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ELECTRIC BLASTING INITIATOR

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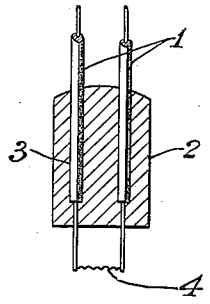


Fig. 1

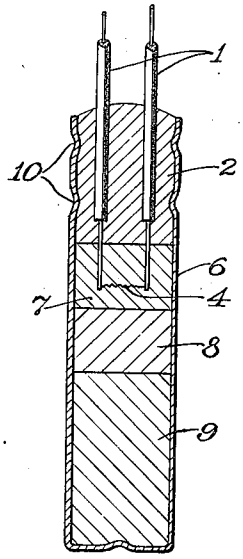


Fig. 3

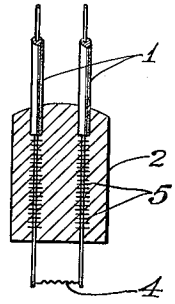


Fig. 2

Stanley L. Handforth
Charles R. Johnson INVENTORS

BY Thos. A. Wilson

ATTORNEY

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ELECTRIC BLASTING INITIATOR

Stanley Lougheed Handforth, Wilmington, Del., and Charles Russell Johnson, West Chester, Pa., assignors to E. I. du Pont de Nemours & Company, Wilmington, Del., a corporation of Delaware

Application December 24, 1937, Serial No. 181,645

6 Claims. (Cl. 102—10)

This invention pertains to electric blasting initiators, and more particularly to a new and improved waterproof electric blasting initiator, and a method of producing the same.

The electric blasting initiators known to the art generally comprise a substantially cylindrical shell of suitable material, usually a metal, which contains one or more heat-sensitive explosive charges. Initiation of the charge is effected by passing an electric current through an electrical conductor of high resistance, thereby causing said wire to reach a temperature exceeding that of the ignition temperature of the initiating charge, which is in immediate contact therewith. This high resistance wire is generally supported by two leg wires suitably held in spaced relationship with one another by means of a bridge plug. Because moisture has a deleterious effect on the various charges employed in different electric blasting initiators and said initiators are frequently subjected to wet and moist conditions before firing, it is imperative that an initiator be waterproof in order to obtain desirable performance. In an effort to protect the initiator, and especially its ignition charges from moisture, it has been customary in the art to superimpose a layer of so-called waterproofing composition above the plug and provide a final closure by means of a sulfur seal.

The usual method of manufacturing initiators of this type consists in embedding the leg wires in a hard cast plug of sulfur, inserting this in the shell, and pouring the heated sealing mixtures behind the plug. Such a method of assembly, however, has several disadvantages. Considerable technique is required to assemble the cap properly and to introduce the waterproofing composition so that the latter does not enter the explosive charge but holds the wires in proper position and seals the cap against moisture. Moreover, to protect the cap adequately against moisture under adverse conditions of storage, it is necessary to use a relatively large amount of the waterproofing composition. Consequently, a long initiator shell is required. A still further objection is found in the fact that this method, since it is not susceptible to mechanical assembly, requires a number of manual operations, which are particularly disadvantageous in view of the sensitive nature of the explosives employed in initiators. Furthermore, the resulting closure cannot be relied upon to give a lasting waterproof seal.

The object of our invention is a new and improved electric blasting initiator. A further object is an electric blasting initiator which is simpler in construction, shorter in length, and more readily adaptable to mechanical assembly. A still further object is an improved electric blasting initiator which is impervious to moisture. Another object is an initiator of enhanced mechanical strength. An additional object is an improved method whereby such an initiator may be produced. Other objects will be apparent as the invention is hereinafter disclosed.

We have found that the foregoing objects may be accomplished by forming about the leg wires of the electric blasting initiator, a plug comprising a thermoplastic resin, which plug serves not only as a means for spacing the leg wires but also provides a waterproof seal about such leg wires and serves as a satisfactory closure means eliminating the necessity for the waterproofing layer and the sulfur sealing layer heretofore required in the art.

The term "thermoplastic" resin is employed to designate a resin which is adequately rigid at normal temperatures and under ordinary conditions of stress but which is capable of deformation to any predetermined shape under heat and pressure. It is especially desirable that said material, comprising a thermoplastic resin, be substantially free from crystalline ingredients, or ingredients crystallizable at room temperature.

Among the various thermoplastic resins which are employed in the manufacture of our new plug, may be mentioned polymerized methyl methacrylate, ethyl cellulose, cellulose acetate, ether resin, modified vinyl halide polymers, aldehyde-treated polyvinyl acetates, the polymerized product of acrylic acid or its derivatives and interpolymers of polymerizable vinyl compounds. The various thermoplastic resins may be used in conjunction with fillers ordinarily employed in the resin art as well as with well known plasticizers, such as a phthalate, for example.

The material comprising the thermoplastic resin is molded about the leg wires by the application of heat and pressure to form a plug of the desired size and shape, said plug being in moisture-proof relationship with said leg wires. After cooling to normal temperature, the bridge plug is inserted in the charged initiator shell and said shell is crimped about the thermoplastic plug to form an assembly that is moisture-proof.

In order to describe our invention more clearly, reference is made to the accompanying drawing which illustrates specific embodiments thereof. The same numerals refer to similar parts throughout the several views. Figure 1 is a ver-

tical view in cross-section of our new thermoplastic bridge plug. Figure 2 is a similar view of our plug, showing a modification of the leg wires, while Figure 3 is a vertical view in cross-section of a complete assembly of an electric blasting initiator which is provided with our new bridge plug.

Referring more specifically to Figure 1, the leg wires are designated by the numeral 1, about which and in waterproof relationship therewith is the plug comprising thermoplastic resin 2. A section of the leg wires within said plug is covered by the insulation material 3, the bridge wire being shown at 4. Figure 2 shows the leg wires provided with the fins 5, which help insure the formation of a waterproof seal between the molding material and said leg wires because of the greater surface presented. Figure 3 shows an electric blasting initiator having the shell 6, which may be made of gilding metal, said shell containing a base charge 9 of tetryl, for example. Above the base charge is shown a primer charge 8, as lead azide, while superimposed on said primer charge is an ignition charge 7, in which is embedded the bridge wire 4. The shell 6 has been crimped about the bridge plug 2 in two separate places designated by 10, to form a closure element which is waterproof.

Our preferred process for producing a waterproof electric blasting initiator comprises introduction of the thermoplastic resin-containing material into a suitable mold. The leg wires passing through said mold are desirably provided with appendages or fins in order to increase the surface available to the plug-forming material and thus insure moisture-proof adhesion to said leg wires. Heat sufficient to bring the material to a molten condition is provided and pressure exerted thereon. After a predetermined time-interval, the mold is allowed to cool and the bridge plug containing the leg wires is removed. Once this assembly has cooled to room temperature, the bridge plug is given a slight heating locally; i. e., at the locus about which the crimp is to be formed, in order to make that portion of the plug rather pliable. It is then inserted into the charged initiator shell and a waterproof crimp is effected, preferably by means of the novel crimper disclosed and claimed in co-pending application Serial No. 181,646 filed December 24, 1937.

We have found that an effective moisture-proof seal results between the side walls of the shell and our preformed bridge plug when this crimper is employed, particularly in view of the uniform and deep crimps made with the same.

Both the process and product according to our invention offer outstanding advantages. Our process offers the advantage that the necessity for the hazardous step of pouring hot, molten sealing compounds into a charged shell, as practiced in the art, is completely eliminated by our convenient steps of sealing a thermoplastic plug about the leg wires and crimping the charged shell thereon to form a waterproof closure. Furthermore, in effecting a satisfactory closure between leg wires and plug, and between plug and shell without the use of layers of sealing or waterproofing compositions, much shorter shells may be employed than heretofore.

Our product possesses the advantages that the thermoplastic resinous plug therein provides a sealing medium greatly superior to those known to the explosives art. Because of its inherent properties, the thermoplastic resin does not permit the slow infiltration of moisture therethrough, as do the crystalline materials generally employed as sealing agents for electric initiators. For this reason, we do not include materials which crystallize at ordinary temperatures, sulfur, for example. Moreover, our thermoplastic resin plug may be altered in form readily, thus permitting a facile assembly of the initiator in which it is used. In addition, the final assembly is characterized by enhanced mechanical strength which permits handling without danger of the disintegration of the sealing compound. Also, our new bridge plug provides a seal that is not subject to either expansion or contraction with variation in temperature. Consequently, such initiators may be stored over long periods of time without becoming insensitive due to the introduction of moisture.

It is apparent that many variations may be made from the embodiments illustrated herein without departing from the spirit and scope of our invention. For example, means other than the fins shown in Figure 2, may be adopted in order to increase the surface of the leg wires. Also, although we have illustrated our invention with particular reference to the simple bridge plug type of electric blasting initiator assembly, it should be understood that the invention is equally applicable to the match head type of assembly, and for use in assemblies of the bridge plug bead type, and concave plug type. We intend, therefore, to be limited only by the following claims.

We claim:

1. In an electric blasting initiator, a plug comprising a thermoplastic resin substantially free from crystalline ingredients, said plug serving as the sole means for spacing the leg wires in the firing circuit and as the sole sealing material to close said initiator, and a crimp extending around a circumference of the shell in the region enclosing said plug forcing the shell wall into and deforming said plug to produce a waterproof closure.

2. The method of producing a waterproof electric blasting initiator which comprises sealing a thermoplastic resinous material substantially free from crystalline ingredients in water-impervious fashion about the leg wires of said initiator to form a plug, and crimping the charged initiator shell by forcing the shell wall into said plug to deform the same producing a waterproof closure.

3. The method of producing a waterproof electric blasting initiator which comprises sealing a thermoplastic resinous material substantially free from crystalline ingredients in water-impervious fashion about the leg wires of said initiator to form a plug, and crimping the charged initiator shell by forcing the shell wall into said plug to deform the same producing a waterproof closure, heat being applied in the locus of said crimping to facilitate said crimping operation.

4. The electric blasting initiator of claim 1 wherein the thermoplastic resin comprises methyl methacrylate.

5. The electric blasting initiator of claim 1 wherein the thermoplastic resin comprises ethyl cellulose.

6. The electric blasting initiator of claim 1 wherein the thermoplastic resin comprises polyvinyl acetate methylal.

STANLEY L. HANDFORTH.
CHARLES R. JOHNSON.