Aug. 2, 1938. G. A. NODDIN 2,125,356

INITIATOR

Filed Nov. 22, 1935

FIG. 5A.

FIG. 5B.

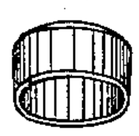

FIG. 5C.

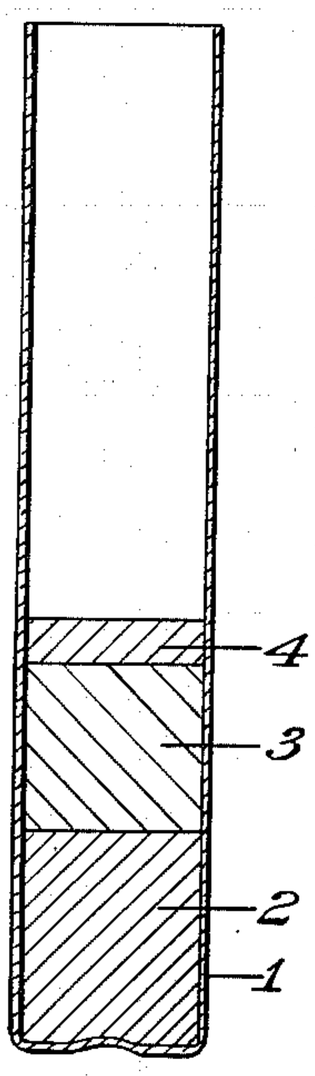

FIG. 1

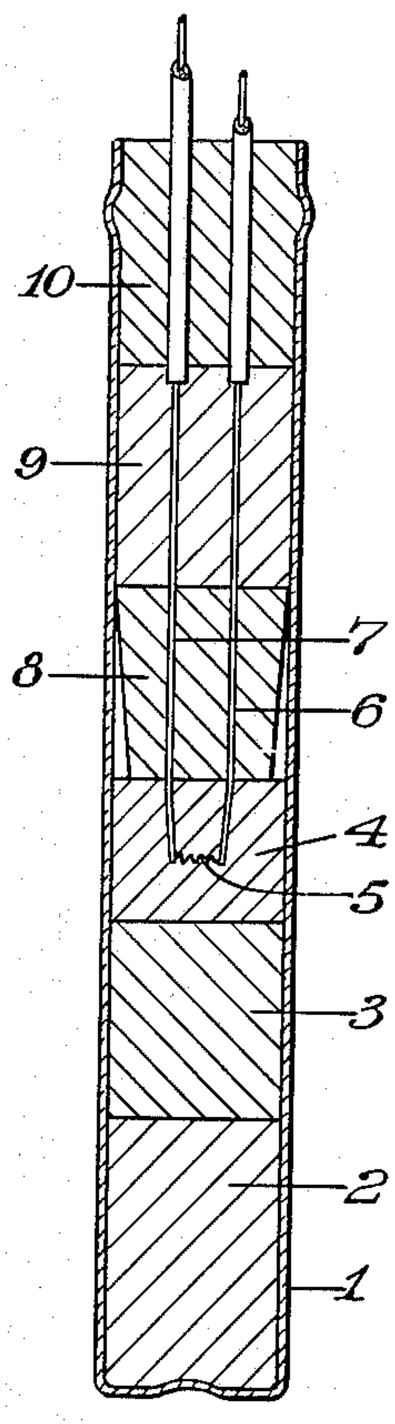

FIG. 2

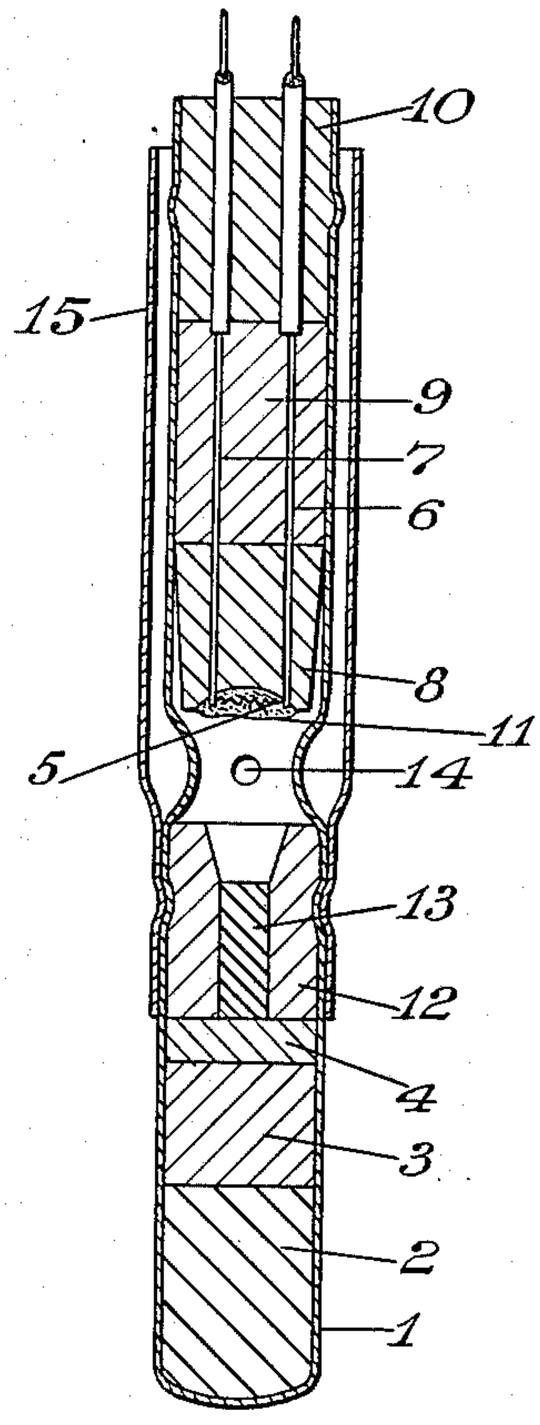

FIG. 3

FIG. 4A.

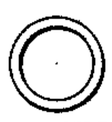

FIG. 4B.

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Patented Aug. 2, 1938 2,125,356

UNITED STATES PATENT OFFICE

2,125,356

INITIATOR

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Application November 22, 1935, Serial No. 51,095

12 Claims. (Cl. 102—9)

This invention relates to initiators for high explosives and more particularly to lead azide blasting caps, in which the explosive charge is contained in a metal shell of improved corrosion resistance properties.

Blasting caps, as manufactured heretofore, have comprised an explosive charge enclosed in a metallic shell. The shell material has usually been either copper, a copper alloy, or aluminum, the metal employed depending on the nature of the various materials used as a charge. When mercury fulminate has been either the main or the priming agent, the caps have ordinarily been constructed of a copper alloy, for example gilding metal. This metal is well adapted in properties for this use, whereas aluminum is rapidly deteriorated by mercury fulminate. Copper and its alloys, on the other hand, are not satisfactory for so-called ordinary caps, in which the end of the shell is open to permit the insertion of a fuse, when lead azide is present as the primary detonating charge. This compound, when in contact with copper or its alloys, forms the very sensitive copper azide, particularly in the presence of moisture and carbon dioxide, which are frequently present in mine atmospheres. As the insertion of the fuse would under these conditions be very hazardous, lead azide can not be used with copper shells for this type of cap.

The use of aluminum for cap shells, however, has been definitely limited, due to the properties of this metal. In the first place, it can not be used with mercury fulminate since the small amount of free mercury present in the fulminate attacks the metal and amalgamates with it. Moreover, when lead azide is present as a primary detonating compound, it is customary to use an additional ignition material, since lead azide is relatively insensitive to ignition by itself. Some of the materials that have shown themselves to be very well adapted for use in ignition compositions, however, have a corrosive effect on aluminum. The use of this metal thus means that certain, otherwise very desirable ignition mixtures can not be used. Finally shells of this metal are lacking both in rigidity and surface hardness. It is evident therefore that aluminum has, up to the present time, been relatively unsatisfactory for use in cap shells.

The object of my invention is to provide an initiator, and preferably a blasting cap, the shell of which has a high degree of resistance to the chemical action of mercury fulminate and of the ingredients of ignition compositions, that have a corrosive action on metallic aluminum. A further object is an initiator having an increased wall strength. A still further object is a shell of treated aluminum, the surface of which possesses the advantages enumerated. Additional objects will be apparent as the invention is described further.

I have found that the foregoing objects are accomplished if the initiator shell is constructed of anodically hardened and superficially oxidized aluminum. Such a shell is obtained by a process that may be designated as anodic oxidation, in which the aluminum shell serves as an anode in an electrolytic process. The oxygen set free at the anode brings about the oxidation of the aluminum and, at the same time, imparts to it an extraordinarily hard surface coating of what I shall hereinafter designate as anodic aluminum oxide. As far as I know, the superior properties of the oxide film applied in this manner cannot be equalled by any other known process, since the aluminum oxide resulting from anodic oxidation appears to be fused into the metal, thereby substantially becoming integral therewith.

Aluminum shells having a surface of anodic aluminum oxide are satisfactory for use with mercury fulminate charges, which material can not be used in contact with unprotected metallic aluminum. I find, however, that the most important field involves the use of lead azide in combination with an ignition composition containing ingredients that rapidly attack unprotected metallic aluminum. Compositions containing lead sulfocyanate, lead hypophosphite or potassium chlorate are instances of such mixtures. As an example of a desirable cap charge, that has heretofore not been adaptable for use in shells having a wall surface of metallic aluminum but that is compatible with my improved shell, I may use a base load of tetryl or other suitable material, a priming charge of lead azide, and an ignition mixture of the following compostion:

	Per cent
Lead sulfocyanate	50
Potassium chlorate	40
Sulfur	10

The advantages of my improved cap shell are shown by the result of storage tests. When shells containing the ignition composition described in the foregoing are exposed to an atmosphere saturated with moisture, the ones having the plain aluminum surface become badly corroded in less than three days, while shells having a surface coating of anodically produced aluminum oxide, according to my invention, are

unaffected even after a storage period of four weeks.

In addition to the increased corrosion resistance given to the shell wall by the surface coating of anodic aluminum oxide, a definite advantage is obtained in the increased strength and surface hardness resulting from such coating. Instead of the usual soft and malleable surface such as is possessed by metallic aluminum, the coated surface has a greatly increased stiffness and a much higher degree of hardness, similar in many cases to that of mild steel. As a result of this added strength, the wall thickness can be materially reduced, thereby effecting a considerable saving in metal cost.

My invention is intended particularly for application to blasting caps of various types, but it may be applied equally well to initiators generally for example to detonators for high explosive shells and bombs and to primers for ammunition.

By way of further description and illustration of my invention, I have shown in the accompanying drawing, in sectional views, three embodiments thereof applied specifically to blasting caps, in which Figures 1, 2, and 3 represent respectively an ordinary or fuse-type blasting cap; an electric blasting cap; and a delay type electric blasting cap. Figures 4—A and 4—B represent side and end views, respectively, of a detonator for a high explosive shell. Figures 5—A, 5—B and 5—C represent inside end, outside end, and side views, respectively, of a priming cup suitable for small arms ammunition.

Referring now generally to Figures 1, 2 and 3, 1 represents an aluminum shell having a surface coating of anodic aluminum oxide. In the shell is placed a base charge 2 of secondary detonating material; a priming charge 3 of a primary detonating compound, for example lead azide; and a suitable ignition charge 4.

In Figure 2 the ignition composition 4 surrounds the high-resistance bridge wire 5 connected between the leading wires 6 and 7, said wires being held in fixed space relationship by means of the bridge plug 8. The cap is closed by means of a waterproofing composition 9 and a sulfur seal 10.

In Figure 3, representing an electric blasting cap of the delay type, the ignition composition 4 is separated from a cemented ignition composition 11 in the concavity in the end of the concave plug 8 by the metal element 12 containing a slow burning fuse composition 13. The delay blasting cap is likewise closed by a waterproofing composition 9 and a sulfur seal 10. A vent 14 is provided whereby the gases evolved in the combustion of the slow burning fuse composition 13 may escape into the space between the shell wall 1 and the metal jacket 15 and thence to the environment.

In the foregoing, I have described my invention in detail. It will be understood that the coating of anodic aluminum oxide may be present in appearance as formed, or that the surface may be covered with an additional coating of a colored pigment for decorative or protective purposes. It will be further understood that I am not claiming generally aluminum shells having an oxide coating, since such coatings may have resulted from incidental surface oxidation, and such coatings will not impart to the shell the advantages resulting from my specifically applied strengthening coating. Various modifications, however, may be introduced without departing from the spirit of the invention. I intend, therefore, to be limited only as indicated by the following patent claims:

I claim:

1. An explosive-initiator comprising an aluminum shell containing an explosive charge, said shell having a corrosion- and abrasion-resistant coating of aluminum oxide.

2. An explosive-initiator comprising an aluminum shell containing an explosive charge, said shell having a surface coating of anodic aluminum oxide.

3. A blasting initiator comprising an explosive charge enclosed in a shell of anodically treated aluminum.

4. A blasting initiator comprising an explosive charge enclosed in a shell of anodically, superficially oxidized aluminum.

5. A blasting initiator comprising an explosive charge enclosed in a shell of anodically hardened and superficially oxidized aluminum.

6. A blasting cap comprising an explosive charge consisting at least in part of a material having a corrosive action on aluminum, and an anodically hardened and superficially oxidized aluminum shell.

7. The blasting cap of claim 6, in which said explosive charge comprises mercury fulminate.

8. A blasting cap comprising a base charge, a primary charge and an ignition charge containing a material having a corrosive action on aluminum, said charges being contained in a shell of anodically hardened and superficially oxidized aluminum.

9. The blasting cap of claim 8, in which said primary charge comprises lead azide.

10. The blasting cap of claim 8, in which said ignition charge comprises a sulfocyanate.

11. A blasting cap comprising a base charge, a primary charge of lead azide, an ignition charge containing an ingredient incompatible with aluminum, said charges being contained in a shell of anodically hardened and superficially oxidized aluminum.

12. A blasting cap comprising a shell having a superficial coating of anodic aluminum oxide, whereby the corrosion- and abrasion-resistant properties of said shell are substantially increased.

GEORGE A. NODDIN.