

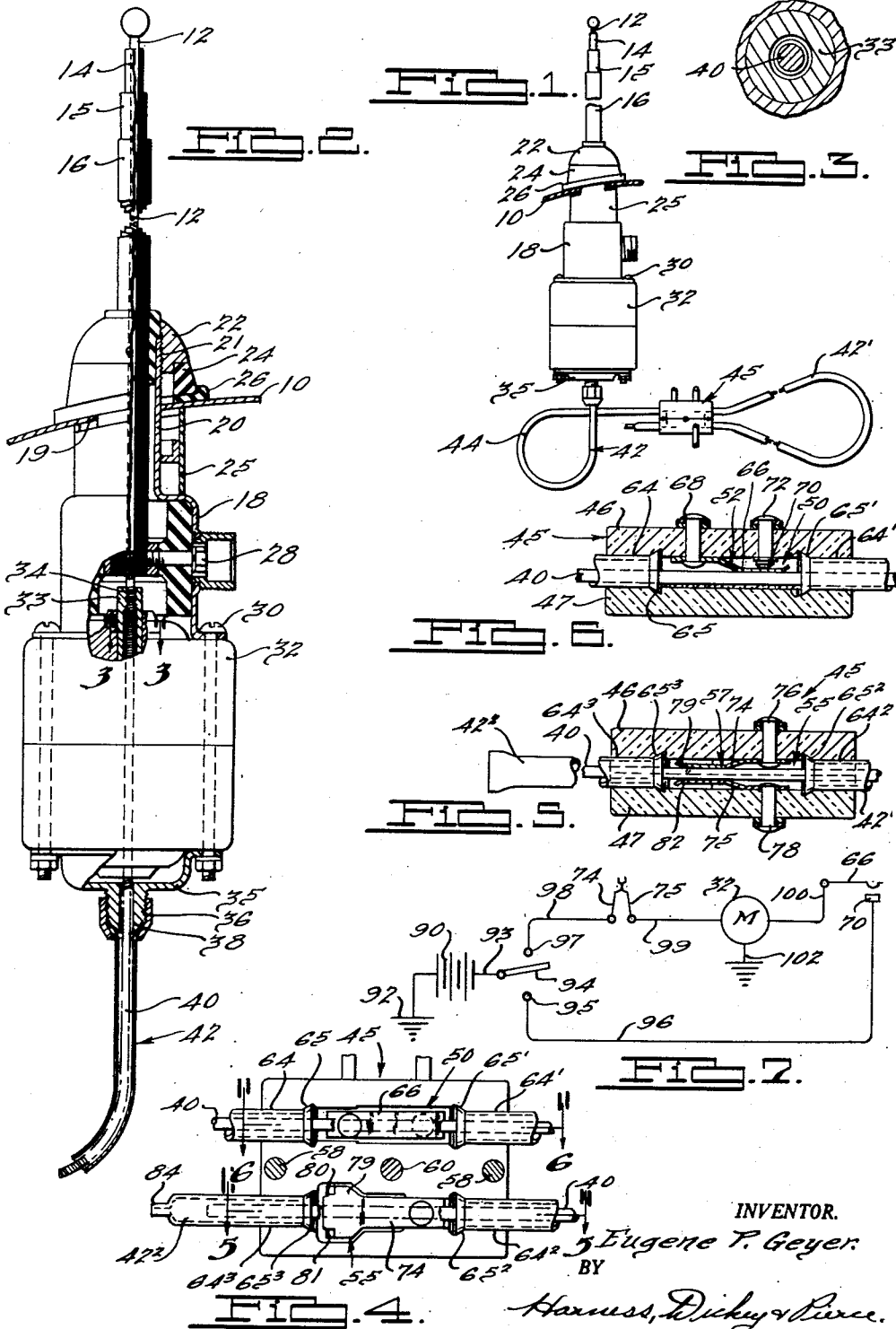
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E. P. GEYER

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EXTENSIBLE AERIAL

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INVENTOR.

Eugene P. Geyer.

BY

Harness, Dickey & Purcell
ATTORNEYS.

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EXTENSIBLE AERIAL

Eugene P. Geyer, Detroit, Mich., assignor, by
mesne assignments, to Pioneer Specialty Com-
pany, a corporation of Michigan

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The present invention relates to telescopically extensible and retractable radio aerials, particularly suitable for use on motor vehicles equipped with radio-transmitting and/or receiving apparatus, although not restricted to such use.

An important object of the invention is to provide improved actuating and controlling means for motivating and for regulating extension and retraction of such telescopic antennae.

An important object of the invention is to provide such a telescopic aerial incorporating a plurality of telescopic sections, all of which are operable by means of a single electric motor, novel and improved means of extreme simplicity and reliability being provided for actuating the antenna sections, as well as novel and improved limit switch controlling means for the electric driving motor.

Other objects and advantages will be apparent upon consideration of the present disclosure in its entirety.

The invention is exemplified in its preferred form in a unitary assembly which incorporates a telescopic antenna construction and an electric motor having a hollow internally-threaded armature shaft coaxial with but mounted below the telescopic antenna rods, a flexible but substantially inelastic externally threaded rod or wire extending through the armature shaft and being threadedly interengaged with the internal threads of such shaft. The flexible wire or rod-like element, which may be termed the "driving wire," is preferably formed of insulating material and is connected at one end to the innermost section of the telescopic antenna structure to actuate the same. The limit switch means to control the action of the motor is operable by the driving wire, and the driving wire serves to insulate the contacts of certain of the switching elements from one another when the switch is in the open circuit position.

In the drawings:

Figure 1 is a side elevational view of a telescopic antenna assembly constructed in accordance with the present invention showing the same installed;

Figure 2 is a view upon a larger scale partly in side elevation and partly in substantially central vertical section, with portions broken away;

Figure 3 is a cross-sectional view taken substantially on the line 3—3 of Fig. 2 and looking in the direction of the arrows;

Figure 4 is an elevational view of the dual limit switch assembly with one side removed;

Figures 5 and 6 are sectional views of the limit

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switch assembly taken substantially on the lines 5—5 and 6—6, respectively, of Figure 4 and looking in the direction of the arrows; and,

Figure 7 is a schematic diagram.

Referring now to the drawings, reference character 10 designates a supporting structure indicated as of sheet metal and which may comprise a body or fender portion of a motor vehicle upon which the aerial is to be installed. The aerial itself may comprise a plurality of telescopic sections, the construction and arrangement of which may correspond to the disclosure of Patent No. 2,580,889 granted January 1, 1952, to Emil Carlson, although the details of construction of the aerial itself are subject to variation, and need not be considered herein. The central or innermost section of the antenna comprises a rod 12, successively enclosed in a plurality of slidable tubular telescopic sections 14, 15 and a fixed outer tubular section 16. It will be understood that the relative travel of each movable section with respect to its next adjacent section is limited so that as each section reaches the end of its relative travel it can thereafter move only in conjunction with such adjacent section.

The outermost antenna section 16 is fixedly supported by, but insulated from, a sheet metal supporting neck member 18 which is of generally stepped cylindrical form, having its upper portion 20, which is of smallest diameter, so formed that it is adapted to project upwardly through an aperture 19 in the body portion 10. The neck is threaded at its upper extremity as indicated at 21 to receive a suitable holding device such as the domed nut 22, which with suitable spacing and gasketing collars as 24, 25, 26, coact to support the antenna structure and housing in generally vertical position and to seal the hole 19, the several antenna sections being thus mounted to project above the body portion 10 in the manner shown and which is now familiar in the art.

The enlarged lower portion of the neckpiece 18 supports a lead-in terminal element 28 to which a transmission line (not shown) may be connected to connect the antenna structure to the radio apparatus. The lower end of neckpiece 18 is open and suitably outwardly flanged and secured as by the screws 30 to the upper end of the housing of the vertically disposed electric motor assembly 32. The electric motor may be of a conventional construction and will require no detailed description. It is of the reversible type and, of course, adapted to operate upon the current supply available from the vehicle battery, under ordinary conditions.

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The armature shaft 33 of the motor is of hollow tubular form and internally threaded, at least at one end, as indicated at 34, the shaft being open at both ends of the motor and coaxial with the antenna rod assembly. A belled sheet metal closure 35 is secured to the lower end of the motor as by the same screws 39, which may be the screws employed to secure together the stator structure and the casing portions of the motor. The bell 35 has a downwardly projecting, externally threaded central boss 36 which is provided with an axial aperture 38 slightly larger than the threaded portion of the central hole in the armature shaft.

A flexible but substantially inelastic rod or wire 40 formed of a suitable plastic having high-insulating characteristics, and also relatively great tensile strength, is secured to the central antenna section 12 and extends downwardly through the hollow armature shaft and the hole 38 in boss 36. The driving wire 40 may be formed of "nylon" and is provided with continuous external screw threads which are threadedly interengaged with the internal threads 34 of the armature shaft.

Secured to and extending downwardly from the nipple portion 36 is a sheathing tube 42 in which the wire 40 is freely slidable. The sheathing tube 42 may be formed of metal and is sufficiently stiff to resist distortion by the actuating wire. Directly below the electric motor casing 22 the sheathing tube is looped once upon itself. Such looped portion is designated 44 and is in the form of a smooth curve which is great enough in radius so that the actuating wire is easily slidable therethrough. Such looped portion effectively prevents the actuating wire from twisting about its own axis in response to rotation of the motor armature, so that when the armature is rotated, the actuating wire is forced to move upwardly and downwardly through the armature shaft 33 to project and retract the telescopic sections of the antenna assembly.

The sheathing tube may be bent to any of a variety of shapes to facilitate its installation and is in fact sufficiently easily bendable so that it may be shaped during installation of the antenna assembly, to adapt the assembly for installation upon vehicles having different body contours. The loop 44 is close enough to the motor, and the driving wire 40 is long enough, so that the driving wire is never pulled out of the loop 44 even when the antenna sections are fully projected.

From the looped portion 44, the sheathing tube is shown as extending horizontally a short distance to a dual limit switch casing, generally designated 45. Details of construction of the dual limit switch assembly are best shown in Figs. 4, 5 and 6. As there indicated, the casing structure is formed of two relatively flat complementary sections 46, 47, which may be of molded plastic and which are contoured to provide two parallel longitudinal passages therethrough, such passages being defined by mating channels formed one-half in each of the casing sections 46, 47. One such longitudinal passageway defines an elongated chamber which is generally designated 50 and which serves to house a limit switch generally designated 52. Switch 52 limits the extent of upward or projecting movement of the antenna sections. The other parallel passageway defines an elongated chamber generally designated 55 which houses

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another limit switch structure generally designated 57. Switch 57 limits the extent of downward or retracting travel of the antenna sections.

The sheathing tube structure is interrupted in the area of each switch chamber so that in the region of each of the limit switches the driving wire is exposed within the casing structure. The two longitudinal passageways are spaced from one another far enough to provide clearance for a pair of securing screws or rivets as 58 which hold the two casing sections together, and also to provide clearance for a central hole as 60 which extends through both casing sections and which is adapted to permit the projection therethrough of a supporting screw (not shown) to enable the switch structure to be secured to a wall or frame portion of a vehicle. At each end, each of the chambers 50, 55 is provided with an open-ended substantially cylindrical terminal portion as 64, 64', 64², 64³, of such size as to fit snugly over and retain the end of the sheathing tube. Each such cylindrical tube-engaging portion is flared at its inner end, as indicated at 65, 65', 65², 65³, to receive a conventional flare formed upon the retained end of the sheathing tube. The sheathing tube sections are thereby positively positioned and held against separation when the switch casing sections are secured together.

Within the chamber 50 of the switch casing is a switch blade 66 formed of spring material such as phosphor bronze. One end of the blade 66 is secured to casing section 46 by a terminal post 68. The other free end of the blade is movable to and from engagement with a contact 70 formed upon the inner end of a terminal post 72 and located within the chamber 50. The free end of the blade 66 is biased to move away from the contact 70 but can only do so when the driving wire 40 is pulled out of the chamber portion 50. When the driving wire is in the chamber, it pushes the blade 66 into engagement with contact 70 to provide an electrical connection between posts 68, 72 in the manner shown in Fig. 6.

Within the chamber 55 in the switch casing are a pair of resilient conductive switch blades 74, 75, which are supported, respectively, by terminal posts 76, 78 carried by the switch casing sections 46, 47. The posts 76, 78 are in transverse axial alignment with one another near one end of the chamber 55, and the blades 74, 75 project longitudinally in the same direction from the posts and are biased to move into contact with one another, although they are held apart when the driving wire is projected between them. As best shown in Fig. 4, the blades 74, 75 are substantially wider than the diameter of the wire at their outer ends. The widened portion of the blade 74 is designated 79, and at each edge of such widened portion, an integral tongue 80, 81, is bent angularly inwardly toward the correspondingly widened end portion 82 of the blade 75. Thus when the driving wire is pulled from between the blades 74, 75, such blades move toward one another until the tongues 80, 81 engage the end portion 82 of the blade 75. Electrical contact between the blades is thus made by portions which are not engaged by the driving wire, and it will be observed that the portions which are thus relied upon to make the electrical contact are relatively sharp, so that if any dirt is carried into engagement with the blades by the driv-

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ing wire, it cannot interfere with proper electrical contact between the tongues 80, 81 and the switch blade portion 82.

After leaving the region of the loop 44, the sheathing tube is connected to the holding portion 64 at the left end of the chamber 50, as the parts are viewed in Figs. 4 and 6. The continuation portion 42' of the sheathing tube which extends from the right end of chamber 50, as shown in the view just referred to, is held by corresponding casing portions 64', 65'. Such portion of the sheathing tube is formed in a smoothly curved loop of substantial diameter, as best shown in Fig. 1, and is returned to connection with the right end of chamber 55, where it is secured by similar holding portions 64², 65², at the right end of the switch casing, as the parts are viewed in Figs. 4 and 5. It will be appreciated that the driving wire only projects between the switch blades 74, 75 when the antenna is fully retracted and that the driving wire thus need only be long enough to project between the blade portions 79, 82, although to afford a margin of safety the driving wire is shown as long enough to project an inch or two beyond the blades 74, 75, such projecting portion being housed in a short extension section 42² of the sheathing tube which is secured with respect to the switch casing by means of similar positioning and flared portions 64³, 65³. The terminal housing section 42² of the sheathing tube is flattened or otherwise closed at its free end, as indicated at 84.

The dual limit switch assembly is located relatively close to the looped portion 44 of the sheathing tube and the parts are so proportioned that the driving wire is only pulled from engagement with the switch blade 66 when the aerial is fully projected.

A suitable electric circuit is indicated in Fig. 7, in which view the source of electrical energy is indicated as a battery 90, which may comprise the storage battery of the car. One terminal of the battery is grounded as indicated at 92. The other battery terminal is connected by a wire 93 to the blade 94 of a single pole-double throw switch, one terminal 95 of which is connected by means of a wire 96 to the switch contact 70 previously described. The other contact point 97 of the single pole-double throw switch is connected by means of a wire 98 with one of the switch blades 74, previously described. The other switch blade 75 is connected by means of a wire 99 to one contact of the reversible electric motor 32. Another terminal of the motor is connected by a wire 100 to the switch blade 66, while the other terminal of the motor is grounded by the wire 102.

When the switch blade 94 is moved into engagement with the contact 95, considering that the aerial is initially in its retracted position, the motor is rotated in a direction to project the aerial, and throughout such projection the switch blade 66 is held in engagement with the contact point 79 by the driving wire 40, and such engagement is maintained unless or until the antenna is fully projected to move the wire 40 to its extreme position in which it is clear of the switch blade 66 and the blade is allowed to open, as previously described. As soon as projection of the aerial commences, the switch contact portions of the switch blades 74, 75 engage one another to complete a connection between switch terminal 97 and the motor 32, so that at any time, the direction of rotation of the motor may be reversed by moving blade 94 to engage switch

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contact 97. This will cause energization of the motor in a reverse direction to retract the antenna, and such retracting movement continues, if the switch is held closed, until when the aerial is fully retracted the wire 40 moves between and separates the switch blades 74, 75, which again stops the motor.

While it will be apparent that the preferred embodiment of the invention herein disclosed is well calculated to fulfill the objects above stated, it will be appreciated that the invention is susceptible to modification, variation and change without departing from the proper scope or fair meaning of the subjoined claims.

What is claimed is:

1. In an extensible and retractable telescopic aerial construction of the type which incorporates a movable aerial rod, an electrically controllable motor, an elongated flexible but substantially inelastic driving element formed of insulating material drivable by the motor and connected to the rod to drive the latter in response to energization of the motor, a sheathing tube in which said element slides when so driven, at least a part of said sheathing tube being looped back upon itself so that two longitudinally spaced portions of said sheathing tube through which the element slides lie relatively close to one another in a lateral direction, parts of the sheathing tube being interrupted in two areas located at said close portions, and a dual limit switch structure for controlling the energization of the motor including two switching devices, one such switching device projecting into each interrupted part of the sheathing tube.

2. Means as defined in claim 1 wherein said dual limit switch structure comprises a housing having a pair of passages therein through which said element is adapted to slide, and contact members carried by the housing and extending into the passages for engagement with said element.

3. Means as defined in claim 1 wherein said dual limit switch structure comprises a housing formed of a pair of complementary casing sections having channels therein defining switch housings through which said element is slidable, and retaining portions for said sheathing tube, said retaining portions comprising recessed extensions of said channels interengageable with said tube.

4. Means as defined in claim 1 wherein said limit switch structure comprises a casing engageable with and adapted to serve as a support for such longitudinally spaced portions of the sheathing tube.

5. Means as defined in claim 1 wherein one switching device comprises a pair of contacts located on one side of the driving element and adapted to be maintained in electrically conductive engagement by said element and a second pair of contacts one contact of which is located on each side of said element, said second pair of contacts being adapted to be maintained disengaged by said element, and means biasing the contacts of the first-mentioned pair apart and the contacts of the second-mentioned pair together.

6. Means as defined in claim 1 wherein one switching device located closer to the motor comprises a pair of contacts located on one side of the driving element and adapted to be maintained in electrically conductive engagement by said element and a second pair of contacts one contact of which is located on each side of said

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element, said second pair of contacts being more remote from the motor, measured along the sheathing tube and adapted to be maintained disengaged by said element, and means biasing the contacts of the first-mentioned pair apart and the contacts of the second-mentioned pair together.

7. In an extensible and retractable telescopic aerial construction of the type which incorporates a movable aerial rod, an electrically controllable motor, an elongated flexible but substantially inelastic driving element formed of insulating material drivable by the motor and connected to the rod to drive the latter in response to energization of the motor, a sheathing tube in which said element slides when so driven, and a limit switch structure comprising two pairs of contacts, the contacts of one pair incorporating one contact yieldably biased to tend to move into engagement with the other, said element being movable to and from an interposed position with

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respect to said contacts when the aerial is near the fully retracted position, whereby the element may in one position separate and insulate said contacts from one another and in another position permit said contacts to move into electrically conductive engagement with one another, the contacts of the other pair incorporating one contact yieldably biased to move out of engagement with the other, said element being movable to and from a position wherein it urges the contacts of said last mentioned pair together when the aerial is near the fully projected position.

EUGENE P. GEYER.

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