

June 18, 1946.

L. A. BURROWS ET AL

2,402,235

BLASTING INITIATOR

Filed April 6, 1940

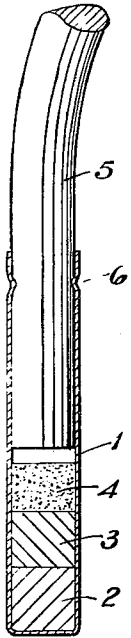


Fig. 1

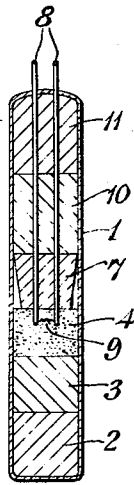


Fig. 2

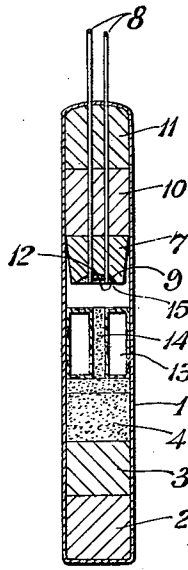


Fig. 3

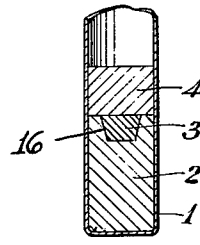


Fig. 4

Lawton A. Burrows
Walter E. Lawson

INVENTORS

BY

Thos. A. Wilson

ATTORNEY

UNITED STATES PATENT OFFICE

2,402,235

BLASTING INITIATOR

Lawton Arthur Burrows, Woodbury, N. J., and
Walter Eastby Lawson, Wilmington, Del., as-
signors to E. I. du Pont de Nemours & Company,
Wilmington, Del., a corporation of Delaware

Application April 6, 1940, Serial No. 328,220

3 Claims. (Cl. 52—2)

1

This invention relates to new and improved explosive compositions and more particularly to blasting caps containing such compositions, in which the assembled cap by a suitable arrangement of charges has been made less sensitive to shock and frictional impacts without the impairment of its ability to function.

Detonators or blasting caps are employed to initiate the explosion of the main charges in blasting and other work where high explosives are utilized. Such caps contain compositions which are more sensitive to impact, shock, and frictional effects than are the commonly-used main charges, dynamite for example. Such materials as mercury fulminate and lead azide are commonly employed as the primary detonating compounds in blasting caps, and their ability to pick up rapidly to their maximum high velocity of detonation when once ignited, especially in the case of lead azide, is the property which makes them particularly suitable for such use. Such compounds are of a relatively high order of sensitiveness to shock. While the necessary amount of primary detonating compound has been materially reduced in blasting caps by use of a supplementary charge of an explosively powerful but less sensitive material designated as the base charge, the sensitiveness of the cap to shock is essentially determined by the most sensitive material present. Any arrangement of charges that decreases the sensitiveness of the assembled blasting cap is a distinct advantage.

An object of the present invention is an explosive composition of the primary detonating type whose sensitiveness to shock has been substantially reduced. A further object is a blasting cap containing such an explosive charge. A further object is a blasting cap possessing a decreased sensitiveness to frictional effects. A still further object is a blasting cap containing a primary detonating charge in which the sensitiveness of such primary charge has been reduced without impairment of the functioning ability of the cap. Additional objects will be described as the invention is disclosed more at length in the following.

We have found that the foregoing objects are accomplished by blending with an explosive charge employed in blasting caps a water-insoluble metal soap in small amount. As such metallic soap, we may employ, for example, calcium stearate, aluminum stearate, magnesium stearate, aluminum oleate, and the like. The particular advantage of our invention will come in the blending of a finely-divided, water-insoluble

2

metal soap with the primary charge in the cap as a phlegmatizing or desensitizing agent. It is especially effective when used in small amount with lead azide.

It will be understood that this invention is applicable in all types of blasting caps containing a primary detonating charge, namely in ordinary caps adapted to be ignited by the spit of a fuse, in electric blasting caps, and in delay caps. By way of more exact illustration, the use of such desensitized blends is shown in the accompanying drawing. Figure I illustrates a fuse type cap. Figure II an electric blasting cap, and Figure III an electric delay cap. Figure IV is a blasting cap wherein the primary charge extends into a cavity in the base charge.

In Figure I, 1 represents a cylindrical aluminum cap shell into which a base charge 2 of tetryl is pressed, over which is placed the primary charge 3 comprising a blend of 98.5 parts of lead azide and 1.5 parts of calcium stearate. A charge 4 of a suitable ignition composition compatible with the shell wall metal is placed above the desensitized primary charge. The fuse 5, containing a small diameter core of black powder, is introduced into the cap shell above the primary charge and is crimped into the shell as indicated at 6. The firing of the cap takes place by lighting the fuse and ignition thereby of the primary charge 3.

Figure II shows an electric blasting cap according to our invention. The base charge 2, of tetryl, for example, is loaded into the bottom of the cylindrical shell 1. Above this base charge is pressed a primary composition 3, comprising 98.5 parts of lead azide and 1.5 parts of calcium stearate. Above the primary charge is superposed the ignition composition 4, which may be of any suitable composition, for example a blend of smokeless powder—double salt of lead nitrate and lead dinitro-ortho-cresylate—potassium chlorate, as disclosed in the copending application of Burrows and Noddin, Serial No. 297,272, filed September 30, 1939. Inserted in this loose ignition charge 4, is a finely-divided, highly-resistant wire 8, which connects the terminals of the leg wires 9. These leg wires pass through the composition bridge plug 7, and are held in place thereby. Above the bridge plug is a water-proofing composition 10 and a sulfur seal 11, in accordance with the usual practice. The blasting cap is brought to detonation by the passage of an electric current through the wires 8, and

bridge wire 9, which becomes heated to incandescence and fires the ignition composition 6.

Figure III shows a delay electric blasting cap in which the base charge 2 is pressed into the bottom of a cylindrical shell 1. Above this is the primary charge 3 consisting of a desensitized composition comprising 98 parts of lead azide and 2 parts of aluminum stearate. The ignition composition 4 is superposed on the primary charge. Above the ignition composition is the delay carrier 13 having a central cylindrical opening longitudinally therethrough, into which has been loaded a slow-burning powder in order to give the desired degree of delay in the firing of the charge. Above this delay element, in turn, and spaced relatively close thereto, is bridge plug 7 having a conical cavity at its lower extremity and centrally located. The fine bridge wire 9 connects the leg wires 8 across this cavity in the plug, and this bridge wire is surrounded by an ignition composition 15 which is fired by passage of the electric current through the leg wires. This in turn ignites the fuse powder in 14. The usual waterproofing composition 10 and sulfur seal 11 are located above the bridge plugs.

Figure IV shows a blasting cap wherein the base charge 2 has a cavity 16, within which is enclosed the primary charge 3. The base charge 2 in this cap comprises tetryl, with which has been blended 0.5% of finely-divided calcium stearate.

It will be understood also that sensitized primary compositions according to our invention can be used with any of the base charges applicable for the purpose. We find our improved primary charge particularly desirable, however, in conjunction with the assembly of Figure IV, in which the primary charge is introduced into a cavity in the less sensitive base charge, so that said primary charge is protected and separated on all sides from the metal cap walls by a layer of the base charge. Under such conditions a cap is provided of a very high degree of safety against hazards of shock and friction. In such caps, the use of lead azide as a primary charge is particularly advantageous. The presence of the conical cavity in the base charge for holding the primary charge makes possible a length of column of protected desensitized azide sufficient to detonate the base charge when commercial caps of the usual size are employed. We have found that the pressing of the cavity in the base charge is facilitated by blending with the base charge composition a small percentage of a water-insoluble metal soap of the type employed to phlegmatize the primary charge. As an ingredient of the base charge, this metal soap,

calcium stearate for example, allows cleaner withdrawal of the pointed press pin from said base charge. A suitable base charge of this type comprises tetryl blended with 0.25 to 2.0% of the metal soap, preferably with an amount of calcium stearate between 0.5 and 1.0%.

The presence of the desensitized primary charge is particularly useful in protecting against frictional effects such as would be exerted by penetration of a nail or like object into the cap. The desensitizing effect is demonstrated by satisfactory results in the nail tests, according to such procedure.

As has been stated, the base charge used in our improved cap may be of any material otherwise suitable. We find tetryl and pentaerythritol tetranitrate particularly desirable materials for such use because of their strength, ready detonability by suitable priming charges, their satisfactory degree of sensitiveness to shock, compatibility with metals, etc.

It will be understood that we wish to employ in general only a relatively small percentage of the safety ingredient in the primary charge. We find amounts less than 5% to be suitable. Lead azide-calcium stearate blends have been shown to possess highly satisfactory properties in the range of 97 to 99.5% lead azide and 3 to 0.5% calcium stearate.

While our invention has been described in detail in the foregoing, it will be understood that many variations may be introduced in compositions and arrangement without departure from the scope of the invention. While the invention has been directed particularly to detonator compositions, it will be understood that it may be employed in any type of explosive device in which explosives of the primary detonating type are used, where decreased sensitiveness to shock and friction is desired. We wish to be limited, therefore, only by the following patent claims.

We claim:

1. An explosive charge of the primary detonating type comprising a primary detonating compound blended with a water-insoluble metal soap in finely-divided form.
2. A blasting cap containing an explosive material blended with a water-insoluble metal soap in finely divided form.
3. A blasting cap containing a primer charge comprising a primary detonating compound blended with a water-insoluble metal soap in finely divided form.

LAWTON ARTHUR BURROWS.
WALTER EASTBY LAWSON.