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ELECTRIC BLASTING INITIATOR

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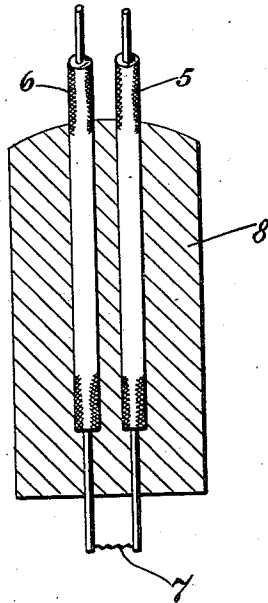


Fig. 1

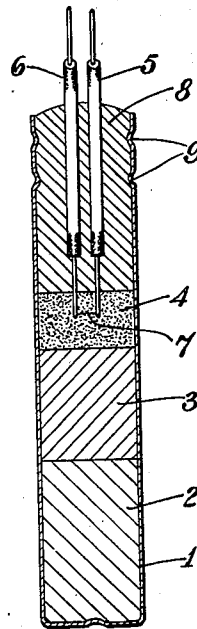


Fig. 2

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ELECTRIC BLASTING INITIATOR

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Application June 6, 1939, Serial No. 277,576

2 Claims. (Cl. 102—28)

This invention relates to a new and improved form of electric blasting initiator and more particularly to electric blasting caps adapted for safe use in the presence of inflammable mine gases.

This application is a continuation-in-part of our previously filed copending application, Serial No. 181,645, filed December 24, 1937.

A common form of electric blasting cap, as used in this country, comprises a cylindrical metal shell into which is loaded a base detonating charge of high explosive, ordinarily with superposed charges of a primary detonating compound, and an ignition material. Above this ordinarily is a formed plug of a diameter just sufficient to allow it to fit within the cap shell. Such a plug is ordinarily made of a sulfur-containing material and serves to hold in place the two leg wires connecting the bridge wire to the firing circuit. Thermoplastic sealing compositions are ordinarily introduced above said plug to give increased protection against water penetration.

From the point of view of water resistance such an assembly may give satisfactory performance. It has the disadvantage, however, that the plug and waterproofing composition are both of combustible nature. The leading wires attached to the wires within the cap are ordinarily insulated with a combustible coating such as cotton yarn and the like.

The object of the present invention is an improved electric blasting initiator adapted for safe use in the presence of inflammable gases and dusts. A further object is an electric blasting cap substantially free from combustible structural materials which may burn after detonation of the cap charges. Additional objects will be disclosed as the invention is described more in detail hereinafter.

We have found that the foregoing objects are accomplished and the disadvantages overcome by means of the electric blasting initiator of our invention which comprises a charged shell, spaced leg wires entering the mouth of said shell, a substantially non-inflammable plug formed about said spaced leg wires and disposed in a position closing the mouth of the said shell. The shell preferably is crimped into the plug to form a water-impervious juncture; preferably the spaced leg wires are covered with substantially non-inflammable insulation and the best results are obtained by effecting a heat seal between said insulation and the non-inflammable plug material. We have found that greatly superior results are obtained by means of a compressible and extensible non-inflammable plug such as polymerized

chlorobutadiene or life non-inflammable compressible extensible material. Although we greatly prefer this embodiment, we may include within the general scope of our invention any non-inflammable plug material, for example, certain chlorine-containing thermoplastics and the like.

While various materials containing chlorine are suitable for use according to our invention, we find it particularly desirable to employ a material capable of vulcanization since this affords an advantageous method of attaining the desired result. As such material, we prefer to use polymerized chlorobutadiene, which may be designated also as polymerized chloroprene.

In order to illustrate our invention more clearly, we shall describe it with reference to the attached drawing which illustrates a preferred embodiment thereof. This is done by way of illustration only, and we do not intend to be limited thereby as to the scope of the invention, since many variations will be apparent to one skilled in the art.

Referring generally to the figures of the drawing, Figure 1 is a vertical elevation of a preferred form of plug according to our invention, while Figure 2 is similarly a vertical elevation of our assembled electric blasting cap containing explosive charges, ignition assembly, and plug of fire-resisting material thermoplastic at the time of application. Similar characters are used to designate corresponding parts in the various figures.

Considering the drawing in greater detail, 8 in Figure 1 represents the formed plug of substantially non-flammable material, with leg wires 5 and 6 passing therethrough and held in fixed and insulated relationship with one another by the solidified plug material. The ends of the leg wires extending beyond the lower end of the plug are connected by the bridge wire 7 of high electrical resistance. A portion of the leg wires 5 and 6 within the plug, and all of such wires below the plug, are bare. The upper parts of said wires in the plug and all such wire above the plug are covered with the detailed type of insulation. Preferably, such insulation is of a substantially non-flammable material, for example, a polyvinyl chloride composition.

In Figure 2, the bridge plug according to our invention is shown as an element of the complete electric blasting cap. Into the cylindrical metal shell 1 is pressed the base charge 2 of a suitable high explosive such as tetryl. Superposed on this is a pressed primary charge 3, for example, of lead azide. Above this in turn and surround-

ing the bridge wire 7 is the ignition charge adapted to be brought to explosive combustion when fired by the passage of the firing current through the ignition circuit. The internal beads or grooves 9 bring about a tight closure of the shell by suitable crimping into the plug material.

A preferred method of producing a waterproof electric blasting initiator according to our invention, comprised of fire-resistant construction elements, consist in passing the leg wires through a suitable mold, introducing the thermoplastic polymerized composition, for example, polymerized chlorobutadiene, into the mold chamber and heating the material and mold to a temperature at which the former becomes plastic and takes the shape of the mold concavity. During this operation the composition will have been sufficiently compressed to form a water-impervious seal about the leg wires and will also be subjected to vulcanization conditions. Arrangements will be made also for making the junction between the plug and the insulated cap wires, for example, covered with an extruded polyvinyl chloride sheath. It will be understood, however, that our invention does not reside in the method and apparatus for molding the plug or for joining plug and insulated wires which feature is disclosed and claimed in copending application, Serial No. 181,647, filed December 24, 1937. Various types of molds may be employed for this purpose and various methods of controlling conditions and bringing about a water-tight relationship. For purposes of close adhesion of plug to leg wires we preferably mold a wedge-shaped extension of the plug protruding from the base thereof, although this also is not a part of the present invention, but is disclosed and claimed in copending application, Serial No. 181,644, filed December 24, 1937.

As previously stated, we prefer to use a composition capable of vulcanization as the material for forming the plug according to our invention, and by use of vulcanized, polymerized chlorobutadiene a plug is obtained which is characterized by the desired properties of substantial non-flammability and compressibility and extensibility whereby complete closure can be obtained by crimping means alone. Various other halogen-containing materials thermoplastic at the time of application, may be used, however, for example, polyvinyl chloride compositions and the like.

While the employment and introduction into the electric blasting cap assembly of the foregoing fire-resistant compressible and extensible plug accomplishes some of the objects of our invention, it is even more advantageous to utilize as insulation on the blasting cap wires a material likewise substantially non-flammable. As such fire-resistant material we again find highly advantageous such chlorine-containing products as polyvinyl chlorides and polymerized chlorobutadiene. As desirable insulation on the cap wires, however, we may choose to employ an extruded ethyl cellulose composition together with a fire-resistant plasticizer such as tricresyl phosphate

and an additional blended fire-retardant such as a chlorinated naphthalene or an inert filler such as inorganic phosphate, for example, magnesium ammonium phosphate or a sulfamic acid salt.

In Figures 1 and 2 the fire-retarding insulation is seen at 5 and 6, passing into plug 8.

The essential feature of our invention is the provision in an electrical blasting initiator of a substantially non-flammable bridge plug, preferably in combination with fire-retarding cap wires. It will be understood that various conventional molding methods may be adopted for molding said plug about the leg wires for forming the insulating coating on the wires, and for effecting a junction between plug and insulated wires. In coating the leg and lead wires also with insulation material various conventional methods may be adapted for effecting this, for example, by a suitable extrusion process.

It will be appreciated by those skilled in the art that many advantages are obtained by means of our invention. Present-day practice in gassy coal mines is to use permissible explosives only, that is, explosives which have been approved as to safety properties in such surroundings. The present invention extends the safety precautions to include also the elements in the electric blasting cap design so that no combustion of such elements will be a cause of hazard.

In describing our invention we have disclosed it as covering, in electric blasting initiators, plugs comprising polymerized organic materials thermoplastic at the time of application and containing chlorine or other element imparting non-flammability properties to said plug. In this grouping of materials we do not intend to include such chlorinated hydrocarbons as the chlorinated naphthalenes and chlorinated diphenyls. While such materials might be satisfactory from the point of view of fire resistance, they do not fulfill the requirements of our invention from the viewpoint of workability when employed by themselves.

It will be understood that many variations may be made from the exact procedures, compositions, and designs without departure from the scope of the invention. We intend to be limited only by the following patent claims.

1. An electric blasting initiator comprising a loaded shell, spaced leg wires provided with an insulation comprising a non-inflammable thermoplastic material entering the mouth of said shell, a plug of non-inflammable rubber-like material of the character described formed about said leg wires and disposed in a position closing the mouth of said shell, and a crimp extending around the circumference of said shell in the region enclosing said plug forcing the shell wall into and deforming said non-inflammable rubber-like plug to complete a water impervious junction.

2. The electric blasting initiator of claim 1 wherein said non-inflammable plug comprises a polymerized chlorobutadiene.

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