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PROXIMITY FUZE

Filed March 14, 1966

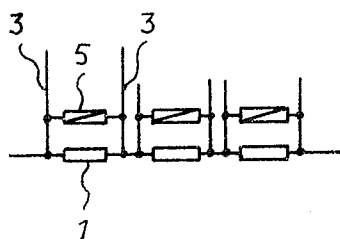


Fig. 1

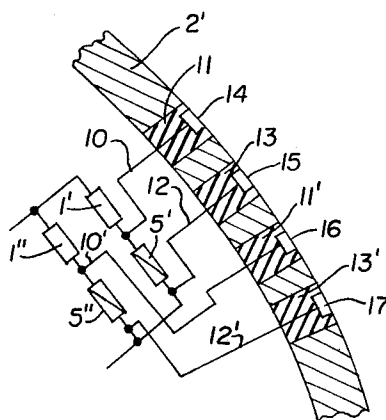


Fig. 3

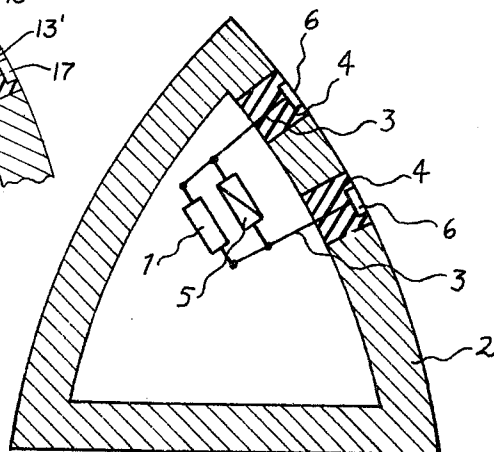


Fig. 2

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PROXIMITY FUZE

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ABSTRACT OF THE DISCLOSURE

Proximity fuze in which an electrical circuit for determining the firing sensitivity of the proximity fuze includes a number of series or parallel connected impedance elements located inside the envelope of the fuze. Each of the impedance elements have subsidiary circuits which include a melting fuze and connectors from each end of the associated fuze which penetrate the wall of the envelope through insulation members providing electrical insulation from the remainder of the envelope and from each other. The connection of each melting fuze and its associated impedance element in the sensitivity circuit provides a predetermined impedance influence or absence of such influence on the sensitivity circuit by the associated impedance element, which influence or its absence is changed by melting of the associated meltable fuze. Terminal ends of each pair of conductors are located at or just under the outer surface of the envelope insulation on portions and an appropriate external current source can be temporarily applied to desired pairs of such terminals to melt a specific meltable fuze to thereby change the impedance and hence sensitivity setting of the sensitivity circuit without gaining access to the interior of the fuze.

Cross reference to related application

Co-pending application Ser. No. 534,066, filed on Mar. 14, 1966 relates to a different construction and method for changing the influence of impedance elements on proximity fuze electrical sensitivity circuits without gaining physical access to the interior of the fuze envelope.

Background

The present invention relates to a proximity fuze for a projectile, such as a bursting shell, which makes the projectile detonate shortly before it hits the target. The proximity fuze radiates energy in the form of electromagnetic waves or sound waves. A part of the radiated energy is reflected from the target returns to and is received by the proximity fuze. When the received energy reaches a predetermined level the fuze ignites the charge in the projectile.

The amount of received reflected energy is greatly dependent on the reflecting power of the target. If the ground is the target, the reflecting power depends upon the character of the terrain and therefore, the distance from the target at which a projectile with a pre-set proximity fuze detonates, will be different for different kinds of target terrain. The distance where detonation occurs is also influenced by the angle of the direction of movement of the projectile in conjunction with terrain surface, also by the speed of the projectile, and whether or not there are woods on the target terrain.

The distance from the target at which detonation should take place, in order to obtain the best possible effect, is dependent on the protecting level of the target, on the angle between the direction of movement of the projectile and the target level and on the capacity of the terrain to prevent the spreading of splinters. For each

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type of projectile the distance from the target at which detonation should occur, in order to cause maximum damage, has a specific value. The damage caused by the projectile when exploded at the desirable specific distance is frequently many times greater than if the projectile is exploded at other distances, which could be rather close to the specific distance.

Before each shot it may as a rule be possible to find out or to estimate the reflecting power and the character of the terrain, such as the presence of woods, and also the protecting level of the target. It may also be possible to know or estimate the speed of the projectile, the angle between the direction of movement of the projectile and the level of the target, and also the specific explosion distance for maximum damage. Therefore, it is possible to increase the effect of the expenditure of ammunition if the proximity fuze of each projectile is capable of being adjusted immediately before the firing, so that each projectile may explode at the desired specific distance and maximum damaging effect will be obtained.

The adjustability may be continuous or non-continuous. Generally the characteristics of the fuze may be changed by adjusting an impedance, such as a resistance, in the electric circuit of the proximity fuze, for example in its amplifier part. It is also possible to change the magnitude of the transmitted energy or to adjust the sensitivity of the receiving means. If a continuous adjustability is wanted, for example in the form of a continuously adjustable potentiometer, special steps have to be taken to ensure a good contact-making in consideration of the forming of oxide on the contact-making parts during storage. Further, there should be a way to effectively prevent the adjustment of the potentiometer from being influenced by the rotation of the projectile. There is a device known for this purpose (U.S. Patent 2,552,482) but it is rather complicated.

Summary

Calculations have shown that it is sufficient to provide an adjustability of the characteristics of the proximity fuze in ten steps or less, in order to obtain a correct adjustment of the distance at which detonation should take place for achieving the maximum damage.

One object of the present invention is to provide a proximity fuze which is adjustable in steps. This adjustability means that the characteristics of the fuze may be altered in steps, so that the desired distance from the target for detonation may be approximatively obtained. By a stepwise adjustment a simpler and more rigid construction can be obtained than by a continuous adjustability.

Another object of the invention is to provide such a stepwise adjustability by enabling an impedance to be adjusted without any need for disassembling the fuze or to make any incision in the fuze or to influence the aerodynamic characteristics of the projectile.

A further object resides in the provision of a proximity fuze according to the invention having a number of series-connected or parallel-connected impedance elements, the elements being connected in a sensitivity-determining electrical circuit of the proximity fuze, and connected to conductors which penetrate the envelope of the fuze and are insulated from the envelope by insulation members, the ends of the conductors being located at or just under the outer surface of the associated insulating members and such outer surface being in level with the outer surface of the rest of the envelope, a melting fuse being connected between two conductors belonging to each impedance element.

Further objects and features of the proximity fuze according to the invention will become apparent from the

following description and claims and from the accompanying drawing, in which:

FIG. 1 illustrates a circuit diagram for a part of an electrical sensitivity-determining circuit of the fuze in which a plurality of impedance elements are connected in series;

FIG. 2 is a simplified section through the proximity fuze, showing one of the impedance elements and its associated melting fuze as in the circuit of FIGURE 1; and

FIG. 3 is a circuit diagram of a second embodiment and illustrates a part of an electrical sensitivity-determining circuit of a proximity fuze in which a plurality of impedance elements are connected in series.

FIGURES 1 and 2 represent an embodiment where a number of impedance elements 1 are connected in series with each other and form a part of an electrical sensitivity-determining circuit, for example a potentiometer (not shown). Each impedance element 1 is located inside the envelope 2 of the fuze and is connected to conductors 3 which penetrate the wall of envelope 1. Conductors 3 are insulated from the envelope wall by insulation members 4.

Each impedance element 1 is shunted by a melting fuze 5. Each end of each melting fuze 5 is connected to one of the conductors 3 which penetrate the wall of the envelope 2. The terminating end of each conductor 3 is located just at the exterior surface of the insulating member 4, and is preferably terminated by a plate-shaped member 6.

When it is desired to connect or activate one of said impedance elements in order to change the sensitivity circuit characteristics of the proximity fuze, the associated melting fuze 5 is blown by temporarily applying a current source to the ends of the associated conductors 3. This is accomplished from the outside of the fuze and no disassembling of the proximity fuze or other incision in the latter is necessary.

In the second embodiment, represented by FIGURE 3, the impedance elements 1' and 1'', as an example, are connected in parallel instead of in series as shown in FIGURE 1. When they are connected in parallel, a melting fuze, respectively, 5' and 5'', should be connected in series with each impedance element, respectively, 1' and 1''. Each end of each melting fuze, 5' and 5'' should be connected to an associated conductor which, in insulated relationship, penetrates the wall of the envelope 2'.

As illustrated in FIGURE 3, branch conductors 10 and 10' from one end of respective melting fuzes 5' and 5'' penetrate the envelope 2' through respective insulated portions 11 and 11' and branch conductors 12 and 12' from the other end of respective melting fuzes 5' and 5'' penetrate the envelope 2' through respective insulated portions 13 and 13'. All of the conductors 10, 10', 12 and 12' terminate in respective plate-shaped members 14, 15, 16 and 17, similar to members 6 described for FIGURE 2. An appropriate level current source, temporarily applied to a pair of terminals such as 14 and 15 or 16 and 17, will cause the melting fuze associated with the selected pair of terminals to melt, whereupon the connection of the associated impedance element 1' or 1'' in the impedance circuit of the sensitivity circuit is disrupted or opened.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiments are therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

We claim:

1. In combination in a proximity fuze which comprises an envelope and an electrical circuit for determining the firing range sensitivity of the proximity fuze, the improvement comprising: a plurality of interconnected impedance elements located inside of said envelope and connected in said sensitivity circuit; and a plurality of subsidiary circuits, each of which is associated and connected in circuit with a specific one of said impedance elements in said sensitivity circuit so that continuity of each of said subsidiary circuits controls the effect of its associated impedance element on the impedance of the sensitivity circuit; each of said subsidiary circuits including conductor means penetrating said envelope and having portions located immediately adjacent the envelope exterior surface; the portions of said envelope penetrated by said conductors constituting electrically insulating means which insulate said conductor terminal portions; said conductor portions and their associated subsidiary circuits providing exteriorly accessible control means by which the impedance effect of each of said impedance elements on said sensitivity circuit can be changed.

2. The combination as defined in claim 1, wherein each of said subsidiary circuits includes a melting fuze and conductors, one from each end of said melting fuze, having terminal portions penetrating said envelope and terminating immediately adjacent the envelope exterior surface; said pairs of conductor terminal portions and their associated melting fuzes providing said exteriorly accessible control means by which the impedance effect of each of said impedance elements on said sensitivity circuit can be changed.

3. The combination as defined in claim 2, wherein said plurality of impedance elements are connected in series with each other in said sensitivity circuit, and each of said subsidiary melting fuze circuit is shunt connected across an associated said impedance element.

4. The combination as defined in claim 2, wherein said plurality of impedance elements are connected in parallel with each other in said sensitivity circuit, and each of said subsidiary melting fuze circuits is connected from one end of and in series with an associated said impedance to one side of said parallel connection.

5. The combination as defined in claim 2, wherein said conductor portions penetrate into and through said envelope and a terminal plate is connected to the terminal end of each conductor portion and accessible at the exterior surface of said insulating means.

6. The combination as defined in claim 2, wherein said conductor portions which penetrate said envelope are embedded in said insulating means with the terminal ends thereof closely adjacent but below the exterior surface of said insulating means.

7. The combination as defined in claim 2, wherein the exterior surface of said insulating means is smoothly contoured with the exterior surface of the remainder of said fuze envelope.

8. The combination as defined in claim 2, wherein the terminating ends of said conductor portions are connected to terminal devices.

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