June 5, 1945. P. E. NARVARTE 2,377,804

BLASTING CAP

Filed May 29, 1943

FIG. 1.

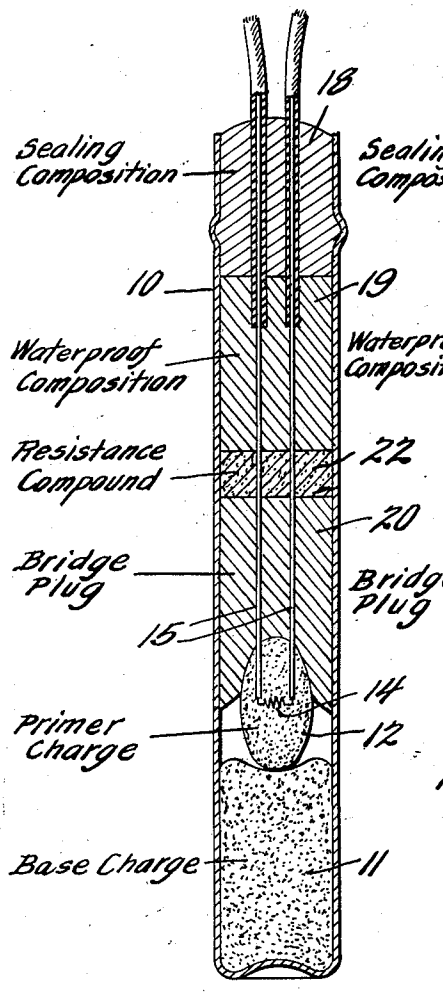


FIG. 2.

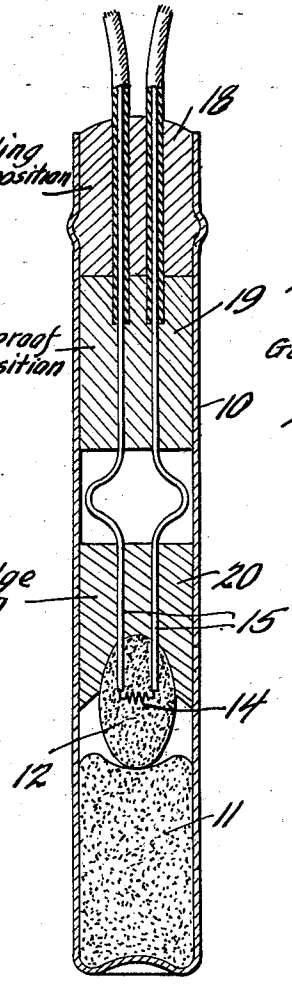
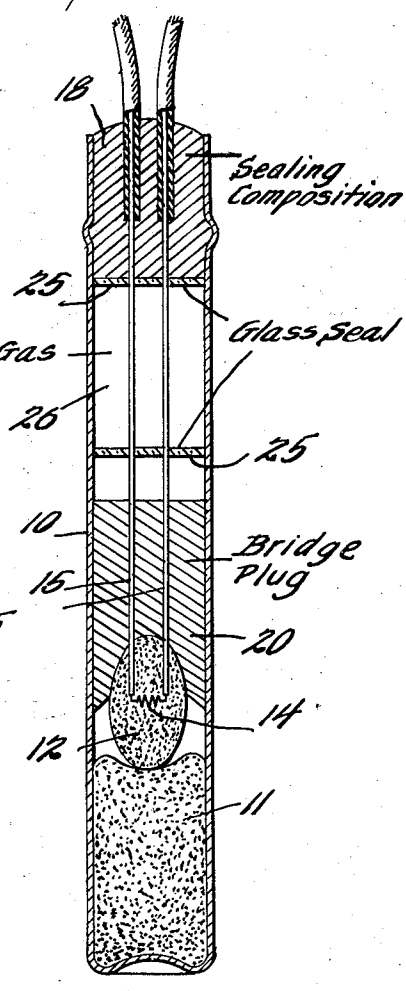


FIG. 3.



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2,377,804

BLASTING CAP

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1 Claim. (Cl. 102—28)

This invention relates to improvements in electric blasting caps, the principal object being the provision of means whereby the possibility of premature or unintentional detonation of the cap resulting from an accumulated electrostatic charge is reduced to a minimum. Although the present improvements possess utility in various fields in which blasting caps and the like are employed, the invention is especially applicable to caps intended or adapted for use in the initiation of seismic impulses in the field of seismic surveying.

The invention is described herein as applied to a conventional form of blasting cap having a metal shell or container in which are suitably disposed a base charge, a primer charge and a fine resistance wire, commonly called a bridge wire, the latter being disposed in continguous relation to the primer charge and being supplied with firing current from leads extending into the shell through sealing and waterproofing plugs. In the normal use of such blasting caps, the conducting leads to the bridge wire occasionally develop an electrostatic charge which discharges to the metal casing at a point in proximity to the primer charge so that the latter is ignited, which in turn detonates the base charge, and such premature and unintentional explosion of blasting caps has not infrequently been the cause of serious accidents. It has been proposed to reduce this risk of premature explosion by connecting one of the conducting leads to the cap shell, but this has not proven satisfactory owing to the possibility of a broken lead or failure of the short between the ends thereof. Furthermore, any method involving deliberate exposure of the firing circuit is necessarily hazardous.

It is, therefore, proposed by the instant invention to provide, in an electric blasting cap of the type described, means constituting a high resistance path between each of the conducting leads and the shell at a point sufficiently spaced from the primer charge to permit the discharge of an electrostatic charge between the leads and the shell without igniting the primer charge. The resistance of this electrostatic discharge path is sufficiently high to prevent appreciable leakage therethrough of the usual ignition current but sufficiently low to permit discharge therethrough of electrostatic charges on the leads or shell such as establish a high potential difference therebetween, and lower than the resistance afforded between the leads and the shell at any point sufficiently close to the primer charge to give rise to the hazard of premature detonation.

Other and further objects and lesser features of the invention will be more apparent to those skilled in the art upon a consideration of the accompanying drawing and following specification wherein are disclosed several exemplary embodiments of the invention with the understanding that such changes and combinations in and of the features thereof may be made as fall within the scope of the appended claim without departing from the spirit of the invention.

Several embodiments of the invention are illustrated in the accompanying drawing, in which:

Figure 1 is a longitudinal sectional view through an electrical blasting cap to which the invention has been applied; and

Figures 2 and 3 are similar views illustrating modified constructions.

The cap shown in Figure 1 comprises a metal shell **10** in which is contained a base charge **11**, for example dynamite or blasting gelatine, and a flash compound or primer charge **12** of fulminate or the like. The primer charge surrounds a resistance or bridge wire **14** of a suitable metal alloy, the bridge wire extending between conducting leads **15** through which the firing current is supplied. The primer charge may first be made into a paste of nitrocotton lacquer, and pressed into the shape shown around the bridge wire, so that on drying and shrinking it adheres closely to the latter. The conducting leads **15** extend into the outer end of the shell through the usual sulphur plug **18** and waterproof plug **19**, and are supported near their lower ends, which are bare, by a bridge plug **20** of insulating material. It will be understood that the structure thus far described is quite conventional and that the details thereof form no part of the present invention except to the extent that they are modified for the intended purpose as hereinafter described.

Intermediate the waterproof plug **19** and the bridge plug **20** is introduced a layer **22** of a suitable resistance compound, for example, graphite, providing a path through which electrostatic charges accumulating on the leads **15** may be discharged to the casing. The composition of this layer should, as hereinbefore indicated, offer sufficiently high resistance to the leakage of firing current between the leads **15** as to prevent substantial lowering of the applied voltage across resistance wire **14**, so that the time required to detonate the cap is not unduly lengthened, but sufficiently low to insure that the high potential electrostatic charges will be discharged therethrough and will not pass from the leads to the shell at a point so near to the priming

charge that unintentional ignition of the latter may occur.

Figure 2 of the drawing illustrates a modified arrangement in which the base leads are deformed at a point intermediate the waterproof plug 19 and the bridge plug 20 so as to extend into close proximity to the metal shell. The spacing between the leads and the shell at this point is appreciable, so that there is no leakage of firing current, but the gap thus provided is sufficiently short to permit the discharge of an accumulated electrostatic charge at this point. Any other suitable construction which in effect extends the conducting parts of the shell and leads into close proximity to form the requisite discharge gap may be employed; for example, gap electrodes may be mounted on the shell, on the leads, or on both. To ensure the maintenance of a gap of fixed length, insulating spacers may be used.

In the embodiment illustrated in Figure 3 of the drawing, the waterproof plug is omitted and seals 25 of suitable material, for instance glass or other vitreous material, are disposed in spaced relation to provide therebetween a chamber 26 in which is contained a suitable gas or vapor capable of ionization to facilitate discharge of an electrostatic charge from the leads to the shell at an appreciably lower potential therebetween than an air gap of similar length.

Various combinations of the several modified forms of the invention may be effected to advantage and are contemplated hereby. Various other forms of leakage path capable of maintaining the shell and leads at substantially the same electrostatic potential, or of reducing the electrostatic potential therebetween, may be employed.

Such elements of Figure 1 as are conventional and as are duplicated in Figures 2 and 3 are designated by the same reference characters.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

An electric blasting cap, said cap including a conducting shell containing a primer charge, a bridge wire embedded in said primer charge and conducting leads connected by said bridge wire, insulating sealing means for said shell in which said leads are laid, and means forming with the shell wall a sealed chamber containing an ionizable gas affording high resistance path between each of said leads and said shell from points on said leads spaced substantially from said primer charge, the resistance of said paths being such as to permit discharge therethrough of electrostatic charges on said leads or shell which establish a high potential difference therebetween, but being appreciably lower than that afforded between said leads and said shell at points adjacent said primer charge, whereby detonation of the cap by electrostatic discharge is precluded.

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