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GRID-COUPLED OSCILLATOR FOR PROXIMITY FUZE USE

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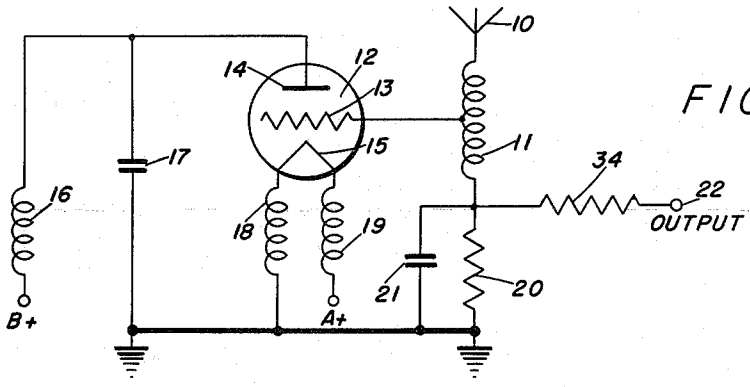

FIG. 1

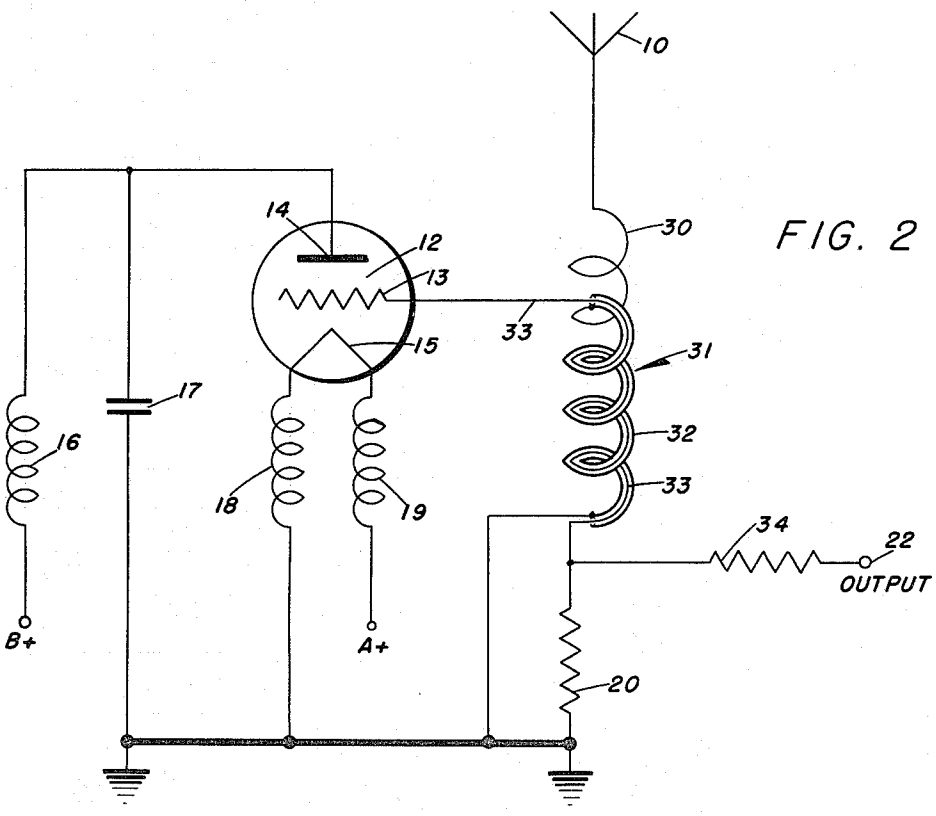

FIG. 2

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GRID-COUPLED OSCILLATOR FOR PROXIMITY FUZE USE

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7 Claims. (Cl. 343—7)

The present invention relates generally to radio proximity fuzes and more particularly to an improved oscillator.

In the operation of proximity fuzes it has been found desirable to use a so-called grid coupled oscillator because it permits greatly increased power output and better stability. However, heretofore known grid coupled oscillator circuits have in general possessed the characteristic of high impedance from antenna to ground, with the result that static charges, built up on the antenna by passage of a fuze through rain, fog, dust, or the like, have produced voltage impulses which have caused premature detonation of the fuze. Obviously, these "weather effects" can be rendered innocuous by providing a very low impedance to ground from any part of the fuze which might collect static charges.

The grid coupling system of the present invention eliminates this high resistance condition by inductively coupling the oscillator tube and tank circuit by means of a construction utilizing a coaxial cable as at least a portion of said tank circuit.

The coaxial cable serves to couple the tube to the tank coil, and coupling is accomplished by connecting one conductor of the coaxial cable directly between antenna and ground while the alternate conductor of the coaxial cable is connected between the grid of the tube and the output terminal of the oscillator. The coaxial cable thus provides both windings of an inductive coupling and the capacitance between the conductors provides the grid capacity to ground.

It is accordingly an object of this invention to provide a grid-coupled oscillator having low impedances to ground.

A further object of the invention is to provide an inductive grid coupling utilizing a coaxial cable as the inductive element.

It is another object of this invention to provide an oscillator system having low potentials to ground.

Other objects and many of the attendant advantages of this invention will be readily appreciated as the same becomes understood by reference to the following detailed description when considered in connection with the accompanying drawings wherein;

Fig. 1 is a diagrammatic illustration of one of the heretofore known grid-coupled systems, and

Fig. 2 is a similar view showing a grid-coupled system embodying the present invention.

The known oscillator system of Fig. 1 comprises an antenna 10 which, in the case of a proximity fuze, is usually a cap on the forward end of the projectile, and the antenna 10 is connected to ground by an impedance-capacity helix usually known as a tank coil 11. A vacuum tube 12 has a grid electrode 13 coupled to the tank coil 11 while potential is applied between the plate 14 and cathode 15 of the tube 12 from a suitable direct current source through a radio frequency choke 16. Preferably, a suitable by-pass capacitor 17 is connected across

the source of potential, and the cathode 15 is preferably provided with radio frequency chokes 18 and 19 to prevent by-passing of the antenna circuit.

In the heretofore known circuit, as shown in Fig. 1, the grid 13 is directly connected to the single conductor of the tank coil 11 and the tank coil 11 is separated from ground by a resistance 20 having sufficient impedance to provide a grid-leak resistance. The grid capacity to ground is provided preferably by connecting directly to the ground terminal of the tank coil 11 with a suitable capacitor 21.

The output terminal 22 is directly connected to the tank coil 11 and so is subject to the weather effects on the antenna 10 and tank coil 11. Because of the high impedance between the tank coil 11 and the ground, static charges tend to build up on the antenna 10 or the coil 11, and the discharge across the ground impedance 20—21 produces transient disturbances which are reflected in the oscillator tube 12 and tank coil 11 and may be supplied to the output terminal 22 where they will be picked up by the amplifier (not shown) and may cause improper or premature operation of the ignition circuit (not shown).

The present invention, shown in Fig. 2, eliminates these disturbances by constructing at least a portion of a tank coil 30 of a strand of coaxial cable 31, to define an inductive coupler, comprising at least two conductors 32—33. One of the conductors of the coaxial cable 31, preferably the exterior conductor 32, is directly connected between the antenna 10 and the ground, and the ground connections are firmly made so that substantially the only impedance to the flow of currents induced by "weather effects" is the impedance of the conductor 32 itself.

The grid 13 of the oscillator tube 12 is connected directly to the other, preferably the innermost, conductor 33 of the coaxial cable 31, while the low potential end of the conductor 33 is connected through a resistor 34 to the output terminal 22 of the oscillator and is separated from ground only by the grid-leak impedance 20. Preferably the coaxial cable 31, while of relatively small size, is selected to provide sufficient capacitance between the coaxial conductors 32 and 33 to provide the grid capacity to ground. This arrangement has the advantage not only of a low impedance from antenna 10 or other portions of the tank coil 30 to ground, but also completely separates the grid circuit from the antenna circuit so that the coupling is completely inductive.

Furthermore, the output potential is separated from ground potential only by the impedance of the grid leak 20 so that there is no high potential to be insulated against in the oscillator system. This simplified system not only eliminates any unnecessary elements or components in the system, but provides all of the operating essentials with a minimum of mechanical components and electrical connections, so that there is an increased overall efficiency because of the lack of possible leakage points in the circuit.

While in this description certain connections have been referred to as being made to ground, it is to be clearly understood that an actual ground connection would not be made, the ground connection being merely a reference point of zero signal potential.

Obviously many modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

What is claimed is:

1. In an oscillator for a proximity fuze, a coupling circuit including a tank coil composed of a conductor of a coaxial cable, one end of said conductor being con-

nected to an antenna and the other end to ground, an output terminal, an oscillator tube having a grid, a coupling coil connected between said grid and said output terminal, said coupling coil being constituted by another conductor of said cable.

2. A coupling circuit according to claim 1, in which the size of the coaxial cable is proportioned to provide optimum capacity between grid and ground.

3. In an oscillator for a proximity fuze, said oscillator having a tube, an antenna, and an output terminal, a coupling circuit for inductively coupling the oscillator tube to the antenna, comprising a tank coil constituted of coaxial cable, the antenna being connected to one end of one of the conductors of said cable, the other end of said conductor being directly connected to ground, one end of another conductor of said cable being connected to the grid of said tube, and the opposite end of said other conductor being connected through an impedance to said output terminal.

4. In a proximity fuze, a grid-coupled oscillator comprising an antenna, a tank coil, an electric valve having a grid, and an output terminal, at least a portion of said tank coil being composed of coaxial cable, the exterior conductor of said cable being connected in series circuit relation between the antenna and ground, and the inner conductor of said cable being connected between the grid of said valve and the output terminal, the proportions of said cable being selected so that the capacitance between the conductors provides a grid capacity to ground.

5. In a proximity fuze, an oscillator including a tube having a grid, an antenna, and an inductive coupler between said tube and said antenna, said inductive coupler comprising a coil of coaxial cable, one of the conductors of said coaxial cable being connected to said antenna and to ground, and another conductor of said coaxial cable being connected to the grid of said tube.

6. In an oscillator for a proximity fuze, said oscillator having an antenna, an output terminal and a vacuum tube having a grid, a coupler for reducing weather effects, comprising a tank coil composed of coaxial cable, said antenna being connected to one of the conductors of said cable, one end of said conductor being directly connected to ground, the grid of said vacuum tube being connected to an alternate conductor of said cable, one end of said alternate conductor being connected through a resistor to the output terminal, a grid leak resistor connected between said alternate conductor and ground, and said coaxial cable providing a capacity connection between said grid and ground.

7. In a proximity fuze, a proximity sensitive circuit including an oscillator tube having a grid, an antenna, an output terminal, and a coil of coaxial cable constituting a coupling for the tube and the antenna, one conductor of said coil of coaxial cable being directly connected between the antenna and ground, and another conductor of said coil of coaxial cable being connected between said grid and said output terminal.

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