

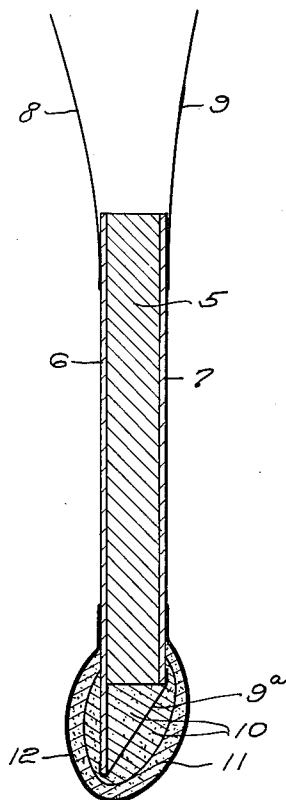
Nov. 14, 1933.

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1,935,495

SLOW MATCH COMPOSITION

Filed Jan. 22, 1931



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UNITED STATES PATENT OFFICE

1,935,495

SLOW MATCH COMPOSITION

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Application January 22, 1931. Serial No. 510,559

23 Claims. (Cl. 52—2)

This invention relates to the production of compositions of matter to be used as deflagrating compositions with relatively slow rates of burning, and which at the same time will ignite readily from a small, quick tongue of flame. More especially, this invention relates to the use of such compositions in electric matches. Its principal object is to provide a type of electric match which will dependably ignite a substance which is comparatively difficult to ignite, such as smokeless powder. Other objects will become apparent in the following complete description of my invention, as for example, deflagrating or kindling compositions having little or no corrosive or other deleterious effects on certain metals and kindling compositions having relatively low hygroscopicities.

Electric matches are in common use to initiate the primary detonating charge in electric blasting caps, or to ignite black powder, as in electric squibs. These electric matches, or preformed fuse heads, may be made in various ways, the deflagrating composition being pressed, molded, or otherwise formed around the bridge wire. One well known type consists of two metal plates, separated by electrical insulations, but joined at one end by the bridge wire and fastened to the lead wires at the other end. The deflagrating composition is molded around the bridge wire end of the plates. In another type, the bridge wire is fastened to the lead wires in a cup or pocket, as in a sulphur plug, which cup or pocket is packed with the deflagrating or kindling composition.

There are a number of compositions which are or may be used around the bridge wire of electric matches, which are used in making electric detonators or electric squibs. A few examples of these are:

1. Cuprous acetylide around the bridge wire, which in turn is surrounded by a mixture of charcoal and potassium chlorate.

2. A mixture of mercury fulminate, nitrostarch, and potassium chlorate.

3. Metallic picrates, as exemplified by lead picrates.

4. Metallic salts of the nitroresorcinols, such as lead mono-, di-, or trinitroresorcinolate.

These electric matches all give a very quick flash, and are entirely satisfactory when used to detonate sensitive explosives, such as fulminates or mixtures containing fulminates. But where it is desired to ignite a substance which is less sensitive to flame, and requires a longer period of contact with the flame, such as grains of smoke-

less powder, these quick matches are unreliable.

I have found that mixtures using nitroaromatic bodies as fuels, together with chromates or dichromates as oxygen carriers, are when intimately mixed in the proper proportions, sufficiently sensitive to ignite from the flash of the initiating composition around the bridge wire of the match, and at the same time sufficiently slow burning to ignite smokeless powder and other deflagrating materials of similar character, even when they exist in the form of relatively large grains or pellets. In using these slow-burning mixtures, it is preferable to use a more sensitive composition, such as one of those mentioned above, directly around the bridge wire, and then apply the slow-burning mixture around this initiating composition.

Following are a few specific examples of some actual mixtures which I have found to ignite readily when used as above described, and to burn with a nice flame, lasting for about one second or more after the initial flash:

	Percent
(1) Trinitrophenylmethylnitroamine (tetryl)	75
Potassium dichromate	25
(2) Ammonium picrate	50
Potassium dichromate	50
(3) Tetryl	75
Potassium chromate	25

Other chromates and dichromates may be substituted for the potassium salts, and other nitroaromatic compounds may be used as fuels. The above are merely a few examples of a number of combinations that may be used, and are not to be considered limiting. Also, the compositions can be varied between quite wide limits, depending upon the intensity and duration of the flash from the initiating composition in contact with the bridge wire, and on the nature of the material which the deflagrating composition is to ignite. For example, I have found that mixture (1) above, when used in conjunction with cuprous acetylide, will function for any variation between 90% tetryl-10% dichromate, and 25% tetryl-75% dichromate. A similar wide range may be used for other mixtures.

Some of the other chromates and dichromates which may be employed as oxygen carriers are those of sodium, ammonium, barium, lead, etc., and some of the other nitroaromatic compounds which may be used as fuels are trinitrotoluene, tetranitroaniline, hexanitrodiphenylamine, picric acid, trinitroresorcinol, and related compounds.

While the primary object of this invention is to provide an electric match which will un-

ingly ignite smokeless powder and the like, its use is not to be limited to this field. Wherever it is desired to ignite a substance which is not quite sensitive enough to flame to function dependably with the present quick match, my slow burning match should find application. It may be used in connection with steel or iron devices without fear of corrosion, which overcomes the objection to chlorate mixtures. The absence of mercury fulminate also allows its use in contact or in connection with aluminum or other metals which are readily amalgamated.

As some of the chromates and dichromates are less hygroscopic than others, this property should be considered where severe conditions of moisture are to be encountered. For example, I have found that matches made using tetryl and potassium dichromate as deflagrating composition show a satisfactory resistance to moist atmosphere, both ingredients being non-hygroscopic.

In making this slow burning match, I prefer to use the type of electric match in which the initiating composition and deflagrating composition are molded around the bridge wire. The compositions are best applied by suspending them in nitrocellulose lacquer or other lacquer which acts as a binder and leaves an inflammable residue on drying, and dipping the bridge wire end of the match structure in this suspension; on removing, a body of the suspension clings to and completely covers the bridge wire and on drying leaves the match head or preformed fuse head. The initiating composition, such as cuprous acetylide or lead picrate, is first applied in this way. When dry, the deflagrating composition is applied over this head. When this is dry, one or more lacquer films may be applied to impart moisture, resistance and mechanical strength.

A match head constructed in accordance with the aforesaid method is illustrated in the accompanying drawing, showing a greatly magnified sectional view of the match head.

In this drawing, 5 designates a strip of insulating material, such as cardboard, for example, having the metallic plates 6 and 7 upon its opposite sides. The lead wires 8 and 9 are connected to the upper ends of these plates and a bridge wire 9^a connects the lower ends of said plates. The bridge wire is first embedded in the initiating composition 10 (cuprous acetylide, for example) which is applied in its plastic state about said bridge wire and allowed to dry or harden. Then the deflagrating composition 11 (ammonium picrate and potassium dichromate, for example) is applied about the composition 10, as by the dipping described. When the composition 11 is dry one or more nitrocellulose lacquer films indicated at 12, may be applied as described, which, while moisture proofing and mechanically strengthening the whole, is inflammable.

While particularly applicable to electric matches or fuse heads, as described above, it should be distinctly understood that my invention is not limited to this use but may be used to advantage as kindling materials elsewhere without being outside its scope. For example, one may have a detonator composition which is too insensitive to the spit of ordinary safety fuse, but will function in a reliable manner from the flame tongues of my new deflagrating or kindling compositions; they in turn being easily ignited by the spit of the safety fuse. The difficulty may accordingly be overcome by introducing a small amount of my new kindling material between the end of the safety fuse and the detonator com-

position. Other exemplary applications of my invention would be the use of my new kindling compositions in priming and delay fuse trains for use in igniting or initiating various types of explosive and incendiary materials. For example, by introducing a small amount of this new kindling material between a difficultly ignitable substance such as a body of nitrocellulose pellets upon the one hand and an ordinary priming or percussion cap upon the other hand; the nitrocellulose pellets may be reliably ignited from the percussion cap, said cap setting off my new kindling material and the latter burning with so sustained a flame as to ignite the nitrocellulose pellets.

Further, it should be distinctly understood that my new kindling composition may be used alone or admixed with other substances, such as binding materials, materials to increase or decrease the speed of burning, and the like, without being outside the scope of my invention.

Having described my invention, what I claim is:

1. A deflagrating composition to be used in a preformed fuse head, composed essentially of tetryl, 25% to 90%, and potassium dichromate, 75% to 10%.

2. In a match head of the type comprising a bridge wire and a coating of a sensitive initiating composition upon said bridge wire, a second coating of a slow match composition about the first named coating, the second coating comprising a nitroaromatic body as a fuel and a chromate as an oxidizer.

3. In a match head of the type comprising a bridge wire and a coating of a sensitive initiating composition upon said bridge wire, a second coating of a slow match composition about the first named coating, the second coating comprising a nitroaromatic body as a fuel and a dichromate as an oxidizer.

4. A deflagrating composition for electric match heads consisting essentially of nitroaromatic bodies as fuels and an oxidizer taken from the group consisting of chromates and dichromates, the whole being substantially chlorine free.

5. A deflagrating composition for matches composed essentially of a fuel taken from a group composed of tetryl and ammonium picrate together with an oxidizer taken from a group consisting of chromates and dichromates.

6. A deflagrating composition composed of a nitroaromatic compound taken from a group consisting of tetryl, ammonium picrate, trinitrotoluene, tetranitroaniline, hexanitrodiphenylamine, picric acid, trinitroresorcinol and an oxidizer consisting of a substance taken from the group consisting of the chromates and dichromates.

7. A match composition comprising a body of a sensitive initiating compound and a body of a deflagrating composition in close association therewith, said deflagrating composition consisting of a nitroaromatic compound taken from the group consisting of tetryl, ammonium picrate, trinitrotoluene, tetranitroaniline, hexanitrodiphenylamine, picric acid, trinitroresorcinol and an oxidizer taken from a group consisting of the chromates and dichromates and the proportions varying from 90% nitroaromatic compound and 10% oxidizer to 25% nitroaromatic compound and 75% oxidizer.

8. A match comprising a body of cuprous acetylide as an easily ignitable medium and a body of deflagrating and more slowly burning material consisting of a nitroaromatic fuel and an

oxidizer taken from the group consisting of the chromates and dichromates.

9. A match comprising a body of a sensitive initiating compound as an easily ignitable medium and a body of deflagrating and more slowly burning material consisting of a nitroaromatic fuel and an oxidizer taken from the group consisting of the chromates and dichromates.

10. An electric match comprising a body of a sensitive initiating compound as an ignitable medium and a body of deflagrating and more slowly burning material consisting of a nitroaromatic fuel and an oxidizer taken from the group consisting of the chromates and dichromates.

11. An electric match comprising a body of sensitive initiating compound as an ignitable medium, and a body of deflagrating and more slowly burning material consisting of a nitrated fuel and an oxidizer taken from the group consisting of the chromates and dichromates.

12. A substantially chlorine-free deflagrating composition comprising a nitroaromatic body as a fuel and at least one oxidizer of a group consisting of chromates and dichromates.

13. A substantially chlorine-free deflagrating composition comprising at least one nitroaromatic body as a fuel, at least one oxidizer of a group consisting of chromates and dichromates, and a binding agent.

14. A substantially chlorine-free deflagrating composition as recited in claim 12 characterized by its binding agent being an inflammable material.

15. A deflagrating, kindling material consisting of at least one nitroaromatic body and at least one oxidizer of the group consisting of chromates and dichromates.

16. A deflagrating material consisting of at least one nitroaromatic body and at least one oxidizer of the group consisting of chromates and dichromates as mixed ingredients.

17. A deflagrating, kindling material consisting of at least one nitroaromatic body, at least one

oxidizer of the group consisting of chromates and dichromates, and a binding agent.

18. In a fuse head, a substantially chlorine-free deflagrating kindling material comprising a nitrated body as the essential fuel, at least one of the group consisting of chromates and dichromates as the essential oxidizing material, and an inflammable binding agent.

19. In an electric match head, a heating means, a coating of a sensitive composition about said heating means, a second coating of a slow match composition about the first named coating, the second coating comprising at least one nitroaromatic body as a fuel and at least one oxidizer of the group consisting of chromates and dichromates.

20. A match composition comprising a body of a sensitive initiating compound and a body of more slowly burning deflagrating composition in close association therewith, said deflagrating composition consisting of a nitroaromatic compound taken from the group consisting of tetryl, ammonium picrate, trinitrotoluene, tetranitroaniline, hexanitrodiphenylamine, picric acid, trinitroresorcinol together with an oxidizer taken from the group consisting of the chromates and dichromates.

21. A relatively slow burning, kindling material comprising at least one nitroaromatic body and at least one oxidizer of the group consisting of chromate and dichromate salts, the products of combustion of which are of such limited chlorine content as to be harmless to metallic materials.

22. A deflagrating, kindling material consisting of a nitroaromatic body and a chromate as admixed ingredients.

23. A deflagrating, kindling material essentially consisting of at least one nitroaromatic body as a fuel, and an oxidizer consisting of at least one chromate.

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45	120
50	125
54	130
60	135
65	140
70	145
75	150