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Apstein

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[54] **CANOPY PENETRATION FUZE**

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[52] **U.S. Cl.** ..... **102/70.2 P,** 102/7.4

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[58] **Field of Search** ..... 102/2, 7.4, 18, 19.2, 70.2, 102/70.2 P

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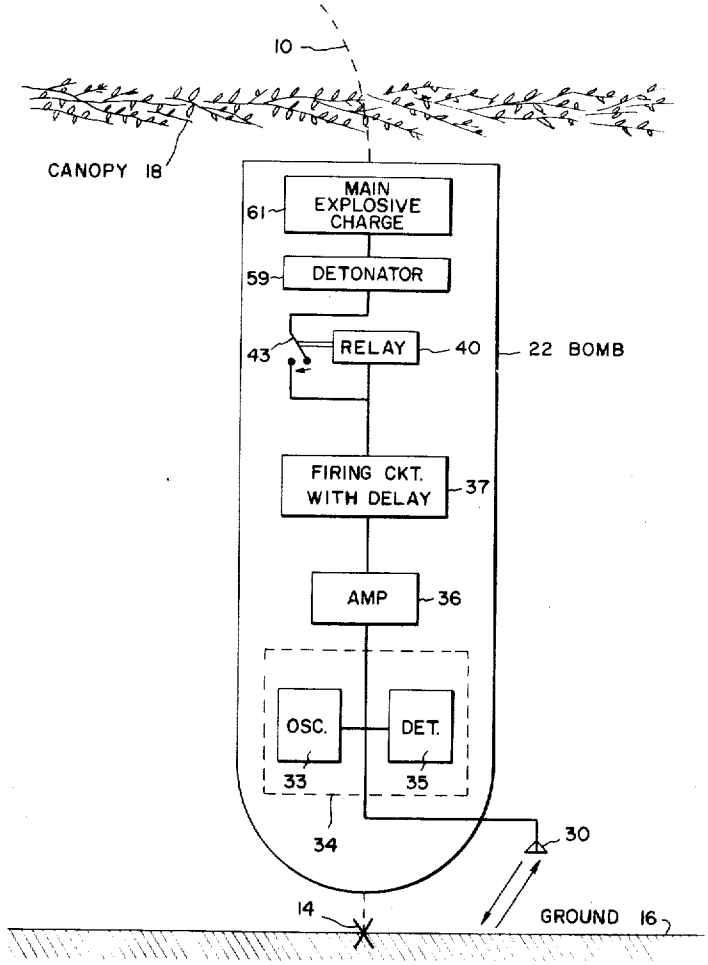
Primary Examiner—Verlin R. Pendegrass

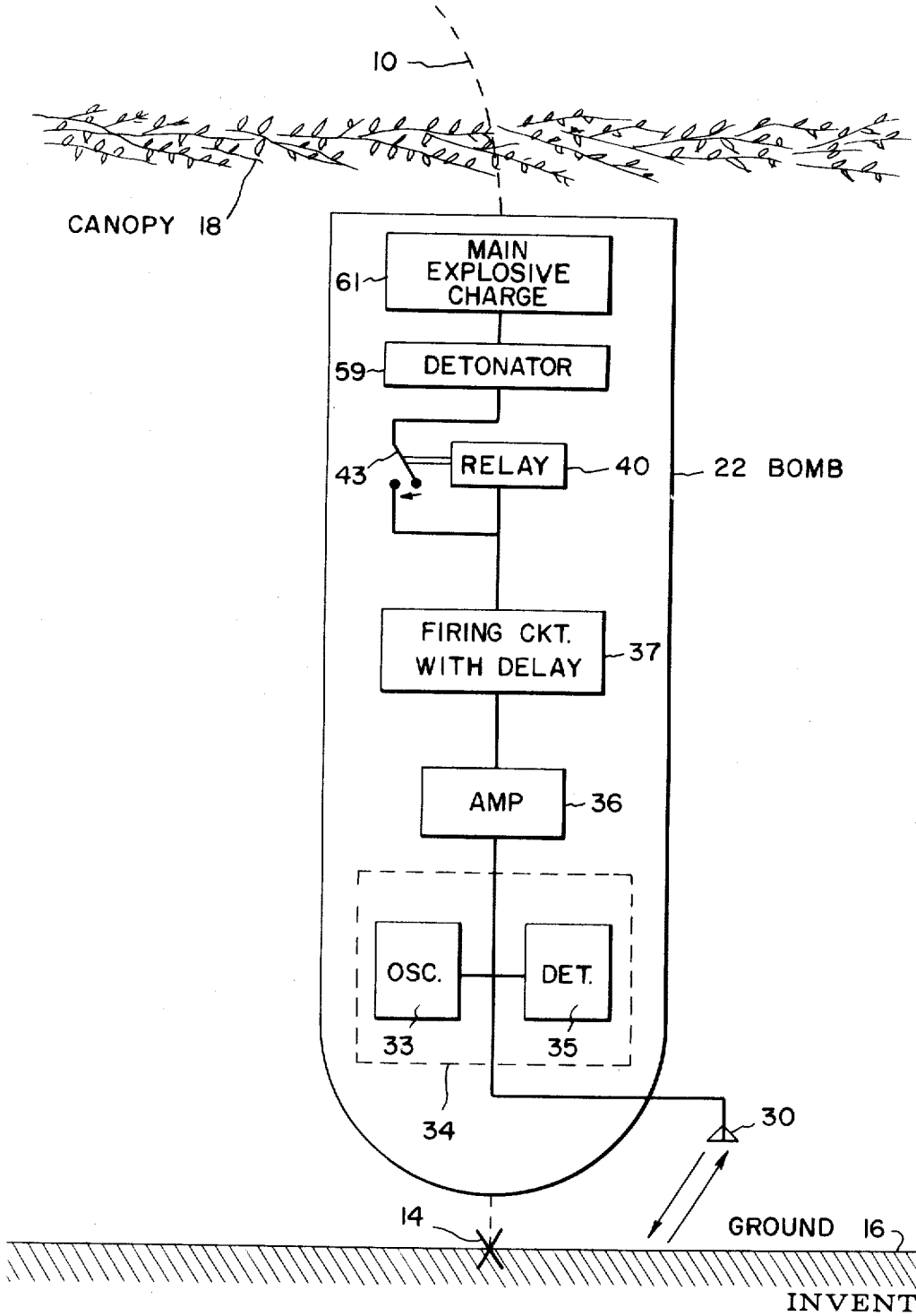
Attorney, Agent, or Firm—Saul Elbaum

[57] **ABSTRACT**

A proximity-type fuze suitable for use against ground targets below a high ground cover, or canopy, such as a thick layer of high foliage. As the fuze approaches the canopy the firing signal resulting from the proximity of the canopy is utilized to operate an explosive switch or other form of latching relay, that closes a short time after receiving the firing signal. Closing of the switch connects the detonator to the firing circuit. A delay circuit allows the fuze to penetrate the ground cover before the firing circuit can again be activated. When the fuze approaches the ground the proximity of the ground produces a second firing signal which will fire the detonator.

2 Claims, 1 Drawing Figure





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CANOPY PENETRATION FUZE

The invention described herein may be manufactured, used, and licensed by or for the Government for governmental purposes without the payment to me of any royalty thereon.

BACKGROUND OF THE INVENTION

When radio proximity-fuzed projectiles are used against ground targets in areas covered by a tall layer of jungle foliage or "canopies," signals reflected from the canopy are likely to cause premature detonation. Because of the protective effect that the canopy may have for ground targets it is important that the projectile carrying the fuze be allowed to pass through the canopy before being detonated.

In most radio proximity fuzes, part of a radio signal radiated by the fuze is reflected from the intended target and is utilized to actuate a firing circuit which causes detonation. In situations where canopy penetration is necessary, a well known expedient has been to incorporate a time delay in the firing circuit so that the fuze detonates at a predetermined time after reflection from the canopy has generated a firing signal. By adjusting the delay time introduced it is possible to fix the distance below the canopy at which the projectile explodes, assuming the speed and angle of descent are known.

Until the present invention, no fuze has solved the problem of attaining detonation of a projectile at some predetermined height above the ground after canopy penetration has occurred, without knowing the height of the ground cover and the speed of descent of the projectile.

It is therefore an object of this invention to provide a proximity fuze, suitable for use against ground targets in situations in which there is a reflective canopy or "ground cover" high above the ground, that will detonate at a predetermined height above the ground regardless of the height of the ground cover.

An additional object of the invention is to provide a proximity fuze that will penetrate a reflective ground cover without initiating an explosive train in the detonator circuit.

A further object is to achieve the foregoing objects in an economical and practical device.

SUMMARY OF THE INVENTION

A proximity fuze for canopy penetration in which the output of the firing circuit is initially connected to a latching relay such as an explosive switch. Upon approach to the canopy the proximity fuze triggers the firing circuit and the firing signal closes the relay, connecting the detonator to the output of the firing circuit. Thereafter, when a second firing pulse is received due to the proximity of the ground, the detonator fires.

DESCRIPTION OF THE DRAWINGS

The specific nature of the invention, as well as other objects, aspects, uses and advantages thereof, will clearly appear from the following description and from the accompanying drawing, in which:

The FIGURE is a schematic representation, not to scale, showing a descending projectile having a canopy-penetration proximity fuze in accordance with the present invention.

DESCRIPTION OF AN EMBODIMENT OF THE INVENTION

Various types of radio proximity fuzes are well known, the doppler type probably being one of the best known. In such fuzes, energy is generated and radiated and the fuze is sensitive to small amount of energy after it is reflected from the target.

In the doppler type fuze, operation depends on interference between the original and the reflected waves. This may occur in several ways. If there is a relative motion between the transmitter and the reflecting target, the reflected waves received at the fuze will differ in frequency from the transmitted waves (doppler effect). Interference results in a peak note equal to the difference in frequency. On the other hand, if the transmitter is frequency or phase modulated, interference with the reflected waves produces a signal whose frequency is a function primarily of the distance to the target. This principle is equivalent to that of the well known FM radio altimeter. Pulse or intermittent circuits to determine time or distance to the target operate on essentially the same principles as the common forms of radar ranging devices.

The actuating signal in a doppler type of fuze is produced by the interference with the transmitter and the fuze of the reflected energy from a target moving with respect to the fuze. The concept of interference of the original and reflected waves is analytically equivalent to a load variation in the transmitting oscillator. Hence, an r-f circuit which responds to variations in its loading will generate a target signal and this signal may be detected in a separate mixing circuit or by a change in some parameter of the oscillator circuit. This signal is then selectively amplified before sending it to a firing circuit which will initiate the detonation of the fuze. The distance from the target at which the fuze operates can be controlled by setting the gain of the amplifier and by adjusting the level of the signal necessary to trigger the firing circuit.

A more detailed discussion of proximity fuzes and doppler type fuzes in particular may be found in the SUMMARY TECHNICAL REPORT OF NDRC entitled RADIO PROXIMITY FUZES FOR FIN-STABILIZED MISSILES, published by the National Defense Research Committee, Washington, D.C., 1946.

In the drawing, a bomb **22** is depicted as approaching a target **14** on the ground **16**, after having penetrated a canopy **18** of tall foliage or the like. The size of the bomb **22** is greatly exaggerated in relation to the height of the canopy for the sake of clarity.

The bomb is equipped with a proximity fuze comprising an oscillator **33**, a detector **35**, an antenna **30** connected to the oscillator-detector circuit (designated by dotted line **34**), a firing circuit **37** with a built in delay, a relay **40**, and a detonator **59** which is connected to the main explosive charge **61**.

For a given orientation of the bomb **22** and the target, the amplitude of the target signal produced in the oscillator-detector circuit **34** is a function of the positions between the target and the bomb. This signal goes through a stage of amplification by amplifier **36** before being applied to the firing circuit **37**. Since firing circuit **37** will be activated when the signal from the amplifier **36** reaches a predetermined amplitude adjustment of the amplifier gain will effectively control the distance

from the target at which the firing circuit **37** will operate.

When the relay **40** holds switch **43** in an open position, only the relay **40** will be connected to the output of the firing circuit. When the relay is activated so as to close switch **43**, the detonator **59** will be connected to the output of the firing circuit **37**.

The descending bomb **22** follows a trajectory generally designated by the dotted line **10**. Upon approaching the canopy **18** the bomb **22** will reach some point near the canopy where the amplified signal from the oscillator-detector **34** is sufficient to trigger the firing circuit **37**. This is due to the reflective effect that the canopy **18** has on the signals transmitted by the oscillator-detector circuit **34**. The output of the firing circuit **37** activates relay **40** and closes switch **43**. This will connect the detonator **59** to the output of the firing circuit **37**. In order to prevent premature detonation the firing circuit **37** has a built in delay so that the firing circuit may not again be triggered until the bomb has safely penetrated the canopy. Upon approach to the ground **16** the oscillator-detector circuit **34** will again produce a signal which when amplified will be sufficient to produce a firing signal at the output of the firing circuit **37**. This second firing signal, unlike the first, is applied to the detonator **59** and thus detonation of the main explosive charge **61** will now occur.

By adjusting the gain of amplifier **36** the point on the trajectory **10** at which the fuze will detonate the explosive may be varied. This means that irrespective of the height of the canopy the fuze may be set to initiate explosion at some predetermined distance above the ground rather than a predetermined time or distance below the canopy.

It will be apparent that if my above-disclosed fuze were to be used in a situation in which it approached the ground without having first passed through a high ground cover, the fuze would not detonate in response to the proximity of the ground. As with most proximity fuzes, it will obviously be desirable to include an auxiliary impact fuze to cause detonation on impact with ground or target in the event that proximity has not already caused detonation.

It will be apparent to those skilled in the art that the embodiments shown are only exemplary and that various modifications can be made in construction and arrangement within the scope of the invention as defined in the appended claims.

I claim as my invention:

1. A canopy-penetration type of proximity fuze, for use against ground targets, that will descend through a high ground cover of foliage or the like without detonating and that will thereafter detonate in response to the proximity of the ground, said fuze comprising:

a. proximity-response signal means to produce a signal upon approach of said means to the canopy and ground respectively;

b. detonator means;

c. means responsive to said signal produced upon approach to said canopy to connect a detonator in circuit with said signal means so that the signal produced upon approach to the ground will activate said detonator.

2. The invention according to claim **1** wherein the signal means includes:

a. an oscillator-detector circuit which emits a signal indicative of the distance to a target;

b. an amplifier connected to said oscillator-detector circuit;

c. a firing circuit connected to the amplifier which will be operable when the signal from the amplifier exceeds a predetermined level, and having a built in delay means to delay reset of the firing means for a short period of time after operation.

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