April 27, 1937. A. G. WHITE 2,078,298

BLASTING

Filed May 22, 1934

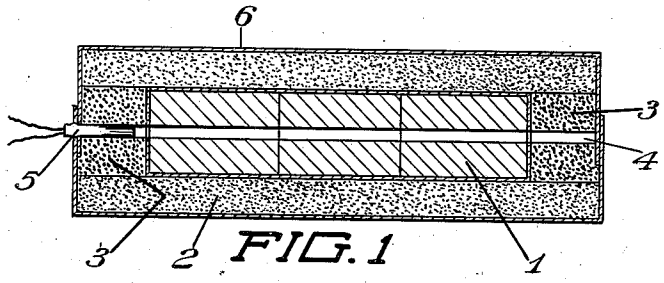


FIG. 1

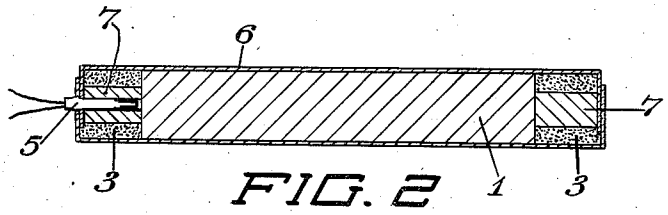


FIG. 2

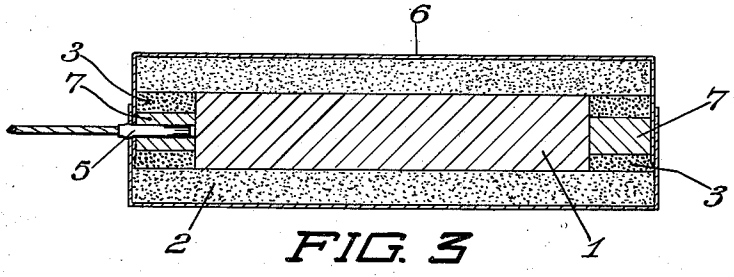


FIG. 3

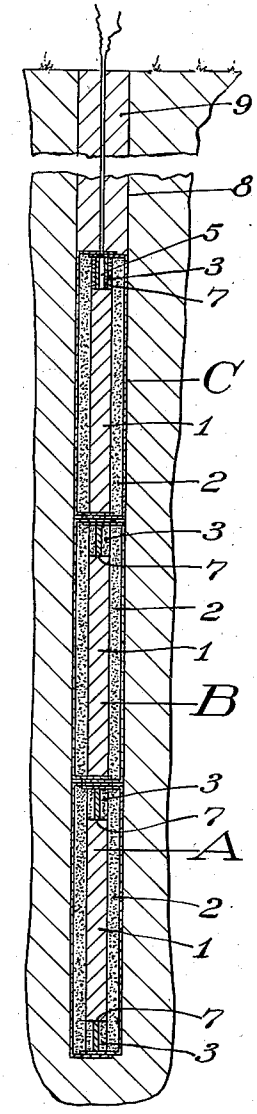


FIG. 4

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BLASTING

Albert Greville White, Saltcoats, Scotland, assignor to Imperial Chemical Industries Limited, a corporation of Great Britain

Application May 22, 1934, Serial No. 726,967
In Great Britain June 8, 1933

7 Claims. (Cl. 102—5)

This invention relates to blasting cartridges, borehole charges and cooling plugs, more particularly those intended for use in fiery mines.

The use in the borehole of plugs made of wood, clay, or wax, or from mixtures of cooling salts is well known. Such devices take the form of cylindrical plugs which may be pierced by a central longitudinal channel through which the fuse or detonator leads are passed. They have been used in the borehole in close proximity to the cartridge holding the detonator, or in some cases the plug has been made to hold the detonator. Hitherto such plugs have not been positively secured to the cartridge, and in practice have been liable to become displaced or separated from the cartridge by irregularities in the borehole, faulty loading, falls of coal-dust, and the like. Consequently the position and alignment of the detonator have sometimes been such that efficient detonation has been impossible.

I have now devised a method by which not only are these disadvantages eliminated, but the plug itself, which is one of cooling materials, more efficiently contributes to the safety of the borehole charge in respect of firedamp ignition.

According to my invention, one or more cylindrical plugs, made from mixtures containing high proportions of cooling salts, are enclosed with the cartridge of blasting explosive in one container at the time of manufacture, and are thereafter permanently associated with it. Each plug is provided with a longitudinal channel adapted to accommodate the detonator, which is inserted at the time of loading the borehole and is thus held in close contact and correct alignment with the explosive charge. Since at least one plug is associated with each cartridge of blasting explosive, a certain minimum amount of cooling material is always present, so that even if the usual stemming material should be accidentally omitted the gaseous products of explosion will be to some extent cooled and confined.

The plugs are made from salts or mixtures of salts which, at the moment of explosion, are capable of cooling the hot gases, either by themselves evolving non-inflammable gases, or by liquefying or vaporizing with absorption of heat. For the purpose of my invention I may use any of the salts commonly employed as cooling agents in blasting explosives; I prefer, however, to use salts decomposable by heat, such as sodium bicarbonate, or salts melting below the temperature of the explosion, such as calcium fluoride, alum or borax. The plugs may be made in the required shape by moulding or casting the salts or mixtures thereof, with small quantities of binding material such as dextrine or plaster of Paris if desired. The length of the plugs may be conveniently from 1 to 2 inches, but greater or lesser lengths may be employed to meet exceptional circumstances. The channel of the plug is of sufficient diameter to allow easy passage of the detonator, and is preferably coaxial with the plug.

One or more of the plugs are enclosed with a cartridge of safety blasting explosive in a common wrapper, thus forming with it a completely wrapped unit. Each or either end of the blasting charge may be so protected. The safety explosive cartridge may itself be enclosed in a wrapper of waxed or unwaxed paper of the like material; or, if the material of the plug is not incompatible with the explosive composition, the end of the cartridge may be in direct contact with the plug. The explosive cartridge may further be surrounded by an annular sheath consisting, for example, of cooling salts. In such cases the annular sheath may be made to overlap the explosive at each end, forming cups into which plugs of appropriate diameter may be fitted. In all cases the explosive charge of the plug or plugs are held together by means of a substantial outer wrapping of waxed or unwaxed paper, or like material.

When the plugs are used with certain explosives, the distance over which the detonation wave is propagated may be reduced below the limit usually considered advisable when files of cartridge are to be fired. This drawback may be avoided by using plugs with a central channel of, for example, ½ to 1 inch diameter, completely filled with a suitable non-rigid explosive of low power and high degree of safety in respect of fire-damp ignition. Suitable compositions for explosives of this type are described in my co-pending British Patent application No. 33805/32. I have successfully used a mixture of the following composition:—

	Per cent
Nitroglycerine	19.6
Sodium chloride	80
Nitrocotton	0.4
	100.0

The detonator is inserted in this low power explosive core. Since the mixture includes a high proportion of cooling salts, its use does not appreciably lessen the degree of safety conferred by the plug.

Plugs cored with low power explosive of the above type may be attached to each or either end of an explosive cartridge in the manner already described. When they are used in conjunction with cartridges already provided with an annular sheath of cooling salts, a file of cartridges, each completely enclosed by flame-quenching material may be fired with certainty of detonation and a high degree of safety.

In order to disclose my invention more clearly reference is made to the attached drawing showing several embodiments thereof. It is to be understood, however, that this is done solely by way of illustration and is not to be regarded as a limitation upon the scope of my invention which has many important embodiments other than those hereinafter more particularly described.

Similar characters are used in the drawing and throughout the accompanying description to refer to corresponding parts thereof.

Referring generally to the drawing, Figures 1, 2 and 3 represent a sectional elevation of explosive cartridges according to my invention, while Figure 4 represents a borehole loaded with three of the cartridges shown in Figure 3.

Referring particularly to Figure 1, a core of explosive 1, for example black powder in pelleted form, is surrounded by a sheath 2 of cooling salts, said sheath extending beyond the ends of the core 1 and forming a cup-shaped cavity for the cylindrical plugs 3, also fabricated of cooling salts. The plugs 3 are provided with a central passageway 4, the entire assembly being enclosed in a paper wrapper 6. At the time of use a suitable blasting initiator, for example an electric squib 5, is inserted in the central passageway 4 at one end of the composite explosive.

In Figure 2, a core of explosive 1, such as safety dynamite, is enclosed in a paper wrapper 6 which extends beyond the ends of the cartridge 1, forming a cup-shaped receptacle for the cylindrical plugs 3 of cooling salts. In this case the central passageways in the plugs 3 are somewhat larger in diameter and are filled with a safety explosive 7, for example an explosive comprising 19.6% nitroglycerine, 80% sodium chloride and 0.4% nitrocotton. A suitable blasting initiator, for example an electric blasting cap 5, is inserted at the time of use into the safety explosive 7 in one of the plugs 3.

In Figure 3, a core of explosive 1, for example safety dynamite, is surrounded by a sheath 2 of cooling salts and the cylindrical plugs 3, whose central passageways are filled with a safety explosive 7, as above described with reference to Figure 2. The entire assembly is enclosed in the wrapper 6 and at the time of use a suitable initiator 5, for example an ordinary blasting cap provided with a length of safety fuse, is inserted in one end of the resulting cartridge as shown.

Figure 4 shows a borehole 8 in a coal seam for example, loaded with three cartridges of explosive according to my invention. The three cartridges A, B and C inserted in the borehole are similar to that illustrated in Figure 3, except that cartridges B and C are provided with one plug 3 each, so that each core of explosive 1 is separated from the adjacent core by a single plug 3, and maintained in propagating relationship therewith by the safety explosive 7 in the central passageway of the respective plugs 3. The last cartridge C inserted in the borehole is provided with a suitable initiator, for example an electric blasting cap, and the borehole is closed with a tamping material 9.

In the foregoing detailed description of my invention it is apparent that many variations may be made without departing from the spirit and scope thereof. I, therefore, intend to be limited only in accordance with the following patent claims.

I claim:

1. An explosive column comprising at least two cartridges of safety blasting explosive, said cartridges being separated by a coaxial, juxtaposed plug of cooling salts having a longitudinal channel therethrough adapted to hold a safety propagating explosive, said plug being enclosed in a common wrapper with at least one of the cartridges of said column, and containing in this longitudinal channel a core of safety explosive, whereby the propagation of the explosion wave throughout the column is assured.

2. The explosive column of claim 1, in which each explosive cartridge is surrounded by an annular sheath of cooling salts extending beyond at least one end of said cartridge, the plug of cooling salts fitting into the cup formed by the extended sheath.

3. A blasting explosive comprising a cartridge of safety blasting explosive, an annular sheath of cooling salts surrounding said explosive and overlapping an end thereof to present a cup, a coaxial, juxtaposed plug of cooling salts, said plug having a longitudinal channel therethrough adapted to hold an initiator and being sufficiently filled with a safety explosive to insure propagation of the explosive wave throughout the charge, and a wrapper enclosing the explosive sheath and plug, and holding the same assembled in cartridge form.

4. A blasting explosive comprising a cartridge of safety blasting explosive with a wrapper thereabout, an annular sheath of cooling salts surrounding said explosive and overlapping at least one end thereof to present a cup, a coaxial, juxtaposed plug of cooling salts being received in said cup and having a longitudinal channel therethrough adapted to hold an initiator and being sufficiently filled with a safety explosive to insure propagation of the explosive wave throughout the charge, and a wrapper enclosing the wrapped and sheathed explosive and the plug, and holding the same in assembled cartridge form.

5. The blasting cartridge of claim 4, in which said cooling salt comprises sodium bicarbonate.

6. The blasting cartridge of claim 4, in which said cooling salt comprises calcium chloride.

7. The blasting cartridge of claim 4, in which said cooling salt comprises borax.

ALBERT GREVILLE WHITE.