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Thomas et al.

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[54] **ELECTROEXPLOSIVE DEVICE**

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[52] **U.S. Cl.** ..... **102/28 R**

[51] **Int. Cl.** **F42b 3/12**

[58] **Field of Search** ..... 102/28, 28 M, 28 EB

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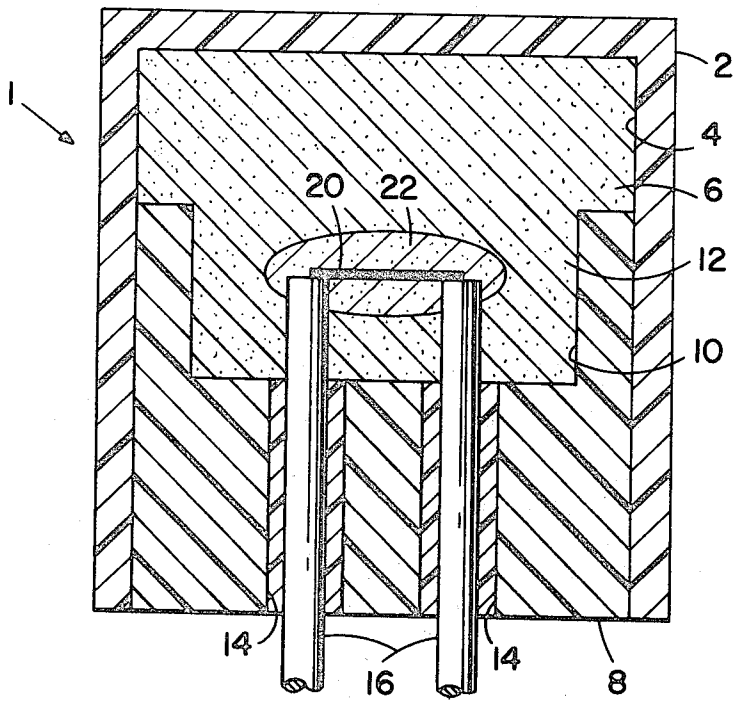
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[57] **ABSTRACT**

An electroexplosive device having its major components, namely the casing, lead wire, bridgewire, and explosive composition all formed of "low Z" elements, i.e., elements having a sufficiently low atomic number which defines only those elements which are transparent to X-ray energy. That is, the X-ray energy may pass readily therethrough, rather than to be absorbed, thereby reducing the hazards that the X-ray normally present to the proper functioning of the device.

6 Claims, 2 Drawing Figures



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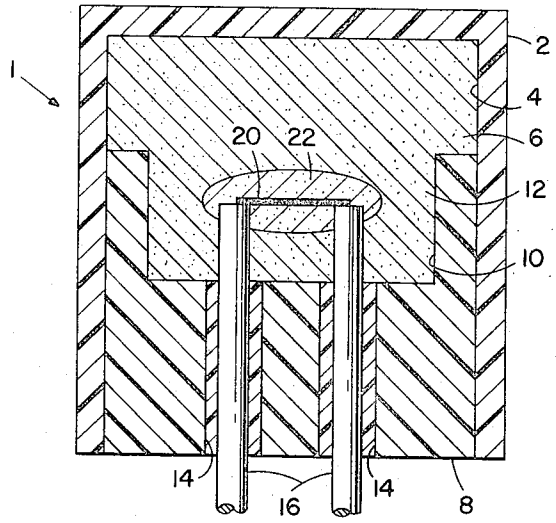


FIG. 1

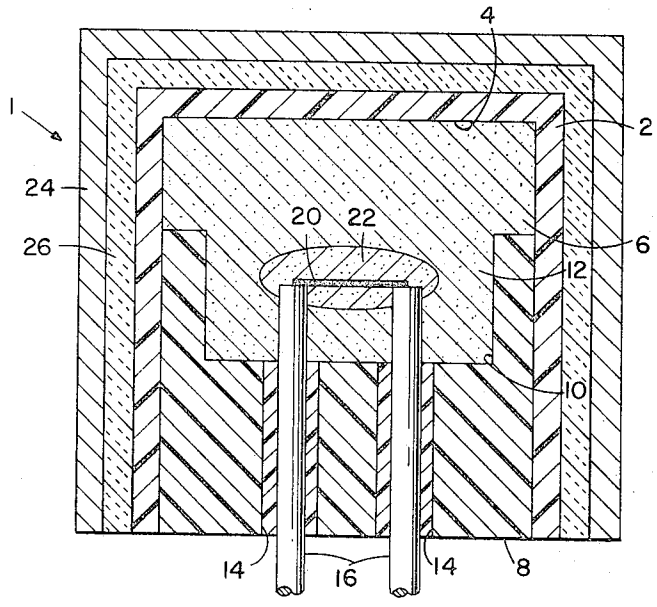


FIG. 2

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ELECTROEXPLOSIVE DEVICE

This invention relates generally to electric igniters, initiators, squibs, detonators and the like devices of the electroexplosive type. More particularly, the present invention embodies an improved electroexplosive device having structure which allows the same to be used effectively in environments subject to hazardous X-ray energy.

An electroexplosive device according to this invention may be used advantageously, for example, in missiles and rocketry for fuel ignition and for activation of controls and switches.

The threat of nuclear warfare poses problems in modern warfare never before encountered. For example, certain nuclear devices, when exploded, emit tremendous levels of X-ray energy. Since X-ray energy is hazardous to proper functioning of conventional electroexplosive devices, the need exists for an initiator which will function with perfection under conditions of high intensity X-ray energy. The present inventive device is useful, therefore, in missiles and the like modern warfare weapons wherein the same may be exposed to hostile environments having high intensity X-ray energy.

It is well known that the absorption of X-ray energy by any material increases proportional to the atomic number, Z, of its elements. Conventional electroexplosive devices in current use employ "high Z" elements such as gold or lead and their compounds, as either the inert components of the initiator, or the same are used in the explosive mixtures thereof. These "high Z" elements, by absorbing more X-ray energy, cause the electroexplosive device to be more hazardous in operation.

The present invention contemplates making the components of electroexplosive devices of "low Z" materials. In this application, "low Z" materials or elements will be defined as those having a sufficiently low atomic number which defines only those materials or elements which are transparent to X-ray radiation. That is, X-ray radiation will readily pass through these "low Z" materials or elements and not be absorbed thereby; For example, these components could be: aluminum, beryllium, carbon or boron as the lead wires and bridgewires; plastics composed of organic materials for the plugs and insulators; and organic or very "low Z" elements as the fuels and oxidizers. Initiators according to this invention will permit more X-ray energy to pass through, rather than be absorbed, thereby reducing the hazards that these X-rays produce.

In view of the foregoing, the primary object of the present invention is to provide an improved electroexplosive device the operation of which will not be adversely affected by X-ray energy.

Another object of the present invention is to provide an electroexplosive device which is capable of satisfactory use in nuclear environments.

The foregoing and other objects of this invention will become more fully apparent from the following detailed description and from the accompanying drawing, wherein:

FIG. 1 is a sectional view of a typical electric initiator constructed in accordance with the present invention; and

FIG. 2 is a sectional view of another embodiment of the invention.

Referring now to the drawing (FIG. 1), wherein for the purpose of illustration, there is shown a typical electric initiator or squib **1** having the elements thereof housed in a case **2.** The case is preferably formed of a plastic or acrylic resin, such as Plexiglas; however, the case could be formed of "low Z" metals, such as beryllium, magnesium, or aluminum i.e., materials which will readily pass X-ray energy therethrough without absorbing the energy. The interior of the case defines a chamber **4** having a main charge **6** disposed therein. The main charge is preferably composed of organic or very low atomic-numbered fuels and oxidizers which pass X-ray energy, therethrough without absorbing the X-ray energy. An end plug **8** made of an organic plastic, such as Plexiglas or phenolics, fits snugly within and thereby closes the open end of the case, retaining the main charge therein. End plug **8** is formed in the inner side thereof with a cylindrical or cup-shaped recess **10** defining a chamber **12.** A pair of axially extending bores **14** are formed in the body of the end plug so as to receive therein a pair of insulated lead wires **16.** The lead wires are preferably secured within bores **14** as by an adhesive, such as epoxy, provided therebetween the insulation and the bores. Bridging the two lead wires is a very thin wire **20,** which functions as a resistance wire. Each of the conducting lead wires, as well as the bridgewire, is formed of a material having a low atomic number, e.g., aluminum, beryllium, carbon or boron. To assure intimate contact between the bridgewire and the main charge, the bridgewire is coated or beaded with a pyrotechnic composition of boron, ammonium nitrate, or other fuel and oxidizer having a low atomic number. Thus, this coating or bead **22** could be the same organic composition as the main charge. Preferably, the bridgewire and bead thereon is disposed within chamber **12,** and the main charge fills this chamber as well as chamber **4.** Secondary flash charges, if utilized, would also be composed of either organic mateials or low atomic-numbered oxidizers and fuels.

Accordingly, the electroexplosive device according to the present invention has all the components thereof made of material having low atomic numbers. In operation, an initiator as described herein will permit more X-ray energy to pass through, rather than be absorbed, thus, reducing the hazard that these X-rays present to the proper function of the device. It should be apparent that, while an exploding bridgewire type electroexplosive device has been described, the inventive concept is equally applicable to all electroexplosive devices, e.g., hot wire, conductive mix, or spark gap types.

A second embodiment of the present invention is illustrated in FIG. **2.** This embodiment differs from that of FIG. **1** in the provision of an exterior housing **24** made of a "high Z" material, such as lead, uranium, tin, thorium, and in the provision of an additonal thermal and shock insulating layer **26** of asbestos or the like material intermediate the outer housing and the initiator case. Thus, in operation it is apparent that the housing and insulating layer together provide shielding means for the initiator and inhibit the passage of X-ray energy into the initiator. However, any X-ray energy that passes through the outer shielding means will not be absorbed readily becasue of the low atomic-numbered elements of the initiator, and will, therefore, pass readily therethrough.

The foregoing is a description of the preferred embodiments of the invention. However, since variation in

the embodiments which have been described may be made within the spirit and scope of this invention, the description is not to be considered as limiting except in the light of the appended claims.

What is claimed is:

1. An electric initiator defined by: a case made of a material having a low atomic number, said case having an open and a closed end; an end plug made of a plastic material and tightly secured within and closing the open and of said case, the inner wall of said plug defining with the closed end of said case a chamber, said end plug further having a pair of axially extending bores formed therethrough; a fuel and oxidizer, each composed of elements having low atomic numbers, filling said chamber; a pair of insulated lead wires secured within said bores and extending into said chamber, said lead wires having conductors made of a material having a low atomic number; and a bridgewire made of a material having a low atomic number bridging the inner ends of the lead wire conductors, wherein, in each instance recited, the term "low atomic number" refers to an element or material whose composition is designated by an atomic number sufficiently low so as to define only those elements or materials which readily passes X-ray energy therethrough while being nonabsorbent thereto.

2. A device as defined in claim 1 wherein a cup-shaped depression is formed in the wall of said end plug facing the closed end of the case, and wherein said bridgewire is disposed within said depression.

3. A device as defined in claim 1 wherein the bridgewire is coated with a pyrotechnic composition of materials having said low atomic numbers.

4. A device as defined in calim 1 further including a thermal and shock insulating liner superimposed about said case, and a housing externally of said liner, said housing being made of a material which will inhibit the passage of X-ray energy therethrough.

5. A device as defined in claim 4 wherein a cup-shaped depression is formed in the inner wall of said end plug, and wherein said bridgewire is disposed within said depression.

6. A device as set forth in claim 4 wherein the bridgewire is coated with a pyrotechnic composition of material having a said low atomic number.

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