections spaced radially outward of said lead screw, a stationary tubular antenna section surrounding said movable tubular antenna sections, said movable tubular antenna sections being extensible beyond and retractable into said stationary tubular section, said movable antenna sections being restrained against rotation, a driver attached to said rod section engageable with and disengageable from said lead screw, a driver on each of said movable tubular antenna sections engageable with and disengageable from said lead screw, and coacting stop means between said movable antenna sections for successively engaging and disengaging the drivers of said sections with said lead screw during extension and retraction thereof.

5. A power operated antenna including, a reversible electric motor, a hollow lead screw drivingly connected with said motor, a movable noncircular rod antenna section extensible beyond and retractable into said hollow lead screw, a movable noncircular tubular antenna section spaced radially outward of said lead screw, a stationary noncircular tubular antenna section surrounding said movable tubular antenna section, said movable tubular antenna section being extensible beyond and retractable into said stationary tubular section, a driver carried by each movable antenna section selectively engageable with and disengageable from said hollow lead screw during extension and retraction thereof, and means for maintaining said movable antenna sections in their fully extended positions.

6. A power operated antenna including, a fixed tubular antenna housing, a reversible electric motor carried by said housing and insulated therefrom, an outer stationary tubular antenna section disposed within said housing and insulated therefrom, a plurality of movable tubular antenna sections disposed within said stationary tubular section and extensible beyond and retractable into said stationary tubular section, said tubular antenna sections being noncircular so as to be restrained against rotation, a hollow lead screw disposed within the innermost movable tubular antenna section and drivingly connected with said reversible electric motor through an insulator coupling, a movable rod antenna section coaxially disposed within said hollow lead screw and having a noncircular cross section, a cap secured to the outer end of the innermost tubular section and having an opening therethrough of a shape complementary to the noncircular cross section of said rod and through which said rod extends whereby said rod section is restrained against rotation, and a driver connected to each movable antenna section selectively engageable with and disengageable from said hollow lead screw during extension and retraction thereof upon rotation of said lead screw by said reversible electric motor.

7. A power operated antenna including, a fixed tubular antenna housing, a reversible electric motor carried by said housing and insulated therefrom, an outer stationary tubular antenna section disposed within said housing and insulated therefrom, a plurality of movable tubular antenna sections disposed within said stationary tubular section and extensible beyond and retractable into said stationary tubular section, said tubular antenna sections being noncircular so as to be restrained against rotation, a hollow lead screw disposed within the innermost movable tubular antenna section and drivingly connected with said reversible electric motor through an insulator coupling, a movable rod antenna section coaxially disposed within said rollow lead screw and having a noncircular cross section, a cap secured to the outer end of the innermost tubular section and having an opening therethrough of a shape complementary to the noncircular cross section of said rod and through which said rod extends whereby said rod section is restrained against rotation, a pair of spring clips attached to said cap and engaging said rod section, said rod section having a pair of notches engageable by said spring clips in the fully extended position thereof, coacting stop means carried by said tubular antenna sections for maintaining the innermost tubular antenna section in its fully extended position, and a driver carried by each movable antenna section selectively engageable with and disengageable from said lead screw during extension and retraction of said movable antenna sections.

8. The antenna set forth in claim 7 wherein the driver connected to said movable rod section comprises a pin internally engageable with said lead screw.

9. The antenna set forth in claim 7 wherein the drivers connected to said movable tubular sections comprise nuts externally engageable with said lead screw.

10. The antenna set forth in claim 7 wherein the upper ends of said tubular antenna sections are inwardly flanged, abutment means adjacent the inner ends of said tubular antenna sections engageable with the flanged end of the tubular antenna section disposed radially outward therefrom, and wherein said rod section has a stop pin engageable with the inner end of said cap.

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