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[54] **PROXIMITY FUZE MICROSTRIP ANTENNA**
4 Claims, 4 Drawing Figs.

[52] U.S. Cl..... **343/705,**
343/846, 343/833, 343/873

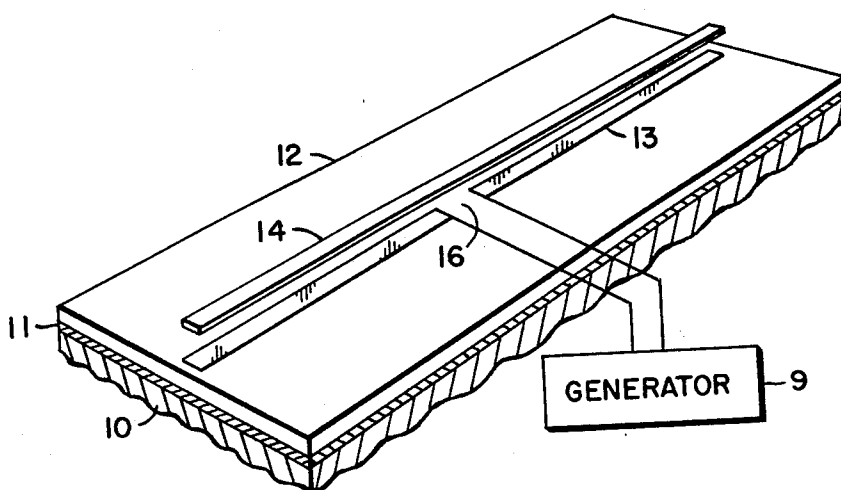
[51] Int. Cl..... **H01q 1/28**

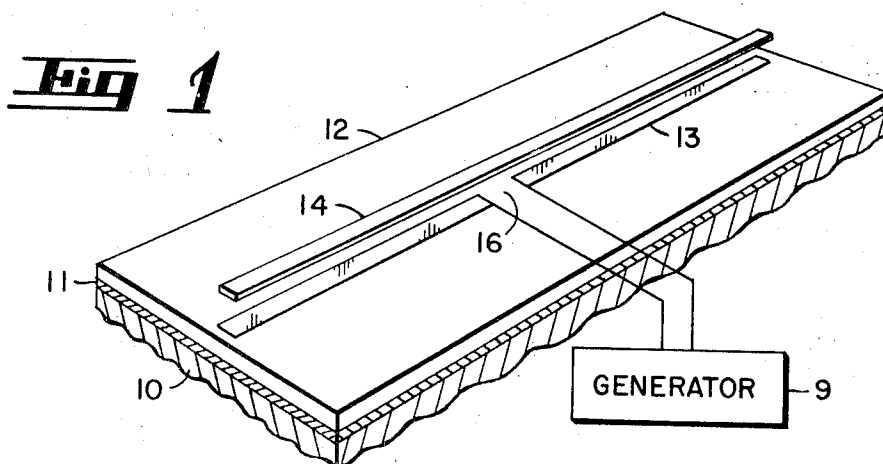
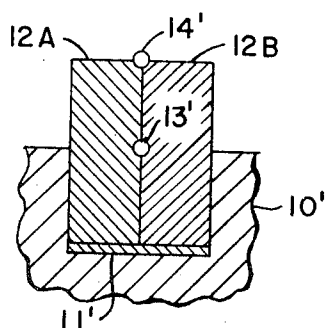
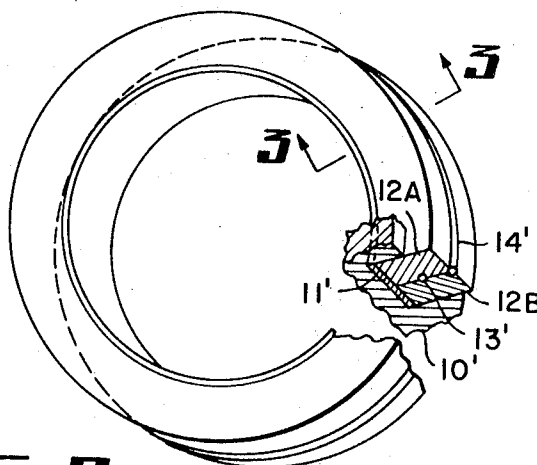
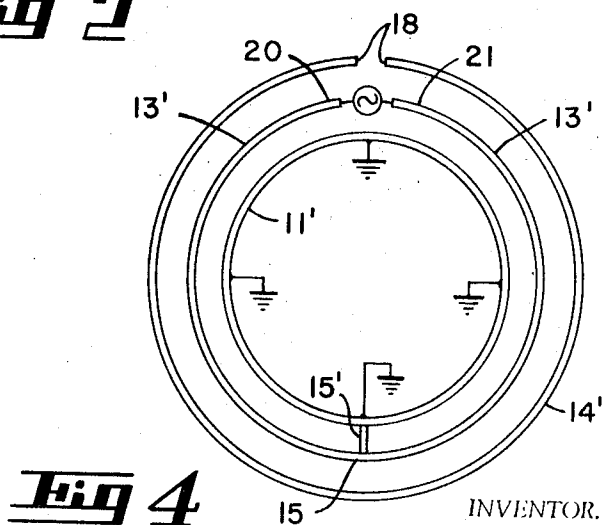
[50] Field of Search..... **343/705,**
708, 732, 741, 809, 818, 833, 845, 846, 847, 848,
866, 873, 785; 333/84 (M)

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ABSTRACT: An energy radiator for use in small projectiles is disclosed. Effective wave propagation is achieved from the radiator by propagating energy along two conductors, one of which is placed above the other as a parasitical element in which the voltage node is displaced approximately 0° with respect to the voltage node of the first conductor.





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PROXIMITY FUZE MICROSTRIP ANTENNA

BACKGROUND OF THE INVENTION

The prior art contains several types of antennas or radiators for use with missiles and the like. Examples are: the slot antenna, disclosed in U.S. Pat. No. 3,296,616, issued to John A. Kuecken on Jan. 3, 1967; the folded slot antenna, disclosed in U.S. Pat. No. 3,394,373, issued to Stephen L. Makrancy on Jul. 23, 1968; and the circular antenna, disclosed in U.S. Pat. No. 3,074,063, issued to Claude W. Horton on Jan. 15, 1963. The objective of various antenna approaches for this usage is to provide an adequately efficient radiator which is extremely small and compact and of such configuration as not unduly to interfere with the exterior ballistics of the missile involved. The radiation pattern is preferably omnidirectional and "dough nut" like in character, to provide uniform performance regardless of the rotational position of the missile.

SUMMARY OF THE INVENTION

This invention provides an energy radiator which has particular utility in a proximity fuze. In one preferred form, the radiator comprises a first conductor arranged so that an imperfect ground plane (hereinafter called "ground plane") for the conductor embraces the missile and the conductor is in a coaxial relation to the ground plane and disposed radially slightly outwardly thereof. A second conductor constitutes a parasitic element and is disposed radially slightly outwardly of the first conductor. The voltage node of the parasitic element is electrically approximately 0° displaced with respect to the voltage node of the first-mentioned conductor and the radiator is excited in a balanced mode with respect to the ground plane and the first-mentioned conductor in such a manner that the first conductor and the parasitic element are excited in aiding phase relationship.

The present invention constitutes a novel approach in energy radiators and particularly in its utilization of readily available components and its facility of manufacture.

A primary object of the invention is to achieve radio frequency radiation from two conductors which are placed closely together and close to the ground plane.

Another object of the invention is to provide a radiator which is not directly affected in its electrical performance by the configuration of the munition body in which the radiator is installed.

A further object of the invention is to provide a radiator which is made up primarily by the usage of a readily available type of transmission line component.

For a better understanding of the invention together with further objects, advantages, and capabilities thereof, reference is made to the following description of the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings:

FIG. 1 is a perspective view of one form of the invention, in a linear configuration;

FIG. 2 is a perspective view, partially cut away, of second embodiment of the invention;

FIG. 3 is a sectional view taken along line 3-3 of FIG. 2, looking in the direction of the arrows; and

FIG. 4 is a schematic plan view of the embodiment of the invention of FIG. 2.

DETAILED DESCRIPTION OF THE INVENTION

Referring first to FIG. 1, there is shown a radiator of high frequency energy comprising a simple piece of MICROSTRIP to which has been added a half-wave parasitic element. The expression MICROSTRIP as herein used has reference to the type of transmission line disclosed in an article entitled "MICROSTRIP Plus Equations Adds up to Fast Designs," Electronics, Oct. 2, 1967 (New York: McGraw-Hill), pp. 109-112. The MICROSTRIP line is a half-wave-length line made

up of a ground plane 11, dielectric 12, and a flat conductor 13, hereinafter variously referred to as the first conductor or the inner conductor. The ends of the conductor 13 are radio frequency open circuits. The MICROSTRIP is mounted in any suitable object 10, such as a projectile, where 10 and 11 may be one and the same. Spaced from the conductor 13 is a one-half-wave length parasitic conductor 14, hereinafter sometimes referred to as the outer conductor or second conductor. The outer conductor is a radio frequency open circuit at both ends. The broken-away section 16 of first conductor 13 constitutes a balanced driving point. A radiation generator 9, such as an oscillating transistor supplies the input feed of radio frequency energy at this point.

This embodiment of the invention consists simply of a half-wave MICROSTRIP line (equivalent of a half-wave open circuited line) plus a half-wave open circuited parasitic line. Voltage nodes exist in the vicinity of the centers of both conductors as far as all lines are concerned. Radiation is achieved by reason of co-phasal, i.e., aiding or in-phase, electrical excitation of the lines and radio frequency losses in the ground plane.

Antennas achieve radiated energy by reason of an unbalance of currents. In accordance with the invention, a MICROSTRIP transmission line is slightly modified by the provision of the parasitic element and the modified form is made to radiate energy by exciting the elements 13 and 14 in aiding fashion. The unbalanced current is obtained due to the imperfect ground plane. The structure illustrated in FIG. 1 comprises essentially a half-wave MICROSTRIP line (which is the equivalent of a half-wave open circuited line) plus a parasitically fed one half-wave open circuited line. Since the current coupling is stronger than the voltage coupling between the two lines 13 and 14, the excitation is aiding or cophasal in time.

Those versed in the art are aware that the requirement that an antenna must operate very close to a ground plane, or that it have a very limited depth, constitutes a rigorous design constraint. The use of MICROSTRIP and the parasitic element in accordance with the invention, meets this requirement in a very simple manner.

Reference is now made to a preferred form of the invention as illustrated in FIGS. 2, 3 and 4 in which similar elements having the same function as in the FIG. 1 embodiment are numbered the same with a prime mark added. The MICROSTRIP element there shown is in a circular configuration and it comprises the ground plane 11' and the first conductor 13'. Again, note that in this embodiment the element or second conductor 14' is a half-wave element. Note further that the voltage maximum point 18 of the element 14' is electrically 180° angularly displaced from the voltage nodal point 15 of the split half-wave line 13'. The nodal point of the half-wave dipole 13' is connected to the ground 11' by means of the shorting bar 15'. The dipole 13' is energized by voltage connected to the high impedance points 20 and 21. The voltages applied to 20 and 21 are 180° out of phase.

The antenna illustrated in FIG. 2 includes the dielectric elements 12A and 12B. The bomblet or missile 10' is grooved and the antenna in accordance with FIG. 2 is simply wrapped around the bomblet, the ground plane element 11' of the MICROSTRIP being in contact with the metallic body of the bomblet 10'. Therefore, 10' and 11' are one and the same.

In the FIG. 2 embodiment the outer conductor 14' may be spaced 0.100 inch from the body of the bomblet, to provide an illustration. That is to say, a spacing of the outermost surface of the antenna from the body of the bomblet may be on the order of 1/100 of a wave length.

While present exemplary embodiments of this invention have been illustrated and described, it will be recognized that this invention may be otherwise variously embodied and practiced by those skilled in the art.

I claim:

1. radiator of particular utility in a proximity fuze comprising, in combination:

a half-wave line of the type comprising a unitary assembly of a lossy ground plane and a dielectric mounting and a first conductor imbedded in the dielectric;

and a parasitic element comprising a second conductor closely spaced outwardly from said first conductor by an amount on the order of 1/100 of the wave length of the energy to be radiated, said line and second conductor being so proportioned and disposed that high frequency energy applied to a feed point on said first conductor electrically excites the first conductor and the parasitic element in the same phase relationship; and means for applying high frequency energy to said feed point.

2. The combination in accordance with claim 1 in which the second conductor is a parasitic half-wave element and in which both ends of said parasitic element are open circuited, whereby the combination comprises essentially two open-circuited half-wave lines.

3. The combination in accordance with claim 1 in which the line is arranged in a first circular configuration, in which the

second conductor is a half-wave element arranged in a circular configuration of slightly larger diameter than the first configuration, and in which the boundary conditions at the ends of both lines and the feed point are arranged such that the voltage nodes of the first conductor and second conductor are electrically displaced by 0°; and means for electrically connecting the midpoint of the first conductor to said ground plane.

4. A radiator comprising, in combination:

a resonant line of the type comprising a unitary assembly of a conductive ground plane and a dielectric mounting and a first conductor imbedded in the dielectric; and

a parasitic comprising a second resonant line closely spaced outwardly from said first conductor and carried by said dielectric, said first line being arranged in a circular configuration and said parasitic element being concentric thereto, said first-mentioned resonant line and said parasitic element being spaced by an amount of the order of 1/100 of the wave length of the energy to be radiated.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,573,831 Dated April 6, 1971

Inventor(s) Gary L. Forbes

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 1, line 7, "stephen" should be -- Stephen --.

line 15, "dough nut" should be -- dough-nut --.

line 26, "os" should be -- of --.

Column 2, line 32, "parasticly" should be --parasitically --

line 34, "cophasal" should be -- co-phasal --.

line 74, insert -- A -- after "1." and before
"radiator".

Column 4, line 13, insert -- element -- after "parasitic" an
before "comprising".

Signed and sealed this 24th day of August 1971.

(SEAL)
Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

WILLIAM E. SCHUYLER, JR.
Commissioner of Patents