ELEVATABLE AND FOLDABLE ANTENNA

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Filed: July 30, 1970

Abstract

An antenna having dipole signal receiving elements pivotally mounted on an antenna body supported upon a parallelogram linkage connected to a rotatable base member. The dipole elements are capable of pivoting between open and closed positions, and the parallelogram linkage includes operating means for raising the antenna body from a retracted position to an elevated position, and the linkage is connected to the dipoles such that the dipoles are automatically positioned to the open signal receiving position upon the antenna body being elevated, and are pivoted to a closed position in general alignment with the antenna body in the retracted position.

References Cited

UNITED STATES PATENTS
1,683,270 9/1928 Taylor et al..................343/894

2,492,989 1/1950 Halstead..................343/915
2,535,049 12/1950 De Rosa..................343/880
2,673,295 3/1954 Wentworth..................343/915
2,895,752 7/1959 De Barrie..................343/882
3,412,404 11/1968 Bergling..................343/714

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13 Claims, 9 Drawing Figures
ELEVATABLE AND FOLDABLE ANTENNA

CROSS-REFERENCE TO RELATED APPLICATION

This is a continuation-in-part of application Ser. No. 789,834 filed Jan. 8, 1969, now U.S. Pat. No. 3,587,104.

BACKGROUND OF THE INVENTION

The invention pertains to the field of antennas, such as television signal receiving antennas, capable of being moved between elevated and retracted positions.

The popularity of recreational vehicles, such as travel trailers and campers, has created a need for antennas, particularly television antennas, to be used with this type of vehicle. The mobile characteristic of recreational vehicles, and the type of use to which they are often subjected, such as movement through underbrush, under low hanging trees and shrubs, and high speed highway travel, has placed peculiar requirements upon the television antennas which are used with such vehicles. The antennas must be of a rugged construction to withstand the vibration and abuse to which they are subjected, but also must be capable of easily handling and storage, as it is common practice with conventional construction to take down the antenna and store the same inside the vehicle when not in use.

The aforementioned application is directed to a permanently installed television antenna which includes dipoles foldable between open and closed positions wherein the dipoles are closed when the vehicle is being transported, and opened when the vehicle is stationary and the antenna is to be operated. However, with the antenna of the aforesaid described application, the disadvantage occurs that the antenna is not vertically adjustable with respect to the vehicle, and since it extends above the vehicle roof line, the likelihood of damage still exists, and if the antenna is installed very close to the vehicle roof line interference with ventilators is experienced as the antenna is rotated, and additionally, the low position of the antenna adversely affects the reception of television signals.

SUMMARY OF THE INVENTION

It is the purpose of the invention to provide an improved antenna of a nature which may be used with recreational vehicles wherein the signal receiving elements are vertically adjustable, and pivot between open and closed positions whereby the antenna body mounting the elements may be lowered to a location adjacent the vehicle roof during travel, and the elements are pivoted to a closed position minimizing the likelihood of wind damage, or damage due to snagging on branches or the like, and the body may be raised to an operative position with the elements open to provide optimum signal reception.

The pivoting of the dipole signal receiving elements between open and closed positions is automatically accomplished as the antenna is raised and lowered. Furthermore, the elevation and retraction of the antenna is accomplished from within the recreational vehicle upon which it is mounted, and the entire antenna assembly may be rotated to achieve optimum signal reception.

In the practice of the invention the antenna body is of an elongated configuration having a plurality of pairs of dipole signal receiving elements pivotally mounted thereon. An actuator rod interconnects the inner ends of the dipoles by means of linkages wherein axial translation of the rod simultaneously produces a pivoting of the dipoles to either a closed position which locates the dipoles in general alignment with the elongated length of the body or actuates the dipole linkages to open the dipoles as to be transversely disposed to the antenna body length for receiving a signal.

The antenna body is mounted upon a parallelogram linkage which is pivotally supported on a rotatable base member mounted upon the vehicle roof. The parallelogram linkage assures that the antenna body will maintain a horizontal orientation during elevation and retraction, and an extension is provided upon one set of the parallelogram linkages which is connected to the dipole actuator rod in such a manner that as the angular movement between the linkages and the antenna occurs during elevation or retraction the dipoles will be automatically pivoted and positioned on the antenna body. When the antenna body is at the full elevated position the dipoles will be at their full open position, and when the antenna body is at the retracted position the dipoles will be in the full closed condition.

Elevation and retraction of the antenna is accomplished within the vehicle, and the antenna assembly may be rotated through 360° by a control also located within the vehicle.

The primary components of the antenna may be formed of light-weight aluminum rods, and both manual and electric means are illustrated for elevating and retracting the assembly.

It is therefore an object of the invention to provide an elevatable and retractable antenna having dipoles positionable between open and closed positions automatically actuated in accord with the vertical movement of the antenna.

BRIEF DESCRIPTION OF THE DRAWINGS

The aforementioned objects and advantages of the invention will be appreciated from the following description and accompanying drawings wherein:

FIG. 1 is a top plan view of an antenna in accord with the invention illustrating the dipoles in the closed condition,

FIG. 2 is an elevational view, partly sectioned, of the antenna of FIG. 1 in the closed and lowered position,

FIG. 3 is a perspective exploded view of the antenna assembly illustrating the dipoles in the open position,

FIG. 4 is a top plan, detail, enlarged view of the inner ends of the dipoles, showing the dipoles in the open position,

FIG. 5 is an enlarged, detail, elevational sectional view of the base member, mounting adapter flange and antenna operating means as taken along Section VI—VI of FIG. 1.

FIG. 6 is an elevational, detail view taken along Section VI—VI of FIG. 1 illustrating the parallelogram linkage orientation with the antenna in the retracted position,

FIG. 7 is an elevational view similar to FIG. 6 illustrating the parallelogram linkage relationship when the antenna is in the elevated position,

FIG. 8 is a bottom view of the interiorly located antenna components taken along Section VIII—VIII of FIG. 5, and

FIG. 9 is a detail, elevational, sectional view illustrating a dipole inner end and operating linkages as taken along Section IX—IX of FIG. 4.

Description of the Preferred Embodiment

The antenna body 10 preferably consists of a section of tubular aluminum conduit 4 or 5 feet in length, and the signal receiving elements are mounted thereon. In the illustrated embodiments two types of elements are shown. A plurality of small fixed dipoles 12 are attached to the body 10 upon dielectric blocks 14, and the dipoles 12 are not intended to move relative to the antenna body and remain in the angular orientation thereto, apparent in FIG. 1.

The folding dipoles 16 consist of three sets of two dipole elements each, and the dipoles include inner ends 18 and outer ends 20. The inner ends of the dipoles are received within tubular sleeves 22 which are in turn pivotally mounted to dielectric blocks 24 mounted upon the body 10. The dipole sleeves 22 are pivotally mounted upon the blocks by pivot pins 26 disposed in a vertical orientation whereby the dipoles are capable of pivoting in a horizontal plane. The pivots 26 include a spring 28 which bears against the underside of the associated block producing a downward biasing action on the pivot, and the pins are headed at their upper end and electrical conducting bus wires 30 interconnected the desired dipoles and an electrical connection is produced at the terminal block 32 mounted on the body to which the antenna lead 34, FIG. 3, is connected.
The upper surface 36 of the blocks 24 functions as a bearing surface for the dipole sleeves, and the dipoles 16 are each capable of pivoting in a horizontal plane between an open position as shown in FIGS. 3 and 4, to the closed condition shown in FIG. 1 wherein the length of the dipole is substantially parallel to that of the body 10.

Pivoting of the dipoles 16 is simultaneously accomplished by means of an actuator rod 38 disposed above the body 10 and parallel thereto. The rod 38 supports a plurality of linkages 40 on pivot pins 42, FIG. 4, and the linkages are connected to the dipole sleeves 22, as will be appreciated in FIGS. 4 and 9 by pivot pins 44. Thus, it will be appreciated that as the rod 38 is axially moved, the link 40 will pivot between the position shown in FIG. 1 to that shown in FIG. 4 moving the dipoles from the closed position of FIG. 1 to the open position of FIG. 4.

The antenna body 10 is mounted upon a parallelogram linkage 46 consisting of a pair of links 48 and a pair of links 50. The linkages 48 are pivotally connected to the body 10 by pivot pin 52 while the links 50 are connected to the antenna body by the pivot 54. A base member 56, mounted upon the roof 58 of the recreational vehicle with which the antenna is employed, includes a pivot pin 60 to which the linkages 48 are pivotally connected to the base member, and pivot pin 62 connects the lower end of the linkages 50 to the base member. In this manner, it will be appreciated that upon the parallelogram linkage being pivoted with respect to the base member, the antenna body 10 will be elevated and retracted while maintaining a horizontal relationship at all phases of operation.

Elevation and retraction of the parallelogram linkage and the antenna body is manually accomplished by means of a worm wheel 64 affixed to the links 48 by a pin 65. The worm wheel 64 meshes with a worm 66 wherein rotation of the worm will produce rotation of the worm wheel and thus pivot the parallelogram linkage 46 upon the pivots 60 and 62.

The mode of mounting and type of installation employed is best appreciated from FIG. 5. The vehicle roof 58 consists of an outer deck 68, and an inner ceiling panel 70 is vertically spaced therebelow. Circular openings 72 and 74 are cut into the ceiling and panel, respectively, to receive the adapter flange 76. The adapter 76 is mounted to the deck 68 by mounting screws, and includes an upper concentric bearing surface 78 which serves as the support for the base member 56, which is provided with a complementary concentric bearing surface 80.

The adapter 76 includes a central bore 82 in which the base member rotation shaft and worm shaft are rotatably mounted, and an outboard support 84 is mounted on the base member 56 for supporting the outer end of the worm 66.

The base member 56 has a shaft 86 keyed thereto which extends downwardly through the adapter bore 82 terminating in a hexagonal configuration at 88. The worm 66 is keyed to the worm shaft 90 which extends through the shaft 86 and terminates at its lower end in a handle mounting portion 92. A detent ring 94 is mounted upon the lower end of the adapter 76 by a snap ring, and the detent ring associates with a rotational adjustment knob 96 having serrations 98 which cooperate with the detents defined on the detent ring. A spring 100 interposed between the operating crank handle 102 attached to the lower end 92 of the worm shaft biases the knob 96 toward the detent ring, and upon grasping the knob 96 the knob serrations may be cleared from the detent to permit rotation of the base member and the antenna assembly. It will be appreciated that the knob includes a hexagonal bore 104 so as to be keyed to the shaft 86, but capable of axial movement thereto.

The crank handle 102 is attached to the worm shaft 90 by means of a set screw 106, and the worm and worm wheel are therefore rotated by the crank handle to elevate and retract the antenna.

As both the handle 102 and the rotational knob 96 are located within the interior of the recreational vehicle adjacent the ceiling panel 70, control and positioning of the antenna is interiordly accomplished, and indicia may be defined upon the knob to indicate the direction of orientation of the antenna body.

An abutment 108 is defined upon the adapter flange for engagement with a rib 110 defined on the base member 56 to limit rotation of the base member 56 upon the adapter to 360°. Thus, it is not possible to wind the lead 34 around the antenna linkages. Additionally, a stop lever 112 is affixed to the worm wheel 64 to engage the base member when the antenna is at its full elevated condition to limit elevation of the antenna.

Preferably, a rest pad 114 is mounted upon the recreational vehicle roof at a spaced location rearwardly from the base member 56, FIGS. 2 and 3, to provide a rest and support for the antenna body when it is fully retracted.

Operation of the antenna will be apparent from the aforementioned. Initially, the antenna will be in the retracted condition as shown in FIGS. 1 and 2, which is the "travel" condition for the antenna, and the rest pad 114 will be located "behind" the base member 56 with respect to the direction of vehicle movement so that when the antenna dipole elements 16 are in the closed condition illustrated in FIGS. 1 and 2 the movement of air past the antenna is from the left to the right, and the dipoles will not be adversely affected thereby, and the likelihood of snagging of the dipoles on branches is substantially eliminated.

When it is desired to elevate the antenna, the crank handle 102 is rotated to rotate the worm wheel 64 in a counterclockwise direction, FIG. 5, which pivots the linkage 46 from the position shown in FIG. 2 to that shown in FIGS. 3 and 7. The linkages 48 are provided with extensions 116 which are pivotally connected to links 118 by pins 120. The links 118 are also pivotally connected by pivots to the actuator rod 38 by means of a block 122. Thus, as the linkages 48 and 50 are being raised to the elevated position, the resultant angular movement of the linkages 48 to the body 10 about the pin 52 causes an axial movement of the actuator rod 38 which pivots the dipoles 16 from the closed position of FIG. 1 to the open position of FIGS. 3 and 4 when the antenna is fully elevated. The crank handle 102 is rotated until the abutment lever 112 engages the base member 56, and thereupon the knob 96 is pulled downwardly to rotate the base member to that location which provides reception of the optimum signal.

To lower the antenna the aforesaid procedure is reversed. The knob 96 is rotated to place the body 10 in alignment with the rest pad 114, and then the crank handle 102 is rotated to produce clockwise rotation of the worm wheel 64 and lower the linkage 46 and the antenna body 10. As the antenna body is lowered, the interconnection of the linkage extensions 116 and the links 118 with the rod 38 produces an axial movement of the actuating rod to pivot the dipoles 16 to the closed condition of FIG. 1. Rotation of the crank handle occurs until the antenna body 10 is snugly resting upon the pad 114.

While the disclosed embodiment is manual in its operation, the elevation and retraction of the linkage may be electrically accomplished by the mounting of a reversible electric motor 124 on the base member 56 connected to the pivot 60 through a speed reduction transmission 126, as shown in dotted lines in FIG. 1. Control of the motor 124 is accomplished by a switch within the vehicle. Likewise, an electric motor and drive means, not shown, could be connected to the shaft 86 to provide an electrical rotation of the base member and antenna assembly about its vertical axis of adjustment.

It is appreciated that various modifications to the inventive concept may be apparent to those skilled in the art without departing from the spirit and scope thereof.

What is claimed is:

1. An elevatable and retractable antenna having signal receiving elements movable between open and closed positions comprising, in combination, a base member, antenna body support means movably mounted on said base member movable between an elevated position and a retracted position, an elongated antenna body mounted on said support
means spaced from said base member, a plurality of elongated signal receiving elements pivotally mounted on said body pivotal between open and closed positions, said signal receiving elements each having an inner end and an outer end, pivot means connecting said inner ends to said body whereby said elements are disposed in general alignment with said body in the closed position and are transversely disposed to said body when in the closed position and are transversely disposed to said body when in the open position, operating means connected to said support means for moving said support means between said elevated and retracted positions, and control means connected to said signal receiving elements automatically pivoting said elements to the open position as said body support means and body is elevated and automatically pivoting said elements to the closed position as said body support means and body is retracted.

2. In an elevatable and retractable antenna as in claim 1 wherein said signal receiving elements are mounted on said antenna body in pairs, at least two pairs of elements mounted on said body and axially spaced thereon relative to each other, said control means including an actuator rod and links interconnecting said inner ends of said elements.

3. In an elevatable and retractable antenna as in claim 1 wherein said control means includes an actuator connected to said support means and connected to said elements whereby movement of said support means pivots said elements between said open and closed positions.

4. In an elevatable and retractable antenna as in claim 3 wherein said control means includes an extension defined on said support means connected to said actuator.

5. In an elevatable and retractable antenna as in claim 4 wherein said control means comprises a parallelogram linkage interposed between said base member and antenna body whereby said body maintains a constant angular relationship to said base member as it is elevated and retracted by said support means.

6. In an elevatable and retractable antenna as in claim 1 wherein said operating means includes a worm wheel connected to said support means, a worm meshing with said worm wheel mounted on said base member, and an operating handle connected to said worm for the rotation thereof.

7. In an elevatable and retractable antenna as in claim 1, bearing means supporting said base member for rotation about a substantially vertical axis and manual operated means connected to said base member for producing rotation thereof.

8. An elevatable and retractable antenna having dipoles movable between open and closed positions comprising, in combination, a base member, bearing means rotatably mounting said base member for rotation about a substantially vertical axis, a parallelogram linkage consisting of a plurality of links pivotally mounted on said base member movable between elevated and retracted positions, an elongated antenna body mounted on said linkage by pivots, a plurality of dipoles pivotally mounted on said body pivotal between a closed position in general alignment with said body and an open position transversely disposed to said body, control means connected to said dipoles for simultaneously pivoting said dipoles between said open and closed positions, connecting means interconnecting said control means to said linkage whereby the angular movement occurring between said linkage and said body as said linkage moves between said elevated and retracted position operates said control means to open said dipoles at said elevated position and close said dipoles at said retracted position and operating means drivingly connected to said linkage for pivoting said links relative to said base member to elevate and retract said linkage and said antenna body.

9. In an elevatable and retractable antenna as in claim 8 wherein said connecting means comprises an extension of one of the links of said parallelogram linkage.

10. In an elevatable and retractable antenna as in claim 8 wherein said operating means includes a worm wheel connected to the pivot of one of said links at said base member, a worm rotatably mounted on said base member meshing with said wheel, and a handle connected to said worm.

11. In an elevatable and retractable antenna as in claim 8 wherein said operating means comprises a reversible electric motor mounted on said base member operatively connected to one of said links.

12. An elevatable and retractable antenna for mounting upon a roof having an upper exterior surface and a lower interior surface wherein the antenna includes signal receiving elements movable between elevated and retracted positions comprising, in combination, a base member rotatably mounted upon the roof adjacent the exterior surface thereof rotatable about a first generally vertical axis, elongated antenna body support means having a first end movably mounted on said base member for pivotal movement about a generally horizontal second pivot axis and having a second end spaced from said first end elevatable and retractable with respect to said base member upon pivoting of said first end about said second pivot axis, signal receiving elements mounted upon said antenna body support means second end for elevatable and retractable movement therewith, operating means mounted on said base member operatively connected to said body support means first end for pivoting said body support means about said second pivot axis, first control means connected to said base member and concentrically related to said first axis for rotational movement thereabout having a lower end extending below the roof of lower interior surface, first manual adjustment means connected to said first control means lower end to manually rotate said base member about said first axis, second control means rotatably mounted on said base member concentric to said first axis connected to said operating means having a lower end extending below the roof interior surface, and second manual adjustment means connected to said second control means lower end for rotating said second control means about said first axis and activate said operating means to elevate and retract said body support means second end and said signal receiving elements.

13. In an elevatable and retractable antenna as in claim 12 wherein said operating means includes a worm wheel concentric with said second axis, and a worm gear mounted upon said second control means meshings with said worm wheel.

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