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Hurst

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[54] **POROUS PARTICLES CONTAINING DISPERSED ORGANIC LIQUID AND GASEOUS COMPONENTS**

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[52] **U.S. Cl.** **149/2,** 149/15, 149/47, 149/62, 149/67, 149/69, 149/55, 149/89, 149/110, 149/112, 149/113, 149/105

[51] **Int. Cl.** **C06b 1/04**

[58] **Field of Search**............149/2, 69, 47, 89, 55, 90, 149/15, 62, 91, 67, 105–107, 110, 112, 113

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[57] **ABSTRACT**

Economical and effective cap sensitive explosive compositions are manufactured by combining appropriate proportions of a non-cap sensitive organic liquid containing oxidizing groups with a porous substrate. The preferred liquid is nitromethane or nitromethane diluted with a hydrocarbon. The preferred substrate is a finely divided ionic nitrate powder. The explosive compositions are rendered cap sensitive and highly brisant by providing a substrate which disperses the organic liquid while maintaining this fluid in intimate contact with dispersed air. The preferred finely divided ionic nitrate substrates used in the present invention are prepared by grinding to the desired particle size, preferably less than 500 microns.

30 Claims, 5 Drawing Figures

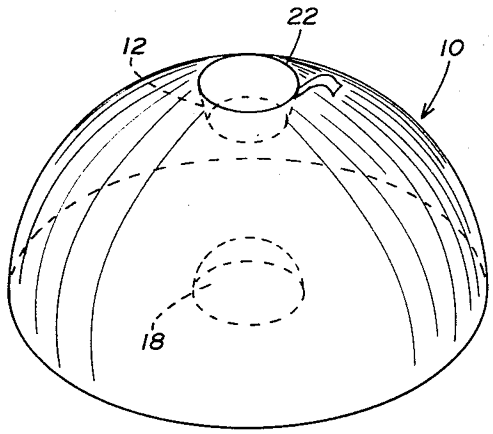

FIG. 1

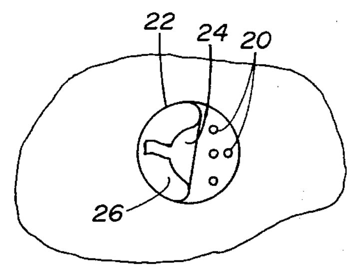

FIG. 2

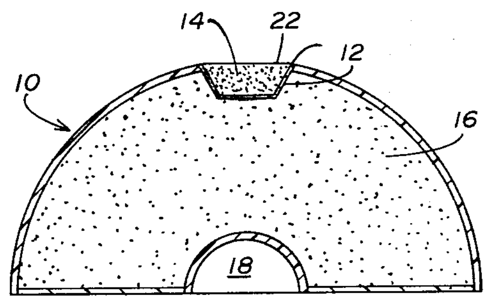

FIG. 3

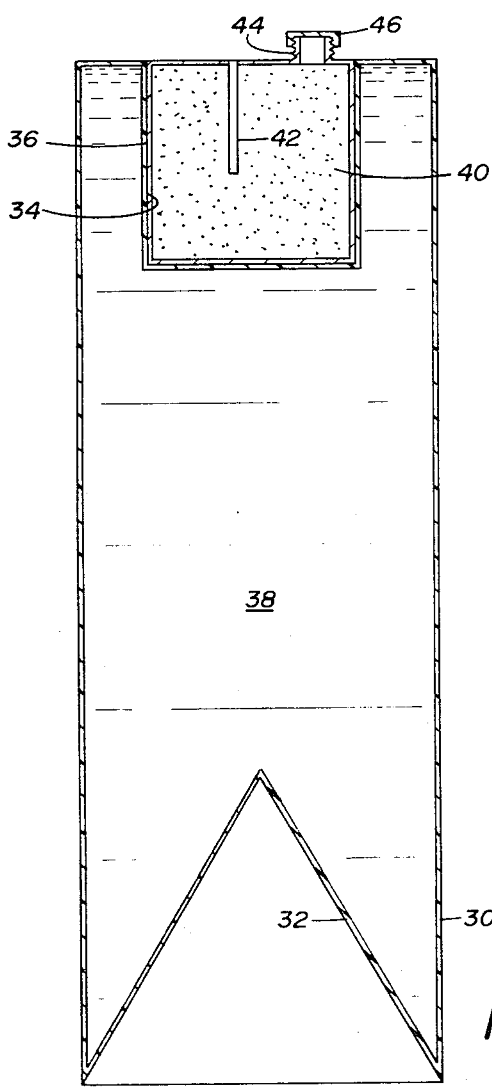

FIG. 4

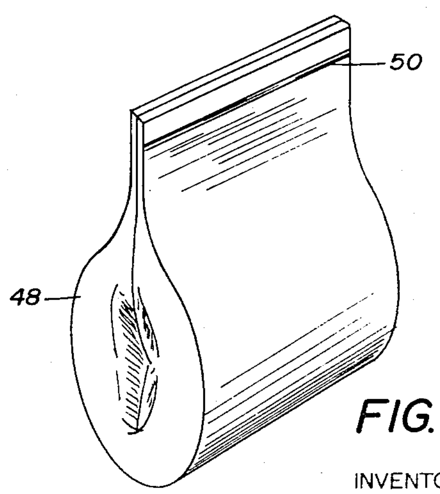

FIG. 5

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POROUS PARTICLES CONTAINING DISPERSED ORGANIC LIQUID AND GASEOUS COMPONENTS

BACKGROUND OF THE INVENTION

This invention relates to an explosive and a method for manufacturing explosives. More particularly, the invention relates to a two component, liquid-solid based explosive and a method for activating the components.

The explosives industry has been for a long time striving for a general purpose explosive and an explosive with substantial brisance which is detonable by a small cap, for example, a number 6 explosives cap. This type of explosive has been manufactured and sold, however, it generally has been uneconomical in the sense that the components of the explosive required to sufficiently sensitize the explosive composition to a number 6 cap are expensive. Another drawback to such an explosive has been that it is extremely sensitive and must be shipped in commerce under the explosive regulations. This again decreases the economic feasibility of use of such an explosive to all but a few consumers. Hence, most general purpose explosives and explosives with substantial brisance are not the type which are detonable by a number 6 cap but require a priming charge. Again, the priming charge causes additional expense in manufacturing and using the explosive.

One way in which explosive manufacturers have thus far tried to circumvent the foregoing problems is to ship an oxidizing composition such as ammonium nitrate separately from a fuel. The two are then intermixed at the site of use to create explosive mixture. All of these compositions, however, have had the drawback that they are not number 6 cap sensitive, but require a primer explosive. For example, U.S. Pat. No. 2,892,377 discloses a sealed container of ammonium nitrate. At the site of use a liquid fuel is injected into the container. The thus formed explosive can be exploded with the aid of a detonator charge. However, the composition disclosed therein is not capable of detonation with a number 6 cap.

Other attempts to make an explosive which is detonable by a number 6 cap have included the utilization of a sensitizing fuel such as a nitroalkane. Some of these attempts have been successful in that an explosive mixture detonable by a number 8 cap can be manufactured. These compositions also have drawbacks. For example, in order to cause the energy released by such a composition to be anywhere near maximum (that is to be oxygen balanced) a substantial amount of nitroalkane is necessary. The best sensitizing nitroalkane, of course, is nitromethane. In order to obtain a powerful explosive composed of nitromethane, for example, and ammonium nitrate, for example, the mixture must contain substantial nonabsorbed liquid. If in the use of such a composition a cap, for example a number 6 cap, is inserted into the mixture below the liquid level line, the composition will not detonate upon explosion of the number 6 cap. However, if the cap for such an explosive is positioned above the liquid level, detonation will occur. The undesirable affect of this phenomenon is that in the normal use of explosives such care in positioning the number 6 cap cannot and is not always taken, thus occasionally resulting in non-detonation upon explosion of the number 6 cap. Such an occurrence, of course, is undesirable from a safety standpoint, and from the standpoint of the manufacturer who is desirable of producing an explosive which will detonate under any condition with a number 6 cap.

Thus, it is desirable to possess an explosive which is sensitive to a number 6 blasting cap. Secondly it is desirable to possess an explosive composition which can be shipped in commerce as a nonexplosive. It is further desirable to have an explosive which is a two component explosive, preferably one being a liquid component and the other being a solid component. It is further desirable to possess a two component explosive composition which is mixed by the ultimate consumer or by a local distributor which can be easily mixed and combined. It is also desirable to possess a two component explosive, one component being liquid, the other component being solid which has a low cost while remaining number 6 cap sensitive.

SUMMARY OF THE INVENTION

The foregoing desirable attributes of an explosive are fulfilled by the present invention. The present invention broadly provides an economical, low cost, number 6 cap sensitive, explosive composition which can be shipped in commerce in two components, one liquid and one solid, and which can be easily mixed at the use situs. Certain preferable forms of the two component explosive are self mixing, thus requiring no shaking or physical intermixing of the two components.

The present invention, therefore, provides a method of activating organic liquids which contain sufficient amounts of oxidizing groups potentially to provide high energy release, but which are normally insensitive to small blasting caps. The invention provides explosive number 6 cap sensitive mixtures comprising a liquid component selected from nitroaliphatic hydrocarbons, nitroaromatic hydrocarbons, aliphatic nitrates and N-nitrohydrocarbons and mixtures thereof, said compounds or mixtures being detonable in large quantities with large boosters but insensitive to small blasting caps, a solid, insoluble, porous, absorbant component selected from alkali and alkaline earth metal nitrates, ammonium nitrate, alkali and alkaline earth metal perchlorates, ammonium perchlorate, diatomaceous earth and expanded low density silica, the said solid component having an average particle size of preferably less than about **500** microns and a substantially uniformly dispersed gaseous component. The gaseous component can be provided in the form of air by limiting the amount of liquid used to a volume less than the interstitial volume of the solid component. The solid component can be either free flowing or sintered. A minor proportion of a hydrocarbon fuel can be admixed with the liquid component if desired. Mixing of the solid, liquid and gaseous components can be accomplished without external mechanical agitation through capillary action in the finely divided solid, producing a homogeneous mixture of solid, liquid and gaseous components. The mixture will not separate or stratify and does not require gelling agents to maintain homogeneity.

Furthermore, a container for the solid component of the two component mixture comprises an enclosure for holding a predetermined amount of the solid component of the explosive mixture, and means in said enclosure for admitting a liquid component thereto. A method for detonating the two component explosive mixture of the present invention comprises adding to the porous solid a non-cap sensitive, potentially detonable liquid, contacting the mixture with an explosive cap having a rating at least equal to a commercial number 6 cap, and exploding the cap, thereby detonating the mixture.

BRIEF DESCRIPTION OF THE DRAWINGS

A better understanding of the invention can be derived by reading the ensuing specification in conjunction with the accompanying drawings, in which:

FIGS. 1 through 3 illustrate one form of a container for the explosive of the present invention;

FIG. 4 illustrates a container for a solid component of the explosive of the present invention, and;

FIG. 5 illustrates a container for a liquid component of the explosive of the present invention.

DESCRIPTION OF PREFERRED EMBODIMENTS

The present invention has two aspects. The first is the provision of a two component cap sensitive explosive which is composed of a liquid component and a solid component containing a dispersed gas. Each of these components is a non-cap sensitive composition which can be shipped in commerce without the normal restrictions and expense applied to compositions rated as explosives. The second portion of this invention relates to containers for the components of the explosive, which containers provide an easy means of combining and intermixing the two non-explosive components to form an explosive composition. Although the aspects of the present invention will be described in terms of preferred embodiments, it is to be understood that many equivalents, substitutions, alterations, and other variations can be made upon the invention as defined in the appended claims without departing from the intention thereof.

Accordingly, the explosive composition of the present invention includes a liquid component which can be stored and transported conveniently in a bottle, can or other suitable container to its site of use. The liquid component of the explosive of the present invention is a non-cap sensitive hydrocarbon material, capable of being freely shipped in normal commerce, which is activated at a use situs by the porous solid component of the explosive of the present invention.

The liquid component of the present invention is characterized by a non-cap sensitive liquid hydrocarbon material containing bonded nitrogen in a positive valence state. Typical compounds of this class of materials are the nitro and nitrated hydrocarbons. Exemplary materials which can be utilized within the scope of the present invention include nitroaliphatic hydrocarbons, nitroaromatic hydrocarbons, aliphatic nitrates, N-nitrohydrocarbons and mixtures thereof. Preferable liquid components include the nitroalkane compounds containing 3 or less carbon atoms and mixtures of the lower dinitroaromatic compounds. Most preferably nitromethane and the dinitrotoluene oils are utilized. The liquid component can be present in amounts from about 6 percent to about 60 percent by weight of the explosive composition. It is most preferred that the liquid component comprise from about 12 percent to about 35 percent by weight of the total explosive composition.

The explosive composition includes a second porous, solid component which can be stored and transported conveniently in flexible or rigid plastic, fiber or other suitable containers to its site of use. The solid component of the explosive of the present invention preferably comprises a non-cap sensitive inert or oxidizing material, capable of being freely shipped in normal commerce. The primary function of the solid component is to provide a porous base or substrate which will uniformly disperse the liquid component by capillary action, thereby automatically providing an intimate mixture of finely divided liquid component and air. A second function of providing additional energy through the reaction of an oxidizing group with excess fuel portion in the liquid component can be provided by an oxidizing solid component. If an oxidizing substrate contains potential gas forming elements in addition to the elements of the oxidizing group a third function of the solid component is to provide expandible gas capable of doing useful work. Solid components usable within the scope of the present invention are alkali and alkaline earth metal nitrates, ammonium nitrate, alkali and alkaline earth metal perchlorates and ammonium perchlorate. Preferred solid components include potassium, sodium and ammonium perchlorates, diatomaceous earth and expanded silica, while ammonium nitrate, sodium nitrate, and potassium nitrate are most preferred.

In the form in which the solid component compositions are usually obtained as articles of commerce, they are not desirable for use in the explosive composition of the present invention. In order to provide a suitable substrate, it is first advisable to comminute the solid material to a particle size less than about 1,000 microns, preferably less than about 500 microns, and most preferably in the range of from about 5 to about 250 microns.

Furthermore, it is desirable to treat the solid component to cause the bulk density of the solid to reach a maximum value under normal handling conditions. It is preferred that the interstitial volume be at least about 10 percent by volume greater than the amount of liquid component to be combined therewith. Most preferably the remaining interstitial volume should be at least about 10 percent greater than the volume of the amount of liquid component corresponding to an oxygen balanced final explosive mixture. Two methods can be used to produce a substrate of the desired lower bulk density. In the first method, the finely divided solid, in a loose, fluffy condition is treated with water, from about 0.2 percent to about 5 percent by weight, preferably about 1 percent. Alternatively, moist air of corresponding water content can be used. The moist solid is then dried at ambient or higher temperatures to produce lightly sintered agglomerates which resist settling and compacting. By the second method the ground solid can be screened through various screens to produce individual fractions of uniform particle size and lower bulk density. Carefully controlled grinding procedures can eliminate the necessity for these secondary treatments in many cases; however, such treatments are useful and generally desirable in producing two component explosive compositions in which long diffusion paths for the liquid are needed and/or in which very rapid mixing is required.

Minor proportions of a fuel component can also be added to the liquid component under certain conditions. Thus, if the porous solid component is an oxidizing material and it is desired to obtain a final explosive mixture which is essentially oxygen balanced, it can occur that the amount of liquid component required exceeds the interstitial volume of the solid component, resulting in a mixture that is not cap sensitive. Under such circumstances, a minor proportion of a fuel component having a higher fuel value per unit volume than the nitrogen containing liquid is admixed therewith. This will produce a final liquid component which can be added to the solid component in lesser volumetric quantity, yielding a final explosive mixture which is oxygen balanced and which contains the necessary interstitially dispersed air. In the case of the aromatic dinitro compositions, a small quantity of a fuel component can be added to the liquid component to reduce the setting point or freezing point to a more convenient range. Fuels which can be used to increase the volumetric fuel value of the liquid component must meet three basic requirements: First, they must be chemically compatible with the liquid component; second, they must be miscible with the liquid component in the desired ratio and; third, they must have a substantially higher volumetric fuel value than the liquid component. Numerous inexpensive commercially available compounds and mixtures meet the above requirements. Examples of such compounds and mixtures are: aromatic hydrocarbons (benzene, toluene, xylene, aromatic naphtha), lower aliphatic alcohols (methanol, ethanol, isopropanol), lower ethers, lower ketones, lower aldehydes, lower organic acids, lower esters, and small quantities of gasoline fraction aliphatic hydrocarbons.

Although the exact theory cannot be proferred, it is believed that the sensitization of potentially detonable, but non-cap sensitive liquids with porous solids proceeds according to the following mechanism. The liquid component is absorbed and dispersed in the solid matrix by capillary action to produce an intimate mixture in which the solid particles are essentially surrounded by liquid films which are in turn bounded by minute layers of gas, normally air. When an explosive cap is detonated in the mixture, it produces intense pressures which compresses the minute gas bubbles adiabatically producing extremely high temperatures at the liquid interface and causing the liquid to explode by heat. The locally exploding liquid in turn compresses more gas bubbles thus propagating the explosition through the mixture. If the solid particles contain oxidizing groups, these in turn react with the hot fuel-rich mixture from the liquid thus adding energy to the explosion as well as gaseous products in most cases. Although it is believed that this is the mechanism by which the two component explosive compositions function, it is not intended that the disclosure or invention be limited by this theory.

The gaseous component of the present invention can be present in amounts ranging from about 2 percent to about 90 percent by volume of the total explosive composition. It is preferred, however that the gaseous component is present in the range of from about **5%** to **50%** by volume.

EXAMPLES

The following examples are presented to further enable one of ordinary skill in the art to reproduce the present invention. In addition, they set out preferred modes of carrying out the foregoing. They are not intended in any manner to be delimitative of the invention, but are intended only as exemplary. All percentages used herein are by weight.

EXAMPLE I

Sodium nitrate crystals are ground by hand with a mortar and pestle to produce a fine powder having an average particle size of less than about 100 microns. A sample of the powder (20 g) is lightly tamped into an aluminum tube (2.5 inches long × ⅞ inch I.D. × 1 inch O.D.) affixed at one end to the center of a square piece of cold rolled steel (3 × 3 × ⅝ inches). Nitromethane (10 g) is added to the contents of the tube without agitation. The metal test fixture is mounted symmetrically on a perpendicular 3 inch length of 2 inch pipe resting on a large steel plate about one-fourth inch thick. A number 6 cap is placed in the top center of the aluminum tube in intimate contact with the contents and detonated. The charge explodes producing a dent in the steel plate which is 0.079 inch deep at the center.

EXAMPLE II

The procedure of Example I is repeated substituting 7 grams of diatomaceous earth for the sodium nitrate. Upon detonation, a loud report occurs and the steel plate is dented 0.029 inch.

EXAMPLE III

The procedure of Example I is repeated substituting 20 grams of potassium nitrate for the sodium nitrate. Upon detonation, a loud report is heard and the steel plate is dented 0.082 inch.

EXAMPLE IV

The procedure of Example I is repeated except that the average particle size of the ammonium nitrate is greater than 100 microns and less than 250 microns. Substantially the same results are obtained.

EXAMPLE V

The procedure of Example I is repeated substituting 20 grams of ammonium nitrate for the sodium nitrate. Upon detonation, a loud report is heard and the plate is dented 0.080 inch.

EXAMPLE VI

A mixture of diatomaceous earth (28 g) and dinitrotoluene oil (20 g, setting point 35° C.) is prepared by warming the components to 75° C. The mixture is wrapped in aluminum foil and placed on a ⅛ inch steel plate on the ground. On initiating the mixture with a number 6 cap, a loud report is heard and the steel plate is significantly bent.

EXAMPLE VII

A mixture of dinitrotoluene oil (120 g, setting point 26° C.) and high boiling petroleum naphtha (10 g) is prepared yielding a liquid composition at room temperature. This mixture is added to 1,000 g of finely divided ammonium nitrate (average particle size less than 100 microns). The final mixture is placed in a plastic bag on a limestone boulder approximately one cubic yard in size. The mixture is detonated with a number 6 cap producing a loud report and shattering the boulder.

EXAMPLE VIII

A mixture of 40 grams of xylol and 185 grams of nitromethane is prepared and added to 1,000 grams of finely divided ammonium nitrate (average particle size less than 100 microns). The final mixture in a plastic bag is placed on a limestone boulder about two cubic yards in size and detonated with a number 6 cap. A loud report is heard and the boulder is shattered.

EXAMPLE IX

A large batch of ammonium nitrate powder is prepared with a high capacity production plant hammer mill. A sample of the material (150 g) having an average particle size less than about 100 microns is firmly tamped into a foil laminate pouch and sufficient nitromethane (75 g) is added to the pouch to produce an oxygen balanced mixture. The final mixture appears very wet with free liquid visible. The foil pouch is placed on a steel plate (3 × 3 × ⅝ inches) and detonated with a number 6 cap. A weak report is heard. The steel plate is undamaged.

EXAMPLE X

The procedure of Example IX is repeated substituting a mixture of 52.2 grams nitromethane and 3.0 grams of xylol for the straight nitromethane to produce a second oxygen balanced mixture of lesser liquid volume with correspondingly greater gas volume. Upon detonation with a number 6 cap a loud report is heard and the steel plate is severely bent and dented.

EXAMPLE XI

The procedure of Example IX is repeated substituting 150 grams of the plant ground ammonium nitrate identical to that of Example IX but the material is mixed with 1 percent by weight water, allowed to stand for 10 minutes, and dried at room temperature for two hours on trays before it is tamped into the pouch. This procedure decreases the ultimate bulk density of the ammonium nitrate. Upon detonation a loud report is heard and the steel plate is severely bent and dented.

EXAMPLE XII

A mixture of 29 grams of nitromethane and 1.7 grams of xylol is sealed in a small pouch made of polyethylene-aluminum foil (0.00035 inch)-polyethylene-polypropylene laminate having an overall thickness less than 0.004 inch. The sealed pouch is placed in an oven at 75° C. for one week. Upon weighing to the nearest one one-hundredth gram, the sample is found to have lost no measurable weight.

EXAMPLE XIII

Finely ground ammonium nitrate (166 g) is sealed in a pouch identical to that described in Example XII. The pouch is immersed in seven inches of water for 1 week.

The pouch is opened and a mixture of 57.7 g of nitromethane and 3.32 grams of xylol is added. The mixture is placed on a steel plate (3 × 3 × ⅝ inches) and detonated with a number 6 cap. A loud report is heard and the steel plate is severely dented and bent.

EXAMPLE XIV

A mixture of finely ground ammonium nitrate (83 g) having an average particle size less than 100 microns and nitromethane (30 g) in a foil laminate cylinder having about 1.1 inch diameter and 6 inches long is immersed half way in an open container of unsensitized nitromethane (1,500 g). A number 6 cap is inserted in the top of the cylinder about 3 inches above the surface of the nitromethane. Upon detonation, a very loud report is heard and extensive ground damage occurs showing that the nitromethane has detonated.

EXAMPLE XV

A mixture of finely ground ammonium nitrate (83 g) having an average particle size less than about 100 microns and nitromethane (35 g) in an aluminum foil laminate pouch is immersed in 2,000 g of prilled ammonium nitrate/ fuel oil (AN/FO) mixture in a plastic bag. The bag is placed on a boulder of about one cubic yard volume. A number 6 cap is placed in the foil laminate pouch. Upon detonation, a very loud report occurs and the boulder is shattered showing that the AN/FO detonated.

In the second aspect of this invention there is provided a number of containers especially adaptable to the two component explosive of the present invention. As previously mentioned, the liquid component and the solid component are held in separate containers until they are to be used. The liquid component can be packaged in standard metal cans, glass bottles or plastic containers. Each of these containers, in addition to being expensive for small packages, has certain other disadvantages. Thus, metal cans tend to rust; glass bottles are extremely fragile and plastic containers allow volatile materials to evaporate over a period of time. All of these problems can be solved by using a novel explosive component packaging material consisting of plastic laminated to aluminum foil preferably forming a sandwich structure with an inner layer of polyethylene bonded to thin aluminum foil or sheeting which is in turn bonded to a second layer of polyethylene. A final outer layer of paper, polypropylene, polyester film, etc. can be added to increase stiffness and strength. Sheets of these materials can be heat bonded or sealed at the polyethylene surfaces to form pouches, sticks and various other configurations, which are tough, waterproof, lightproof, diffusion proof and inexpensive. These same properties make foil laminate packaging ideally suited for the solid component with the added advantage that the containers are flexible, which is a highly desirable property for many explosive applications.

The explosive composition of this invention is prepared by adding the liquid component to the solid component in its package. Thus, after mixing, the solid container becomes in practice a cap sensitive explosive container with excellent properties. The impermeability of the foil laminate prevents evaporation of liquid components while acting as a very efficient moisture barrier. Foil laminate containers would, therefore, also be equally suitable for packaging conventional explosives. In practice, the foil laminate packaged explosive components are used as follows. First, one end of a package containing an amount of solid component insufficient to fill the container is torn or cut off. Second, one end of a second, preferably oblong package containing an amount of liquid component insufficient to fill the container is torn or cut off. Third, the liquid component is poured into the solid component package. When all the liquid has been absorbed, the torn end of the solid component package is rolled or folded tightly to reseal the package. A number **6** or larger detonating cap is placed firmly against the solid component package or inserted through a hole in the package and detonated.

Numerous explosive devices are adaptable for use with the two component explosive composition. These devices include but are not limited to: lined and unlined shaped charges, boulder breaking charges, boosters, secondary blasting charges, seismic charges, fuses, bombs, grenades, mines and borehole charges. A novel use of the two component explosive is in devices containing dual explosive charges the secondary charge of which is a detonable non-cap sensitive explosive such as nitromethane or an ammonium nitrate fuel oil mixture (AN/FO). The primary or booster charge is the two component explosive. In the case of nitromethane, the liquid of the secondary charge can be used as a liquid component of the two component explosive.

FIGS. **1**, **2**, and **3** show a perspective, partially broken away top view, and cross-sectional elevation view of a dual explosive demolition device utilizing AN/FO as the main charge and the two component explosive of the present invention as a booster charge. Referring to these three figures jointly, the dual explosive device includes a secondary charge container generally designated **10** containing a recessed portion **12** for holding the primary or booster charge **14**. The secondary charge **16** is confined in the remainder of the secondary charge container **10**. The secondary charge container can also have formed therein a recessed portion **18** to shape the secondary charge. The container **10** and recessed portion **12** can be composed of any suitable material such as polystyrene. Preferably the secondary charge container **10** is hermetically sealed to prevent moisture from entering the container, thus detrimentally affecting the secondary charge material **16** inside the container **10**.

In this embodiment of the invention, the recessed portion **12** containing the primary booster charge **14** has openings **20** therein to the exterior thereof. Placed over these holes **20** is a sealing member **22** which can be formed of conventional sealing material having adhesive on one side **24** and composed of an aluminum, paper or other moisture impervious material on the other side **26**. In operation, the sealing member **22** is peeled back from the openings and the liquid component of the two component booster charge is admitted to the recess **12** and allowed to mix with the solid component **14** therein. The booster charge is thus prepared in accordance with the foregoing procedure. This procedure and packaging system provides an effective safe charge of extremely low cost. Furthermore, since the containers and charges therein are not rated as primary explosives, the instant container can be shipped very economically through interstate commerce.

FIGS. **4** and **5** show another embodiment of a dual explosive, lined, shaped charged device capable of puncturing several inches into cold rolled steel. The container for the secondary charge **30** is cylindrically shaped with a charge shaping conical section **32** in the bottom thereof. The cylindrical secondary charge container **30** has a recess **34** in the top thereof for receiving a primary charge or booster container **36**. The booster container **36** is removably inserted in the recess **34**. The secondary charge container **30** contains a cap insensitive material **38** such as nitromethane. The booster charge **40** in the booster container **36** contains the solid component of the present invention. The booster container also contains a bore or recess **42** for receiving a number **6** or larger explosives cap. Also provided in the booster container is an opening **44** which has a removable lid thereon, here shown as threaded cap **46**.

In operation, the liquid component of the explosive composition of the present invention is poured into the container **36** through the opening **44**. Thereafter a cap is inserted in the bore **42** and exploded to detonate the booster charge which in turn detonates the secondary charge **38** in the secondary container **30**. The liquid component of this embodiment of the present invention can be contained in a foil laminate pouch **48** such as described above. In this particular embodiment as shown in FIG. **5**, the liquid component of the present invention is contained in a foil laminate pouch **48** shown in FIG. **5**. The foil laminate pouch is formed from a single sheet of material and is heat sealed across its top portion **50** after the liquid component is placed therein. In this embodiment, the foil laminate pouch can be formed, for example, from a first interior layer of polyethylene laminated to a metal foil layer, for example aluminum foil. Laminated to the exterior of the aluminum foil is a second layer of polyethylene on top of which an exterior most layer of paper, polypropylene, polyester film or the like can be laminated.

As will be apparent to those of ordinary skill in the art upon reading the present disclosure, many variations, alterations, substitutions and equivalents are applicable to the various disclosed embodiments of the present invention. It is the intent, however, that the concepts disclosed herein be limited only by the appended claims.

What is claimed is:

1. An explosive, number **6** blasting cap sensitive, composition comprising:

a solid, porous, absorbent component of particles having a size of less than about 1,000 microns and being selected from alkali and alkaline earth metal nitrates, ammonium nitrate, alkali and alkaline earth metal perchlorates, ammonium perchlorate, diatomaceous earth and expanded low density silica;

a liquid component admixed with said solid component in a volumetric amount less than the interstitial volume of said solid component and dispersed by capillary action within said solid component, said solid component being insoluble in said liquid component, and said liquid component being composed of a non-cap sensitive liquid hydrocarbon containing bonded nitrogen in a positive valence state, and wherein said capillary action results in from about 2 percent to about 90 percent by volume of said composition of a substantially uniformly dispersed gaseous component.

2. The explosive composition of claim 1 wherein the liquid component is selected from nitroaliphatic hydrocarbons, nitroaromatic hydrocarbons, aliphatic nitrates, N-nitrohydrocarbons and mixtures thereof.

3. The composition of claim 2 wherein said solid component has an average particle size of less than about 500 microns.

4. The composition of claim 3 wherein said solid component has an average particle size of from about 5 to about 250 microns.

5. The composition of claim 2 wherein said liquid component additionally comprises:

a minor proportion of a hydrocarbon fuel admixed with said liquid component.

6. The composition of claim 2 wherein said gaseous component comprises at least about 5 percent by volume of said explosive composition.

7. The composition of claim 2 wherein said liquid component comprises from about 6 percent to about 60 percent by weight of the explosive composition.

8. The explosive of claim 7 wherein said liquid component comprises from about 12 percent to about 35 percent by weight of said explosive composition.

9. The explosive composition of claim 2 wherein said liquid component is a nitroalkane.

10. The composition of claim 9 wherein said nitroalkane is nitromethane.

11. The composition of claim 2 wherein said liquid component is a dinitrotoluene oil.

12. The composition of claim 5 wherein said liquid component is a nitroalkane admixed with a minor proportion of a soluble hydrocarbon fuel.

13. The composition of claim 12 wherein said nitroalkane is nitromethane.

14. The composition of claim 13 wherein said hydrocarbon fuel is an aromatic hydrocarbon.

15. The composition of claim 5 wherein said liquid component is a mixture of dinitrotoluene containing a minor proportion of a hydrocarbon fuel.

16. The mixture of claim 2 wherein said solid component is ammonium nitrate.

17. The composition of claim 2 wherein said solid component is sodium nitrate.

18. The composition of claim 2 wherein said solid component is potassium nitrate.

19. The composition of claim 2 wherein said solid component is sodium perchlorate.

20. The composition of claim 2 wherein said solid component is potassium perchlorate.

21. The composition of claim 2 wherein said solid component is ammonium perchlorate.

22. The composition of claim 2 wherein said solid component is diatomaceous earth.

23. The composition of claim 2 wherein said solid component is expanded silica.

24. The composition of claim 2 wherein said gaseous component is air present in an amount between about 5 percent and about 50 percent by volume of the total composition.

25. The composition of claim 1 wherein the bulk density of the solid component is less than about 1.4 g/cc.

26. The composition of claim 25 wherein the bulk density of the solid component is less than about 1.0 g/cc.

27. The explosive composition of claim 2 further comprising a booster charge located in proximity to a secondary non-cap sensitive explosive.

28. The explosive mixture of claim 27 wherein said secondary explosive comprises a mixture of ammonium nitrate and fuel oil.

29. The explosive composition of claim 27 wherein said secondary charge comprises nitromethane.

30. The composition of claim 27 wherein said explosive composition is in the form of a shaped charge.

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