

[54] **ELECTRICALLY SMALL DIPOLAR ANTENNA UTILIZING TUNED LC MEMBERS**

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[51] Int. Cl. **H01q 9/28**

[58] Field of Search **343/828, 829, 830, 895, 343/747, 807**

[56] **References Cited**

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[57] **ABSTRACT**

A miniaturized dipolar antenna having high radiation efficiency includes two parallel spaced capacitor plates shunting an inductance which is connected in a perpendicular orientation to the plates. In a first embodiment for VHF operation, the inductance is a coil having an adjustable ferrite slug core which permits tuning of the antenna. In lieu of the slug, a coaxial variable capacitor may be connected in series with the plates. In a second embodiment for UHF operation, the inductance consists of parallel positioned conductor rods perpendicularly connected between the capacitor plates. A coaxial variable capacitor connected in series with the plates permits tuning of the antenna.

5 Claims, 4 Drawing Figures

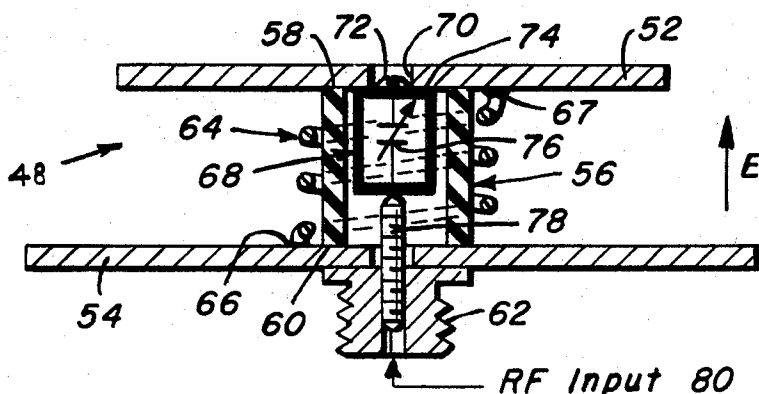


Fig. 1

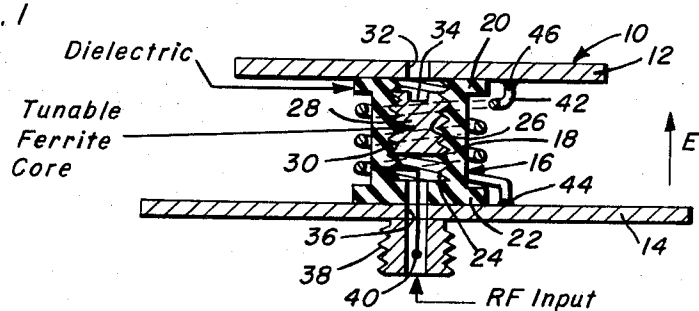


Fig. 2

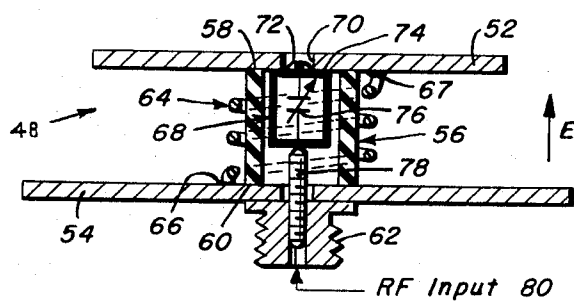


Fig. 3

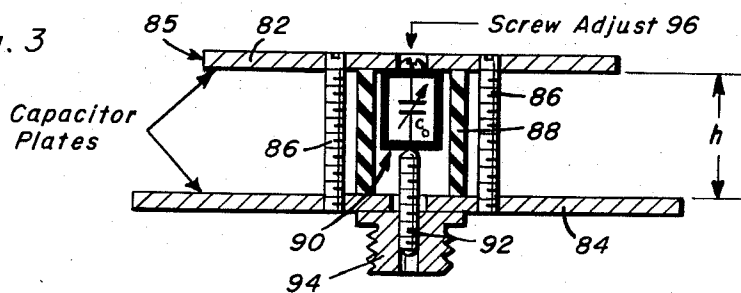
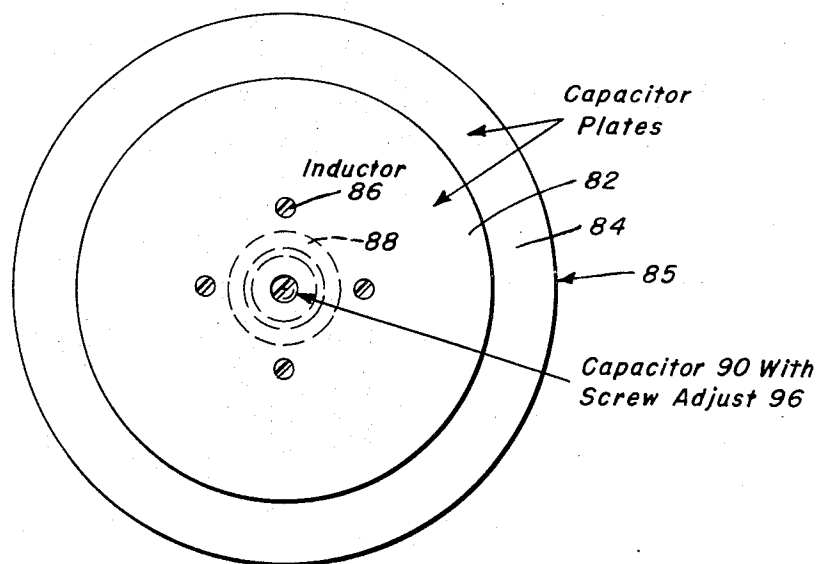


Fig. 4



ELECTRICALLY SMALL DIPOLAR ANTENNA UTILIZING TUNED LC MEMBERS

RIGHTS OF THE GOVERNMENT

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

FIELD OF THE INVENTION

The present invention relates to omnidirectional antennas, and more particularly to a miniaturized dipolar antenna that utilizes tuned LC members in its structure and has high radiation efficiency.

BRIEF DESCRIPTION OF THE PRIOR ART

In the past, many different attempts have been made to miniaturize dipolar antennas which have high radiating efficiencies and an omnidirectional pattern. A major disadvantage of prior art antennas has been the inclusion of radiating members that produce radiation that is polarized in several directions. Accordingly, if the antenna is to be used at ground level, horizontal polarization results in heavy attenuation due to the earth.

In addition, prior art approaches to achieve substantial radiation energy levels has resulted in antenna designs that are far from miniaturized. Accordingly, these prior art devices do not meet requirements of small size, both mechanically and electrically.

A further disadvantage of the prior art resides in the precision of part fabrication which results in high costs.

BRIEF DESCRIPTION OF THE PRESENT INVENTION

The present invention is a truly miniaturized dipolar antenna which consists of simply fabricated capacitor plates that cooperate with an inductance to form a tuned LC antenna resonating at a frequency which produces efficient, relatively high levels of radiation energy in an omnidirectional pattern, and linearly polarized in a single direction.

The generic structure of the invention includes two annular capacitor plates that are perpendicularly interconnected by an inductance to form a highly efficient tuned LC circuit. The capacitor plates are radiating elements and are structurally adapted to be potted thereby maximizing the structural rigidity and shock resistance of the antenna.

The above-mentioned objects and advantages of the present invention will be more clearly understood when considered in conjunction with the accompanying drawings, in which:

BRIEF DESCRIPTION OF THE FIGURES

FIG. 1 is a cross sectional view of a first embodiment of the present invention which includes a tunable ferrite core.

FIG. 2 is a cross sectional view of a second embodiment of the present invention which utilizes a variable capacitor to accomplish tuning of the antenna in the VHF region.

FIG. 3 is a cross sectional view of a third embodiment of the present invention which utilizes straight rods as

the inductance portion of the antenna LC circuit. Tuning is accomplished by a coaxial variable capacitor.

FIG. 4 is a top plan view of the embodiment illustrated in FIG. 3.

DETAILED DESCRIPTION OF THE INVENTION

Referring to the figures, and more particularly FIG. 1 thereof, the cross sectional view of a first embodiment of the present invention is illustrated. The embodiment is particularly adapted to function as a VHF antenna. The illustrated antenna is generally indicated by reference numeral 10 and includes two parallel spaced circular capacitor plates 12 and 14. The plate 12 is somewhat smaller than the plate 14. It has been found experimentally, that a slight difference in the size of the capacitor plates improves the bandwidth and other operating characteristics. Further, the difference in size between the capacitor plates facilitates the potting of the illustrated structure which increases the structural integrity and shock resistance of the antenna. It is mentioned that this feature is also associated with the embodiments to be discussed hereinafter.

The inductor 42 is mounted on a support member 16 which has a central cylindrical portion 18 axially mounted with respect to the capacitor plates 12 and 14. The support member 16 has enlarged annular boss portions 20 and 22 for suitable connection to the confronting surfaces of the capacitor plates 12 and 14. Inwardly of the support member 18 is a generally cylindrical opening with threads 26 formed therealong. The opening is coaxial with the capacitor plates, which likewise lie along a common axis. Within the opening 24 is a ferrite core 28 which includes threads 30 therearound to permit adjustment of the core position within the support member 16, the latter being fabricated from an insulator material.

The core 28 cooperates with the helical coil 42 to effect a variable inductance connected in circuit with the capacitor plates 12 and 14 to form a high efficient resonant LC circuit that has its natural resonant frequency altered slightly by the tunable ferrite core.

A small central opening 32 is formed in plate 12 to allow access of a screwdriver to engage the slit 34 which is formed in the ferrite core 28. The opening 32 is axially disposed relative to the capacitor plates 12 and 14. A second coaxially formed opening 36 appears at the center of plate 14 to permit the passage of the feed end 40 for coil 42, through the support member 18. The feed end exits through the wall of support member 18 for helical formation around the side of support member 18. The end 40 is connected to the feed line of a coaxial cable (not shown) at the connector 38. The connector 38 is connected with the outer conductor of the coaxial cable to complete an r.f. connection.

With respect to the inductor 42, it has its lower end connected at 44 to the capacitor plate 14 while the upper end 46 is connected to the capacitor plate 12. The feed end 40 is, in essence, connected to intermediate point along the length of the inductance coil 42.

As indicated by the vector E, the field radiated by the antenna is linearly polarized. For purposes of illustration, with the antenna oriented as depicted, a vertical polarization exists. This minimizes horizontal polarization which is undesirable because high attenuation by the earth occurs when the antenna is placed on or in the ground.

A further advantage of the ferrite slug is to permit impedance matching in addition to tunability.

The dimension between the plates is purposely chosen to be small thereby effecting the suppression of horizontal polarization. This capability is enhanced by making the coil inductor radius small compared with the radius of the plates. When the capacitor plates are large relative to the size of the coil, the capacitor plates become the predominant radiating elements and govern the resulting omnidirectional, linearly polarized radiated field.

It is to be emphasized that these features of the invention pertain to the embodiments to be discussed hereinafter.

A second embodiment of the present invention is illustrated in FIG. 2 and generally represented by reference numeral 48. This embodiment of the invention operates as a VHF antenna, and is similar to the first embodiment, with the exception of a coaxial variable capacitor in lieu of the tunable ferrite core of FIG. 1. However, in essence, this embodiment as well as the remaining two embodiments to be discussed hereinafter, include simply constructed capacitor plates used in conjunction with an inductor to form a highly efficient LC tuning circuit for radiating energy.

In the second embodiment of FIG. 2, the capacitor plates 52 and 54 are similarly constructed and oriented as the plates 12 and 14 of FIG. 1. An insulator cylindrical support member 56 is coaxially oriented, along with the plates 52 and 54, along a common axis. The support member 56 is appropriately connected at opposite ends thereof to the confronting surfaces of the capacitor plates at points 58 and 60. A connector 62 is electrically connected to the lower capacitor plate 54. The connector provides the r.f. input 80 to the capacitor plates 52 and 54. In actuality, the connector 62 is connected with the outer conductor of a coaxial cable (not shown) as explained in connection with FIG. 1. The inner conductor of such a cable is connected to the pin 78, as will be explained hereinafter.

The lower end 66 of coil 64 is electrically connected to the capacitor plate 54. In a similar manner, the upper end 67 of the coil 64 is connected to the capacitor plate 52.

In lieu of the tunable ferrite core 28 of the embodiment shown in FIG. 1, a coaxial variable capacitor is used instead. Such a capacitor is available on the market from several sources including the Johanson Manufacturing Corporation of New Jersey, and is identified by model number 5502. The variable capacitor 68 is mounted within the opening in support member 56. A small opening 70 is formed in the center of capacitor plate 52 to permit access of a screwdriver to a screw adjust 72 on the capacitor 68. Electrically, the upper plate of the capacitor 68 is connected to the capacitor plate 52, as indicated by reference numeral 74. The lower plate 76 of the variable capacitor 68 is connected to the pin 78 which, as previously mentioned, connects to the innerconductor of the mentioned coaxial cable (not shown). In effect, the capacitance of variable capacitor 68 is connected in series with the capacitance of capacitor plates 52 and 54. By adjusting the screw adjust 72, the operating frequency of the antenna may be adjusted.

FIG. 3 illustrates a third embodiment of the present invention which is particularly adapted for utilization in

the UHF mode. The top plan view of the embodiment is shown in FIG. 4.

The embodiment of FIGS. 3 and 4 is generally indicated by reference numeral 85 and is seen to include a plurality of parallel spaced conductor posts 86 that are symmetrically positioned relative to the axis of capacitor plates 82 and 84. Inasmuch as this embodiment operates in the UHF region a minimum of inductance is required. To achieve this requirement, straight wires or posts are utilized. An insulator sleeve 88 is positioned in coaxial relationship with the plates 82 and 84. The hollowed sleeve 88 supports a coaxial variable capacitor 90 therein. This capacitor is of the same type as 68, previously discussed in connection with FIG. 2. The purpose of the variable capacitor is likewise the same. In addition, the variable capacitor 90 insures a means for symmetrically coupling r.f. energy from the connector 94 to the capacitor plates 82 and 84. As in the case of the variable capacitor previously discussed, a pin 92 is connected to one plate thereof and serves to connect with the innerconductor of a coaxial cable. The screw adjust 96 is the same as the screw adjust 72 of the variable capacitor 68 in FIG. 2.

Thus, with the explanation as set forth hereinbefore, it will be appreciated that the present invention offers simplicity in design for achieving efficient radiation in a dipolar antenna that is principally constructed from LC components forming a tuned resonance circuit.

I wish it to be understood that I do not desire to be limited to the exact details of construction shown and described, for obvious modifications can be made by a person skilled in the art.

Wherefore I claim the following:

1. A miniaturized dipolar antenna comprising:

first and second capacitor plates disposed in coaxial parallel spaced relation;

a helically wound inductor coil positioned between the plates in coaxial relation thereto for electrical connection therewith to form a tuned LC resonant circuit;

adjustably positioned ferrite core coaxially disposed inwardly of the coil for tuning the operating frequency of the antenna; and

means connected to the inductor and the capacitor plates for introducing an r.f. signal to the antenna which energizes the inductor and the capacitor plates causing radiation of energy into a far field from the capacitor plates.

2. The subject matter set forth in claim 1 wherein a first end of the coil is electrically connected to a first plate while the second end of the coil is electrically connected to a second plate, and further wherein the means for introducing an r.f. signal to the antenna includes a lead from a r.f. input to an intermediate point of the coil.

3. The subject matter set forth in claim 1 together with a coaxial variable capacitor positioned inwardly of the coil and connected in series with the capacitor plates for tuning the operating frequency of the antenna.

4. A miniaturized dipolar antenna comprising:

first and second capacitor plates disposed in coaxial parallel spaced relation;

at least one conductive post perpendicularly mounted between the plates for electrical connection therewith to form a tuned LC resonant circuit;

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a coaxial variable capacitor positioned adjacent the post and connected in series with the capacitor plates for tuning the operating frequency of the antenna; and
means connected to the inductor and capacitor plates for introducing an r.f. signal to the antenna which energizes the inductor and the capacitor

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plates causing radiation of energy into a far field from the capacitor plates.

5. The subject matter of claim 4 wherein a plurality of symmetrically arranged conductive posts are mounted between the capacitor plates for electrical connection therewith.

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