Aug. 28, 1962 R. D. MORROW 3,051,903

RADIO ANTENNA

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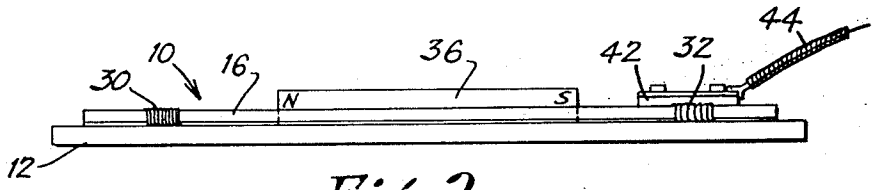


Fig. 2

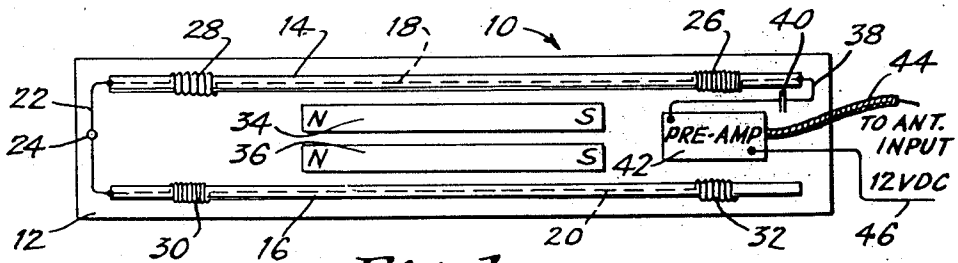


Fig. 1

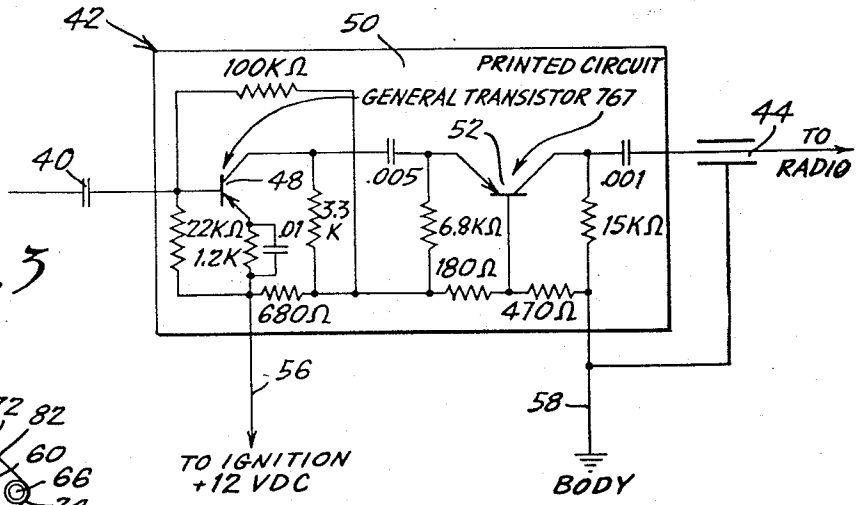


Fig. 3

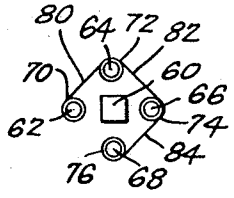


Fig. 4

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RADIO ANTENNA

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This invention relates to radio antennas and more particularly is concerned with a ferrite core type antenna of novel construction particularly suited for use in automobiles.

In order to improve the overall appearance of modern automobiles and to provide optimum wind resistance characteristics at high speeds it is desirable that the automobile radio antenna be completely contained within the outlines of the vehicle. An especially convenient place for a radio antenna is to locate it beneath the automobile, preferably mounted near the bottom of one of the body panels.

However, up to the present time no satisfactory answer has been found to the problem of eliminating the noise fields surrounding any type of antenna located beneath a moving automobile. These noise fields are partly due to the ignition system and partly to the discharges of static fields set up by the action of the rotating wheels. A further type of noise to which the under car antenna is especially prone is the intermittent contact noise caused by poor bonding of the metal portions of the car. An additional disadvantage that had to be overcome was that up to two thirds of the available ground wave was lost during wet weather on reinforced concrete roads. It is for the above reasons that automobile manufacturers discontinued the use of under car aerials some time in the middle 1930's.

The medium frequency radio waves in the broadcast band ranging from 550 to 1600 kc. penetrate the earth's surface to a distance of 50 feet or more depending upon the power output in watts and ground constants. While fairly consistent reception for distances of up to 50 miles and more in conventional whip type antenna receivers resulting largely from the ground wave is possible it is apparent that a substantial extension of this distance is possible by a close to the ground under the car type antenna which eliminates the noise interference described above.

The present invention provides a novel antenna unit of general utility but one that is especially suited for use beneath automotive vehicles. By means of the novel antenna of the present system, the noise fields set up by the ignition system, by the rotating wheels and by the various other metal portions of the car are substantially eliminated. Furthermore, no significance change in receiving properties have been noted with changes in weather or with specific road surfaces. Reception has been equally good during wet weather on reinforced concrete roads as it has been on other road surfaces in clear weather.

It is, therefore, a primary object of the present invention to provide a novel radio receiving antenna.

Another object of the present invention is to provide a radio antenna particularly suited for use beneath a moving automotive vehicle.

Another object of the present invention is to provide a novel antenna substantially increasing the distance of radio signal reception from a particular station.

Another object of the present invention is to provide a radio receiving antenna having substantially increased noise elimination.

These and other objects and advantages of the invention will be more apparent upon reference to the following specification, claims and appended drawings wherein:

FIGURE 1 is a plan view of the novel radio receiving antenna of the present invention.

FIGURE 2 is a side view of the antenna of FIGURE 1.

FIGURE 3 is a circuit diagram for the preamplifier shown in FIGURE 1, and

FIGURE 4 shows a modified embodiment of the antenna of the present invention.

Referring to the drawings, FIGURES 1 and 2 show the novel antenna of the present invention generally indicated at **10** on a mounting board **12** of suitable insulating material such as Bakelite or the like. Extending lengthwise of the mounting board or support are a pair of ferrite rods **14** and **16** preferably but not necessarily of circular cross-section. Surrounding each of the cores are coils **18** and **20**.

The cores **14** and **16** may be made of any of the conventional ferrite material such as Fe_3O_4 or the metal ferrites such as copper ferrite, nickel ferrite, magnesium ferrite, zinc ferrite, cobalt ferrite and cadmium ferrite. Other suitable ferrite materials may also be employed. The coils surrounding the cores **14** and **16** are connected in series by lead **22**. If desired, the lead may be secured to the mounting board by a suitable insulating pin or clamp **24**.

While the coil may extend throughout the length of each core, it has been found to exhibit greatly superior properties if wound, beginning at about 1 and ½ inches from each end of the ferrite rod toward the center of the rod. On the right hand end of the rod **14** as indicated at **26** the coil is preferably tightly wound for a suitable number of turns and in one example for fourteen turns. The wire then extends straight along side of the core to the point indicated at **28** where the coil is loosely wound with a suitable number of turns which in the same example were twenty in number. The series coil on core **16** is similarly wound at **30** with fourteen turns of tightly wound wire and at **32** with approximately twenty turns of loosely wound wire.

Positioned between the cores **14** and **16** are a pair of permanent magnets **34** and **36** adhesively or otherwise suitably secured to the mounting board **12**. The permanent magnets are positioned so that their north poles and corresponding south poles are at adjacent ends of the magnets as shown in FIGURE 1. The output from the series coils is taken by way of lead **38** through a .01 microfarad coupling capacitor **40** to a preamplifier **42**. The preamplifier is connected to the receiver input through shielded lead **44** and to a twelve volt D.C. supply through lead **46**.

FIGURE 3 shows the circuit diagram for the preamplifier **42** wherein the output from the antenna coil is lead through coupling capacitor **40** to the base input of transistor **48**. Transistor **48** is preferably mounted on a printed circuit board **50** as is a second transistor **52** and the associated preamplifier circuitry. The transistors are conventional and by way of example only may be designated as General Transistors 761. The output from the collector of transistor **48** is coupled to the emitter of transistor **52** with the output to the radio taken over the shielded lead **44**. Transistor **48** is preferably self-biased from a 12 volt D.C. supply by way of lead **56**. Ground return is through lead **58** to ground which in automobiles is normally the vehicle body.

FIGURE 4 shows a modified antenna wherein the single magnet **60** is surrounded by four ferrite cores **62**, **64**, **66** and **68**. While four cores are shown any reasonable number such as three, five, six or more may be utilized depending upon the relative sizes of the cores, the magnet, the number of coil turns and other factors.

Surrounding each of the four cores are coils **70**, **72**, **74** and **76**. As in the previous embodiment the coils are all connected in series by the leads **80**, **82** and **84** and are spaced from the magnet.

In one unit constructed in accordance with the present

invention the ferrite cores 14 and 16 have a length of 18 inches and are spaced from each other on 2 and ½ inch centers. The cores are ⅜ of an inch in diameter and wound with number 22 wire. The permanent magnets 34 and 36 are spaced parallel ¼ of an inch apart and are alnico-5 permanent magnets. They are 6 inches long, ¾ of an inch deep and ½ of an inch wide.

Tests were made with this unit in conjunction with a 35 db AVC Delco selectronic car radio, which is standard equipment on most 1956 Buick automobiles. The unit was mounted on a 2¾ inch thick insulator from the chasis and approximately 7 inches from the ground.. The trimmer condenser was set in the radio for optimum performance and the car was tested under all weather conditions including rain, snow, fair, cloudy and the like. The unit exhibited almost level gain characteristics for the medium broadcasting frequencies of from 550 to 1600 kc.

The operation of the above unit at night over long distances and on wet reinforced concrete did not have any noticeable effect on the unit efficiency. Wheel static and poor body joints have absolutely no effect on the efficiency of the unit. While traveling from Pittsburgh, Pennsylvania to Cleveland, Ohio constant radio reception with no noise was obtained up to the very outskirts of Cleveland and maintained with noise but very readable even in the heart of Cleveland, a distance of some 140 miles by road. Even more dramatic results have been obtained while driving in the fairly populated country around Columbus, Ohio, approximately 200 miles from Pittsburgh.

It has been found that varying the distance between the ferrite rods from the 2½ inch center-to-center distance described affects the tuning of the radio receiver. By varying the parameters of the antenna unit it is possible to obtain good broad band reception. For example, units having ferrite rods ranging from 12 to 18 inches in length have been constructed and it is possible to utilize the antenna at high frequencies in the order of 150 megacycles. Furthermore, units have been constructed employing three parallel ferrite rods instead of the two shown In all cases, however, the coils are similarly wound in series and at least one magnet placed between adjacent rods.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiments are therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

What is claimed and desired to be secured by United States Letters Patent is:

1. A radio receiving antenna comprising at least two parallel ferromagnetic cores, a coil wound around each of said cores, each of said coils comprising a tightly wound portion at one end of said cores and a spaced loosely wound portion at the other end of said cores, means connecting said coils in series, and magnetic means positioned between said cores.

2. An antenna according to claim 1 wherein said cores

are four in number and are spaced about a common axis.

3. An antenna according to claim 2 wherein said magnetic means comprises a single permanent magnet with its longitudinal axis coinciding with said common axis.

4. A radio receiving antenna comprising a pair of parallel ferromagnetic rods, a separate helical coil wound about each of said rods, each of said coils comprising a tightly wound portion at one end of said rods and a spaced loosely wound portion at the other end of said rods, means electrically connecting said coils in series with their overlapping magnetic fields adding, and permanent magnet means positioned between said rods.

5. An antenna according to claim 4 wherein said permanent magnet means comprises a pair of parallel permanent magnets with adjacent ends having similar polarity.

6. A radio receiving antenna comprising a pair of parallel ferromagnetic rods, a separate helical coil wound about each of said rods, each of said coils comprising a tighly wound portion at one end of said rods and a spaced loosely wound portion at the other end of said rods, means electrically connecting said coils in series with their overlapping magnetic fields adding, permanent magnet means positioned between said rods and preamplifier means coupling said coils to a radio receiver through a shielded lead.

7. A radio receiving antenna comprising a pair of parallel adjacent ferrite rods, a separate helical coil wound around each of said rods, each of said coils comprising a tightly wound portion at one end of said rods and a spaced loosely wound portion at the other end of said rods, an electrical lead connecting said coils in series with their overlapping magnetic fields reinforcing each other, and a pair of spaced parallel permanent magnets between said rods, said magnets being aligned with adjacent ends of similar polarity.

8. An antenna according to claim 7 wherein said rods are spaced on 2½ inch centers, are ⅜ inch in diameter and are from 12 to 18 inches long and mounted on an insulated board.

9. An antenna according to claim 8 wherein said rods are 18 inches long.

10. An antenna according to claim 9 wherein said permanent magnets are six inches long, ¾ of an inch deep, ½ inch wide and are spaced ¼ of an inch apart about a center line between said rods.

11. An antenna according to claim 10 wherein said coils are wound from number 22 wire.

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