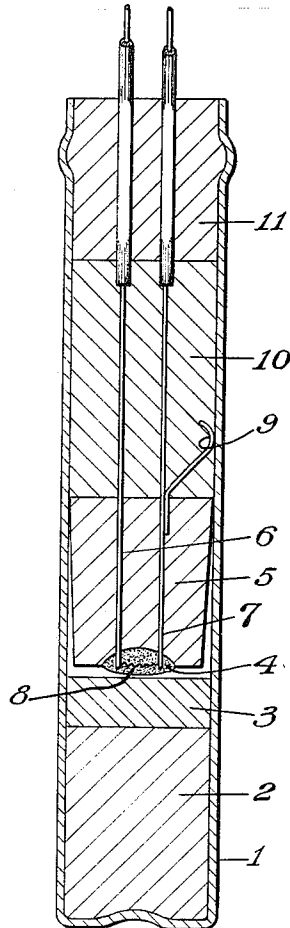


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L. A. BURROWS
IGNITION COMPOSITION
Filed Oct. 30, 1935

2,086,533



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UNITED STATES PATENT OFFICE

2,086,533

IGNITION COMPOSITION

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Application October 30, 1935, Serial No. 47,386

17 Claims. (Cl. 52—2)

The present invention relates to a new and improved ignition composition, and more particularly to such compositions for use in electric blasting caps.

As is well known, blasting initiators consist usually of cylindrical shells or capsules containing a base charge of explosive material, an ignition composition superposed thereon, and a means for firing the ignition composition. Depending on the nature of the base charge employed, these blasting initiators are conveniently classified into: (A) detonators or blasting caps, suitable for use with detonating or high explosives; and (B) igniters or squibs, adapted for use with deflagrating explosives. They are further classified on the basis of the firing means employed into: (1) electric blasting initiators, which use an electric current to ignite the ignition composition; and (2) ordinary blasting initiators which are initiated by a suitable length of safety fuse.

For general use, the ignition compositions above referred to should possess a number of properties such as ease of ignition, large heat of reaction, uniformity in ignition, availability, and the like. For other rather special uses, however, as for example in electric blasting caps to be employed in seismographic explorations, the ignition composition should possess, in addition to the above mentioned properties, a very rapid rate of ignition. In other words, the interval or lag between the instant the firing current is applied and the instant the ignition composition bursts into flames should be very small.

As more fully explained in co-pending application, Serial No. 47,385 filed October 30, 1935, the interval or lag above referred to is the result of two separate factors. The first of the factors, which may be termed the "bridge wire lag", is the interval or lag between the application of the current and the fusion or breaking of the bridge wire. The second lag, or "induction period", as it will hereinafter be designated, is the interval between the breaking of the bridge wire and the detonation of the cap. At a given amperage, the "induction period" is a definite characteristic property of each ignition composition.

The ignition compositions heretofore available have in many cases not possessed to the desired degree all the properties hereinbefore mentioned. While many of the available compounds have been satisfactory for use in initiators to be employed in ordinary blasting operations, the long "induction period" of these compounds has generally precluded their use in electric blasting caps

of the type required in seismographic explorations.

The object of the present invention is a new and improved ignition composition. A further object is such a composition suitable for use in electric blasting initiators generally. A still further object is an ignition composition of the character described which is suitable for use in a fast electric blasting cap. Other objects will be apparent as the invention is hereinafter more fully described.

I have found that these objects may be accomplished by employing an ignition composition comprising at least one of the compounds selected from the group consisting of the silver and mercury derivatives of chlorinated azodicarbonamidine. The structure of these salts is not known with certainty, but it seems proper to designate them as the respective salts of NN' dichloro-azodicarbonamidine. These salts are very sensitive to heat, possess a low firing current, and are very rapid in ignition. Electric blasting caps provided with either one of these salts are extremely fast.

As pointed out in co-pending application, Serial No. 47,385 filed October 30, 1935 compounds which have a negligible or immeasurable "induction period" are generally susceptible to static electricity. The compounds according to my invention are no exceptions to this rule. Dangers from this source, however, may be avoided by employing any of the means disclosed in the above mentioned application, whereby the electrostatic susceptibility of the blasting initiator may be substantially reduced. The advantages of great speed may, therefore, be achieved in an electric blasting initiator which is substantially free from susceptibility to static electricity.

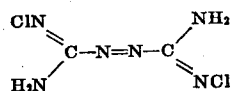
The silver and mercury salts of NN' dichloro-azodicarbonamidine may be prepared from aminoguanidine nitrate as the starting material. The latter compound may be oxidized to azodicarbonamidine dinitrate by means of potassium permanganate, according to the directions of Thiele (Ann. 270, 39 (1892)). The azodicarbonamidine dinitrate is then halogenated, as for example by the procedure of Schmelke and Marks (Jour. Amer. Chem. Soc. 56, 1610 (1934)) to produce NN' dichloro-azodicarbonamidine.

The silver salt is produced by dissolving one part of the dichloroazo compound in water at 90° C. and adding thereto with stirring a solution of two parts of silver nitrate, dissolved in water, and sufficient ammonia to redissolve the precipitated silver oxide. A dark red precipitate forms immediately. On continued stirring at

90° C., this precipitate turns black. If desired, the salt may be co-precipitated with various non-explosive materials, such as dextrine, in order to reduce the sensitiveness of the material to friction.

5 The mercury salt is prepared by dissolving one part NN' dichloro-azodicarbonamidine in hot water and adding thereto with stirring an aqueous solution of mercuric acetate. Ammonia is added from time to time to keep the reaction mixture just slightly acid at the start, and slightly alkaline toward the end of the reaction.

A flocculent red precipitate is obtained. The formula given by Schmelkes and Marks for N:N' dichloroazodicarbonamidine is



20 It is difficult to state exactly the formulas of the silver and mercury salts, but it will be understood that the metal in question has replaced at least a portion of the hydrogen in their formula. I do not wish to be limited, however, by the accuracy of the formulas given.

25 Both the silver and the mercury salts of NN' dichloroazodicarbonamidine are extremely fast ignition compounds and may be used as loose ignition compounds in all types of blasting initiators, including squibs, igniters, detonators, delay electric detonators, and the like. I prefer to employ them, however, in electric blasting caps, and more particularly in electric blasting caps of the concave plug type.

35 In order to describe my invention more clearly, I shall refer to the attached drawing, which represents a vertical section of a concave type of electric blasting cap. 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.

40 Referring to the drawing, the blasting cap comprises a shell 1 of suitable electrically-conducting material such as a metal, for example aluminum, and the like. In the base of this shell is placed a base charge 2 of tetryl, and a priming charge 3 of lead azide superposed thereon. An ignition composition 4, comprising one of the salts according to my invention, for example the silver salt of NN' dichloroazodicarbonamidine, is disposed at least partly within a cavity at the base of the concave plug 5 which holds the leg wires 6 and 7 in fixed space relationship. The high resistance or bridge wire 8 joins the two ends of the leg wires 6 and 7, and is surrounded by the ignition composition 4 in the cavity. The shell 1 is closed by the waterproofing composition 10 and the sulfur seal 11.

55 The ignition composition 4, comprising the silver salt for example, is prepared in any suitable manner, but we prefer to gelatinize the silver salt of NN' dichloroazodicarbonamidine with nitrostarch and apply this plastic composition, suspended in amyl acetate, to the cavity in the concave plug 5. The same procedure may be used with the mercury salt, if desired, with similar results.

60 One of the leg wires 7 is provided with a means 9 whereby the electrostatic susceptibility of the cap is substantially reduced. This may comprise any of the means disclosed and claimed in co-pending application, Serial No. 47,385 filed October 30, 1935, whereby the static electricity is caused to pass harmlessly to the shell wall 1, at a point outside the locus of the ignition composition 4. In general, these means may be pro-

duced (1) by forming a low resistance spark gap or arc between at least one of the leg wires and the shell wall, such that the resistance across the arc provided is substantially less than that of the arc between the shell wall and the firing circuit at the locus of the ignition compound 4. A second method consists in (2) forming an actual, electrically-conducting connection between the shell wall and one of the leg wires at a point outside the locus of the ignition com- position 4.

15 The means illustrated in the drawing comprises a short length of wire 9, as for example copper or stiff iron wire, which is soldered or otherwise affixed to the leg wire 7. The wire 9 contacts the shell wall 1, forming an electrical circuit therewith.

20 The electric blasting cap illustrated has three very desirable properties. In the first place, with an overall time lag of less than 2×10^{-4} seconds, it is faster than any cap heretofore known. In the second place, the cap has no measurable "induction period." Thirdly, the electrostatic susceptibility which is usually characteristic of fast ignition compositions has been substantially reduced to a safe maximum by the means 9, which grounds the firing circuit to the shell wall. These results are likewise obtained by employing the mercury salt in a similar manner.

25 In the foregoing detailed description, I have illustrated my invention with particular reference to the silver salt of NN' dichloro-azodicarbonamidine. It is apparent, however, that the mercury salt of NN' dichloro-azodicarbonamidine may be employed in substantially the same manner, with substantially the same results. Furthermore, while I have particularly pointed out the application of my invention to a fast electric blasting cap, it is apparent that the ignition composition is widely applicable, as for example in squibs, delays, detonators, and the like, whether fired by electrical means or with the aid of safety fuse. Other variations in the application of my invention will be apparent to any one skilled in the art. I therefore intend to be limited only in accordance with the following patent claims.

I claim:

1. As a new composition of matter, a compound selected from the group consisting of the silver and mercury derivatives of chlorinated azodicarbonamidine.

2. An ignition composition comprising at least one of the compounds selected from the group consisting of the silver and mercury derivatives of chlorinated azodicarbonamidine.

3. An ignition composition in an electric blasting initiator, comprising at least one of the compounds selected from the group consisting of the silver and mercury derivatives of chlorinated azodicarbonamidine.

4. In an electric blasting cap containing a detonating base charge and a priming charge, an ignition composition comprising at least one compound selected from the group consisting of the silver and mercury derivatives of chlorinated azodicarbonamidine.

5. The ignition composition of claim 4, in which said ignition composition is gelatinized with nitrostarch.

6. In an electric blasting cap of the concave plug type, a gelatinized ignition composition comprising at least one of the compounds selected

from the group consisting of the silver and mercury salts of chlorinated azodicarbonamidine.

7. The ignition composition of claim 6, in which said composition is gelatinized with nitro-starch.

8. In an electric blasting initiator, the firing circuit of which is provided with a discharging means whereby the susceptibility of the initiator to static electricity is substantially reduced, an ignition composition comprising at least one member of the group consisting of the silver and mercury salts of chlorinated azodicarbonamidine.

9. In an electric blasting initiator, the firing circuit of which is provided with a discharging means whereby static electricity is caused to pass harmlessly to the shell wall of the initiator, an ignition composition comprising at least one compound selected from the group consisting of the silver and mercury salts of NN' dichloro-azodicarbonamidine.

10. In an electric blasting cap, the firing circuit of which is provided with a discharging means whereby static electricity is caused to pass harmlessly to the shell wall of said blasting cap at a point outside the locus of the ignition composition, an ignition composition comprising the silver salt of NN' dichloro-azodicarbonamidine.

11. In an electric blasting cap, the firing circuit of which is provided with a discharge means whereby static electricity is caused to pass harmlessly to the shell wall across an arc formed between the shell wall and the firing circuit at a point outside the locus of the ignition composition, an ignition composition comprising the

silver derivative of chlorinated azodicarbonamidine.

12. In an electric blasting cap containing an ignition composition, the firing circuit of which is provided with a discharging means whereby static electricity is caused to pass harmlessly to the shell wall of said blasting cap through an electrically-conducting connection between the firing circuit and said shell wall at a point outside the locus of said ignition composition, an ignition composition comprising the silver salt of NN' dichloro-azodicarbonamidine.

13. In an electric blasting cap, the firing circuit of which is grounded to the shell wall thereof, an ignition composition comprising the silver derivative of chlorinated azodicarbonamidine.

14. In an electric blasting cap of the bridge plug type, one leg wire of which blasting cap is grounded to the shell wall thereof, a gelatinized ignition composition comprising the silver salt of NN' dichloro-azodicarbonamidine.

15. The ignition composition of claim 14, in which said composition is gelatinized with nitro-starch.

16. In an electric blasting cap of the match-head type, the firing circuit of which is provided with a discharging means whereby static electricity is caused to pass harmlessly to the shell wall of said blasting cap, a gelatinized ignition composition comprising the silver salt of NN' dichloro-azodicarbonamidine.

17. The ignition composition of claim 16, said composition being gelatinized with nitrostarch.

LAWTON A. BURROWS.

CERTIFICATE OF CORRECTION.

Patent No. 2,086,533.

July 13, 1937.

LAWTON A. BURROWS.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 3, first column, line 29, claim 11, for the word "discharge" read discharging; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 19th day of October, A. D. 1937.

(Seal)

Henry Van Arsdale.
Acting Commissioner of Patents.