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PLASTIC EXPLOSIVE COMPOSITION

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The present invention relates to a plastic explosive which possesses a high degree of fluidity.

Plastic explosives have, in the past, found extensive use as demolition agents and in steel shearing. However, these plastic explosives have been too stiff to pump and often have a high degree of tenacity. In order to utilize modern machinery techniques in explosive technology, a need developed for a plastic explosive composition of sufficient power for industrial and military requirements, and with sufficient fluidity to be pumped, yet after ejection or expulsion, retaining its shape and resisting diffusion into the surrounding medium.

An object of this invention is to provide a fluid plastic explosive composition which maintains its fluidity and plasticity between 0 and 125° F.

Another object of this invention is to provide a plastic explosive composition of high brisance and high blast characteristics.

A further object is to provide a plastic explosive composition which is pumpable, yet retains its shape.

A still further object is the provision of a plastic explosive composition of high brisance which is nonadhering.

Other objects and advantages of the present invention will be apparent as the description proceeds.

It has been found that the foregoing objectives may be attained by the addition of a mixture of a nonaromatic hydrocarbon oil and nitro-aromatic oils to a plastic explosive composition. The resulting product has the desirable characteristics of being a material that can be pumped, retains its shape, is nonsensitized, has excellent explosive power, and is nonadhering.

To prepare this composition, a plastic high explosive is thoroughly kneaded with a nonaromatic hydrocarbon oil, sufficient to impart the desired fluidity to the mixture. A nitro-aromatic oil is added until the desired degree of nonadherence is attained. It is apparent that the proportions of the ingredients may be varied somewhat according to the properties most suitable for the intended use. The plastic explosive compounds were compounded essentially of an insoluble explosive compound, an aliphatic hydrocarbon polymer, and a plasticizer.

As the insoluble explosive compound, the nitramine cyclo-trimethylene trinitramine, cyclo-tetramethylene tetranitramine and ethylene dinitramine are operable. Solid insoluble polynitrate esters such as cellulose nitrate are also operable. Inorganic nitrates such as ammonium nitrate, hydrazine nitrate, and calcium nitrate are satisfactory. Poly-nitro aliphatic solid materials showing a low solubility in the plasticizer and the fluidizing oils are operable.

The polyaliphatic binder, in order to be operative, must be noncrystalline. Although noncrystalline polyethylene and polypropylene-type materials were found to be suitable, polyisobutylene resulted in a superior product. A molecular weight range of from 20,000 to 500,000 can be employed successfully.

Plasticizers of the di-ester type are operative. The preferred compounds are formed from a dibasic organic acid having from 6 to 12 carbon atoms esterified with an alcohol having from 4 to 20 carbon atoms. Dibutyl phthalate, di-2-ethyl-hexyl sebacate, and didecylazelate, for example, are all operative.

It has been found that nonaromatic hydrocarbon oils

having between 8 and 30 carbon atoms are satisfactory. Aliphatic and cycloaliphatic hydrocarbon oils are preferred but naphthenic hydrocarbon oils are operable. The aromatic content of the oil should be below 10% and preferably below 5%.

Any nitro-aromatic compounds or combinations thereof that are oils or produce oils in combination with the nonaromatic hydrocarbon oils are suitable. The nitro-aromatic compound can be a mono-aromatic or a poly-aromatic compound, the main criterion being that an oil is produced at the temperature of operation. Eutectic mixtures are conveniently employed to produce oils from otherwise solid materials. Mono-nitrotoluene, dinitrotoluene, trinitrotoluene, mono-nitronaphthalene, nitrodiphenyl, dinitrodiphenyl, ortho-nitrodiphenyl ether, and nitrophenanthrene all are operative either alone or in combination. A particularly suitable nitro-aromatic oil is the eutectic of commercial dinitrotoluene with mononitrotoluene oils derived from commercial trinitrotoluene production.

As a preferred example, the following proportional mixture is suitable: 76% of cyclo-trimethylene trinitramine; 8% of a desensitizing binder composed of polyisobutylene (molecular weight 20,000 to 500,000), di-2-ethyl-hexyl sebacate and a plasticizer of di-2-ethyl-hexyl sebacate in the ratio of 1:2.5:0.75 respectively; 8% of a nonaromatic hydrocarbon oil having 8 to 18 carbon atoms; 5% of dinitrotoluene oil; and 3% of mono-nitrotoluene.

Further preferred examples include ethylene dinitramine or mixtures of cyclo-trimethylene trinitramine and cyclo-tetramethylene tetranitramine together with polyisobutylene and a plasticizer such as dibutyl phthalate, didecyl azelate or di-2-ethylhexyl sebacate, a hydrocarbon oil containing 8 to 18 carbon atoms and a nitroaromatic compound capable of causing non-tackiness.

As many seemingly different embodiments of the invention will be apparent without departing from the spirit and scope thereof, it must be understood that the invention is not limited to any specific embodiment except as defined in the appended claims.

I claim:

1. A pumpable nonadhering explosive composition comprising 60% to 90% cyclo-trimethylene trinitramine; 3.2% to 12.83% of a desensitizing binder composed of polyisobutylene with a molecular weight of between 20,000 and 500,000, a plasticizer of di-2-ethyl-hexyl sebacate, and a mineral oil of 8 to 30 carbon atoms in the ratio of 1:2.5:0.75; 3.36% to 7.8% of a hydrocarbon oil having 8 to 18 carbon atoms; 2.07% to 8.3% of dinitro-toluene oil and 1.37% to 5.54% of mononitrotoluene.

2. A pumpable nonadhering explosive composition comprising about 76% cyclo-trimethylene trinitramine; about 8% of a binder of polyisobutylene, di-2-ethyl-hexyl sebacate and mineral oil in the ratio 1:2.5:0.75, respectively; approximately 8% hydrocarbon oil containing 8 to 18 carbon atoms; about 5% of dinitrotoluene oil and approximately 3% of mono-nitrotoluene.

3. A pumpable, nonadhering explosive composition comprising cyclo-trimethylene trinitramine, polyisobutylene having a molecular weight between 20,000 and 500,000, di-2-ethyl-hexyl sebacate, a hydrocarbon oil containing 8 to 18 carbon atoms selected from the group consisting of aliphatic and cycloaliphatic oils, and a nitro-aromatic compound capable of causing nontackiness of the cyclo-trimethylene trinitramine, polyisobutylene and di-2-ethyl-hexyl sebacate mixture.

4. A pumpable, nonadhering explosive composition comprising cyclo-tetramethylene tetranitramine, polyisobutylene having a molecular weight between 20,000 and 500,000, di-2-ethyl-hexyl sebacate, a hydrocarbon oil containing 8 to 18 carbon atoms selected from the group con-

sisting of aliphatic and cycloaliphatic oils, and a nitro-aromatic compound capable of causing nontackiness of the cyclo-tetramethylene tetranitramine, polyisobutylene and di-2-ethyl-hexyl sebacate mixture.

5. A pumpable, nonadhering explosive composition comprising ethylene dinitramine, polyisobutylene having a molecular weight between 20,000 and 500,000, dibutyl phthalate, a hydrocarbon oil containing 8 to 18 carbon atoms selected from the group consisting of aliphatic and cycloaliphatic oils, and a nitro-aromatic compound capable of causing nontackiness of the ethylene dinitramine, polyisobutylene dibutyl phthalate mixture.

6. A pumpable, nonadhering explosive composition comprising cyclo-trimethylene trinitramine, cyclo-tetramethylene tetranitramine, polyisobutylene having a molecular weight between 20,000 and 500,000, didecylazelate, a hydrocarbon oil containing 8 to 18 carbon atoms selected from the group consisting of aliphatic and cycloaliphatic oils, mono-nitrotoluene, and dinitrotoluene, said mono-nitrotoluene and said dinitrotoluene causing nontackiness in said explosive composition.

7. A pumpable, nonadhering explosive composition comprising about 75% of an oil insoluble explosive compound, an aliphatic hydrocarbon polymer having a molecular weight between 20,000 and 500,000, a plasticizer of the di-ester type formed from a dibasic organic acid having 6 to 12 carbon atoms esterified with an alcohol having from 4 to 20 carbon atoms, a hydrocarbon oil selected from the group consisting of aliphatic and cycloaliphatic oils, and a nitro-aromatic compound capable of causing nontackiness of said oil insoluble explosive compound.

8. A pumpable, nonadhering explosive composition comprising

(*a*) a nitro type explosive selected from the group consisting of:

(1) cyclotrimethylene trinitramine

(2) ethylene dinitramine

(*b*) a binder of an aliphatic hydrocarbon polymer

(*c*) a plasticizer of the diester type formed from a dibasic organic acid having 6–12 carbon atoms esterified with an alcohol having from 4–20 carbon atoms

(*d*) a hydrocarbon oil mixed with said explosive compound capable of causing fluidity of said explosive compound without dissolving said explosive compound

(*e*) a nitroaromatic compound capable of causing non-tackiness in said explosive compound.

9. An explosive composition in accordance with claim 8, wherein the hydrocarbon oil capable of causing fluidity is selected from the group consisting of aliphatic and cycloaliphatic oils.

10. An explosive composition in accordance with claim 8 wherein the binder of an aliphatic hydrocarbon polymer has a molecular weight of 20,000 to 500,000.

11. An explosive composition in accordance with claim 8 wherein the nitroaromatic compound capable of causing non-tackiness is a eutectic of dinitrotoluene and mono-nitrotoluene.

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