

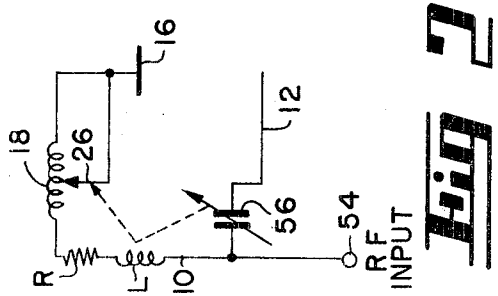
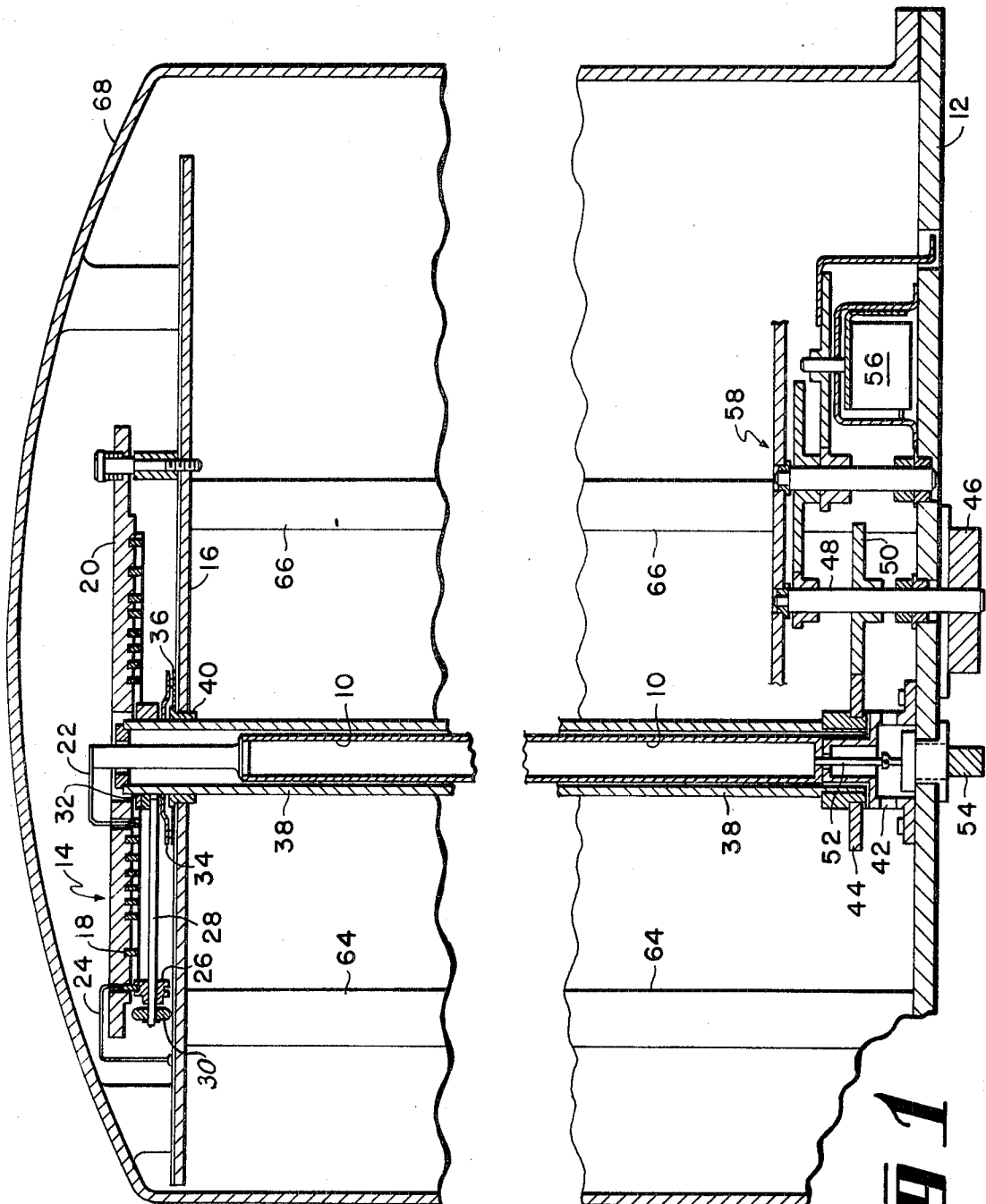
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3,513,473

INDUCTIVELY LOADED CAPACITIVE ANTENNA

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**Fig 1**

**Fig 2**

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**INDUCTIVELY LOADED CAPACITIVE  
ANTENNA**

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5 Claims

**ABSTRACT OF THE DISCLOSURE**

A short vertical post radiator is top-loaded by means of a variable inductance and a capacitance in series. The inductance is a spiral conductor which is adjusted by a roller contact driven on the turns of the spiral conductor. The capacitance is a conductive plate supported above the ground plane of the antenna. The spiral conductor is supported above the capacitance plate.

**SUMMARY OF THE INVENTION**

The antenna provided by this invention represents an advance over other known electrically short antennas. This antenna is of the inductively loaded capacitance type and it provides an efficient, electrically short, low-profile in which the matching capabilities are self-contained over the frequency range of operation. The antenna operates by resonating its center post, using a top-loading series inductance and capacitance. Heavy capacitance top-loading, in the form of a conductive plate plus the inductive spiral, produces a nearly uniform current distribution over the length of the monopole, thereby providing a relatively large radiation resistance and increasing efficiency. The inductor is variable and consists of a spiral supported about the capacitance plate. The variable inductor provides an impedance transformation which simplifies the problem of matching. An additional variable shunt capacitor is also used for impedance matching. The antenna is advantageous over other known electrically short antennas in that it permits efficiencies which are as good or better than antennas of comparable size, and it offers greater freedom of choice in the selection of its configuration or form to adapt it to a particular application, e.g., aircraft, vehicular, etc.

**THE DRAWING**

FIG. 1 is a cross sectional view of a preferred embodiment of this invention; and

FIG. 2 is a schematic representation of the antenna.

Referring to FIG. 1, the antenna comprises a vertical monopole conductor 10 insulatedly supported on a horizontal conductive plate 12 which is a part of the ground plane of the antenna. The monopole conductor 10 is top-loaded by means of a spiral inductor generally indicated at 14 and a capacitance plate 16.

The inductor 14 comprises a spiral conductor 18 embedded in an insulating dielectric plate 20. The inner end of the spiral conductor 18 is connected by means of a wire 22 to the top of the monopole conductor 10, while the outer end is connected by means of a wire 24 to the conducting capacitance plate 16.

The inductor 14 is made variable by means of a roller contact 26 adapted to roll on the turns of the spiral conductor 18 and axially movable on an electrically conductive horizontal rod 28, one end of which is supported above the plate 20 on an insulated roller 30, and the other end of which is carried by a disk 32. An electrical connection from the conductor 18 to the capacitance plate is completed through a spring contact 34 urged against a metal ring 36 conductively bonded to the capacitance plate 16.

The disk 32 is affixed to the upper end of a dielectric drive tube 38 rotatably supported between an insulating bearing 40 in the capacitance plate 16 and a bearing 42 affixed to the ground plane conductive plate 12. The lower end of the drive tube 38 carries a gear 44 driven manually by means of a control knob 46 through a shaft 48 and a gear 50.

The monopole conductor 10 is angularly fixed to the bearing 42 by means of a key or any other conventional arrangement, and an electrical connection is made from the monopole conductor through a wire 52 to an R.F. input connector 54.

As the control knob 46 is rotated, the drive tube is rotated, causing the roller contact 26 to roll on the conductor 18, thereby changing its effective length by shorting out a portion of it. Simultaneously the input impedance to the antenna is matched by driving a variable capacitor 56 through gearing 58. The variable capacitor is connected by means of wires (not shown) between the wire 52 of the monopole conductor 10 and the ground plane conductive plate 12. However, the control knob 46 can be replaced by a servo motor which is controlled by conventional detectors. This offers a technique for automatically tuning this antenna using conventional servo techniques.

The capacitance plate 16 is supported in part by means of dielectric supports 64 and 66 and, in addition, by means of connections to a fairing or cover 68. The capacitance plate 16 supports the dielectric plate 20.

Schematically the antenna may be presented as shown in FIG. 2. R.F. input is applied at the terminal 54 to the monopole conductor 10 which is top-loaded by the inductor 14 connected in series between the capacitor consisting of the capacitance plate 16 and the ground plane conductive plate 12. The resistor R represents the radiation resistance while the inductor L represents the monopole conductor inductance. As the roller contact 26 is moved, upon rotation of the drive tube 38, the length of the conductor 18 shorted on the capacitance plate 16 is varied. The variable capacitor 56 is simultaneously varied.

Electrically the monopole conductor of this antenna is very short, and in a practical case may amount to much less than one-tenth of a wavelength. Under ordinary circumstances there would be a relatively linear current distribution along the conductor 10, i.e., at the top there would be zero current while at a distance down from the top the current would increase as a sinusoidal function. For electrically short radiators this would be essentially a linear increase. By top-loading the monopole conductor with an inductor and capacitor in series, the capacitor comprising the capacitance plate 16 and the conductive plate 12 in the ground plane, I am able to achieve a uniform current distribution throughout the length of the monopole conductor.

It will be apparent to persons skilled in the art that this invention is subject to various modifications and adaptations. It is intended therefore that the scope of the invention be limited only by the appended claims as interpreted in the light of the prior art.

What I claim is:

1. An antenna tunable to a radio frequency comprising: a monopole conductor having a length which is a small fraction of a wavelength at said radio frequency; a conductive plate; means for insulatedly supporting the bottom of said monopole conductor vertically on said conductive plate, said conductive plate comprising the ground plane of said antenna;
- a capacitance plate supported at the top of said monopole conductor, the plane of said capacitance plate being parallel to said ground plane;

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a variable inductor insulatedly supported above said capacitance plate; and

connecting means completing a series connection from said monopole conductor to said inductor and said capacitance plate, said connecting means comprising an electrical connection from said monopole conductor to one end of said inductor, and another electrical connection from the other end of said inductor to said capacitance plate.

2. The invention as defined in claim 1 wherein said variable inductor comprises a spiral conductor mounted on an insulating board;

a roller contact rotatable on said spiral conductor, said roller contact being electrically connected to said capacitance plate.

3. The invention as defined in claim 2, and means for rotating said roller contact on said conductor, said means comprising a hollow dielectric drive tube mounted concentrically with said monopole conductor, said monopole conductor being fixedly positioned within said drive tube, said drive tube being rotatably supported on said conductive plate, said roller contact having a shaft, said shaft being fixedly supported from said drive tube at right angles thereto, said roller contact being longitudinally movable along said shaft.

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4. The invention as defined in claim 3, and an impedance matching variable capacitance connected between the bottom of said monopole conductor and said ground plane.

5. The invention as defined in claim 4, and means for simultaneously rotating said drive tube and varying said variable capacitance.

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