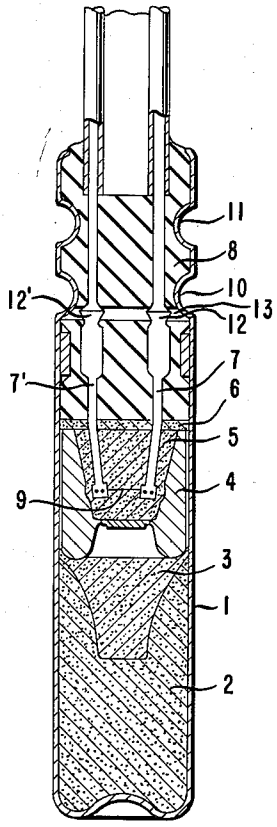
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BLASTING CAP

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BLASTING CAP

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The present invention relates to a novel electric blasting cap for use in blasting operations. More particularly, the present invention pertains to an improved electric blasting cap which is protected to a great extent from premature detonation caused by electrostatic discharges at low energy levels.

In the field, electric blasting caps are sometimes subjected to electrostatic energy which can cause premature detonation of the cap due to sparking depending upon a variety of circumstances. This is especially true of blasting caps having a powdered lead styphnate ignition composition. A tendency toward premature detonation is, of course, extremely dangerous to personnel who handle caps or who are in the vicinity when explosive shots are being set up. There are a number of ways in which electrostatic discharges commonly cause premature detonation of an electric blasting cap, as will be more particularly hereinafter described.

It is an object of the present invention to provide a novel blasting cap which is to a great extent protected against premature detonation resulting from electrostatic discharge. It is a further object of the invention to provide such a blasting cap which is simple, convenient and may be economically fabricated. These and other objects of the invention will become apparent from a consideration of the ensuing specification and claims.

The invention is particularly concerned with electric blasting caps having a powdered, crystalline lead styphnate ignition composition. Powdered lead styphnate, as commonly used for ignition purposes in electric blasting caps is very dusty and can "fluff up" into various locations within the blasting cap itself where it may be subjected to contact with an electrostatic discharge. Under certain circumstances the lead styphnate dust may flash and propagate to the main ignition charge causing the cap to fire. I have greatly minimized this danger by providing atop the lead styphnate ignition composition a thin layer of a powdered substance of such a consistency and density that it tends to act as a cover for the lead styphnate composition to prevent the egress of lead styphnate dust from the ignition area. This powdered cover layer will permit the bridge wire to pass through it during the manufacturing operation such that the bridge wire can be embedded in the ignition composition, but in the final assembled cap product, the cover layer effectively insulates the ignition composition from the rest of the shell.

A more complete understanding of the invention may be gained from a study of the attached drawing which represents a cross-sectional view of an electric blasting cap prepared in accordance with the present invention.

In the drawing, 1 represents the outer metal shell which houses the components of the blasting cap, 2 is a base load, as for example PETN, and 3 represents a primer load which may be lead azide or any other suitable composition that is commonly used for priming purposes in electric blasting caps. A plastic capsule 4 s positioned within the shell atop the primer load 3. The capsule holds the lead styphnate ignition composition 5 which may contain in addition to the lead styphnate any of a variety of compounding ingredients, such as micronized graphite for static dissipation, calcium stearate for improved flowability, etc. The cover layer 6 is positioned

just on top of and directly adjacent to the lead styphnate ignition composition. A pair of leg wires 7, 7' extend through a rubber plug 8 which seals the top of the cap. The leg wires have a conventional bridge wire 9 between them which is buried in the ignition composition. The shell and the rubber plug are crimped as at 10 and 11 for sealing purposes. The leg wires 7, 7' are provided with beaded portions 12, 12' which sit in a transverse channel 13 in the rubber plug 8 to provide a harmless path for an arc which might result from the application of excessive voltage to the cap.

In ordinary electric blasting caps, premature detonation of the cap because of electrostatic discharge usually results in one of two principal ways: electrostatic discharge from a leg wire to the shell at the plug-ignition composition interface or a similar discharge between the shell and the beaded portion 12 of a leg wire in the groove 13 provided for this purpose. In the former case the discharge can ignite the ignition composition directly. In the latter case, it may ignite any lead styphnate dust which has drifted up around the leg wires which in turn can propagate to the main body of the ignition composition.

The cover layer 6 of the present invention serves to effectively seal off the ignition composition from the top portion of the cap and thus serves to prevent premature detonation via the aforementioned mechanisms. A wide variety of powdered materials may satisfactorily be employed to form the cover layer. This layer may be either explosive, combustible, or inert in nature except that, if explosive, it must be considerably less sensitive to electrostatic discharge than lead styphnate powder for it to afford the desired protection. Generally speaking, an explosive powder should have an ignition probability of zero when subjected to an electrostatic energy of 0.060 joule.

The cover layer is preferably formed of a powder having a relatively fine particle size so that the bridge wire can pass through it into the lead styphnate ignition composition without pulling any of the cover layer down with it. In this connection, the powdered material should have a nominal particle size not exceeding 60 microns. It is best if the cover layer powder has good compressibility characteristics so that it may become wafer-like when compressed between the ignition composition in the plastic capsule and the plug. In this manner it effects a good, high density seal between the plug and the ignition composition and will tend to inhibit the formation of an electrostatic spark from occurring at this interface.

The cover layer should also exhibit good stability to moisture and heat. In this latter connection, the powder should be stable at temperatures up to about 220° F. For convenience in loading the powdered material into the cap, the powder should be relatively free flowing in nature.

The cover layer may be electrically conductive in which event it can provide a direct lead wire-to-shell circuit to afford a predetermined non-sparking path for an electrostatic charge. In this connection, the conductivity of the layer may be varied over a wide range. A naturally conductive cover layer, such as a finely divided metal like powdered copper, iron, or aluminum may be used or a non-conductive layer may be rendered conductive by the addition of finely powdered graphite, or the like.

For an explosive cover layer, especially good results have been obtained with lead nitrate-bis-basic lead-4,6-dinitro-o-cresylate. This is a complex of a lead nitrate formed by the reaction of a lead nitrate-sodium hydroxide solution with dinitro-o-cresol and is generally represented as follows: $(C_7H_5N_2O_5)_2Pb \cdot 2Pb(OH_2) \cdot Pb(NO_3)_2$.

For an inert cover layer, good results have been achieved with finely divided dibasic lead phosphite. Other explosive compositions are also operable including, for example, fine powdered PETN, RDX, and black powder.

The cover layer may also be formed from combustible materials such as smokeless powder, bismuth, selenium, tellurium, or magnesium mixed with barium peroxide. On the other hand, the cover layer may be essentially inert and in this connection such materials as powdered barium peroxide, cement, and various oxides of common metals such as aluminum, zinc, copper, lead, and iron are wholly satisfactory.

The plastic capsule 4 serves as a container for the lead styphnate ignition composition and also serves to insulate this sensitive ignition composition from the shell wall. Further details of this plastic capsule may be found in pending application Serial No. 627,539, filed December 5, 1956, in the names of C. R. Johnson and M. E. Swanson, now U.S. Patent No. 2,878,752, issued March 24, 1959.

In manufacturing caps in accordance with the present invention the cap is assembled in the usual way up to the point where the ignition composition has been inserted. At this stage the thin cover layer is added and the plug containing the leg wires is inserted into the cap, the bridge wire passing through the cover layer and embedding itself in the ignition composition. The cap is then crimped in the conventional way.

The cover layer of the present invention affords valuable and reliable protection against premature detonation due to electrostatic discharge. In terms of material and fabrication costs, it is relatively inexpensive and convenient to install.

The invention is applicable to regular electric blasting caps as well as to delay caps. In the latter case, the cap will contain a suitable delay train between the ignition composition 5 and the primer load 3.

The invention has been described in the foregoing specification. It will be readily apparent to those skilled in the art that many changes may be made in the assembly, compositions, and procedures described without departing from the scope of the invention. It is intended therefore to be limited only by the following claims.

I claim:

1. An electric blasting cap comprising an outer shell, a base load at the bottom of said shell, a priming composition directly adjacent to and just atop said base load, a plastic capsule containing a powdered lead styphnate ignition composition above the priming composition, a pair of leg wires supporting a bridge wire embedded in said ignition composition, a plug member within said shell and positioned at the top thereof supporting said leg wires and sealing the contents of the shell, and a separate, relatively thin cover layer of a compressible powdered substance between the top surface of the ignition composition and the bottom surface of the plug member, said powdered substance being substantially less sensitive to initiation by electrostatic discharge than powdered lead styphnate.

2. An electric blasting cap having an outer shell, which contains in ascending order, a base load, a priming composition, and a plastic capsule containing powdered lead styphnate ignition composition, and having a plug member atop the ignition composition which supports a pair of leg wires mounting a bridge wire at their lower end which is embedded in the ignition composition, the novel improvement which comprises a separate, relatively thin cover layer of a compressible powdered substance between the top surface of the lead styphnate ignition composition and the bottom surface of the plug member, said powdered substance being substantially less sensitive to initiation by electrostatic discharge than powdered lead styphnate.

3. An electric blasting cap as in claim 2 wherein said last-mentioned compressible powdered substance is itself a detonating explosive compound.

4. An electric blasting cap as in claim 2 wherein said last-mentioned compressible powdered substance is itself a non-explosive composition.

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