Sept. 19, 1961 E. R. SANDERS 3,000,314

PROXIMITY FUZE

Filed March 19, 1946

FIG. 1

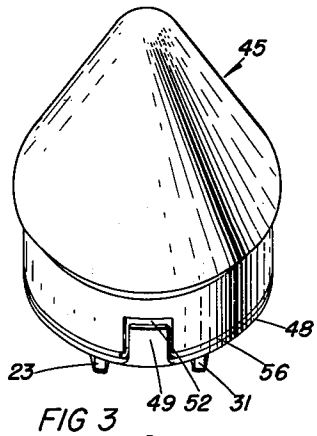


FIG. 2

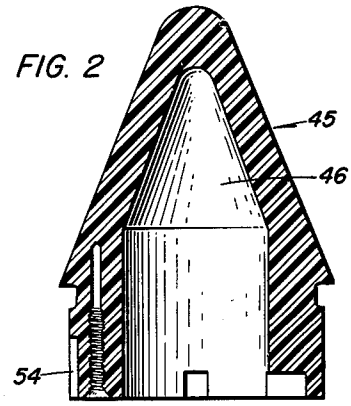


FIG. 8

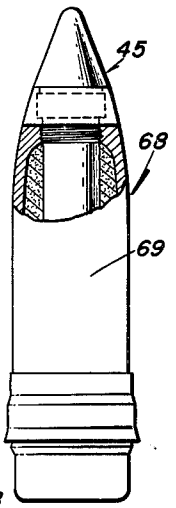


FIG. 4

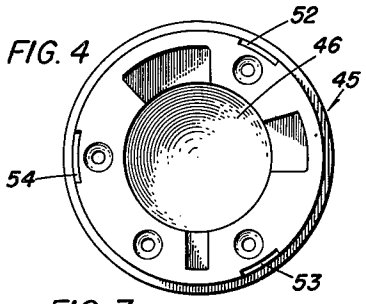


FIG 3

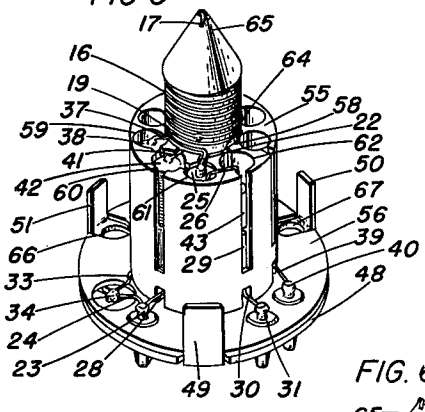


FIG. 7

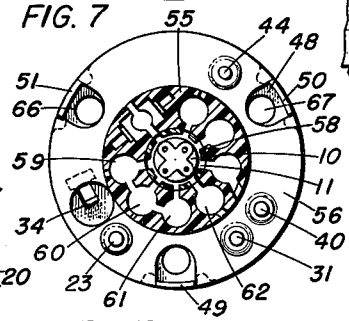


FIG. 6

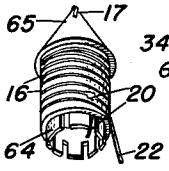


FIG. 5

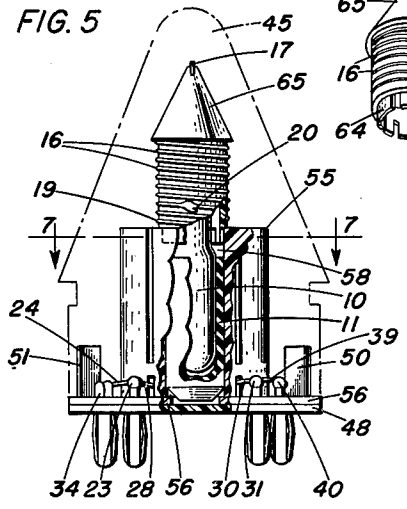
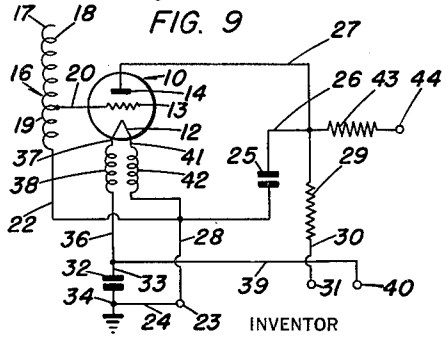


FIG. 9



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FUZE

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4 Claims. (Cl. 102—70.2)

The present invention relates generally to electrically detonated missiles and more particularly to an improved electronic fuze construction of the general type disclosed in the copending patent application of Merle A. Tuve and Richard B. Roberts, Serial Number 471,388, filed in the U.S. Patent Office on January 6, 1943, entitled "Fuze," and assigned to the same assignee as the present application and invention, now abandoned.

In the above-mentioned copending application there is disclosed an electronic fuze adapted to cause detonation of a projectile upon attainment of proximity to a target. Briefly stated, a fuze of this type comprises an oscillator for generating radio-frequency wave signals, an antenna system including an "exciter" antenna and the projectile casing for radiating the signals, an amplifier coupled to the oscillator for selectively amplifying a modulation signal in the oscillator plate or work circuit, the last-mentioned signal having a predetermined amplitude indicative of target proximity, and a gas-filled grid-controlled tube responsive to the amplified modulation signal for producing a discharge current. The fuze is associated with an electrical igniter which is actuated by this discharge current and with suitable detonating and bursting charges for causing explosion of the projectile when it comes close to a target.

Difficulty has been experienced at the time of firing the projectiles equipped with such fuzes from a gun, because of the loosening of the conventional cap-type antenna. Such an antenna is disclosed in the aforementioned patent application. Loosening of the soldered connection between the oscillator section and the cap-type antenna is another source of operating difficulty. These phenomena tend to cause premature detonation of the missile. Additionally, the nose portion of a projectile fitted wtih a fuze having such an antenna must be waterproofed with extreme care in order to prevent the entrance of water or vapor into the fuze interior.

Prior-art fuzes sometimes operate prematurely when the projectile enters a cloud. One theory holds that such operation is caused by shock excitation of the oscillator by collision with electrically charged raindrops, this excitation resulting in a pulse of sufficient amplitude to cause firing of the gas-filled tube. While I do not propose to be limited to any particular theory of causation, I avoid this undesired effect by surrounding the antenna with a relatively thick dielectric nose, thus keeping the charged particles away from the antenna.

It is an object of the present invention, therefore, to provide an improved fuze construction in which the antenna is securely mounted within the interior of the projectile nose, so that the conventional cap type antenna may be dispensed with and its attendant disadvantages avoided.

It is also an object of the invention to provide an improved fuze construction featuring an antenna mounted within the projectile and permitting the employment of a relatively strong plastic nose.

Another object of the invention is to provide in a fuze a unitary antenna, oscillator coil and matching transformer, with a view to obtaining a light, compact fuze construction.

It is, in summary, a broad object of the invention to provide an improved proximity fuze of light weight

and reliable and compact construction. Such considerations are of paramount importance in fuzes for small missiles.

For a better understanding of the present invention, reference is made to the following description taken in connection with the accompanying drawings, and its scope will be pointed out in the appended claims.

Referring to the drawings:

FIG. 1 is a perspective view of a preferred embodiment of fuze in accordance with the present invention, the protective cap being in place;

FIG. 2 is an elevational sectional view of the protective cap;

FIG. 3 is a perspective view of the fuze, the cap not being in place;

FIG. 4 is a rear view of the protective cap, looking toward its nose;

FIG. 5 is a side elevational view of the fuze, the relative position of the cap being indicated by a dashed line;

FIG. 6 is a perspective view of the coil form and antenna included in the embodiment illustrated in FIGS. 1 to 5;

FIG. 7 is a plan view of the oscillator support included in the fuze, the projecting receptacle portion thereof being shown in section;

FIG. 8 shows the fuze installed in a projectile;

FIG. 9 is a diagram of the electrical circuit of the improved fuze.

Reference is made to FIG. 9 in a brief description of the electrical elements of the FIG. 1 embodiment. Included in the fuze is an electronic tube **10** having an electron emitting filamentary cathode **12**, a control electrode **13** and an anode **14**. A coil of conductive material **16** having an antenna extension-portion **17** and an inductive portion **19**, serving as the oscillator coil, is coupled to the oscillator tube. Specifically, conductor **20** connects a tap of coil **16** to the tube control electrode and conductor **22** connects one lead of the coil to ground terminal **23**. The tank circuit of the oscillator also includes a capacitor **25**, connected to ground terminal **23** by conductor **28** and to anode **14** by conductor **27**. Anode **14** is coupled to a suitable source of current (not shown) through a plate resistor **29**, conductor **30** and terminal **31**. A signal output circuit from anode **14** comprises conductor **27**, resistor **43**, and a terminal **44**, which last-mentioned terminal is adapted to be coupled to the tmplifier imput circuit (not shown). The filament heating current is completed from a source (not shown) through chokes **38** and **42** and conductors **37**, **41**, **36**, **39**, **28**, and terminals **40** and **23**. Conductor **24** connects terminal **23** to a grounded terminal **34**. Between terminals **34** and **40** is a series combination of condenser **32** and conductor **33**. The circuit component and conductors illustrated in FIGS. 3, 5, and 6 have the same reference numerals as their respective symbols shown in FIG. 9 and will not hereinafter further be described.

Referring now specifically to FIG. 1 of the drawing the numeral **45** indicates generally a converging projectile nose made of plastic dielectric material and of relatively thick one-piece construction. As best seen in FIG. 2 the cap has a hollow interior defining a chamber **46**. This nose serves as a protective cap for the fuze.

The fuze proper, contained within the cap, is shown in FIG. 3. It includes a support member **48** having clips **49**, **50** and **51** adapted to engage with the side walls of complementary ones of recesses **52**, **53**, and **54** in the cap. Rigidly secured to the base is an oscillator receptacle member **55**. Positioned between the receptacle and the base is an insulating spacer **56**, provided with apertures for terminals **23**, **31**, **34**, **40**, and **44**. The base is formed with a central well **58**. Tube **10** is

placed within a rubber envelope **11** and members **10** and **11** are disposed within well **58**. The receptacle is formed with a series of smaller wells **59**, **60**, **61**, and **62** located symmetrically about well **58** and having wiring channels in communication therewith. Choke **38** is placed in well **59**, along with condenser **32**. Choke **42** is contained in well **60**. Condenser **25** is enclosed by the walls of well **61**. Well **62** contains resistors **29** and **43**. Fitted by compression into well **58** is a closure member **64**, having an integral conical cap **65**. Coil **16** is wound on form **64**. By this expedient of placing the tube within a central well and the other oscillator components in wells symmetrically located with respect thereto, considerable space saving is effected.

After the fuze components have been secured in place and wired and the cap has been engaged with base **48**, the whole assembly is rigidly secured by pouring a suitable potting compound through openings **66** and **67**. FIG. 8 illustrates the relationship between the fuze and a conventional projectile **68** the nose being so formed as to merge with a streamlined casing **69**, and the nose being secured to the casing by any suitable means.

Portion **19** of the coil constitutes an inductance parameter of the oscillator tank or radio-frequency-determining circuit and portion **18**, above the top of conductor **20** on coil **16**, cooperates with portion **19** to form one magnetically linked circuit of an impedance matching transformer, coupling the antenna to the tube **11**. Portion **19** serves as the other magnetically linked matching transformer circuit. The antenna of the improved fuze is shown at **17** and is formed by bending an extension of coil **16** upwardly to extend axially through the cap **65**. The upper end of the antenna is bent over the upper end of said cap and is thus effectively anchored.

In operation the fuze is installed in the projectile as shown in FIG. 8. The oscillator generates radiant-energy carrier signals. Target proximity changes the radiation resistance of the radiating system comprising antenna **17** and the projectile casing. This change causes a modulation signal to appear at terminal **44**. The remaining phases of operation are generally similar to the corresponding phases of operation of the fuze described in the above-mentioned copending application. It should be particularly understood that the thickened wall of the projectile nose largely eliminates premature detonation due to the collision of the projectile with positively charged raindrops, in the event the projectile passes through a cloud.

It is desired particularly to call attention to the fact that, as the antenna is contained entirely within the projectile nose, there will be no external soldered antenna connections to melt at high temperatures and produce intermittent contact, with resultant premature fuze operation.

While there has been shown what is at present considered to be a preferred embodiment of my invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the true spirit of the invention, and it is therefore intended in the appended claims to cover all such changes and modifications as fall within the true scope of the invention.

I claim:

1. In a fuze of the type including radio-frequency signaling apparatus having at least one electron tube and adapted to cause explosion of a missile upon attainment of target proximity, a chambered nose enclosing said apparatus and having a relatively thick wall, means for positioning said tube in said fuze and including a protective casing for said tube, a cap for closing said casing, and a radiating antenna coupled to said apparatus and secured to said cap, said relatively thick wall screening said antenna from electrical impulses due to ionized droplets of moisture contacting said nose during flight of the projectile, whereby premature operation of the fuze will be prevented.

2. In a fuze as recited in claim 1 wherein said cap is of conical shape and is formed with an axial bore, and wherein said radiating antenna is carried in said bore.

3. In a radio proximity fuze, a hollow ogive projectile nose of relatively thick water-tight insulating material, a base secured to said nose, and with said nose defining a chamber wholly within the nose, radio proximity fuze components housed within said chamber, said components including an electronic tube, a substantially tubular casing enclosing said tube, a cap on said casing, an oscillator coil and an impedance matching transformer wound on said casing, a continuation of the conductor forming said transformer projecting axially within said nose to form an antenna, said antenna being attached to and rigidly supported by said cap.

4. In a radio proximity fuze, a hollow ogive projectile nose, the front end of said nose being completely closed, a closure for the rear end of the ogive, said nose and said closure defining a chamber, radio proximity fuze components housed within the chamber, said components including an oscillator coil and an impedance matching transformer, an antenna connected to said transformer and extending within the chamber, and means for rigidly securing said antenna, said nose having a relatively thick insulating wall screening said antenna from the effects of any ionized particles which may contact said nose during flight of the projectile and tend to cause premature detonation of said projectile.

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