Jan. 28, 1958 M. APSTEIN ET AL 2,821,139

SHIELDED INITIATOR

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Fig. 1.

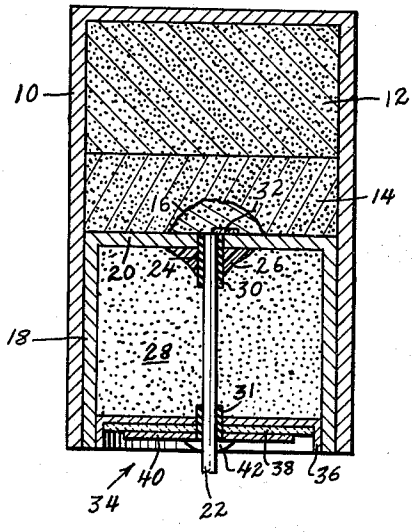
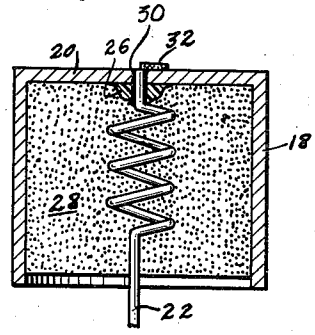


Fig. 2.



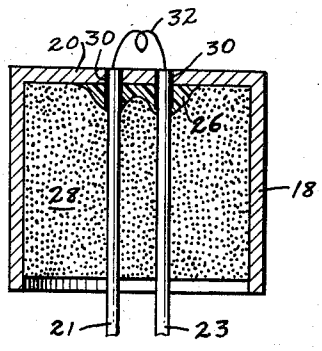


Fig. 3.

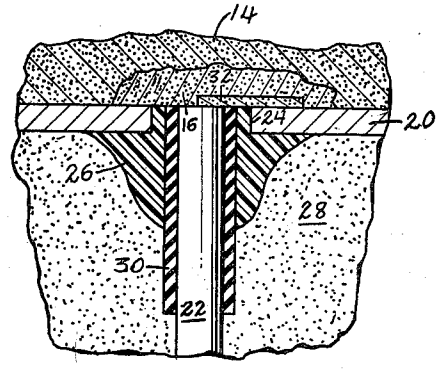


Fig. 4.

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SHIELDED INITIATOR

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9 Claims. (Cl. 102—70.2)

(Granted under Title 35, U. S. Code (1952), sec. 266)

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

This invention relates to electrical pyrotechnic initiators.

Electrical pyrotechnic initiators are often used near electromagnetic radiation. This creates a serious hazard because the electrical leads sometimes act as an antenna and substantial energy is received in them and transmitted to the initiators. The problem is most serious when the frequency of the radiation is the highest. Then a very short section of unshielded wiring will receive large amounts of energy. By the term "electrical pyrotechnic initiator," we mean any device which ignites a burning or exploding charge in response to an electrical signal, such as detonators, primers or explosive motors.

In fuzes for ordnance explosive devices, electrical initiators are extensively used. Generally these initiators are highly sensitive because of difficulties of obtaining and applying high levels of energy in the device. Also, in addition to stray radiation present, it is possible that high energy radiation would be purposely directed at the fuze in an attempt to detonate it prematurely.

The present invention provides novel shielded initiator assemblies having integral means for attenuating high-frequency electromagnetic energy reaching the assembly.

An object of this invention is to provide an initiator sensitive to D. C. or low-frequency electrical energy which is not sensitive to high-frequency electromagnetic radiation.

Another object is to achieve the above with a device that is sturdy, simple, and reliable, yet cheap and easy to manufacture.

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

Fig. 1 is a sectional view of an initiator in accordance with this invention.

Fig. 2 is a sectional view of a modified form of attenuator.

Fig. 3 is a sectional view of another modified form of attenuator.

Fig. 4 is an enlarged partial section of the junction of the conductor and shell of the forms shown in Figures 1 and 2.

As seen in Fig. 1, an initiator in accordance with the invention has an outer tubular or cup-shaped metallic case **10**. A pyrotechnic charge is contained in the case adjacent to the closed end. This charge is composed of three parts: main charge **12**, lead charge **14**, and primer spot **16**.

Also contained in case **10** is attenuator shell **18**. The shell is tubular or cup-shaped and co-axial with case **10**. The closed end **20** of shell **18** is in contact with the pyrotechnic charge. Central conductor or wire **22** extends into axial hole **24** in the closed end **20**. The wire is held in place by bonding material **26** such as epoxy resin.

The shell **18** is filled with a "lossy" magnetic material **28** which will be described in detail later. Wire **22** is covered with insulation **30** in the vicinity of the shell **18** to prevent current leakage to the shell. A high-resistance bridge **32** connects wire **22** with closed end **20** at the shell and is in contact with priming spot **16**. As shell **18** is in electrical contact with case **10** the bridge **32** electrically connects wire **22** to the case. These bridges are well known to the art and may be carbon or resistance wire. Or the bridge and priming spot may be replaced with a conductive mix explosive.

At the open end of shell **18** is a capacitor **34**, consisting of metallic disc **36**, metallic plate **40**, and dielectric sheet **38** therebetween. Capacitor **34** is coaxial and fits in the end of shell **18**; disc **36** makes mechanical and electrical contact with shell **18**. Insulator **31** on the wire **22** in the vicinity of disc **36** insulates it from the disc **36**. A spot of solder **42** attaches wire **22** to plate **40**, which contacts the outer surface of sheet **38**.

The lossy magnetic material **28** is one which will absorb and attenuate the high frequency electromagnetic field which may have been induced in wire **22**. Such materials are known and may consist of electronic powdered iron; however, we prefer to use a ferrite. Electronic powdered iron is a ferromagnetic material of purified iron, or other metals in combination with iron, used in powder form, consisting of particles having micron or submicron dimensions, insulated from each other by an insulating coating or by an insulating binder, or both. It is widely used commercially as electronic core material and is known in the trade by such names as carbonyl iron, Mepham hydrogen-reduced iron, powdered molybdenum Permalloy or Sendust. A ferrite is a ceramic semiconductive ferromagnetic material composed of several metallic oxides having an inverse spinel structure, such as various stoichiometric or non-stoichiometric forms of manganese zinc ferrite, nickel zinc ferrite, magnesium zinc ferrite, and others using bivalent or trivalent substitutions of copper, aluminum, cobalt, lithium and other metals. It is commercially available under such trademarks as Ferroxcube, Ferramic, or Ceramag. To be most effective as an attenuator of high frequency signals these materials must be close to the conductor; therefore there is no insulation between the conductor **22** and the material **28**. Because the materials are not good conductors, they do not appreciably attenuate the normal firing signal to the initiator, which does not have high frequency components.

The attenuator shown in Fig. 2 is the same as that of Fig. 1 except the wire **22** is in the form of a helix within the lossy magnetic material **28**. This serves two purposes. First, it provides more contact between the conductor and the lossy material; this effect could be achieved by zig-zagging the wire as well. Second, the helix also acts as a high-frequency choke, increasing the impedance to the undesired energy.

The attenuator shown in Fig. 3 is designed for two-wire initiators. It is the same as the attenuator of Fig. 1 except that wires **21** and **23** are parallel to the axis of the shell rather than coaxial. In this figure the bridge **32** is illustrated as a resistance wire. In all cases the lossy magnetic material is proximate to the bridge.

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

We claim:

1. A shielded initiator comprising: a case, a pyrotechnic charge contained within the case, a central electrical conductor within the case, a high resistance bridge electrically connected to the central conductor, said bridge in physical contact with said pyrotechnic charge, and a

lossy magnetic material surrounding the conductor, said lossy magnetic material being proximate to said bridge.

2. The invention as defined in claim 1 wherein said lossy magnetic material is a ferrite.

3. The invention as defined in claim 2 wherein said ferrite is manganese zinc ferrite.

4. The invention as defined in claim 1 whereby said lossy magnetic material is electronic powdered iron.

5. The invention as defined in claim 1 with the addition of a capacitor between said central conductor and said case.

6. The invention as defined in claim 1 wherein said bridge is electrically connected between said central conductor and said case.

7. The invention as defined in claim 6 wherein said central conductor is helical.

8. The invention as defined in claim 1 with the addition of a second conductor surrounded by said lossy magnetic material and wherein said bridge is electrically connected between said two conductors.

9. A shielded initiator comprising: a tubular case, a pyrotechnic charge in said case, a coaxial tubular shell closed at one end in said case in electrical contact therewith, said closed end in contact with said pyrotechnic charge, said closed end having a hole coaxial with the shell, a central conductor in the shell extending into the hole, a bridge of high resistance material in contact with the pyrotechnic charge between the conductor and the shell, and ferrite in said shell surrounding said central conductor.

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