

July 3, 1934.

H. A. LEWIS
IGNITION COMPOSITION
Filed April 2, 1932

1,964,825

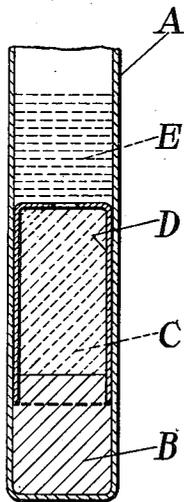


Fig. 1

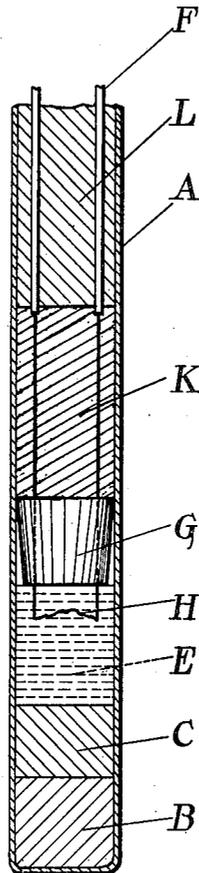


Fig. 2

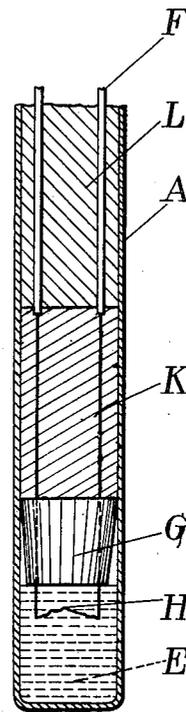


Fig. 3

Harold A. Lewis INVENTOR.

BY

Wm. S. Lewis
ATTORNEY.

UNITED STATES PATENT OFFICE

1,964,825

IGNITION COMPOSITION

Harold A. Lewis, Woodbury, N. J., assignor to
E. I. du Pont de Nemours & Company, Wil-
mington, Del., a corporation of Delaware

Application April 2, 1932, Serial No. 602,810

15 Claims. (Cl. 52—2)

This invention relates to ignition compositions and more particularly to an improved ignition composition comprising a sulfocyanate, an oxidizing agent and an inorganic combustion accelerant as initiating agent in various types of blasting assemblies.

Ignition compositions of the type covered by this invention have numerous applications. Such a composition may be used, for example, as a loose charge in an electric blasting cap, in which the ignition composition is fired by means of a fine wire embedded in the loose charge, said wire being brought to incandescence by the passage of an electric current through it. A second use for such a composition is as a loose charge in an electric squib of the closed shell type, in which case the flame from the ignition composition causes the firing of a deflagrating explosive, black blasting powder for example. A further use of such a composition is in igniters, match-heads, etc., in which case the ignition material may be cemented to the firing bridge wire. In the latter, the ignition composition may be formed into a paste by various means and, if so desired, may be subsequently coated and waterproofed by suitable agents. A still further field of application for such a type of composition is in blasting caps which are fired by means of fuse, and more particularly in the so-called composition blasting caps of the well-known type.

As commonly manufactured, a composition blasting cap comprises a metallic shell containing at its base a charge of secondary detonating compound, with a charge of a primary detonating material superimposed on this. Above this primary charge, or mixed with it, an ignition composition has been customarily used.

Various metals and alloys have been in common use for the manufacture of blasting cap shells, notably aluminum and gilding metal (copper-zinc). As secondary detonating compounds tetranitromethylaniline (tetryl), pentaerythritol tetranitrate, trinitrotoluene and picric acid have been used, while other compounds such as hexanitrodiphenylamine, erythritol tetranitrate, etc., either alone or mixed with other compounds, have proved satisfactory. The above materials are ordinarily used in compressed condition but, when desired, cast charges of these materials may be made.

These secondary detonating compounds according to prior practice have been brought to complete and instantaneous explosion only under the influence of a violent shock. For this reason, primary detonating charges have been used super-

imposed on the secondary charges. As an example of a suitable primary charge, mercury fulminate may be used, either alone or mixed with an oxidizing agent such as potassium chlorate. Lead azide is another very highly important example of such a primary detonating compound. If desired, these primary charges may be enclosed within a capsule, since the added confinement in this case gives increased efficiency to the detonating action.

When mercury fulminate is used in such an inner capsule, a common ignition composition is a mixture of mercury fulminate and potassium chlorate in the ratio of 65 parts to 35 parts respectively. With lead azide in both capsule and non-capsule type caps, the normal or basic lead salts of styphnic acid and picric acid have been commonly employed.

In addition to the foregoing compositions, mixtures of lead sulfocyanate or other sulfocyanate and an oxidizing agent, such as potassium chlorate or perchlorate, have been used. Also in my U. S. Patent 1,797,509, a composition comprising lead sulfocyanate, potassium chlorate and ground Pyro powder has been disclosed.

All the ignition compositions described in the foregoing have certain disadvantages. Mercury fulminate, for example, is an expensive compound, and its mixtures are objectionable because of high cost. Furthermore, commercial mercury fulminate is not adapted for use with cap shells of certain metals, aluminum for example, since the commercial material almost invariably contains some free mercury, which amalgamates with the shell. The salts of styphnic acid and picric acid have been commonly employed as ignition materials for lead azide. These salts, however, are characterized by high sensitiveness to static electricity and friction, which fact renders them hazardous in manufacture and unsatisfactory for commercial use. Mixtures of sulfocyanates and potassium chlorate, with or without the presence of a low ignition point fuel such as ground Pyro powder, have been generally satisfactory but are not altogether desirable from the point of view of charging properties, ease of ignition, explosion temperature, and particularly rate of combustion.

The object of my invention is to provide an ignition composition which is relatively insensitive to shock, friction and static electricity effects. A further object is to provide such a composition which is satisfactory for use with the metals and alloys commonly employed for cap shells. A

60

65

70

75

80

85

90

95

100

105

110

still further object is to provide a relatively inexpensive ignition composition which possesses improved properties with respect to ease of ignition, high heat of combustion, uniform and rapid burning and satisfactory loading.

I have found that an improved ignition composition is obtained, which satisfies the objects of my invention, by the use of a mixture of a sulfocyanate, and oxidizing agent and an inorganic combustion accelerator. I have found lead sulfocyanate to be a satisfactory and desirable sulfocyanate, although other sulfocyanates may be used, the copper salt for example. Potassium chlorate I have found to be the most suitable oxidizing agent for use in my ignition composition, although other oxidizing materials may be used in place of this such as potassium perchlorate, red lead, barium nitrate, etc. As inorganic combustion accelerant I prefer to use a metalloid of Group VI of the periodic system, particularly sulfur, though other inorganic materials may be substituted for this, for example metallic magnesium, metallic aluminum, zirconium, etc. By the term metalloid alone, I wish to designate an element which is on the borderline between the metals and the non-metals in that it forms chemical compounds with both hydrogen and with oxygen. The metalloids of Group VI, for example, comprise the elements sulfur, selenium and tellurium.

A satisfactory composition for my improved ignition mixture contains the ingredients named in the amounts of 30 to 70% lead sulfocyanate, 30 to 60% potassium chlorate and 1 to 20% sulfur. A preferred composition is such as the following:

	Per cent
Lead sulfocyanate.....	50
Potassium chlorate.....	40
Sulfur.....	10

It will be understood, however, that this invention is not limited to the materials or proportions given above, and that these are merely illustrative of preferred compositions.

Ignition compositions containing sulfur, such as are described in the foregoing may be used as initiating materials in various types of blasting devices. Such compositions are advantages, for example, as loose charges in electric blasting caps and in electric squibs of the closed type, where the ignition composition surrounds the bridge wire used for firing the main charges. Such a composition may be used to advantage also in an electric match-head, where the material is cemented, or caused to adhere, to the fine bridge wire by means of suitable agglutinants. I find my improved ignition composition most satisfactory, however, for use as a pressed charge in the ordinary type of blasting cap, where the firing of the ignition composition is brought about by means of the flame from a fuse. Such a composition is particularly desirable when superimposed upon a primary charge of lead azide, either enclosed in a capsule or not so enclosed. Under such conditions of use, my improved composition possesses desirable properties not possessed by any previous ignition compositions.

By way of more exact description, the use of my composition is shown diagrammatically in the attached drawing, where three types of initiators are illustrated. Figure I shows an ordinary fuse type blasting cap, with inner capsule,

in which A represents the cap shell, B the base charge, preferably of tetryl, C a primary charge of lead azide for example, enclosed in the capsule D, said primary charge being superimposed on the base charge. E represents the ignition composition according to my invention, which composition is fired by means of the flame of a fuse. Figure II illustrates an electric blasting cap in which again A represents the cap shell, B a base charge, C a primary charge, preferably of lead azide, and E an ignition composition according to my invention, which is fired by means of an electric current passing through the leading wires F and bringing the bridge wire H to incandescence. In this figure, the leading wires are held in place by means of the conical bridge plug G, with the waterproofing composition K above the bridge plug, and the sulfur seal L at the top. Figure III represents an electric squib of the closed type, in which A is the squib shell, of metal or other resistant material. E represents my ignition composition, which is fired by the electric current passing through the leading wires F and the bridge wire H, the leading wires again held in place by the concave plug G.

My invention has been described in detail in the foregoing in various embodiments. It will be understood, however, that various departures from the details described are permissible. I intend to be limited in my invention only as indicated in the following patent claims.

I claim:

1. An ignition composition comprising a sulfocyanate, an oxidizing agent, and an accelerant taken from the group consisting of the readily combustible metals and the metalloids of Group VI of the periodic system.
2. An ignition composition comprising a sulfocyanate, an oxidizing agent and metallic magnesium.
3. An ignition composition comprising a sulfocyanate, an oxidizing agent and metallic aluminum.
4. An ignition composition comprising a sulfocyanate, an oxidizing agent, and a metalloid of Group VI of the periodic system.
5. An ignition composition comprising a sulfocyanate, an oxidizing agent and sulfur.
6. An ignition composition comprising lead sulfocyanate, an oxidizing agent and sulfur.
7. An ignition composition comprising lead sulfocyanate, potassium chlorate and sulfur.
8. An ignition composition comprising approximately 30 to 70% lead sulfocyanate, 30 to 60% potassium chlorate and 1 to 20% sulfur.
9. An ignition composition as the top charge in a blasting cap, said composition comprising a sulfocyanate, an oxidizing agent, and an accelerant taken from the group consisting of the readily combustible metals and the metalloids of Group VI of the periodic system.
10. An ignition composition as the top charge in a blasting cap, said composition comprising a sulfocyanate, an oxidizing agent and sulfur.
11. An ignition composition as the top charge in a blasting cap, said composition comprising lead sulfocyanate, an oxidizing agent and sulfur.
12. An ignition composition as the top charge in a blasting cap, said composition comprising lead sulfocyanate, potassium chlorate and sulfur.
13. An ignition composition as the top charge in a blasting cap, said composition comprising 30 to 70% lead sulfocyanate, 30 to 60% potassium chlorate and 1 to 20% sulfur.
14. An ignition composition as the top charge

in a composition blasting cap, containing a charge of a secondary detonating compound and a primary charge of lead azide, said ignition composition comprising lead sulfocyanate, potassium chlorate and sulfur.
 5 15. An ignition composition as the top charge

in a composition blasting cap, containing a charge of a secondary detonating compound and a primary charge of lead azide, said ignition composition comprising 30 to 70% lead sulfocyanate, 30 to 60% potassium chlorate and 1 to 20% sulfur.
 HAROLD A. LEWIS.

80

85

10

90

15

95

20

100

25

105

30

110

35

115

40

120

45

125

50

130

55

135

60

140

65

145

70

150

75