Jan. 6, 1953 J. A. NELSON ET AL 2,624,844

BROAD BAND ANTENNA

Filed March 4, 1946

FIG. 1

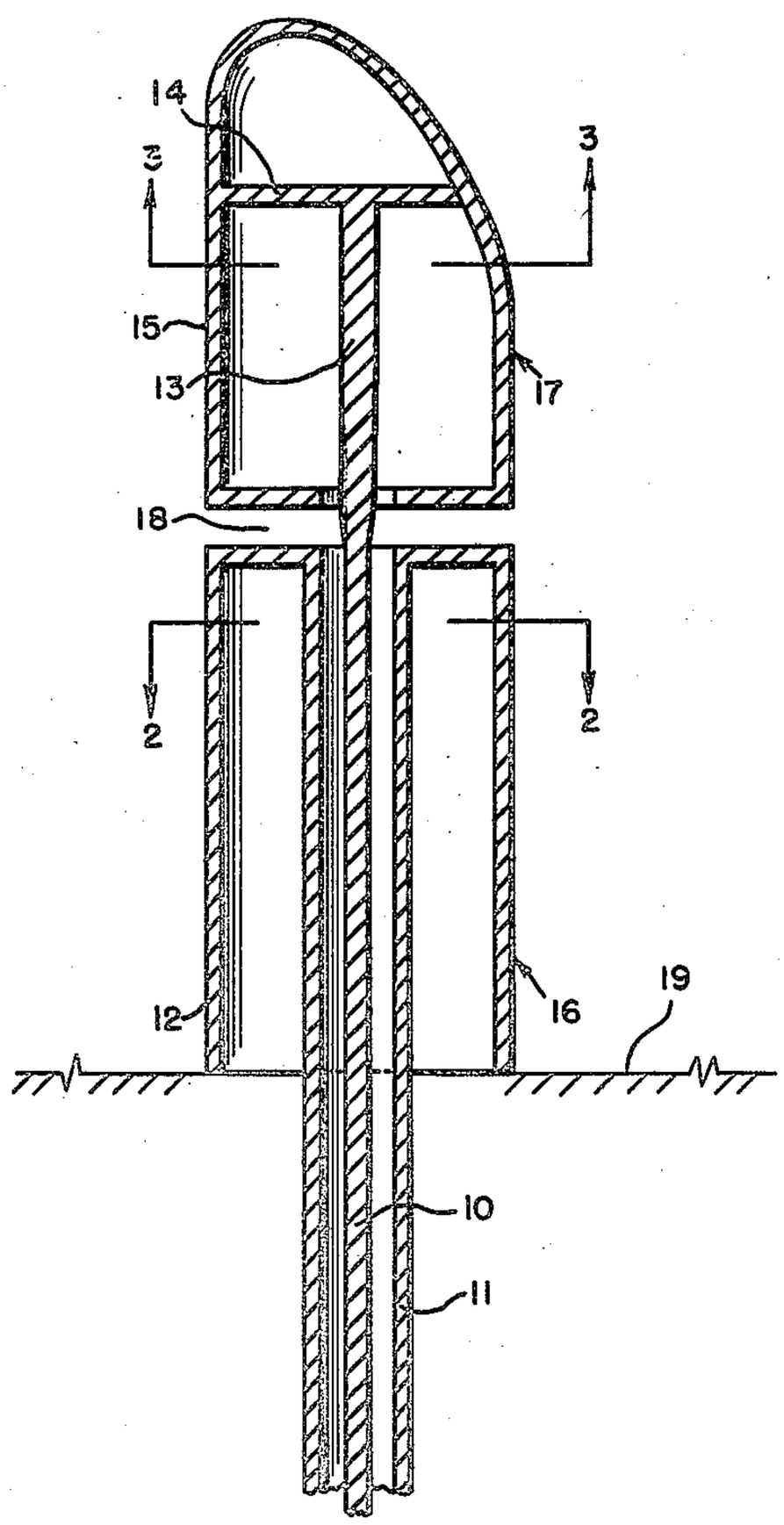


FIG. 3

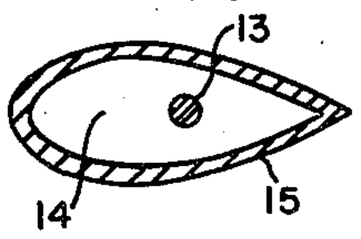
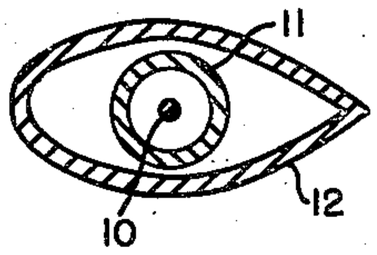


FIG. 2



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BROAD BAND ANTENNA

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10 Claims. (Cl. 250—33)

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This invention relates generally to electrical apparatus and more particularly to a broad band sleeved stub antenna.

The conventional quarter-wave stub antenna utilizing a grounded sleeve is a relatively narrow band antenna, since the large impedance variations of the antenna with respect to frequency cause impedance mismatches resulting in standing waves on the feeder line.

It is an object of the present invention to provide a stub antenna which will operate effectively over a wide range of frequencies.

More specifically, it is an object of the present invention to provide a broad band sleeved stub antenna whose impedance is relatively constant over a wide range of operating frequencies, thereby preventing standing waves resulting from impedance mismatches.

An antenna having these characteristics is obtained by using a sleeved stub and by impedance compensation introduced by series inductance and lumped capacitance of elements forming a part of the antenna.

Other objects, features and advantages of this invention will suggest themselves to those skilled in the art and will become apparent from the following description of the invention taken in connection with the accompanying drawing in which:

Fig. 1 is a cross-sectional view of an antenna embodying the principles of this invention;

Fig. 2 is a sectional view of Fig. 1 taken at 2—2; and

Fig. 3 is a sectional view of Fig. 1 taken at 3—3.

Referring now to Fig. 1, a broad band, sleeved stub antenna is shown. A coaxial transmission line having an inner conductor 10 and an outer conductor 11 has about it a sleeve 12, connected to a ground plane 19, and where the outer conductor 11 terminates, this outer conductor 11 is made integral with sleeve 12.

Inner conductor 10 is connected to a stub 13 which is of a different diameter, and the transition from inner conductor 10 to stub 13 is accomplished by a short taper. Stub 13 terminates in a baffle 14 which joins stub 13 to a sheath 15.

The antenna may be physically divided into two major portions, sleeved portion 16 and sheathed portion 17. The outside surface of these two portions form the radiating elements and each of elements 16 and 17 is approximately an eighth-wavelength long corresponding to the low point of the operating frequency band.

Fig. 2 shows in cross-section the location of sleeve 12 with respect to inner conductor 10 and outer conductor 11, and Fig. 3 shows in cross-section the location of stub 13 within sheath 15.

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The device shown in the drawing is a broad band sleeved stub antenna particularly adapted for use in aircraft, employing lumped capacitance and a series inductance such that the impedance compensation introduced by this series inductance and lumped capacitance makes possible a lower standing wave ratio over a wider frequency band than it is possible to obtain without the use of such impedance compensation.

The feed-point impedance of this antenna is determined by the relative lengths and the diametrical dimensions of the two major portions, sleeved portion 16 and sheathed portion 17. The value of series inductance inserted in the antenna system is determined by the diameter and length of stub 13 and by the position of baffle 14 in sheath 15. The lumped capacitance associated with this antenna is a function of the separation of sleeved portion 16 and sheathed portion 17 and the surface area of the parallel plates at that place. The place at which this capacitive action occurs is generally designated by the number 18.

Thus it is seen that in a sleeved stub antenna, constructed substantially as described, the series inductance built into the sheathed portion and the lumped capacitance existing between the ends of the sleeve portion and the sheathed stub portion are so adjusted that the feed-point impedance resulting from the combination of the impedance of the antenna radiating surfaces and the reactance of the series inductance and the lumped capacitance is relatively constant over a wide range of operating frequencies, thereby permitting the operation of the antenna over a wide range of frequencies.

While there has been here described one embodiment of the present invention, it will be manifest to those skilled in the art that various changes and modifications may be made therein. It is therefore aimed in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of the invention.

What is claimed is:

1. A broad band sleeved stub antenna comprising a coaxial transmission line having an inner conductor and an outer conductor, a grounded sleeve about and connected to said outer conductor at one end, an extension of said inner conductor of said coaxial transmission line beyond said one end of said outer conductor, a baffle connected to said extension of said inner conductor, and a sheath connected to said baffle, said sheath inclosing

said baffle and said extension of said inner conductor, the outer surfaces of said sheath and sleeve providing antenna radiating surfaces, portions of said sleeve being adjacent and parallel to portions of said sheath to provide lumped capacitance, said baffle and said extension of said inner conductor and said sheath being dimensioned to provide series inductance in combination with the impedance of the antenna radiating surfaces and said capacitance to cause the impedance of said antenna to remain substantially constant over the entire operating frequency band.

2. A broad band sleeved stub antenna comprising a coaxial transmission line having an inner conductor and an outer conductor, a grounded sleeve about and connected to one end of said outer conductor, a sheathed stub including an inner conductor and an outer conductor, said inner conductor of said sheathed stub being connected to said inner conductor of said transmission line, said sleeve and said outer conductor of said sheathed stub having adjacent and parallel portions providing a capacitance that compensates for the change in impedance of said antenna with operating frequency.

3. A broad band antenna comprising a coaxial transmission line having an inner conductor and an outer conductor, a sleeve about and connected to said outer conductor for providing one radiating surface, an extension of said inner conductor, a sheath about said extension for providing a second radiating surface, said sheath and sleeve being mounted adjacent one another to provide capacitive coupling therebetween, said sheath and said extension being dimensioned to provide an inductance in series with the capacitance of said coupling and the impedance of said transmission line.

4. The antenna of claim 3, wherein said sleeve and said sheath have a length that is substantially one-eighth of a wavelength at the operating frequency of said antenna.

5. The antenna of claim 1, wherein said inner conductor and its extension have different diameters and are joined by a tapered conductor.

6. An antenna having a broad band frequency response, comprising a coaxial transmission line

having an inner and an outer conductor, a sleeve having one end grounded and its other end connected to said outer conductor, said sleeve being axially disposed about said coaxial line, a stub conductor having one end connected to said inner conductor to form an extension thereof, and a sheath axially disposed about said stub conductor and having one short circuited end, the other end thereof being parallel to said other end of said sleeve to form a capacitor therewith, said stub conductor and sheath being so dimensioned as to form an inductance which together with said capacitor will cause said antenna to have a substantially constant impedance over the frequency band of said antenna.

7. The antenna of claim 6, further including a baffle connecting the other end of said stub conductor to said sheath.

8. The antenna of claim 7, wherein said stub conductor and said inner conductor have different diameters and are interconnected by a tapered conductor.

9. The antenna of claim 8, wherein said sheath and said sleeve respectively have lengths of substantially one-eighth of a wavelength at the antenna operating frequency.

10. The antenna of claim 9, wherein said sheath and said sleeve have a teardrop, cross-sectional outline.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,096,782	Brown	Oct. 26, 1937
2,184,729	Bailey	Dec. 26, 1939
2,235,506	Schelkunoff	Mar. 18, 1941
2,239,909	Buschbeck	Apr. 29, 1941
2,267,951	Roosenstein	Dec. 30, 1941
2,479,227	Gilbert	Aug. 16, 1949
2,480,172	Willoughby	Aug. 30, 1949
2,533,073	Woodward Jr.	Dec. 5, 1950