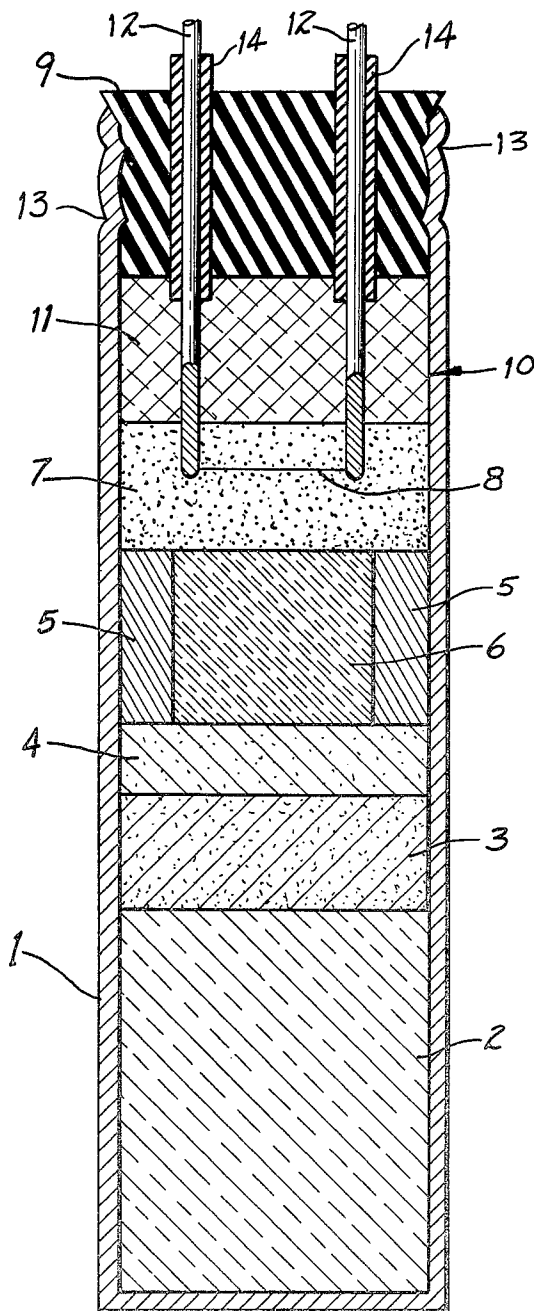


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COMPOSITION COMPRISING BARIUM CHROMATE, BORON
AND LEAD DIOXIDE
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COMPOSITION COMPRISING BARIUM CHROMATE, BORON AND LEAD DIOXIDE
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This invention relates to an improved ignition composition. More particularly, the invention relates to electric blasting detonators containing a novel ignition composition.

Various ignition compositions have been available heretofore for use in igniting priming compositions in detonators and the like. Some of the disadvantages inherent in the use of ignition compositions heretofore are as follows:

- (1) The ignition composition is extremely sensitive to static electricity and the like which may cause unprogrammed ignition and detonation.
- (2) The ignition compositions are not stable over a wide range of temperature conditions.
- (3) When freshly prepared, certain ignition compositions are extremely violent when ignited, and the resulting explosive force frequently snuffs out the flame without igniting the charge.

It is a primary object of this invention to overcome the disadvantages of ignition compositions available heretofore.

Another object of the invention is to provide an improved ignition composition having reliable ignition properties.

Still another object of the invention is to provide an ignition composition having improved di-electric resistance.

A further object of the invention is to provide an ignition composition having a firing time that is substantially insensitive to loading pressures.

It is another object of the invention to provide an ignition composition having a firing time which is substantially insensitive to a wide range of temperature conditions.

Still another object of the invention is to provide an ignition composition having a high auto-ignition temperature.

These and other objects of the invention will be apparent from the following detailed description thereof.

A novel ignition composition comprised of a mixture of boron, barium chromate, and lead dioxide has now been discovered.

The improved results set forth above in the objects are readily obtained when the ignition composition is comprised of the following:

Component:	Weight percent range
Barium chromate	65-78
Boron	7-16
Lead dioxide	10-20

For shorter pulse time and optimum heat content, it is preferred however to maintain the proportion of ingredients in the composition within the following ranges:

Component:	Preferred weight percent range
Barium chromate	69-71
Boron	15-16
Lead dioxide	14-16

It will be recognized by those skilled in the art that it is possible to prepare ignition compositions by mixing barium chromate, boron, and lead dioxide in proportions out-

side of the above mentioned ranges and still obtain some or all of the improvements set forth in the objects.

Mixing of the above mentioned components to form the novel ignition composition may be effected in any convenient manner. For example, the solid components in the above mentioned proportions are mixed with water to form an aqueous slurry and the slurry is then placed in a ball mill or other comminuting device to finely divide the solid components as well as to effect commingling of the solid particles into a substantially homogeneous mixture.

Prior to use as the novel ignition composition, the solid components should be placed in finely divided form. This can be effected by comminuting prior to or during the mixing step.

After the desired degree of comminution is attained and the desired homogeneous mixture is attained, water or other liquid that may be present is separated from the mixture of solids by filtering and subsequent drying. The resulting dry mixture of solids may then be used as is to form the ignition composition of an electric detonator, or if desired, may be grained or pelletized prior to inserting into an electric detonator.

The drawing shows a sectional elevation view of a suitable delay electric igniter employing the novel ignition composition of this invention. Detonator case 1, which may be formed of a metal such as aluminum, gilding metal or a plastic such as ethyl cellulose is partially filled with a base charge 2, such as cyclotrimethylenetrinitramine (cyclonite), pentaerythritol tetranitrate (PETN), tetryl, and the like. A heat sensitive high explosive 3, such as lead azide, is placed above the base charge 2, and a heat sensitive priming charge 4 is placed above high explosive 3. A suitable swaged lead tube carrier 5 is provided above the priming charge 4 to contain an appropriate delay mixture 6, such as barium dioxide/selenium, zirconium/nickel or other suitable delay mixture. If desired a mixture of barium chromate, boron and lead dioxide in the above defined proportions may be densified by pressing or otherwise and employed as a delay mixture 6. The novel igniter mixture 7 of this invention, in loose powder, pellet, or granular form, as the case may be, is positioned adjacent to the delay mixture 6. A bridge plug assembly 10 formed of a plastic bridge plug 11 containing lead wires 12 coated in part by insulation 14 and having a high resistance bridge wire 8, such as platinum or platinum-tungsten alloy joining two adjacent uninsulated ends of the lead wires 12, is inserted into case 1. Bridge plug assembly 10 is positioned so that bridge wire 8 is in contact with the igniter mixture 7. A rubber closure plug 9 having two openings through which the opposite end of the lead wires 12 are passed is then inserted into the tube of the case 1 adjacent to bridge plug 11. Circumferential crimps 13 are then formed in case 1 around closure 9 in order to seal the tube of the case. Detonators of other designs employing other priming compounds and other base charges can also be used.

Detonators containing the novel ignition mix of this invention are not readily detonated inadvertently because they resist firing due to electrostatic discharge and other stray electric currents found in coal mines and the like.

In addition to employing barium chromate, boron and lead dioxide in the above mentioned proportions, other additives may be employed in small proportions. For example a binder such as gum arabic may be added in a proportion equivalent to between about 0.5 and about 2 percent by weight of the mixture without adversely affecting the characteristics of the mixture. If desired, silicon dioxide may be added to the mixture in a proportion equivalent to between about 2 and about 4 percent by weight of the mixture to improve its flowability without adversely affecting the characteristics of the mix.

The following examples are presented to further illustrate the invention without any intention of being limited thereby. All parts and percentages are by weight unless otherwise specified.

EXAMPLE I

Barium chromate (69.27 parts), boron (15.72 parts), and lead dioxide (15.00 parts) were admixed with 146 parts of water in a ball mill for a period of about 20 hours. The resulting comminuted mixture was then filtered and the residue heated to dryness and screened through a 30 mesh U.S. standard screen. The resulting ignition composition was employed in the preparation of a group of detonators wherein each detonator was formed by filling gilding metal cases having an inside diameter of about 0.254 inch and a length of about 1.250 inches with about 4.6 grains of cyclonite as a base charge, 3 grains of lead azide as a primer, 2.3 grains of the foregoing novel ignition mixture pressed to provide a delay column, and 2.3 grains of the novel ignition mixture prepared as described above. A bridge plug assembly having a bridge plug formed of sulfur and a platinum alloy bridge wire was inserted into the ignition mixture, a Neoprene closure was then sealed above the bridge plug assembly by circumferential crimping. Detonators prepared as described above were provided with shunted lead wires and alternating current was then passed across the shunts to simulate currents frequently found in coal mines due to transient current through the earth. It was found that the detonators withstood a voltage in the range of about 2500 to 3000 volts. In contrast, similar detonators containing a mixture of lead and selenium as the ignition mixture, when subjected to the same conditions detonated at 450 volts or below.

In addition the firing time of several detonators from the group containing the novel ignition mixture of this invention were found to be unaffected by loading pressures. In contrast, detonators containing a lead-selenium mixture were markedly affected by loading pressures.

EXAMPLE II

Detonators from the group of Example I containing the novel ignition mixture of this invention were found to have an auto-ignition temperature of 196° to 199° C. For purposes of comparison detonators containing a lead-selenium mixture as the ignition composition were found to ignite in the range of 160° to 170° C.

EXAMPLE III

Detonators from the group of Example I containing the novel ignition mixture of this invention were found

to provide very narrow time spreads when fired at 1 ampere of current.

Total firing time for novel ignition mixture

	Milliseconds
5 Average time -----	28.87
Maximum time -----	30.57
Minimum time -----	26.88
Spread time -----	3.69

10 Various modifications of the invention, some of which have been referred to above, may be employed without departing from the spirit of this invention.

I claim:

1. An ignition composition comprised of a mixture of barium chromate, boron, and lead dioxide.

2. An ignition composition comprised of between about 65 and about 78 percent by weight of barium chromate, between about 7 and 16 percent by weight of boron, and between about 10 and about 20 percent by weight of lead dioxide.

3. An ignition composition comprised of between about 69 and about 71 percent by weight of barium chromate, between about 15 and about 16 percent by weight of boron, and between about 14 and about 16 percent by weight of lead dioxide.

4. An electric detonator comprising an ignition composition comprised of a mixture of barium chromate, boron and lead dioxide, a bridge wire embedded in the ignition composition, an initiator of lead azide, and a base charge selected from the group consisting of cyclonite, pentaerythritol tetranitrate and tetryl.

5. An electric detonator comprising an ignition composition comprised of a mixture of between about 65 and about 78 percent by weight of barium chromate, between about 7 and 16 percent by weight of boron, and between about 10 and about 20 percent by weight of lead dioxide, an initiator of lead azide, and a base charge selected from the group consisting of cyclonite, pentaerythritol tetranitrate and tetryl.

6. An electric detonator comprising an ignition composition comprised of a mixture of between about 69 and about 71 percent by weight of barium chromate, between about 15 and about 16 percent by weight of boron, and between about 14 and about 16 percent by weight of lead dioxide, an initiator of lead azide, and a base charge selected from the group consisting of cyclonite, pentaerythritol tetranitrate and tetryl.

No references cited.