United States Patent

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[54] **FERRITE ROD ANTENNA WITH LONGITUDINALLY SPLIT SLEEVE**
7 Claims, 3 Drawing Figs.

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[56] **References Cited**
UNITED STATES PATENTS
3,267,478 8/1966 Schiefer 343/788
3,453,634 7/1969 Gilbert 343/788

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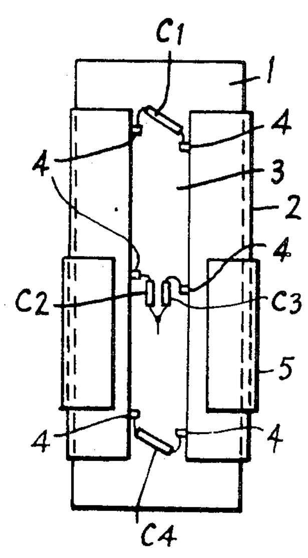
ABSTRACT: This invention relates to aerials comprising a ferrite rod disposed within a longitudinally split sleeve of electrically conducting material and where a substantially uniform capacitance exists or is provided across the split. According to this invention the resonant frequency of the aerial can be adjusted by varying the inductance of the split sleeve disposed around the ferrite rod.



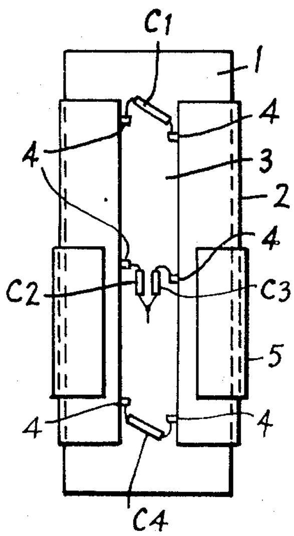


Fig.1

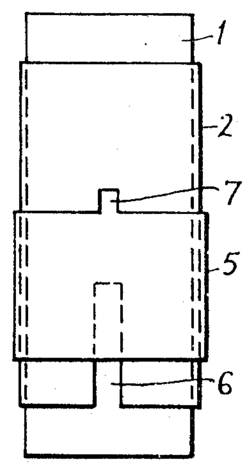


Fig.2

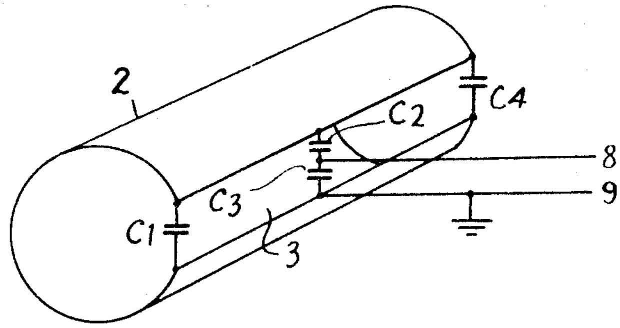


Fig.3

FERRITE ROD ANTENNA WITH LONGITUDINALLY SPLIT SLEEVE

The present invention relates to aerials comprising a ferrite rod and particularly intended for operation in the upper HF, VHF or UHF frequency bands.

The invention is particularly concerned with such aerials in which a ferrite rod is disposed within a longitudinally split sleeve of electrically conducting material and where a substantially uniform capacitance exists or is provided across the split, which in conjunction with the inductance of the sleeve causes the aerial to be resonant at a required operating frequency.

From one aspect the invention provides a magnetic dipole aerial employing a ferrite rod wherein the resonant frequency of the aerial can be adjusted by varying the inductance of a split sleeve of electrically conducting material disposed around said ferrite rod.

From another aspect the invention provides a magnetic dipole aerial comprising a ferrite rod, a longitudinally split sleeve of electrically conducting material disposed around said rod over port of its length, an aperture in said sleeve, and a member of electrically conducting material in contact with the external surface of said sleeve and movable so as to cover or uncover said aperture.

Preferably the aperture is a slot extending longitudinally of the sleeve over part of its length. The member may advantageously be a further sleeve which is axially slidable on the external surface of the split sleeve between positions in which it covers or uncovers the slot.

Advantageously the slot extends for about one-third of the axial length of the split sleeve, and the further sleeve is slightly longer.

The member, such as the further sleeve, may be provided with a projection to facilitate its adjustment relative to the slot or other aperture in the split sleeve.

According to a feature of the invention, substantially uniformly distributed capacitance is provided across the split in the sleeve by connecting capacitor means of effectively equal capacity across the split at spaced points.

According to a further feature of the invention, the coupling to the aerial is effected in a capacitive manner by forming one of the capacitor means connected across the split in the sleeve from at least two serially connected capacitors whose effective capacity is equal to that of the other capacitor means connected across the split and connecting the leads to the aerial across one of the serially connected capacitors. The serially connected capacitors are also of such relative values as to provide a required power match of the aerial to a load.

The invention will now be further described, by way of example, with reference to the accompanying drawings, in which:

FIG. 1 is a plan view of one embodiment of aerial according to one embodiment according to the invention, looking in the direction of the split in the sleeve.

FIG. 2 is a plan view of the aerial of FIG. 1, looking in a diametrically opposite direction, and

FIG. 3 illustrates a method of providing coupling to the aerial of FIG. 1.

FIGS. 1 and 2 show, not to scale, an embodiment of a magnetic dipole aerial intended, for example, for use over a frequency range of approximately 142 to 152 Megacycles. The aerial assembly comprises a ferrite rod 1, embraced for a major part of its length by an electrically conductive cylindrical sleeve 2 having a longitudinal split defining a gap 3 throughout its length. The opposite edges of the gap 3 are capacitively connected to each other by a plurality of capacitors, such as C1, C4 and serially connected capacitors C2 and C3, uniformly distributed over a length of the sleeve 2. The capacitors may be connected directly to the sleeve 2, or, as shown, be attached to lugs 4 formed from turned up projections at the edge of the gap 3. Partially surrounding the cylinder 2, and a sliding fit thereon, is a split electrically conductive sleeve 5 of a length less than one-half the length of the sleeve 2 and slightly greater than a longitudinal slot 6 in the sleeve 2, the length of slot 6 being about one-third of the length of the cylinder 2. As shown the slot 6 is diametrically opposite the gap 3, though its position is not critical. The effect of the slot is to increase the inductance of the sleeve 2. A tab 7, either attached to or formed from the sleeve 5, is utilized to move the sleeve 5 axially, so as to adjust the inductance of the sleeve 2. Minimum inductance is obtained when the slot 6 is completely masked by the sleeve 5 and maximum inductance is obtained with slot 6 completely exposed, i.e. uncovered by the sleeve 5.

To maintain equal distribution of capacitance along the gap 3 in the sleeve 2, all the bridging capacitors should be approximately equal, i.e. the effective capacity of serially connected capacitors C2 and C3 at the center of the gap 3 should be substantially equal to that of the other capacitors bridging the gap. With the size of aerial involved, at the relevant midfrequency of 147 Megacycles it has been found that capacitance provided at three points, i.e. at the center and near each end, is adequate.

The outer surface of the sleeve 2 tends to be electrically 'dead' and a tapping on the inductance of the cylinder is therefore not effective as a coupling means to the aerial. The coupling to the aerial is therefore made capacitive, as illustrated in FIG. 3, which shows the cylindrical sleeve 2, gap 3 and capacitors C1 to C4, with leads 8 and 9 being taken from each terminal of capacitor C3 to form the connections for the aerial. Capacitors C2 and C3 are of such value as not only to provide an effective capacitance equal to that of each of capacitors C1 and C4 but also to provide a substantially optimum power match of the aerial to a load.

Preferably the sleeve 2 and the sleeve 5 are made from a material such as beryllium copper and preformed so that sleeve 2 firmly grips the ferrite rod 1 and the sleeve 5 is a spring fit on the sleeve 2 to give good electrical contact therewith. In order to obtain a high Q factor when using such material, both the sleeve 2 and the sleeve 5 are preferably silver plated.

The sleeve 2 may be locked in position on the ferrite rod 1 by known means, such as a sealing glue, as may the sleeve 5 on the sleeve 2, after adjustment of the sleeve 5 as a trimming operation, e.g. in setting up a receiver operating on a fixed frequency.

In the embodiment described the slot 6 is 0.7 inches long, the cylindrical sleeve 2 is 1.8 inches long and the rod 1 has a length of 2.2 inches. Movement of the sleeve 5 provides about 14 percent change in inductance and a turning range of ±5 Megacycles on a center frequency of 147 Megacycles. The range of adjustment of inductance with slot length is nearly linear, but the mean position lies slightly short of half the slot length from the inner closed end of the slot. For maximum control it is desirable to fit the capacitors C1 and C4 as near to the ends of the sleeve 2 as is possible.

The aerial as described provides the following advantages:

1. Reduced material cost as only one accurately ground ferrite rod is required, whereas previous constructions require two such rods.
2. Easier assembly due to discarding the internal coupling loop, used in prior constructions.
3. Provision of a simple and cheap means of adjustment that requires little space.
4. A mechanically strong assembly as only a single ferrite rod is used with no break at the center and the rod is supported throughout the majority of its length by the conductive split sleeve.

The ability to vary the inductance of the aerial and hence its resonant frequency with little increase in overall size is of particular advantage in small portable radio sets designed to be carried unobtrusively on the person.

Tests on about 170 Megacycles have shown that an aerial as described using a ferrite rod 2.2 inches long and of 0.3 inches diameter is of the order of 16 db. down in performance on a half wave dipole aerial about 36 inches in length. This degradation is offset to some extent in practice by the fact that the high Q of the magnetic aerial enables a tuned circuit employed with a dipole or quarter wave aerial to be dispensed with, so removing the insertion loss of the circuit. Also, due in part to the outer surface of the split sleeve being electrically 'dead' the resonant frequency of the aerial is not materially affected by proximity to an object, such as the human body, as is the case for a half or quarter wave rod aerial. This characteristic is particularly important for radio sets carried on the person.

I claim:

1. A magnetic dipole aerial comprising a ferrite rod, a split sleeve of electrically conducting material disposed around said ferrite rod, an aperture in said sleeve and a member of electrically conducting material movable to cover or uncover said aperture, thereby to vary the inductance of said split sleeve to adjust the resonant frequency of the aerial.

2. A magnetic dipole aerial comprising a ferrite rod, a longitudinally split sleeve of electrically conducting material disposed around said rod over part of its length, an aperture in said sleeve, and a member of electrically conducting material in contact with the external surface of said sleeve and movable so as to cover or uncover said aperture.

3. An aerial as claimed in claim 2, wherein the aperture is a slot extending longitudinally of the sleeve over part of its length.

4. An aerial as claim in claim 2, wherein the member is a further sleeve which is axially slidable on the external surface of the split sleeve between a position in which it covers the aperture and a position in which it uncovers the aperture.

5. An aerial as claimed in claim 2, wherein substantially uniformly distributed capacitance is provided across the split in the sleeve by connecting capacitor means of effectively equal capacity across the split at spaced points along the sleeve.

6. An aerial as claimed in claim 5, wherein the coupling to the aerial is effected in a capacitive manner by forming one of the capacitor means connected across the split in the sleeve from at least two serially connected capacitors whose effective capacity is equal to that of the other capacitor means connected across the split and means connecting the leads to the aerial across one of the serially connected capacitors.

7. An aerial as claimed in claim 2, wherein the split sleeve and the member of electrically conducting material are made of beryllium copper.