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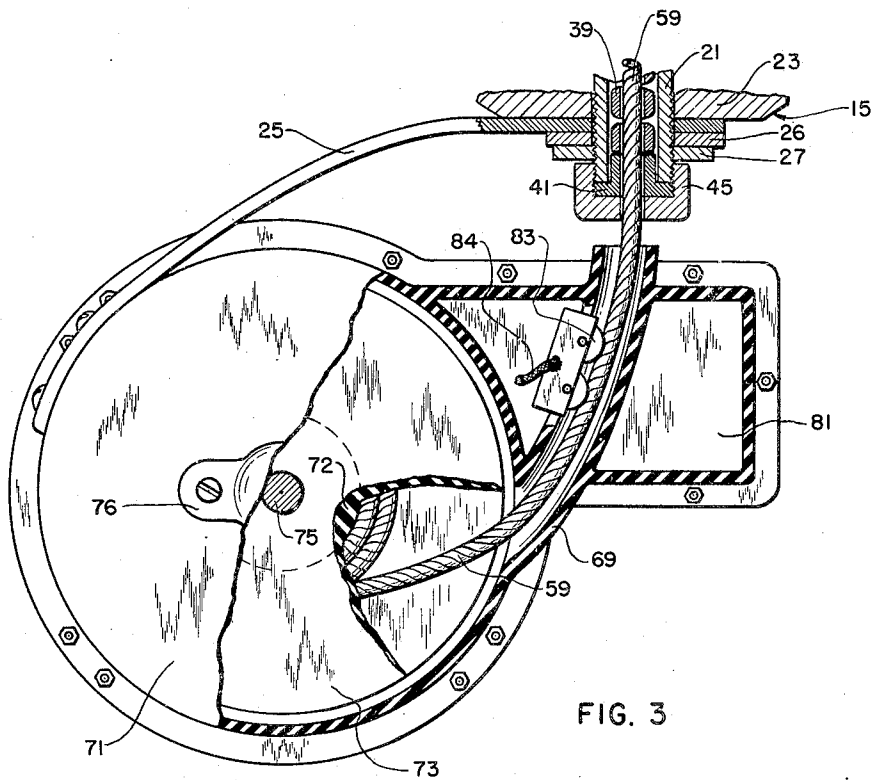


FIG. 3

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The invention described herein may be manufactured and used by or for the Government for governmental purposes, without the payment to me of any royalty thereon.

The present invention relates to antennas, and particularly to adjustable or tunable antennas.

In certain types of electronic equipment, such as radio communication apparatus operable on more than a single frequency, large losses of efficiency occur due to the fact that suitable tunable antennas are not available. Not only should such antennas be tunable so as to obtain maximum power of propagation and maximum consistency of pattern of propagation, when used as a radiator, and maximum receptivity, when used as a collector, but they should preferably be so constructed mechanically as to be adapted to withstand rigorous service, as in motor vehicle use, and they should also be designed to allow easy replacement of damaged parts.

It is therefore an object of the present invention to provide an antenna which is tunable.

It is a further object to provide a tunable antenna which is adapted to vehicular use and the like.

It is a further object to provide a tunable antenna which is also collapsible.

It is still another object to provide a tunable antenna wherein the radiator-collector portion thereof, which is most likely to sustain breakage when subjected to hard usage, may be simply and quickly replaced.

It is a further object to provide an antenna which may be tuned without the use of compensation networks.

It is a further object to provide a tunable antenna which is completely mechanical in operation.

These and other objects and advantages of my present invention, which will be better understood as the detailed description progresses, are obtained in the following manner.

In a preferred embodiment of the present invention I provide an antenna which includes a radiator-collector made up of a plurality of telescoping tubular sections of approximately equal length, and a base to which the tubular section of largest diameter is secured. A flexible shaft extends through the telescoping tubes and has one end secured to the tube of smallest diameter, and the other end wound upon a drum preferably rotated by an electric motor. The radiator-collector is lengthened by rotating the drum by means of the motor so as to unwind the

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flexible shaft, and it is collapsible by reversing the direction of rotation of the drum.

The said radiator-collector may be tuned by extending it to any length between its collapsed and fully extended positions. Tuning may be controlled by a precalibrated dial or by means of suitable meters which allow maximum efficiency to be checked during use.

In the accompanying specification there is described, and in the annexed drawings shown, what is at present considered a preferred embodiment of the present invention. It is, however, to be understood that said invention is not limited to said embodiment, inasmuch as changes may be made within the spirit and scope of the appended claim.

In said drawings, Figure 1 is an elevational view partly sectioned and partly cut away of a vehicular antenna embodying the present invention;

Figure 2 is an enlarged vertical sectional view, taken along the line 2—2 of Figure 1, the housing of the connection box being shown in elevation; and

Figure 3 is a further enlarged vertical section of the lower portion of the antenna, taken along the line 3—3 of Figure 2.

Referring now more particularly to the drawings, the antenna illustrated is secured through an aperture in an insulating disk 11 which in turn is secured about its periphery to a mounting bracket 13 secured to a motor vehicle (not shown).

The antenna includes a mounting clamp made up of a lower clamp member 15 and an upper clamp member 17. The upper clamp member 17 is an annulus provided with an outwardly extending clamp flange 19 at its upper end and a downwardly extending tubular flange 21 at its lower end. Said flange 21 is externally threaded.

The lower clamping member 15 is annular in shape and encircles the tubular flange 21 mentioned above and is provided at its lower end with an outwardly extending clamping flange 23.

A flat metal reel bracket 25 which bends downwardly into an arc at its outer end and is secured to the lower end of the flange 21 by a lock washer 26 and nut 27 which nut also urges the clamping flanges 19 and 23 together so as to securely grip therebetween the insulating disk 11 and an annular dish type insulator 29.

A heavy coaxially disposed helical spring 31 is secured to the upper end of the upper clamping member 17 and an annular antenna socket 33 is secured to the upper end of said spring 31. A flexible tubular sleeve 35, of rubber or the

like, encircles the spring 31 and is fastened about the upper clamping member 17 and the antenna socket 33 by means of a pair of hose clamps 37 or the like.

A flexible tubular guide 39 extends axially through the upper clamping member 17, the spring 31 and the antenna socket 33. Said guide 39 may be made in any suitable manner, such as flexible "goose necks" as used in adjustable electrical fixtures, or such as the "flexible sheath 15", which is described and illustrated in a pending United States patent application on "Flexible members," filed in the name of Norman E. Lee, on February 21st, 1946 and bearing Serial Number 649,448.

Said guide 39 is provided at its lower and upper ends respectively with outwardly extending lower and upper guide flanges 41, 43. Said lower guide flange 41 is gripped between the lower end of the tubular flange 21 and a cup 45 which is threaded on to the lower end of said flange 21. The upper guide flange 43 is gripped between an upwardly facing shoulder on the inside of the antenna socket 33 and the lower end of a radiator-collector 47.

The radiator-collector 47 comprises four telescoping antenna sections 51, 52, 53, 54 (although any number of such sections may be used). The lowermost antenna section 51 is externally threaded at its lower extremity so as to be threadably joined to the antenna socket 33. The upper end of said section 51 terminates in a tubular throat 55 of slightly lesser diameter. The second telescoping section 52 makes a slidable fit inside the throat 55 of said section 51 and its lower end is provided with an outwardly rolled edge 57 to keep it from separating from the lower section 51 and the said edge 57 makes a sliding fit within the said section 51 below the throat 55 thereof. The upper end of said section 52 is provided with a constricted throat 55 similar to that already described. The next section 53 is a duplicate of the section 52 except that it is of lesser diameter so as to make a sliding fit within said section 52. The uppermost section 54 is of a diameter to make a sliding fit within the section 53 below it and is also provided at its lower end with an outwardly rolled edge 57 (not shown). Said uppermost section 54 need not be provided with a throat 55.

A flexible shaft 59 extends through the guide 39 and all of the antenna sections 51, 52, 53, 54. The said flexible shaft 59 may be made in any suitable manner as, for instance, in the conventional manner which comprises a core made up of one or more longitudinally disposed flexible spring wires which wire or wires are surrounded by several layers of helically wound spring wire, the successive layers being wound in opposite directions.

The upper end of said flexible shaft 59 is joined to an externally threaded tip 61, which is locked to the upper end of the uppermost antenna section 54 by means of a diametrically positioned pin 63. A lock washer 65 and an internally threaded spherical knob 67 are secured to said tip 61. The flexible shaft 59 extends downwardly through an aperture in the cup 45, passes through an arcuate tubular chute 69 into a cylindrical reel housing 71 where it is wound around the core 72 of a rotatable reel 73, the bitter end of said flexible shaft 59 being secured to said core 72.

The reel housing 71 is held in place below the insulating disk 11 by being secured to the outer

end of the reel bracket 25. The shaft 75 of the reel 73 is sustained in suitable bearings 76 and may be rotated by means of a slow speed electric motor 77 which operates through a friction clutch 79. Integral with the reel housing 71, and extending outwardly therefrom, is a connection box 81 through which passes part of the chute 69.

Within said box 81, the chute 69 is slotted to admit a pair of contact wheels 83 which are rotatable and provided with circumferential grooves which frictionally grip the flexible shaft 59 and make electrical contact therewith. An electrical conductor 84 leads from said contact wheels 83 to a conventional coaxial connector 85. Said conductor 84 passes through a conventional thermocouple unit (not shown), which is housed in the connection box 81, the leads from which unit are connected to the binding posts 87 from which connection may be made to a suitable meter (not shown).

Preferably the housing 71, the chute 69, the connection box 81, and the reel 73 are of a dielectric material, such as a suitable plastic, to avoid any objectionable electrical effects.

In the operation of the antenna just described, if the motor 77 is operated in one direction so as to rotate the shaft 75 (as shown in Figures 1 and 3) in a counterclockwise direction, the flexible shaft 59 will be fed up the chute 69 and through the guide 39 to the antenna sections 51, 52, 53, 54. As the upper end of said flexible shaft 59 is fastened to the upper end of the uppermost telescoping section 54, it will raise said section with it. When said section 54 has extended its maximum amount, the rolled edge 57 at its lower end will catch the constricted throat 55 of the next section 53 and thus cause said section to move upwardly with it. As rotation of the motor 77 is continued, telescoping section 52 will likewise be raised until the radiator-collector 47 is extended its maximum length. Should the motor not be stopped immediately, the friction clutch 79 will prevent damage to any parts.

When the motor 77 is operated in the opposite direction, so as to rotate the shaft 75 (as shown in Figures 1 and 3) in a clockwise direction the flexible shaft 59 will be wound up on the reel 73 and thus the sections 51, 52, 53, 54 will be caused to telescope, one within the other, until the radiator-collector 47 is completely collapsed. Again, the friction clutch 79 will prevent damage to the parts should rotation of the motor 77 be continued.

In order to obtain most efficient operation of the radiator-collector 47, it may be tuned by means of the meter (not shown) mentioned above. Thus it will be extended to that length which the meter indicates gives most satisfactory operation. Tuning may also be accomplished by means of a precalibrated dial (not shown).

The contact wheels 83 are maintained in good electrical contact with the antenna and hence electrical connection is made to the antenna through the coaxial connector 85, the conductor 84, the said wheels 83 and the flexible shaft 59.

The antenna just described is particularly well adapted for motor vehicle use although it may be used in other installations. The spring 31, the flexible tubular sleeve 35 and the flexible guide 39 will allow flexure of the antenna and will act to attenuate vibrations and shocks. The telescoping radiator-collector 47 itself should also preferably

have a limited amount of flexibility for vehicular service.

In the event that, in the use of the antenna just described the radiator-collector 47 sustains any injury, it may be readily removed and replaced by another. This is accomplished by merely removing the knob 67 and pin 63 whereupon the lower antenna section 51 may be unscrewed from the antenna socket 33 and all of the sections 51, 52, 53, 54 may be slipped upward and removed from the flexible shaft 59. A complete new radiator-collector 47 may then be installed by slipping the same over the flexible shaft 59, screwing the lower end of the antenna section 51 of greatest diameter into the antenna socket 33 and pinning the upper end of said shaft 59 to the upper end of the antenna section 54 of smallest diameter by means of the pin 63. If only one of the antenna sections 51, 52, 53, 54 is damaged it may be removed from the radiator-collector 47 and replaced merely by separating said sections.

While there has been described what is at present considered a preferred embodiment of the invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the invention, and it is, therefore, aimed in the appended claim, to cover all such changes and modifications as fall within the true spirit and scope of the invention.

What is claimed is:

In a tunable transmitting antenna system for use with vehicles, a radiator extensible in length for operation over a predetermined range of frequencies, said radiator comprising a plurality of telescoping tubular sections of successively smaller

diameters, a flexible shaft extending through said radiator and having one end secured to the telescoping section of smallest diameter, means for disconnecting said shaft from said smallest section, a flexible base for said radiator to allow lateral displacement thereof, a flexible guide through said base for the flexible shaft, a reel upon which the flexible shaft may be wound, means to rotate the reel in both directions of rotation, said means being calibrated in terms of frequency of operation of said antenna system, a chute to guide the flexible shaft between the reel and the flexible guides mentioned above, whereby upon the rotation of the reel in one direction the radiator may be reduced in length for operation on a higher frequency, and upon rotation of the reel in the opposite direction the radiator may be increased in length for operation on a lower frequency.

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