July 7, 1959 G. R. ELLIS 2,894,260

VARIABLE LOADED WHIP ANTENNA

Filed April 15, 1958

Fig. 1.

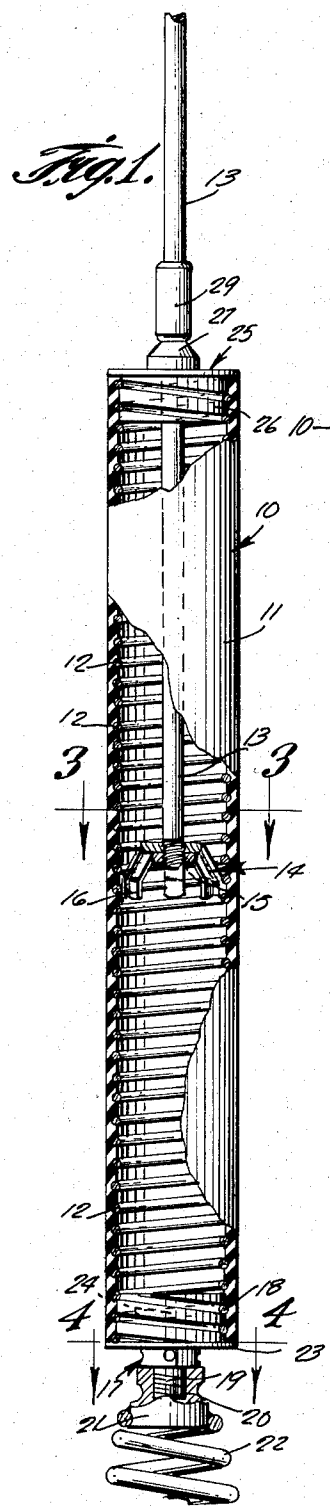


Fig. 2.

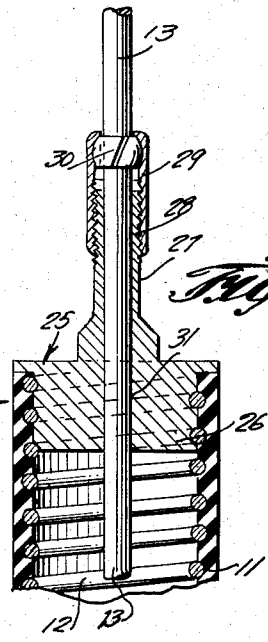


Fig. 3.

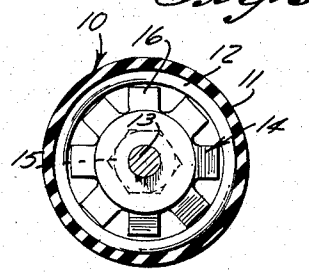


Fig. 4.

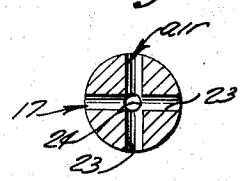
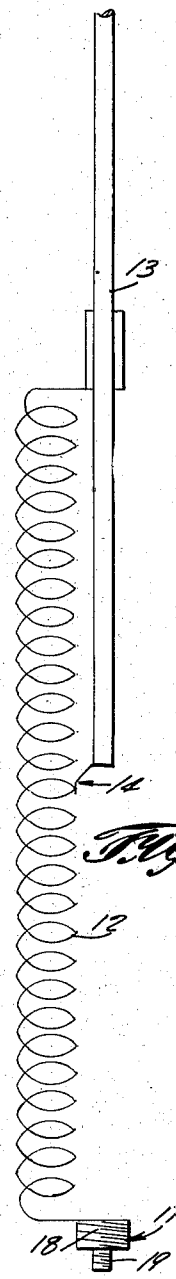


Fig. 5.



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VARIABLE LOADED WHIP ANTENNA

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3 Claims. (Cl. 343—745)

This invention relates to an antenna.

This invention is an improvement over the multiband mobile antenna loading coil shown and described in my prior Patent No. 2,719,920.

The object of the invention is to provide an all band mobile antenna wherein only one loading coil is required to cover a wide range of operating frequencies, and wherein the value of inductance may be adjusted in steps of one turn each.

A further object of the invention is to provide mobile antenna wherein the antenna or radiating system of mobile radio communication equipment can be adjusted to exact resonance at any frequency within the range for which the antenna is designed.

A further fundamental object of the present invention is to provide a mobile antenna which has greater efficiency and more radiated power per watt of input and wherein the antenna is very inexpensive to fabricate or manufacture.

Other objects and advantages of the present invention will be apparent from the following specification taken in conjunction with the accompanying drawings, in which:

Figure 1 is an elevational view of the all band mobile antenna of the present invention, and with parts broken away and in section.

Figure 2 is an enlarged fragmentary elevational view illustrating the upper portion of the antenna, and with parts broken away and in section.

Figure 3 is a sectional view taken on the line 3—3 of Figure 1.

Figure 4 is a sectional view taken on the line 4—4 of Figure 1.

Figure 5 is a view illustrating schematically the wiring diagram for the present invention.

Referring in detail to the drawings, the numeral 10 indicates the device of the present invention which is shown to comprise a tubular form 11 which is fabricated of a suitable material such as a plastic having a good dielectric and high impact characteristic. Arranged within the tubular form 11 is a wire inductance 12, and the inductance 12 is embedded approximately as shown in the drawings so that approximately 60% of the diameter of the wire 12 is embedded in the inside surface of the plastic tube 11. This arrangement forms a weatherproof loading inductance of exceptionally high electrical merit or "Q" and good mechanical strength.

Extending into the tube or form 11 is a whip antenna 13 which has a sliding contact 14 connected to its inner end, and the contact 14 is adapted to be secured on the antenna 13 by means of a nut 15. The contact 14 is provided with fingers 16 which physically and electrically engage the wire inductance 12.

The numeral 17 indicates a metal bottom piece which has a first portion 18 of increased diameter, and the portion 18 is threaded and threadedly engages the lower end of the inductance 12. The bottom piece 17 further includes a stud 19 which is adapted to engage a support

member 21 that has a recess 20 therein, and a spring 22 may be arranged in engagement with the support member 21. As shown in the drawings such as Figure 4, the bottom piece 17 is further provided with air openings or passageways 23 and 24.

As shown in the drawings, there is further provided a metal top piece which is indicated generally by the numeral 25, and the top piece 25 includes a first section 26 which is threaded externally for threaded engagement with the top of the inductance 12. The top piece 25 further embodies an upstanding stem or shank portion 27 which is threaded as at 28, Figure 2. A knurled collar 29 is arranged in threaded engagement with the portion 28 of the stem 27, and a locking ferrule 30 is surrounded by the collar 29.

Thus, according to the present invention it will be seen that there has been provided an all band mobile antenna wherein there is provided a tubular form 11 molded of plastic of good dielectric and high impact characteristics, and the wire inductance 12 has approximately 60% of its diameter embedded in the inside of the plastic member 11 so as to form a weatherproof loading inductance of good electrical merit or "Q" as well as good mechanical strength.

The sliding contact 14 is secured on the whip antenna 13 by means of the nut 15, and the contact 14 makes physical and electrical contact with the exposed surface of the turns of inductance 12.

The metal bottom piece 17 has its larger diameter portion 18 threaded the same as the number of turns per linear inch of the inductance 12, and the bottom piece 17 is screwed into the plastic tubular form 11, so that the exposed portion of the turns of inductance 12 act as female threads. This attaches the bottom piece 17 to the plastic tubular form 11 and also makes electrical contact with the inductance 12. The bottom piece 17 is drilled longitudinally and laterally as at 24 and 23 so as to form a passage or breather holes in order to ventilate the inductance 12. This also serves to insure that the air inside the tubular form 11 is maintained at the same atmospheric pressure as the outside to thereby prevent condensation of moisture inside the inductance 12. The bottom piece 17 is provided with a stud 19 of a suitable diameter and thread to fit a conventional flexible mobile mount. However, in the event center loading of the antenna is desired, the stud may be screwed or threaded into a section of the antenna above the spring mount.

There is further provided a metal top piece 25 which has its large diameter portion or section 26 threaded the same as the number of turns per linear inch of the inductance 12. The metal top piece 25 is threaded into the plastic tubular form 11, using the exposed portion of the turns of the inductance 12 as the female threads. This serves to attach the metal top piece 25 to the plastic tubular form 11 and also serves to make electrical contact with the inductance 12. The metal top piece 25 is drilled longitudinally or provided with a bore as at 31 for the passage of the whip antenna 13.

The knurled locking nut or collar 29 is drilled and tapped to screw onto the small diameter portion 28 of the top piece 25 so as to compress the locking ferrule 30 around the whip antenna 13 in order to hold the whip antenna 13 in any predetermined position.

In Figure 5 there is illustrated diagrammatically the circuit diagram that corresponds to the structure shown in Figure 1.

The operation of the all band mobile antenna of the present invention is as follows. It will be seen that by virtue of its mechanical design, the turns of the inductance 12 between the metal top piece 25 and the sliding contact 14, are short circuited by the whip antenna 13. Thus, with the whip antenna 13 extended to its maximum

length, the sliding contact **14** is at the top of the inductance **12** so as to cause a minimum number of turns to be shorted. In this position the number of unshorted or active turns in the inductance **12** are maximum and the antenna is resonant at the lowest frequency for which it is designed.

As the whip antenna **13** is pushed into the inductance **12**, the number of unshorted or active turns in the inductance **12** diminishes to thereby progressively raise the resonant frequency of the antenna or radiating system. With the whip antenna **13** pushed in so that the sliding contact **14** is at the bottom of the inductance **12**, all the turns of the inductance **12** are shorted and the antenna or radiating system is resonant as an odd quarter wave antenna at its highest frequency as determined by the physical length of the whip antenna **13**. In view of the fact that the value of the loading inductance **12** may be changed or adjusted one turn at a time, this permits the antenna or radiating system to be tuned to exact resonance at any frequency within the high and low frequency limits for which the antenna is designed. Thus, it will be seen that there has been provided a method of using the antenna or radiator itself as the shorting switch.

Thus, it will be seen that there has been provided a mobile antenna whereby the antenna or radiating system of mobile radio communication equipment can be adjusted to exact resonance at any frequency within the range for which the antenna is designed.

Some of the advantages of the present invention are as follows. Only one loading coil is required to cover a wide range of operating frequencies. The value of the inductance may be adjusted in steps of one turn each. Exact tuning to resonance is possible at any frequency within the designed range. Furthermore, there will be elimination of burned or damaged switch contacts since switching is accomplished at the low current portion of the coil. There will also be higher electrical merit or "Q" of loading inductance and there will be greater efficiency through elimination of losses due to long leads from desired turn to shorting switch. Furthermore, there will be more radiated power per watt of input since very critical tuning adjustments are possible for each operating frequency. Furthermore, there will be more radiated power per watt of input since the loading coil is in free space as the antenna or radiator, and the device is very inexpensive to manufacture.

In the present invention the method of switching or adjusting to resonance is the same as that shown in my prior Patent No. 2,719,920, but as previously stated, the present invention represents an improved version of the multiband mobile antenna loading coil set forth in my prior patent.

Minor changes in shape, size and rearrangement of details coming within the field of invention claimed may be resorted to in actual practice, if desired.

I claim:

1. In a device of the character described, a tubular form, a coil of wire arranged in said tubular form and providing an inductance, a whip antenna extending into the tubular form, a sliding contact connected to the inner end of the antenna and said contact engaging the exposed surface of the inductance, a metal bottom piece having a first threaded portion threadedly engaging the lower end of the inductance, there being air openings in said bottom piece, said bottom piece being provided with a stud of reduced diameter for engagement with a mount, a metal top piece having a first section threadedly engaging the upper portion of the inductance, there being a central bore in said top piece for the projection therethrough of the antenna, said top piece further including an upstanding stem which is threaded externally, a knurled collar engaging said threaded stem, and a locking ferrule positioned within said collar.

2. The structure as defined in claim 1, wherein said tubular form is fabricated of plastic material having a good dielectric and high impact characteristic.

3. In a device of the character described, a tubular form, a coil of wire arranged in said tubular form and providing an inductance, a whip antenna extending into the tubular form, a sliding contact connected to the inner end of the antenna and said contact engaging the exposed surface of the inductance, a metal bottom piece having a first threaded portion threadedly engaging the lower end of the inductance, there being air openings in said bottom piece, said bottom piece being provided with a stud of reduced diameter for engagement with a mount, a metal top piece having a first section threadedly engaging the upper portion of the inductance, there being a central bore in said top piece for the projection therethrough of the antenna, said top piece further including an upstanding stem which is threaded externally, a knurled collar engaging said threaded stem, and a locking ferrule positioned within said collar, said tubular form being fabricated of plastic which has a high impact characteristic and good dielectric properties, the wire inductance having approximately 60% of its diameter embedded in the tubular form.

References Cited in the file of this patent

UNITED STATES PATENTS

719,005	Hogg	Jan. 27, 1903
2,839,752	Webster	June 17, 1958