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J. B. SMITH

DETONATING OR BLASTING CAP

Filed Feb. 10, 1923

Fig. 1.

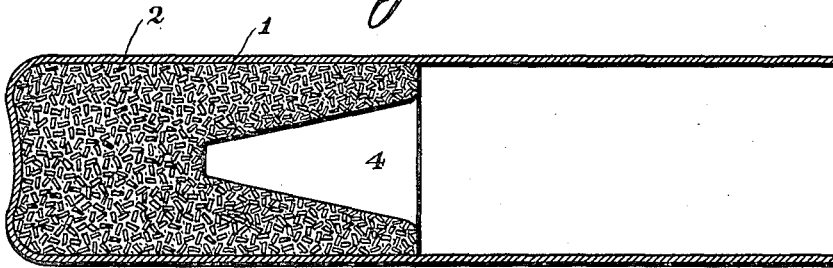
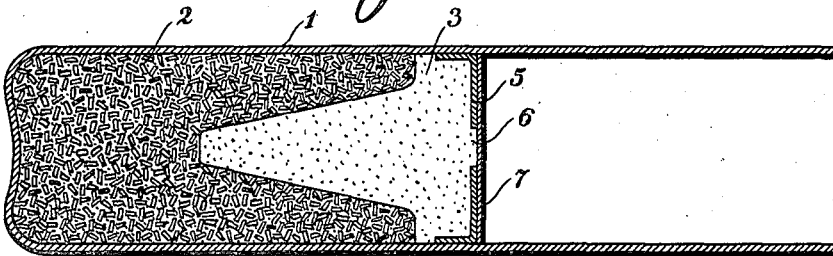


Fig. 2.



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UNITED STATES PATENT OFFICE.

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DETONATING OR BLASTING CAP.

Application filed February 10, 1923. Serial No. 618,243.

To all whom it may concern:

Be it known that I, JOHN B. SMITH, a citizen of the United States, and residing at East Alton, county of Madison, Illinois, have invented the new and useful Improvement in Detonating or Blasting Caps, of which the following is a specification.

This invention relates to explosives, and more particularly to detonating or blasting caps.

This application is a continuation of application Serial Number 485,047, filed July 15, 1921, as to common subject matter.

A detonating or blasting cap usually consists of a drawn shell having a charge of an explosive compound, such as mercuric fulminate or a mixture of mercuric fulminate and potassium chlorate.

Of the aromatic nitro-compounds, trinitro-toluene is the most stable. It is less dense and slower in detonation than picric acid but has the great advantage of being more stable, does not form the sensitive salts and is less poisonous. Moreover, it is fairly cheap and can be transported with safety. Its use as a priming charge for blasting purposes is, however, limited on account of its being more insensitive to detonation than other compounds of the nitro-hydrocarbon group. Thus it requires more than twice the amount of fulminate of mercury to effect detonation than does picric acid, and even double the amount of the initiator of detonation will not always secure its detonation. Furthermore at the commencement of the detonation there are often irregularities and the velocity may not be maintained.

Picric acid will detonate violently when submitted to a moderate blow, one gram of fulminate of mercury being sufficient to detonate the same. Picric acid further has the advantage that it will induce the detonation to neighboring parts of a less sensitive explosive. Moreover when mixed with trinitro-toluene, it has the effect of rendering the latter more sensitive to detonation.

The character and velocity of a wave of detonation is of the same order as that of sound waves through solids. Accordingly when an initiator of detonation sets up an initiating wave so as to detonate a less sensitive explosive, the waves combine to produce beats in a resultant wave whose amplitude may reach high limits. Accordingly such a

resultant wave will readily detonate a comparatively insensitive explosive.

One of the objects of this invention, therefore, is to combine the characteristics of a comparatively sensitive explosive, such as picric acid, with a less sensitive but more stable explosive, such as trinitro-toluene, in order to produce a combined charge having the desired characteristics and requiring a minimum amount of the initiator of detonation, such as fulminate of mercury.

Another object of this invention is to develop a detonating or blasting cap, whereby a cheap and otherwise desirable, but comparatively insensitive, explosive may be employed as the major part of the charge.

Further objects will appear from the detail description taken in connection with the accompanying drawing, in which:

Figures 1 and 2 are longitudinal sections through a detonating or blasting cap embodying this invention and showing its method of formation.

In accordance with an embodiment of this invention, the shell 1 contains a combined charge 2 comprising a mixture of a comparatively sensitive explosive, such as picric acid, mixed with a less sensitive explosive, such as trinitro-toluene, together with an initiator of detonation 3, such as fulminate of mercury. The components of the charge are uniformly mixed and forced or pressed into the shell under high pressure and preferably the charge is recessed as shown at 4, this recess being preferably conical. The initiator 3 is then placed over the charge so as to fill the recess and a flanged disc 5 having a central perforation 6 may be placed over the initiator and pressed into position. The disc may then be capped with a waterproofing film 7 of a material which is pervious to fire, such as a mixture of nitrated cotton in ethyl-acetate. It is to be understood that the loaded cap may be used with any suitable fuse or other igniter. The ordinary trinitro-toluene of commerce, which is the 1-2-4-6 or alpha isomer having a melting point of 80.6° C. and of a fineness to pass through an 80 mesh screen may be used. However, the 1-2-3-4 or beta isomer having a melting point of 112° C. or the 1-3-4-6 or gamma isomer having a melting point of 104° C. may be used.

Upon ignition of the initiator and the detonation of the same, it will set up a wave

of detonation which will detonate the more sensitive component of the mixture, such as picric acid, so as to set up a supplementary wave of detonation. The two waves will combine so as to produce a resultant wave of detonation having beats whose amplitude is higher than that of either the initiating or supplementary wave. The combined wave will, therefore, serve to detonate the less sensitive component (trinitro-toluene) of the charge mixture. Furthermore, due to the fact that the charge is recessed, the effect is intensified considerably for the reason that when the waves of detonation reach the cone-shaped cavity, waves of compression start out perpendicular to the conical surface and these meet in the center producing a much greater effect than is the case if the charge is not recessed. Furthermore in view of the fact that the more sensitive component of the charge is distributed throughout the less sensitive component, the detonation of the less sensitive component is not only accomplished by pressure but the temperature is suddenly raised throughout the mass by the detonation of the less sensitive component, thereby enhancing the detonation of the latter. This distribution of the more sensitive component, such as picric acid, throughout the mass of the less sensitive component furthermore has the effect of inducing the detonation of the former to neighboring particles of the latter and also to render it more sensitive to detonation.

The result is, therefore, that by the employment of the compounds of the character of and arranged as described, the amount of the fulminate may be considerably reduced, due to the fact that the amount required is only that necessary to detonate the more sensitive component, such as picric acid. Moreover the amount of the charge itself required to detonate a given blasting charge may also be considerably reduced, due to the fact that the explosive wave set up by the less sensitive charge component combines with the initiating and supplementary waves and their resultant wave, to form a final resultant wave of detonation forming beats and having also a high amplitude. Thus as a practical example, it has been found that a blasting cap described as above containing a total charge including the initiator of twelve (12) grains, will have a power equivalent to that of a blasting cap containing a charge of sixteen (16) grains composed of eight-five per cent (85%) of fulminate of mercury and fifteen per cent (15%) of chlorate of potassium. Accordingly the volume of the cap is not only reduced, but its cost is considerably cheapened.

The following is a typical example of the proportions found to secure the best results when using a mixture of trinitro-toluene and picric acid as a combined charge and fulmi-

nate of mercury as an initiator of detonation.

Trinitro-toluene	36.4%
Picric acid	19.6%
Fulminate of mercury	44.0%

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The amount of each of the ingredients may, however, be varied to suit requirements in any particular case. While it has been found that a mixture of trinitro-toluene and picric acid is the most suitable for accomplishing the objects of this invention, it will be understood that the character of the charge components may be varied. Thus other aromatic nitro-compounds which are more sensitive to detonation may be used instead of picric acid as, for instance, trinitroxylol, trinitronaphthalene, trinitroresorcinate, tetranitroresorcinate, trinitromethylaniline, tetranitromethylaniline, hexanitrodiphenylamine, trinitrocresol, etc.

Furthermore two or more of such sensitive components may be used in combination with a less sensitive component. Furthermore initiators of detonation other than fulminate of mercury may be used, such as lead azide.

While reference has been had to certain theories in order to explain the advantageous features of this invention, it is and will be understood that this invention is not limited to any theory of operation. It is further obvious that various changes may be made in detail without departing from the spirit of this invention; it is, therefore, to be understood that this invention is not to be limited to the specific details shown and described.

Having thus described the invention, what is claimed is:

1. A detonating or blasting cap containing as a combined charge a sensitive explosive mixed with a less sensitive aromatic nitro-compound.

2. A detonating or blasting cap containing as a combined charge a sensitive aromatic nitro-compound mixed with a less sensitive aromatic nitro-compound.

3. A detonating or blasting cap containing as a combined charge a sensitive explosive mixed with trinitro-toluene.

4. A detonating or blasting cap containing as a combined charge a sensitive aromatic nitro-compound mixed with trinitro-toluene.

5. A detonating or blasting cap containing as a charge picric acid mixed with trinitro-toluene.

6. A detonating or blasting cap containing as a charge a small quantity of sensitive explosive mixed with a larger quantity of a less sensitive aromatic nitro-compound.

7. A detonating or blasting cap containing as a charge 19.6 parts of picric acid mixed with 36.4 parts of trinitro-toluene.

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8. A detonating or blasting cap comprising, a shell containing as a combined charge a sensitive explosive mixed with a less sensitive aromatic nitro-compound, together
5 with an initiator of detonation therefor.

9. A detonating or blasting cap comprising, a shell containing as a combined charge 19.6 parts of picric acid mixed with 36.4 parts of trinitro-toluene, together with 44
10 parts of fulminate of mercury.

10. A detonating or blasting cap comprising, a shell containing as a recessed charge, a sensitive explosive mixed with a less sensitive aromatic nitro-compound together with
15 an initiator of detonation in the recess.

11. A detonating or blasting cap comprising, a shell containing as a recessed charge, picric acid mixed with trinitro-toluene together with fulminate of mercury in the
20 recess.

12. In the art of making detonating or blasting caps, the process comprising, mixing a sensitive explosive with a less sensitive aromatic nitro-compound and placing
25 an initiator of detonation on the charge.

13. In the art of making detonating or blasting caps, the process comprising, mixing a sensitive explosive with a less sensitive aromatic nitro-compound, compressing
30 the charge in the shell and placing an initiator of detonation on the charge.

14. In the art of making detonating or blasting caps, the process comprising, mixing picric acid with trinitro-toluene and
35 placing fulminate of mercury on the charge.

15. In the art of making detonating or blasting caps, the process comprising, mixing a sensitive explosive with a less sensitive aromatic nitro-compound, compressing
40 the charge in the shell to form a recess in the charge, and placing an initiator of detonation on the charge.

16. A detonating or blasting cap comprising, a main charge, a supplementary charge of greater sensitiveness mixed therewith,
45 and an initiator of detonation of greater sensitiveness than the supplementary charge.

17. A detonating or blasting cap comprising a shell containing, a charge of trinitro-toluene and picric acid, and a priming
50 therefor.

18. A detonating or blasting cap, containing as a charge, an intimate mixture of trinitrotoluene and picric acid, and an agent
55 to initiate detonation.

19. A detonating or blasting cap, containing as a charge, a mixture of trinitrotoluene, picric acid and a nitrated aromatic compound, capable of being detonated by a more
60 sensitive substance.

20. A detonating or blasting cap, containing as a charge, a mixture of trinitrotoluene, picric acid and a nitrated aromatic compound, and a sensitizing agent.
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21. A detonating or blasting cap, containing, fulminate of mercury and an intimate mixture of trinitrotoluene and picric acid.

In testimony whereof I affix my signature this 29th day of January, 1923.

JOHN B. SMITH.