United States Patent

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[72] Inventor **John J. Reidy**
105 West Meadow Road, Wilton, Conn. 06897

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[54] FERRITE LOOP ANTENNA FOR VEHICLE MOUNTING

4 Claims, 2 Drawing Figs.

[52] **U.S. Cl.** **343/702,** 343/788, 343/867
[51] **Int. Cl.** **H01q 7/08**
[50] **Field of Search** 343/787, 788, 908, 702, 867

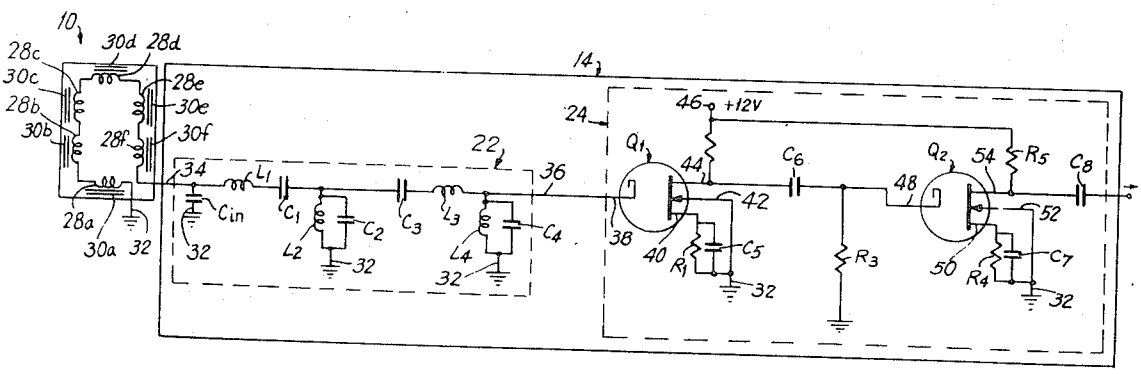
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Primary Examiner—Eli Lieberman
Attorney—Robert I. Pearlman

ABSTRACT: An omnidirectional antenna comprises a radial array of dipoles radially distributed in the horizontal plane over 360°. Each dipole has a coil wound on a ferrite core with the coils being serially connected and wound in mutually aiding electromagnetic relationship. The antenna is supported by an RF amplifier module adaptable to be mounted on a vehicle.



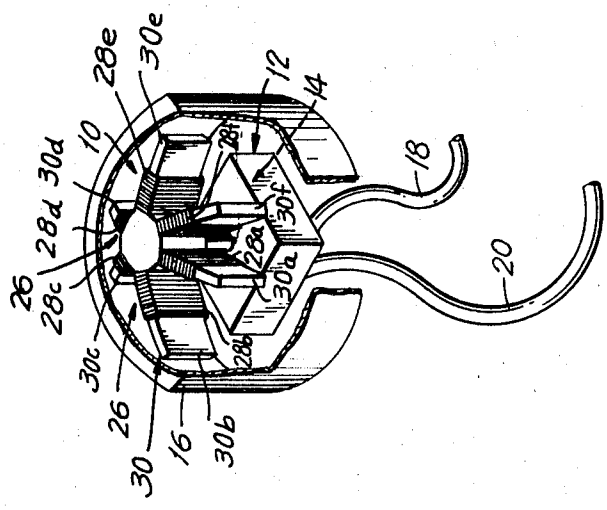


FIG. 1

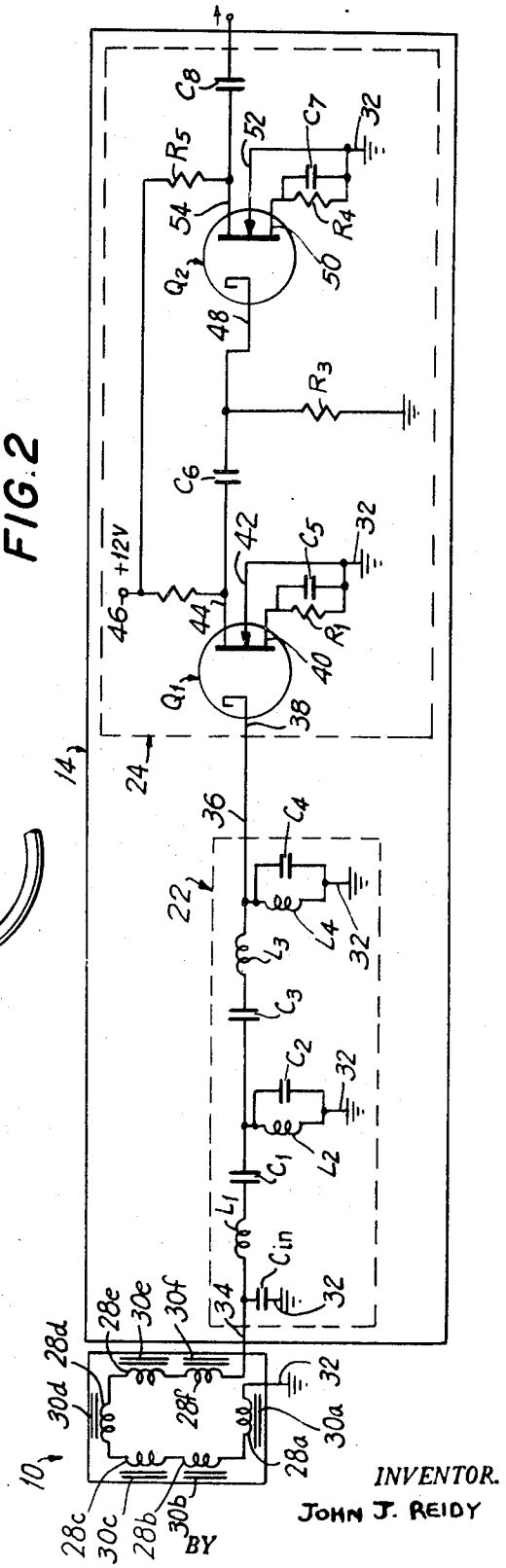


FIG. 2

INVENTOR.
JOHN J. REIDY
BY

FERRITE LOOP ANTENNA FOR VEHICLE MOUNTING

This is a continuation of application Ser. No. 709,258, filed Feb. 29, 1968, now abandoned.

The present invention relates to antenna systems and more particularly to an omnidirectional, unified, mobile antenna system preferably in miniaturized form.

In conventional mobile antenna systems it is customary to locate the receiving antenna on the vehicle exterior, remote from the RF amplifier, mixer, IF, and detector circuits inside the vehicle, to take advantage of height, minimal interference and other atmospheric advantages. Accordingly, it has been found that the radiofrequency transmission lines connecting the receiving antenna to the filter and RF amplifier circuits are significant sources of loss and noise.

The present invention is directed to the provision of an omnidirectional mobile antenna having a sensitivity and efficiency not obtainable with conventional mobile antenna systems. This is achieved by employing a unique radial array of dipoles distributed in the horizontal plane over 360°. Furthermore, each coil of each dipole is electrically connected in series with its adjacent coil, with the coils being wound in mutually aiding electromagnetic relationship. The antenna array is supported by an RF amplifier module adaptable to be mounted on a vehicle.

It is therefore, an object of the present invention to provide an improved, highly sensitive and efficient omnidirectional antenna system.

It is a further object of the present invention to provide a mobile antenna system in accordance with the preceding object, in which the signal output of the antenna is maintained substantially constant with variation in the orientation of the antenna.

The features of the invention which are believed to be novel are set forth with particularity in the appended claims. The invention itself, however, both as to its organization and method of operation, together with further objects and features thereof may best be understood with reference to the following description taken in conjunction with the accompanying drawings wherein:

FIG. 1 is a perspective view drawn substantially to scale, of an antenna system constructed in accordance with the principles of the present invention in one embodiment thereof, with a portion thereof broken away,

FIG. 2 is an electrical schematic diagram of the antenna system of FIG. 1.

Referring to the drawings, and in particular to FIG. 1, there is shown a miniaturized mobile receiving antenna assembly suitable for mounting on the roof of a vehicle for intervehicle mobile radio communication, comprising an upright omnidirectional antenna **10** supported by a chassis **12** housing an RF amplifier module **14**. Chassis **12** is suitably shaped at its lower surface to facilitate the mounting of chassis **12**, supporting antenna **10**, to the roof of a vehicle in a manner sufficiently secure to withstand mechanical vibration and shock during the course of travel of the vehicle. Furthermore, in order to provide protection from the elements of weather, antenna **10** and chassis **12** are enclosed by an inverted cup-shaped plastic shroud **16** which allows substantially unimpeded transmission of radio signals therethrough.

Electrical power for amplifier module **14** may suitably be provided by the vehicle battery (not shown) which is typically 12 volts DC, via input cable **18**. The amplifier signal output from amplifier module **14** is carried from the output of amplifier module **14** to the control panel (not shown), typically located within the vehicle below the dashboard, via output cable **20**, where the amplified signal is heterodyned and the difference between the two frequencies is amplified, detected and then visually or aurally presented.

As shown in FIG. 2, amplifier module **14** which comprises band-pass filter circuit **22** and amplifier circuit **24**, comprise solid-state components possessing the characteristics of ruggedness, reliability and compactness, thereby enabling module **14** to be packaged in chassis **12**, which typically is approximately 1 ×1×½ inches in size, and to be disposed proximately to antenna **10** as shown in FIG. **1**.

Referring to FIg. 1, miniaturized antenna **10**, whose overall dimensions are approximately 1 inch high by 1½ inch wide, is shown to comprise multiple radially arranged dipoles **26** distributed over 360° in the horizontal plane, having equal coil windings **28***a*,—**28***f*, disposed on respective core arms **30***a*,—**30***f* of ferrite core **30**, thereby rendering antenna **10** omnidirectional substantially in horizontal plane. Furthermore, the extremities of coil windings **28***a*,—**28***f* are interconnected in end-to-end series relationship as shown schematically in FIG. **2**, with the magnetic flux of the combination being in mutually aiding, i.e., additive relationship.

Referring to FIG. **2**, one end of coil **28***a* is connected to ground terminal **32**, while the detected signal output of antenna **10** is taken from one end of end coil **28***f* and applied to band-pass filter circuit **22** via conductor **34**. Filter circuit **22** is seen to comprise two L-filter stages, passing frequencies in the commercial broadcast band, i.e., 0.5 to 1.5 megacycles.

It is noted that, since amplifier module **14** is directly connected to coil **28***f* of antenna **10**, the need for a usually required radiofrequency transmission line to couple the output from antenna **10** to the input of band-pass filter circuit **22**, is obviated, thereby achieving a substantial increase in the signal-to-noise ratio and efficiency, otherwise attainable.

Input conductor **34** is connected to the junction of capacitor C*in* connected to ground **32**, and the series arranged of inductor L1 and capacitor C1, with the other end of capacitor C1 being connected to one end of the parallel arrangement of capacitor C2 and L2, while the other end of capacitor C2 and inductor L2 is connected to ground terminal **32**. The second L-filter stage comprises serially connected capacitor C3 and inductor L3 having one end thereof connected to the junction of capacitors C1 and C2 and the other end thereof connected to one end of inductor L4 and capacitor C4 connected in parallel, while the other end of capacitor L4 and capacitor C4 is connected to ground terminal **32**. The output of band-pass filter circuit **22** is taken from the junction of inductors L3 and L4 and applied to RF amplifier circuit **24** via conductor **36**.

Amplifier circuit **24** is a two stage RF amplifier, including first stage N-channel field effect transistor Q_1 whose output is applied to second stage N-channel field effect transistor Q2. The use of field effect transistors in amplifier circuit **24** is particularly advantageous since they have excellent isolation characteristics.

Conductor **36** applies the band-pass filtered RF signal from filter circuit **22** to source electrode **38** of transistor Q1, while the parallel arrangement of resistor R1 and capacitor C5 interconnect drain electrode **40** and ground **32**. Gate electrode **42** is connected directly to ground **32**, while the other drain electrode **44** is connected to bias supply voltage terminal **46** (typically plus 12 volts) via load resistor R2.

The output from first amplification stage transistor Q1 is taken from drain electrode **44** via coupling capacitor C6 and is applied to source electrode **48** of transistor Q2, which is connected to input resistor R3 having the other end thereof connected to ground **32**.

The second amplication stage comprising transistor Q2 is arranged similarly to transistor Q1. Thus, drain electrode **50** is connected to ground **32** via resistor R4 and capacitor C7 in parallel, gate electrode **52** is connected directly to ground **32**, and drain electrode **54** is connected to supply terminal **46** through load resistor R5. The amplified RF signal output is taken from drain electrode **54** via coupling capacitor C8, and thence to the heterodyning circuitry via output cable **20**.

The following circuit constants are illustrative values of the circuit elements of band-pass filter circuit **22** and amplifier circuit **24**, which may be utilized in a receiver system operating in the commercial broadcast band of 0.5 to 1.5 megacycles:

Capacitor C_{in}	19.7 pf.
Inductors L1 & L3	1.28 mh.
Capacitors C1 & C3	26 pf.
Inductor L2	502 μh.
Capacitor C2	64 pf.
Coils **28***a*,—**28***f*	each 0.24 mh.
Transistors Q1 & Q2	type3N139

Resistors R1 & R4	220 ohms
Capacitors C5, C6 & C7	0.01 μf.
Resistors R2 & R5	2.2 K
Resistor R3	100 K
Capacitor C8	1000 μf.

While there has been shown a particular embodiment of the present invention it will be understood that it is not wished to be limited thereto, since modifications can be made both in the circuit arrangement and instrumentalities employed and it is contemplated in the appended claims to cover any such modifications as fall within the true spirit and scope of the invention.

What is claimed is:

1. An antenna system comprising an omnidirectional antenna and amplifier means in circuit with the output of said antenna, said antenna including a horizontally oriented radial array of loop antennas radially emanating from a central point so as to be distributed in the horizontal plane over 360°, said radial loop antenna array comprising a plurality of coils electrically connected in series respectively wound on an equal number of ferrite cores arranged in a radial array from a central point in mutually aiding electromagnetic relationship, said coils having a fixed number of active turns, said amplifier taking the form of an amplifier module which forms a base upon which said antenna having horizontally oriented radial array of loop antennas is positioned.

2. The antenna system of claim 1 which is miniaturized so as to be readily mounted on an automobile.

3. The antenna system of claim 1 wherein said amplifier means includes band-pass filter circuit means in circuit with the output of said antenna and RF amplifier circuit means in circuit with the output of said filter circuit means.

4. An antenna system comprising an omnidirectional antenna and amplifier means in circuit with the output of said antenna, said antenna including a horizontally oriented radial array of loop antennas radially emanating from a central point so as to be distributed in the horizontal plane over 360°, said radial loop antenna array comprising a plurality of coils electrically connected in series respectively wound on an equal number of ferrite cores arranged in radial array from a central point in mutually aiding electromagnetic relationship, said coils having a fixed number of active turns, and wherein said amplifier takes the form of an amplifier module which forms a base upon which said antenna having a horizontally oriented radial array of loop antennas is positioned.

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