Sept. 20, 1932. H. A. LEWIS 1,877,772

INITIATOR

Filed April 24, 1931

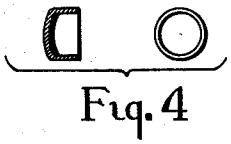


Fig. 4

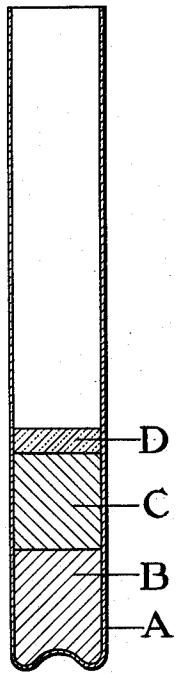


Fig. 1

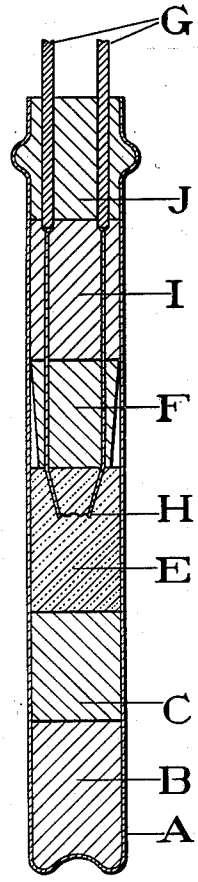


Fig. 2

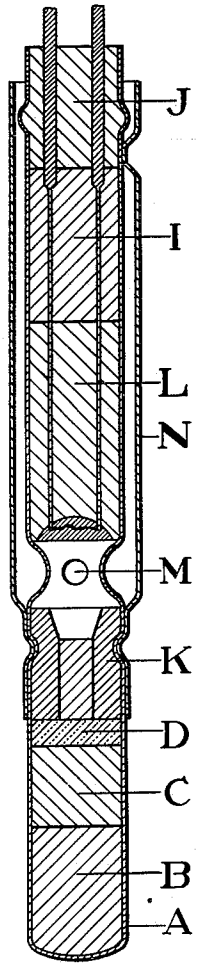


Fig. 3

Fig. 5.



Harold A. Lewis, INVENTOR

BY HIS ATTORNEY

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1,877,772

UNITED STATES PATENT OFFICE

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INITIATOR

Application filed April 24, 1931. Serial No. 532,472.

This invention relates to initiators for high explosives and more particularly to lead azide blasting caps and the like, and comprises a treated steel alloy shell in combination with an explosive charge for the same.

Blasting caps as heretofore manufactured have usually comprised a shell of gilding metal (copper-zinc), or aluminum, or its alloys. By the term "blasting caps" as used herein I means to include either a fuse or ordinary cap, an electric blasting cap, and/or a delay electric blasting cap. Descriptions of each type follow hereinafter. Blasting caps having mercury fulminate as the main charge or as a priming agent have usually been constructed of gilding metal, because of e compatibility of mercury fulminate with ch copper alloys. Caps containing lead ide have usually been made of aluminum or its alloys, since this compound in combination with copper or copper alloys forms supersensitive copper azide, particularly in the presence of moisture and carbon dioxide, thus making such combinations hazardous and prohibitive. Furthermore, it has been found that aluminum-shell, lead-azide primed caps give off an excessive flash upon detonation, probably because of the combustion of the aluminum shell. This flash is frequently sufficient in intensity to ignite inflammable gases, such as are present in gaseous coal mines, thus making this type of shell also hazardous and prohibitive.

Detonators for high explosive shells and priming cups for small arms ammunition have also commonly been made of gilding metal, of brass, or of copper-nickel alloys. Besides excessive cost of such shells and other parts made of these metals, they have had other inherent disadvantages.

There are other disadvantages in both aluminum and copper blasting caps, aside from cost and non-uniformity of form and composition, in that when either is used for blasting in the mining of salt, the fine metal particles that result are generally objectionable in the salt and render the salt unsatisfactory for many purposes. For example, when such salt is used in tanning processes, a discoloration of the hides invariably results. Furthermore, when these types of blasting caps are used in connection with the blasting of coal, any unexploded caps later present a serious hazard in the subsequent use of the coal. In either case, neither the particles nor the unexploded caps can be conveniently removed from the mined material by the most suitable means, namely, the magnet, because of the non-magnetic properties of these metals.

Other metals have been suggested for use in the manufacture of blasting caps but have not found application because of various disadvantages.

An object of my invention is to provide an initiator that is universally suitable for all types of firing and blasting operations. A further object of my invention is to provide an initiator, the metallic material of which is compatible with both mercury fulminate and lead azide. Another object of my invention is to provide an initiator which is constructed of less expensive materials than those heretofore known and used. A still further object of my invention is to provide an initiator, and particularly a blasting cap, which is magnetic. Other objects will be apparent as the description proceeds.

These objects are accomplished by the following invention, in which I have found that nitrided steel alloys, when used in combination with mercury fulminate and lead azide, is compatible therewith, yields a product that is non-corrosive, does not give off an objectionable flash when exploded, and has magnetic properties, besides many other advantages.

The nitrided steel alloy above mentioned is produced by a "nitriding" process. By the term "nitriding" as used herein is meant that

process in which the steel alloy is treated at elevated temperatures with substances which give off nitrogen, such, for example, as ammonia. It is believed that in this process an iron nitride is thus formed on the surface of the metal. By the term "steel alloy", as used herein, I mean to include any of the common alloys of steel, which are recognized to take on a definite hardness when nitrided.

These comprise steels containing 1 to 5 per cent of materials such as copper, aluminum, chromium, manganese, and the like, in addition to the small quantities of the ordinary impurities in iron such as carbon, phosphorus, sulfur, etc.

In carrying out the process, a steel alloy shell is formed in any suitable manner, and heated to an elevated temperature, and ammonia is passed over the shell for a sufficient period to produce a surface resistant to corrosion. For example, temperatures of 800° to 1200° F, may be advantageously used, and, at these temperatures, periods of time varying from one-half to ten hours may be employed. At these temperatures and time periods, the rate of ammonia passed may be such that the percentage of decomposition of the ammonia may vary from 5 to 95 per cent, depending upon the surface coating desired.

Upon cooling, a shell is obtained that is very resistant to atmospheric corrosion, and at the same time has the satisfactory properties which make it desirable in a detonator cap or similar combination. Furthermore, I have found that when the steel alloy shell is annealed before the nitriding process, its brittleness is reduced, and it is less liable to crack when crimped upon the fuse. Other methods of nitriding the steel may be used such as heating the caps or shells in an oven in the presence of a nitrogen containing material, such, for example, as guanidine compounds, or other similar compounds that yield nitrogen upon heating.

The nitrided steel alloy shells described herein may be dyed, lacquered, metal coated, or metal plated to improve the appearance, or for the purpose of protection of the shell, and for this purpose a coating is proposed that is compatible with the explosive charges incorporated therein. For example, dyes in solution, lacquers containing nitrocellulose, resins, etc., and coatings or platings of various suitable metals are satisfactory.

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. Figure 4 represents a detonator for a high explosive shell, and Figure 5 priming cups suitable for small arms ammunition.

In each of Figures 1, 2 and 3, A represents a nitrided steel shell which may be a plain shell or one coated or plated as hereinbefore described. B represents a charge of a secondary detonating material, for example tetryl, while C represents a charge of a primary detonating compound, for example, of lead azide.

In Figure 2, E, F, G, and H, represent the usual elements of an electric blasting cap in which E is adapted to be fired by the bridge wire H carried by the firing wire G.

Figure 3 represents an electric blasting cap of the delay type in which the delay element K is substituted for the loose charge E in Figure 2. When fired the burning gases from the relay element may escape through the opening M and may be carried through the outer sleeve N. Elements F, I, J, and L, in Figures 2 and 3 represent a water-proofing and sealing composition. Figures 4 and 5 represent respectively a detonator for a high explosive shell and priming cups for small arms ammunition of conventional design.

Whereas I have described my invention as applicable particularly to blasting caps, it will be apparent that it may equally well be applied to primers for ammunition and to detonators for high explosives shells and drop bombs.

Therefore, by the term "initiators", used herein, I mean to include blasting caps for use with commercial explosives such as dynamite, detonators for high explosive shells, depth bombs, hand grenades, and the like, and primers for small arms ammunition.

It is to be understood that the foregoing examples are illustrative only and that other embodiments exist and may be practiced within the scope of my invention. For example, nitrided steel alloy shells may be used in combination with other explosive charges such as the series of so-called straightfulminate detonators. It is to be further understood that I do not intend to be limited in my invention except as indicated in the following patent claims:

I claim:

1. An initiator comprising in combination an explosive charge and a nitrided steel alloy shell encasing the charge.

2. A blasting cap comprising in combination an explosive charge and a nitrided steel alloy shell encasing the charge.

3. A detonator comprising in combination an explosive charge and a nitrided steel alloy shell encasing the charge.

4. A priming cup comprising in combination an explosive charge and a nitrided steel alloy shell encasing the charge.

5. An initiator comprising in combination a charge of a secondary detonating compound, a charge of a primary detonating

compound, and a nitrided steel alloy shell encasing the compounds.

6. A blasting cap comprising in combination a charge of a secondary detonating compound, a charge of a primary detonating compound and a nitrided steel alloy shell encasing the compounds.

7. A detonator comprising in combination a charge of a secondary detonating compound, a charge of a primary detonating compound and a nitrided steel alloy shell encasing the compounds.

8. A priming cup comprising in combination a charge of a secondary detonating compound, a charge of a primary detonating compound and a nitrided steel alloy shell encasing the compounds.

9. An initiator comprising in combination a charge of a secondary detonating compound, a charge of lead azide and a nitrided steel alloy shell encasing the compounds.

10. A blasting cap comprising in combination a charge of a secondary detonating compound, a charge of lead azide, and a nitrided steel alloy shell encasing the compounds.

11. A detonator comprising in combination a charge of a secondary detonating compound, a charge of lead azide and a nitrided steel alloy shell encasing the compounds.

12. A priming cup comprising in combination a charge of a secondary detonating compound, a charge of lead azide and a nitrided steel alloy shell encasing the compounds.

13. An initiator comprising in combination a charge of tetryl, a charge of lead azide, and a nitrided steel alloy shell encasing the charges.

14. A blasting cap comprising in combination a charge of tetryl, a charge of lead azide, and a nitrided steel alloy shell encasing the charges.

15. A detonator comprising in combination a charge of tetryl, a charge of lead azide, and a nitrided steel alloy shell encasing the charges.

16. A priming cup comprising in combination a charge of tetryl, a charge of lead azide, and a nitrided steel alloy shell encasing the charges.

17. An initiator comprising in combination an explosive charge and an annealed, nitrided steel alloy shell encasing the charge.

18. A blasting cap comprising in combination an explosive charge and an annealed, nitrided steel alloy shell encasing the charge.

19. A detonator comprising in combination an explosive charge and an annealed, nitrided steel alloy shell encasing the charge.

20. A priming cup comprising in combination an explosive charge and an annealed, nitrided steel alloy shell encasing the charge.

21. An initiator comprising in combination an explosive charge and a nitrided, coated, steel alloy shell encasing the charge.

22. A blasting cap comprising in combination an explosive charge and a nitrided, coated, steel alloy shell encasing the charge.

23. A detonator comprising in combination an explosive charge and a nitrided, coated, steel alloy shell encasing the charge.

24. A priming cup comprising in combination an explosive charge and a nitrided, coated, steel alloy shell encasing the charge.

25. An initiator comprising in combination a charge of lead azide, and a nitrided steel alloy encasing the charge.

In testimony whereof I affix my signature.

HAROLD A. LEWIS.