Nov. 14, 1961 N. D. FOLEY 3,008,415

HERMETICALLY SEALED PROXIMITY FUZE

Filed Nov. 17, 1949

FIG. 1

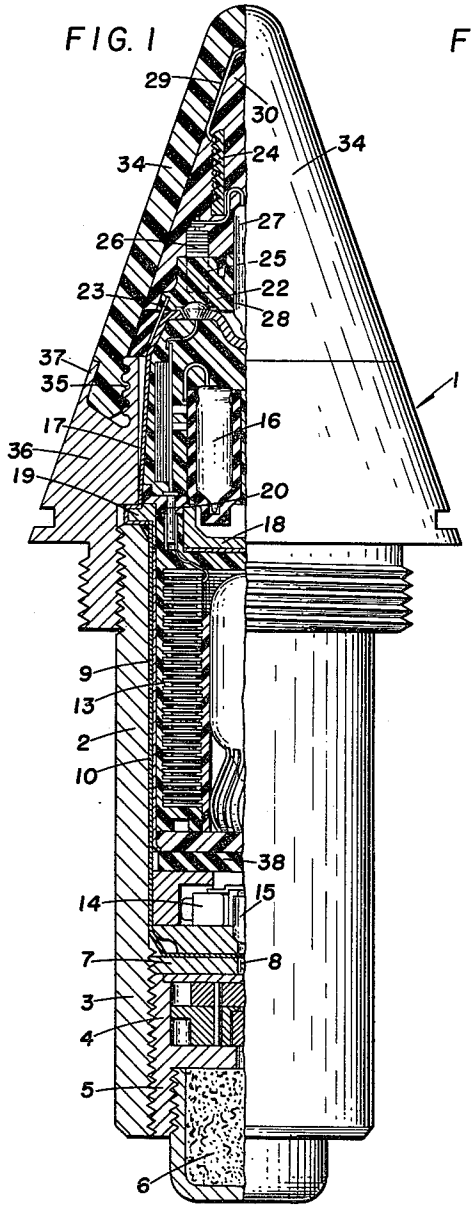


FIG. 3

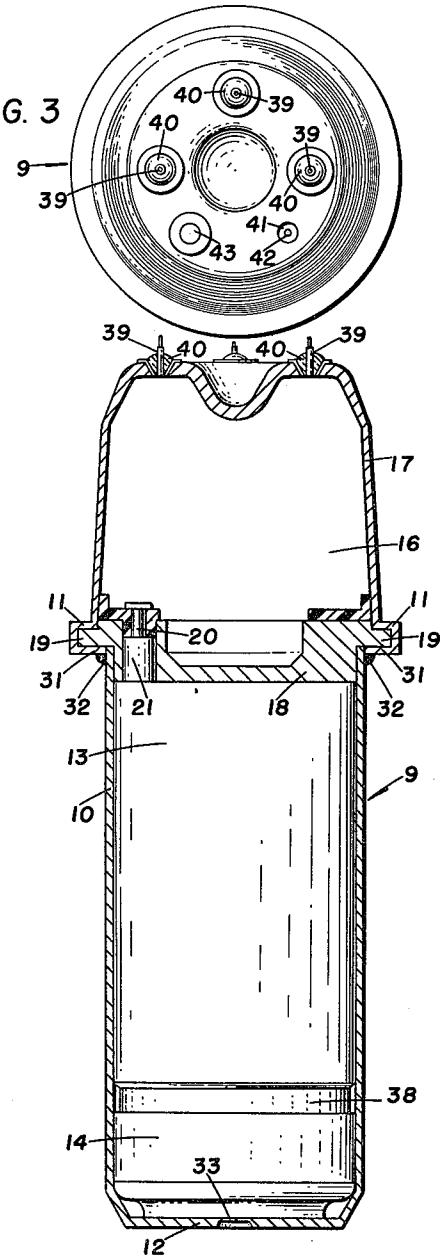


FIG. 2

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HERMETICALLY SEALED PROXIMITY FUZE

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The present invention relates to improved hermetically sealed proximity fuze structure.

In radio proximity fuzes as designed and constucted up to the present time much difficulty has been experienced with failure of fuzes to operate due to the entry of moisture into the interior of the fuze casing. More particularly, it has been found that moisture causes damage, with the result that the life of the fuzes is greatly reduced when they are subjected to the effects of high temperatures, extreme humidity and other conditions found in service. Experience with radio proximity fuzes has proven definitely that waterproofing, to be effective, must be inherent in the fuze and not dependent upon compression or gasket seals, or seals of any composition subject to short-time deterioration.

In addition to their inability to withstand conditions of high humidity, as above stated, the present radio proximity fuzes have been found to be incapable of successful firing at relatively high velocities, because of the softening and collapsing of the plastic noses under the high temperature engendered. Further, collapse of the front case or nose due to pitting under high temperature may cause premature operation of the fuze if the projectile receives a high potential charge when leaving the ionized cloud of the gun blast. Such premature operation is attributed to the dissipation of the charge caused by the spinning off of melted particles on the front case.

Therefore, one of the principal objects of the present invention is to provide radio proximity fuze structure wherein all the critical components are enclosed within a hermetically sealed can, to the end that effective waterproofing will be assured.

Another object of the invention resides in the provision of fuze structure embodying improved high-temperature-resisting material for the nose or front case to the end that failures and prematures due to collapse of noses of plastic material will be avoided and premature operation due to such nose failure prevented.

The invention seeks, as a further object, to provide a radio proximity fuze having longer shelf life, greater mechanical stability and improved performance at high velocities and high temperatures and under extremely high set-back forces.

Still another object of the invention is to provide proximity fuze structure wherein the critical components are contained within a hermetically sealed can and within an amplifier shield-can to constitute a standard capsule which may be built in quantity and stored, any one of a variety of oscillator assemblies being attachable to said capsule at any time.

Other objects and many of the attendant advantages of this invention will be appreciated readily 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 longitudinal sectional view, partly in elevation, of fuze structure according to the invention;

FIG. 2 is a longitudinal sectional view of the waterproofing casing, certain of the contents being shown; and

FIG. 3 is an end view of the shield can.

Referring now to the drawings in detail and first to FIG. 1 thereof, the numeral 1 indicates generally the improved fuze. The fuze, according to this invention,

includes an outer casing 2 which is provided with an internally threaded rear end portion 3 into which is screwed a safety unit 4 of the twin rotor type described in patent application Serial No. 534,785, filed May 9, 1944 for Safety Device, now Patent No. 2,711,695. The safety unit 4 is provided with an extended counterbored internally threaded portion 5, which receives a conventional auxiliary detonator 6.

Inwardly of the unit 4 is a partition 7 having a central aperture 8 located to aline with appropriate apertures in the unit 4 and with a discharge opening in the squib unit, described in detail hereinafter.

As pointed out in the objects set forth, an important purpose of the invention is to provide sealing for those components of a radio proximity fuze which are most susceptible to damage due to weather changes. To this end there is provided a can 9 of relatively thin sheet metal and of such diameter that it will fit snugly within the casing 2. The can 9 is seen best in FIG. 2 of the drawings and, by referring to this view, it will be observed that said can, which is of drawn steel, is formed with a cylindrical side wall 10. The can is closed at its rear end by an end wall 12. It will be noted that the rear end 12 of the can 9 has a spot of reduced thickness of metal at its center, as shown at 33. This thin spot affords an easy centrally located path for the flash from the squib to the detonator.

Enclosed within the can 9 are a deferred action battery 13 and a delay-self-destruction unit 14 which contains a squib 15, seen fragmentarily in FIG. 1, positioned so that when the fuze operates the resulting blast will puncture the rear end wall 12 and enter the auxiliary detonator through the aperture 8 and the apertures in the unit 4.

The invention contemplates the provision of a standard proximity fuze amplifier, which is shown generally at 16. A shield can 17 of metallic material surrounds the amplifier and is secured to the base 18 thereof. The base 18 is provided with a radial flange 19 which overlies a flange 11, formed on can 17, and is secured thereto by spot welding, in at least three places. As will be seen, the amplifier is connected electrically with the battery 13 by pins 20 which engage in sockets carried in the battery turrets 21.

Referring to FIG. 3, there are shown three terminals 39 each of which is insulated from the shield can 17 by a bead 40 of a suitable glass such as used in "Kovar" seals and which will make a gas-tight fused seal with the steel of the can 17. Originally each terminal 39 is a Kovar tube of very small bore. The terminal wires from certain of the electrical components within the can 9 and the shield can 17 are passed through these tubes. Said wires are then cut off at proper length, and soldered to the Kovar tubes, to constitute said external terminals 39.

Another opening 41 is made somewhat larger than the wire 42 which passes through it. This wire is the "ground" and eventually is soldered to the metal surrounding it, thus at the same time closing the opening 41 hermetically with the solder. However, before this is done, the potting compound is introduced through the opening 43, while the end shown in FIG. 3 is uppermost. During this time, the air will escape through opening 41.

When the potting is completed, opening 41 is closed by soldering, and then the tightness of the entire device is tested by applying compressed air to opening 43. If there are no leaks, this opening is then closed by a disc or pin, which is soldered in place to complete the sealing of the capsule.

It should be understood that, in assembling, the safety delay-self-destruction unit 14 is first placed in the can 9, and the battery 13 is then placed in said can and the amplifier unit 16 secured in place and properly connected with the battery. A rubber disc 38 is located between

the unit **14** and the battery **13**, as shown. The whole operation is effected in such manner that the entire unit will be hermetically sealed and thus will form a standard unit or capsule to be used with oscillators of various types, in a manner discussed in detail hereinafter.

Inasmuch as the individual units to be accommodated in can **9** have tolerances of over-all lengths, there may be considerable variations in the totals when assembled. To make it possible to seal the units in the can under the requisite pressure, they are first inserted in the can, and then subjected to suitable compression. While thus compressed, the open end of the casing is sheared off to make its internal length correct. This will leave it in proper condition to slip over the rear end of the base **18**.

While so positioned, the can **9** is spot-welded to the said base **18** at at least four places, so as to hold it firmly, with compression on the enclosed units. The spots are next cleaned to accept solder; the flange **31** is turned over flat against the rear face of the flange **19**, and a continuous solder fillet **32** is formed around the joint to seal the shield can **17** hermetically to the can **9** at their junction.

An oscillator unit for the invention is shown in FIG. 1. This unit comprises a skeleton base member **22** of molded plastic material with an attaching skirt **23** of metallic material and of generally frusto-conical shape molded thereinto. A coil form **24** of generally cylindrical shape, and provided with a spiral groove to receive the coil turns, is fitted in a cylindrical groove axially of the base **22**. As shown in dotted lines, the base **22** is formed with an annularly arranged cluster of recesses **25** to receive the resistors, chokes and capacitors employed in the oscillator circuit. One of said chokes is shown at **26**. The oscillator vacuum tube **27** is carried in an axial recess **28** in the base **22**, said recess being constricted near its rear end to limit the tube against rearward displacement. The leads of the tube are connected with the other components by suitable conductors in a well known manner.

The oscillator unit is of the general type disclosed in patent application of J. J. Hopkins, Serial No. 651,871, filed March 4, 1946, for Fuze. More particularly, the antenna comprises a curvilinearly arranged strand of wire **29** which is turned over a generally conical plastic nose **30** and embedded in the surface thereof. The antenna **29** may be an extension of the oscillator tank coil, which is an impedance matching transformer wound about the form **24**. All of the components are retained rigidly in position on the base by injection of a plastic material having suitable heat-resisting characteristics and are of sufficient ruggedness to withstand the forces acting on the radio proximity fuze while being fired from a gun.

The nose of the fuze has a plastic end piece **34**. This is subjected to a heating effect when the fuze moves through the atmosphere at high velocity. Materials heretofore used were objectionable in that the heat thus produced softened the plastic, and the tremendous air friction abraded particles from the softened surface.

When a projectile is fired from a gun, it must traverse the cloud of ionized smoke or other particles at the mouth of the gun barrel. In doing so the surface of the fuze nose becomes charged. At this time the fuze is not yet armed, hence no firing occurs due to the charge. However, the fuze is in the armed condition when the above mentioned heating and softening occur, hence the removal of particles from its surface by air friction may dissipate the charge, thus causing an electrical disturbance which may be sufficient to actuate the fuze prematurely.

The nose piece **34** according to the present invention is

not subject to this action because it consists of a plastic, which, for the purposes here involved, is indestructible. The material is chemically identified as polytetrafluoroethylene, a plastic developed by du Pont. This substance does not melt, and is not attacked by any acid or gas. Extreme heat does not soften or char it, but merely causes a slight superficial volatilization. Its electrical and nonhygroscopic properties are superior to those of polystyrene, and its mechanical resistance to flexure and impact are comparable to those of ethocel.

The nose piece **34** is machined to provide an internal thread **35** fitting on the corresponding thread of the metal base member **36**. The flange **37** is then pressed down against the nose piece **34** to complete the nose. Alternatively, the plastic may be molded directly to an insert, with equivalent anchoring means or methods.

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 a proximity fuze, an assembly comprising an amplifier, a deferred action source of power, a squib and a safety device, and a hermetically sealed metallic container enclosing the said assembly, said container having a top wall formed with openings, terminals projecting therethrough, and means insulating the terminals from the wall.

2. A nose for a fuze having a casing made of polytetrafluoroethylene.

3. The process of making a proximity fuze assembly containing electrical and mechanical components, hermetically sealed in a container, which consists in inserting the components in the container, subjecting them to pressure to force them into intimate end-to-end contact with one another, cutting the container to the correct length to accommodate them in their compressed condition, and thereupon sealing the container hermetically while maintaining this condition.

4. A hermetically sealed assembly for use as a unit of a proximity fuze, comprising two metal cups each having a closed end, electronic apparatus, a power source, and a squib, said three last named devices being housed in said cups jointly, said cups being located mouth to mouth and hermetically sealed to each other.

5. An assembly as defined in claim 4, having in addition an annular flange projecting outwardly from the assembly at the line of junction of the cups with each other.

6. In a proximity fuze, a sealed metallic unit containing amplifying and igniting means, said unit having a top wall, terminals carried by the top wall and insulated therefrom, and an oscillator unit mounted on the top wall and having leads connected to said terminals.

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