Aug. 22, 1944. A. B. MILLER 2,356,337

ELECTRIC BLASTING CAP

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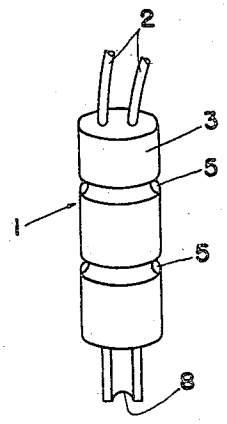


FIG.-1

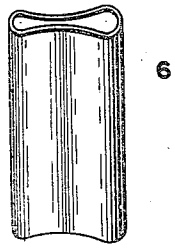


FIG-2

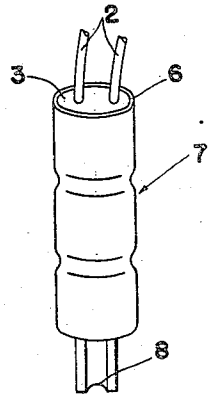


FIG.-3

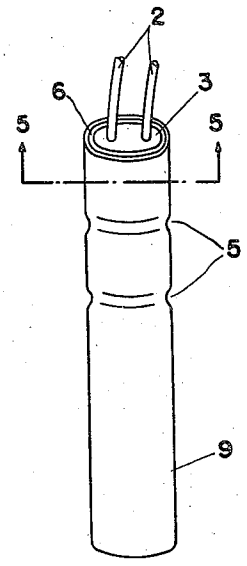


FIG.-4

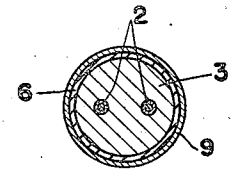


FIG.-5

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ELECTRIC BLASTING CAP

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2 Claims. (Cl. 102—28)

This invention relates to electric firing devices and more particularly to electric blasting caps in which the firing assembly and the cap shell are integrally joined, the joint between the firing assembly and the cap shell being formed in a manner that compensates for expansion and contraction and effects a seal which provides a completely water proof assembly.

Heretofore in the manufacture of electric firing devices, for example, electric blasting caps, it has been the custom to cast a sulfur plug about a pair of lead wires in a manner which provides a pair of terminals adapted to be bridged with a high resistance bridge wire to form suitable firing assemblies for example, a bridge plug, cavity type plug or match head. The firing assemblies so formed have been inserted into a cap shell containing an explosive charge at the closed end thereof so that the bridge wire is in initiating contact with the explosive charge. To position a bridge plug or the like, the art normally introduces a waterproofing composition into the shell just above the bridge plug which binds the bridge plug into place, and on top of this waterproofing composition there is introduced a sealing composition in order to more definitely seal the bridge plug into the shell. The waterproofing materials used may be tar or asphalt or similar sticky materials while the sealing compound is normally sulfur.

The above type caps have not been entirely satisfactory because it is difficult to obtain an electric cap that is completely waterproof, especially when the cap is used under a high head of water. High heads of water are often encountered in blasting operations, especially in deep hold quarry blasting, in seismograph work and in oil well shooting. The blasting caps sealed in accordance with the prior art often allowed water to reach the explosive composition and cause desensitization thereof.

Further difficulties have been encountered due to lack of storage qualities of the caps. Thus the tar or asphalt waterproofing may during storage in hot weather find its way past the bridge plug and into the explosive charge or onto the bridge wire and when either or both of such occurrences are encountered failure of the plasting cap often results. Difficulties are also encountered whenever the caps are exposed to very cold temperatures because the tar or asphalt hardens and adhesion to shell walls is reduced to a point that will not resist any appreciable amount of water pressure.

The object of this invention is to provide a blasting cap which may be easily and efficiently sealed against all outside influences.

A further object of this invention is to provide a bridge plug assembly which will act as an effective seal for a blasting cap shell.

A further object of this invention is to provide a method of sealing electric blasting caps in a completely waterproof manner. A further object of this invention is to provide a bridge plug which will permit the construction of a shorter blasting cap.

A further object of this invention is to provide a bridge plug assembly that is not effected by changes in temperature.

A still further object of this invention is to provide a bridge plug assembly for electric blasting caps which will expedite mechanical assembly.

Other and further objects of this invention will appear hereinafter.

The objects of this invention are in general accomplished by providing an elastic sleeve or coating between the blasting cap shell or casing containing an explosive charge and the bridge plug assembly which is placed within the casing and in initiating contact with the explosive charge therein. Thus, in accordance with the present invention there is provided a bridge plug assembly comprising lead wires that are held in dielectric relation with each other by a molded or cast plug composed of an electrical insulating material, or the lead wires are inserted through apertures formed in a plug and firmly positioned therein by suitable operations. The plug which holds the lead wires in spaced relationship is formed to the proper diameter to fit within a loaded blasting cap shell. The plug either during the molding, casting or forming operations or after it is formed may be provided with grooves about its periphery. Normally a plurality of grooves will be formed on the surface and the grooves will be so located that after insertion of the plug into the blasting cap shell, the shell may be crimped into coacting relationship with the grooves in a manner that provides an integral assembly. The crimping of the shell into the grooves, in itself however does not provide a seal that is completely waterproof and in accordance with this invention the blasting cap is waterproofed by placing between the bridge plug and the blasting cap shell a layer of elastic material which preferably adheres tenaciously both to the plug and to the metal of the shell. This elastic material may be in the form of a preformed

sleeve which is placed about the plug or it may be in the form of a coating composition applied to the surface of the plug and/or to the surface of the blasting cap shell, or the two methods may be combined, however, the elastic material fills any voids between the plug and the shell itself and effectively waterproofs and seals the blasting cap assembly in a manner that provides a firing device that is completely waterproof.

Having now indicated in a general way the nature and purpose of this invention, there follows a more detailed description of preferred embodiments thereof, with reference to the accompanying drawing in which

Fig. 1 is a perspective view of a preformed bridge plug.

Fig. 2 is a perspective view of a sleeve of elastic material which is adapted to form the joint between the plug and the blasting cap shell.

Fig. 3 is a perspective view of the sleeve of Fig. 2 and the plug of Fig. 1 after they have been assembled for insertion into a blasting cap shell.

Fig. 4 is a completely assembled blasting cap shell.

Fig. 5 is a cross sectional view along line 5—5 of Fig. 4.

Referring now to the drawing there is shown a bridge plug assembly 1 which comprises a pair of lead wires 2 held in a dielectric relation with one another by a plug 3. The plug 3 may be molded, cast or otherwise formed about the leg wire 2 or it may be formed per se and the leg wires 2 inserted therethrough. In either operation the leg wires are so positioned in the plug that a waterproof joint is obtained between the wires and the material making up the plug.

The plug 3 may be prepared from materials such as sulfur, synthetic resin of the phenolaldehyde type either unfilled or filled; urea-aldehyde resin filled or unfilled; porcelain compositions; laminated paper; vulcanized fiber; Masonite; and other similar dielectric materials which have the proper tensile strength and which may be bonded to the leg wires that are to be inserted through the plug or which are to be surrounded by a cast or molded plug.

The plug 3 has grooves 5 molded or formed into its periphery so that a strong mechanical bond may be formed between the blasting cap shell and the bridge plug by crimping the shell into the grooves. For purposes of illustration two grooves 5 are shown, however if desirable one or more grooves may be formed on the surface or the grooves may take the form of spirals or definitely located indentations. These grooves, spirals or indentations are formed on the periphery of the plug 3 in a definite manner so that it is possible to form similar grooves in the blasting cap shell in such a way that a positive mechanical bond is formed therebetween.

After forming the bridge plug 1 comprising a pair of leg wires 2 and a plug 3, there is placed on the surface of the plug 3 a sleeve 6 (Fig. 2) so that an assembly 7 is produced. The assembly 7 comprises the bridge plug of Fig. 1 with the sleeve of Fig. 2 slipped thereabout and is in proper form for insertion into a blasting cap shell. The bridge plug assembly has the lead wires 2 electrically connected together by a highly resistant bridge wire 8 usually platinum or an alloy thereof. This bridge wire 8 effects the detonation of the blasting cap, when an electric current is applied thereto.

Upon completing the assembly of the bridge plug and the elastic sleeve, the formation of the electric blasting cap is in order. This is accomplished by inserting into a loaded blasting cap shell 9 the bridge plug-elastic sleeve assembly 7, positioning it in the proper relation to the shell and crimping the shell in a manner that forces the shell walls into the grooves 5 of the plug. The crimping operation adequately seals the blasting cap for use in all explosives operations and forms a waterproof assembly which is especially desirable for use in explosive operations where a high degree of water resistance is required.

In order to show the highly desirable sealing affected by the elastic sleeve 6 a cross section of Fig. 4 along lines 5—5 is shown as Fig. 5. This figure shows the method by which the waterproof assembly is obtained. Thus the elastic sleeve 6 forms a perfect joint between the bridge plug 3 and the blasting cap shell 9.

The elastic sleeve 6 shown in Fig. 2 may be fabricated as a tube adapted to slip over the bridge plug or as a sheet adapted to be wrapped about the plug and this sleeve or sheet may be of any desirable thickness, but a thickness of between about 0.005 and 0.0005 inch and preferably about 0.001 inch has been found to be the best means of obtaining a high water resistant seal. In addition to the fabricated sleeve or sheet, the plug may be coated by spraying or brushing or by means of an ink pad, kissroll or the like with an elastic material. Elastic materials adaptable for use as sleeves, sheets, or coatings in accordance with this invention are for example rubber, gutta percha, chicle, balata, "neoprene," plasticized polyvinyl chloride and/or acetate, solutions or emulsions of these and other equivalent compounds or mixtures may be utilized for applying the material to the plug or shell.

Adherence between the plug shell and elastic material may be facilitated by applying priming solutions of cementitious compounds in suitable solvents to the periphery of the plug and also if desired to the inner surface of the blasting cap shell, inserting the coated plug into the shell, and crimping the two together. The adherence may be further increased by warming the shell slightly before the crimping operation.

By manufacturing blasting caps in accordance with this invention many advantages over the old type of blasting cap will appear. Thus the blasting cap may be reduced in length by doing away with the waterproofing composition and with the sealing composition. This lack of necessity of using waterproofing and sealing compounds reduces the operation necessary in manufacturing caps and thus reduces the cost of the caps. Further, by avoiding the use of waterproofing, failures due to flowage during hot storage are prevented. A further advantage is a greatly increased water resistance of the finished assembly and the much neater outside appearance of the cap itself. Other advantages will become apparent to those skilled in the art upon practicing this invention.

It will be understood that the details and examples herein before set forth as illustrative only, and that the invention as broadly described and claimed is in no way limited thereby.

What I claim and desire to protect by Letters Patent is:

1. An electric blasting cap having its component parts prefabricated and adapted to mechanical assembly which comprises, a bridge plug of dielectric material formed about a bridge

assembly, said bridge plug having at least one groove about its periphery, and a relatively thin sleeve of a resilient material interposed between said bridge plug and a charged shell, said charged shell crimped to engage said groove in the bridge plug, the elastic material being highly compressed whereby the resilient properties thereof compensate for differences in thermal expansivity between the plug and shell to form a water impervious cap.

2. The electric blasting cap according to claim 1 wherein said sleeve is preformed of a rubber-like resilient material.

ABRAHAM B. MILLER.