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Picard et al.

[11] **3,738,276**

[45] **June 12, 1973**

[54] **CONTAINER WITH CONTROLLABLY DESENSITIZED EXPLOSIVE MIXTURES**

[75] Inventors: **Jean P. Picard**, Morristown; **H. William Voigt, Jr.**, Stanhope; **Lawrence W. Pell**, West Orange, all of N.J.

[73] Assignee: **The United States of America as represented by the Secretary of the Army**, Washington, D.C.

[22] Filed: **Nov. 17, 1971**

[21] Appl. No.: **199,452**

[52] **U.S. Cl.** ..... **102/7.2**, 102/58, 102/70 R, 102/90

[51] **Int. Cl.** **F42c 1/00**

[58] **Field of Search** ..... 102/7.2, 58, 90, 102/70 R

[56] **References Cited**

UNITED STATES PATENTS

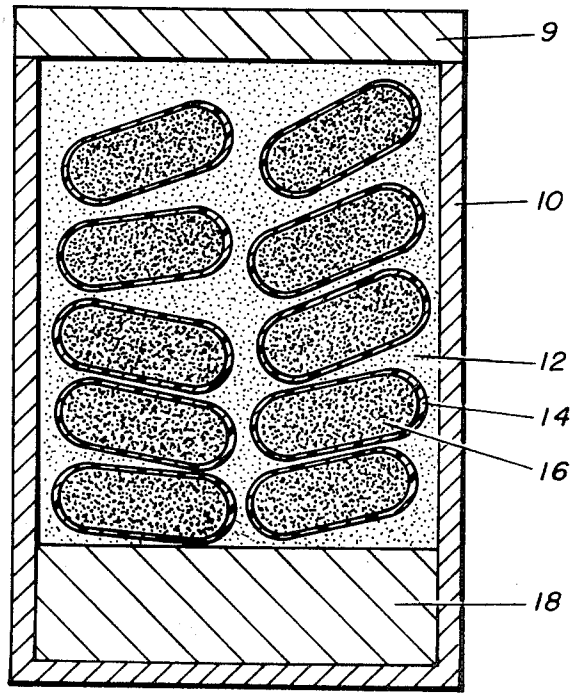
2,368,310	1/1945	Lecky et al.	102/70 R
2,958,277	11/1960	Snelling	102/6

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[57] **ABSTRACT**

A composite semi-liquid system for thickening halogenated organic liquids, such as Freon 113 (a registered trademark of E. I. DuPont de Nemours & Co.) to improve safety in the formulation and handling of certain highly-sensitive-to-detonation mixtures, for example, a mixture of secondary and primary explosives, or a combination of a solid sensitive oxidizer with a pyrotechnic fuel. The thickened halocarbon is used in two stages, first a selected combination of gelling agents such as Cab-O-Sil M-5 (a registered trademark of the Cabot Corporation) and Bentone 38 (a registered trademark of N. L. Industries, Inc.) is incorporated into the halocarbon and the resultant slurry is then used to desensitize the explosive by admixture. The desensitized explosive is packaged in a container which is permeable to the halocarbon vapor and this package is immersed in a vessel containing a halocarbon gel obtained by selective gellation with gellants such as Alumagel (a registered trademark of Witco Chemical Co.); this second gel provides a means for preventing a rapid escape of the liquid from the vessel if a leak occurs.

6 Claims, 2 Drawing Figures



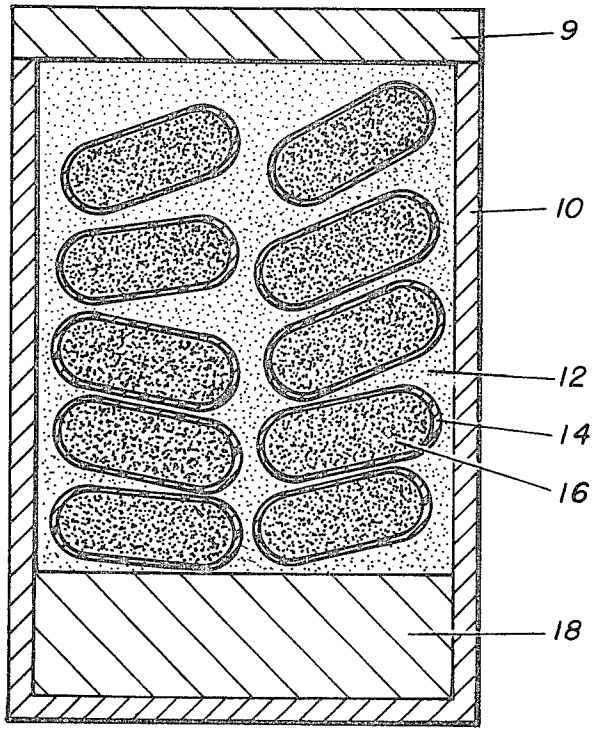


FIG. 1

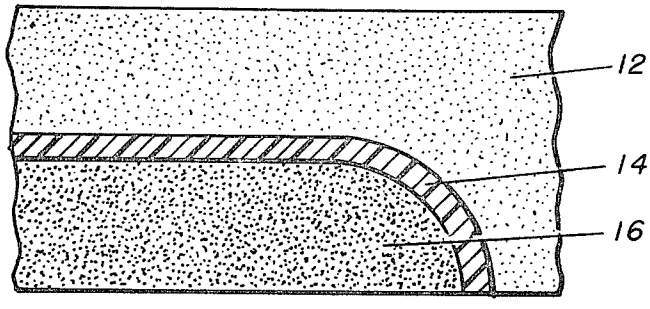


FIG. 2

CONTAINER WITH CONTROLLABLY DESENSITIZED EXPLOSIVE MIXTURES

The invention described herein may be manufacture, used and licensed by or for the Government of the United States for governmental purposes without the payment to us of any royalty thereon.

BACKGROUND OF THE INVENTION

For certain battlefield applications, it is desirable to have a large number of packaged explosives, either mines or noisemaking devices or both, dispersed in preselected areas of the battlefield. An extremely advantageous method of accomplishing this is by aircraft deployment. This air dispersal necessitates the use of a large outer container, in which the smaller packages are disposed, prior to dispersal. Normally, after the small explosive packages are prepared, they are placed in the container at the point of preparation. The explosives or noisemakers are generally packed in small, vapor permeable, packages such as fabric bags or plastic film packets.

In the past, the practice has been to render these explosives safe by immersion in an environment of liquid halocarbon. The immersed explosives were then packaged and shipped. These attempts to render the explosives safe by treatment with such an environment have not been completely satisfactory and the danger has been compounded by the material handling process, which is a manual, batch type process, made necessary, because the viscosity of the halocarbon was not sufficient to keep the ingredients dispersed in a homogeneous manner. This type of process is relatively inefficient because Freon is lost to the atmosphere and further, it is hazardous to the operators.

Attempts have been made to thicken the Freon by the use of Cab-O-Sil alone, but in a number of cases this resulted in increased rather than decreased sensitivity when the items dried out, due to surface phenomena of the finely divided Cab-O-Sil particles in the mixture. In addition to safety considerations, it was necessary to develop a system which would desensitize the explosive for a pre-determined amount of time and then allow the explosive to arm itself. The large container used to disperse the small packages had to be capable of containing the explosives, in battlefield conditions, in a desensitized, unarmed manner until they were deployed. This was especially difficult with a liquid halocarbon system because of the likelihood of solvent evaporation and premature arming of the explosive if the large container was pierced by rifle fire or shrapnel. In addition, if any leaks developed during shipping, through accident or rough handling, the contained explosive packages might arm prematurely and cause serious damage. Further, a means of preventing impact detonation was necessary to render this type of deployment system feasible.

It is, therefore, an object of this invention to provide a halocarbon gel system for controllably desensitizing sensitive-to-detonation mixtures.

A further object is to provide a halocarbon gel system for improved safety in loading and shipping sensitive-to-detonation mixtures.

Another object is to provide a safer method for deploying sensitive-to-detonation mixtures under battlefield conditions.

Yet another object is to provide a safer, continuous method for preparing and loading certain sensitive-to-detonation mixtures.

Other objects and many of the attendant advantages of this invention will be readily appreciated as the same become better understood by reference to the following description, wherein it is shown that the above-mentioned objects are attained and the prior art deficiencies are overcome by the use of a desensitizing slurry intimately mixed with the sensitive explosive in combination with a protective gel, disposed in a large outer container around the packaged, desensitized explosives, to accomplish these objects.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a cross-sectional view of a typical filled container.

FIG. 2 is an enlarged view of the interface between the outer protective slurry, the bag or envelope material and the inner desensitizing slurry.

Throughout the drawings the same numerals refer to the same items.

DESCRIPTION OF A PREFERRED EMBODIMENT

Our invention can best be shown in the context of the entire munition. As shown in FIG. **1**, the bags or envelopes **14** are filled with the desensitized slurry mixture **16.** The filled bags **14** are then loaded into a container **10** and surrounded with the outer protective gel **12.** The container **10** is provided with a controllable opening means **9** and a propulsion means **18** to deploy the filled bags **14** when desired. In operation, when the bags **14** are to be air deployed, the opener **9** is activated and then the bags **14** are propelled out of the container by use of the propulsion means **18.** The outer gel **12** falls away, leaving the bags **14** filled with desensitized slurry **16** to fall to the ground and arm themselves through halocarbon evaporation. This evaporation of solvent makes the item progressively more sensitive to detonation. The outer protective gel **12** is used as an additional safety means to prevent inadvertent evaporation from the inner gel **16** if the container **10** were perforated. If such perforation did occur the outer gel **12** would form a plug to prevent evaporation. The inner slurry **16** is formulated so that it will not form a film on drying, thus allowing halocarbon to escape through the bag **14.** Further, the outer gel **12,** while wetting the surface of the bag, does not form a film which will prevent evaporation of the liquid from the inner slurry **16.**

In FIG. **2,** the interfaces between the inner desensitized gel **16** and the outer protective gel **12** surrounding the bag **14** are shown. In operation, the bag **14** is made of vapor permeable material so that the solvent from the gel **14** can evaporate through it.

The desensitizing slurry is mixed with sensitive, explosive or pyrotechnic compositions. The rheological properties of this slurry are such that the components of the composition will remain suspended in it for the life of the slurry. In addition, since the slurry desensitizes the composition, thorough mixing, to insure homogeneity, can be accomplished in relative safety. The halocarbon evaporation from the desensitized mixture can be controlled by selecting the proper thickening agents and by proper choice of bag or packaging materials. Continuous processing of separate items is made possible because of the relative safety and homogeneous condition of the mixture and because the items

can be separately weighed, if necessary, without rapid weight loss due to halocarbon evaporation. The protective gel in which the filled, desensitized mixture packages are placed, also has rheological properties which prevent it from pouring out of a vessel, through an aperture suddenly opened in the vessel. In addition, the gel can be so designed that its rheological properties will dissipate the impact force of a bullet so that the desensitized mixture in the containers will not detonate inadvertently. By the use of the composite system of our invention these types of explosive or noisemaker can be loaded, shipped and deployed under battlefield conditions in relative safety.

The composite system; i.e., the inner desensitizing slurry in admixture with the explosive or pyrotechnic and the outer protective gel in the large container, must conform to certain parameters. The outer or protective gel must be capable of forming a plug so that if a leak in the container develops the gel will fill the hole to prevent the loss of all the gel in the container. The inner desensitizing slurry must be particulate in nature rather than a film former, to allow the item to arm through solvent evaporation. Additionally it cannot be excessively particulate because the surface activity of an excessively particulate mixture increases the sensitivity of the mixture to an undesirable level. The interface between the outer protective gel and the surface of the packages must also be such that a film will not be formed on the packages which would prevent proper evaporation by retarding vapor transmission. Since the inner desensitizing slurry must not be a film former to allow proper evaporation, in essence it is a thick slurry rather than a true gel. There are two requirements of this slurry; i.e., first to wet and desensitize the explosive and second to evaporate and allow the explosive to arm; therefore, many of the parameters are largely empirical. The slurry must effectively meet both criteria and therefore it can neither irreversibly desensitize the explosive nor take more than a practical amount of time to allow the halocarbon to evaporate. Additionally, the gellant used must be present in small amounts so that when the liquid evaporates, the amount of gellant remaining will not adversely affect the sensitivity of the packaged mixture. Further, the amounts of gellant used must be large enough to insure safety and controlled evaporation by forming a proper slurry. Generally, a halocarbon liquid is used for this inner desensitizing slurry because of its relative inactivity towards the sensitive mixtures and because of its high rate of evaporation. Any liquid could be used with our invention, however, if it did not react with or dissolve the ingredients of the mixture and if it evaporated within practical time limits.

The outer protective gel, which is a true gel, must be capable of dissipating the impact force from a bullet or piece of shrapnel to prevent detonation of the explosive packages, it must be capable of forming a plug in holes in the container to prevent liquid evaporation and it must not form a film on the explosive packages such that the liquid would be unable to evaporate from the packages after they are deployed. The type of gel used must conform to the criteria outlined and preferably will be a halocarbon gel but any other gel, for example, a water gel can be used so long as it meets the above criteria.

The gelling agents that can be used with our invention are any gelling agents or thickening agents which will form a particulate slurry with the liquid used to desensitize the explosive mixture or form a plug-forming gel with the liquid used for the outer protective gel and which will also form a gel that will protect the mixtures from the impact force of bullets or shrapnel.

The particulate desensitizing slurry of our invention is formed by using a particulate type thickening-agent in combination with a gelling agent. The particulate thickening agents used include adsorbent, inorganic, silica or alumina compounds usually of sub micron size which have a surface area of more than 100 square meters per gram, such as Cab-O-Sil M–5. The gelling agents used include organic ammonium salts of acid clays such as Bentone 38, which is an organic magnesium montmorillorite, or Bentone 34, a dimethyl dioctadecyl ammonium, magnesium aluminum silicate. The gellant used can be varied depending on the physical properties of the liquid to be gelled.

The particulate thickening agent gellant combination used may contain ratios ranging from 50 percent by weight particulate agent to 50 percent by weight gellant to 85 percent by weight particulate agent to 15 percent by weight gellant. If less than 15 percent gellant is used, the slurry becomes overly sensitive due to rapid drying on the surface. If more than 50 percent gellant is used, the slurry stability excessively retards evaporation. The preferred composition is 75 percent particulate agent to 25 percent gellant to achieve a balance between the amount of particulate material present and gel stability.

The particulate size of particulate thickening agents that may be used with our invention will depend on their physical characteristics. Generally, the particle size can be from about 0.007 microns to 0.1 microns, preferably from about 0.007 to 0.012 microns for optimum results.

The total amount of the combination particulate thickening agent-gellant that can be used effectively to form the desensitizing slurry of our invention is usually from about 1 to about 4 percent by weight of the total slurry, preferably about 1 to 2 percent. The minimum specified is to insure stability of the gel and the maximum to insure that the explosive mixture will not lose its sensitivity on drying because of the presence of too much gellant diluent.

The outer protective gel can be made from a non polar liquid and a suitable gelling agent, such as a water insoluble aluminum di-soap of the formula $(RCOO)_2OH\ Al$, wherein R is an aliphatic or alicyclic hydrocarbon radical containing from seven to 22 carbon atoms. Preferably, (RCOO) represents the radical of a monobasic acid selected from the group consisting of lauric, myristic, palmitic, oleic, linoleic, naphthenic, 2 ethylhexoic, stearic and mixtures thereof. If water is used to form the gel, gelatin or any suitable gelling agent may be used.

The amount of gellant used for the outer protective gel is usually from about 1 percent to about 4 percent of the total weight of the gel, preferably from about 1 percent to about 2 percent. If there is not enough gellant, the protective gel will not plug holes developing in the container, and if there is too much gellant, the gel will be too thick and the container will be difficult to pack. Additionally, the proper amount of gellant must be used to prevent film forming on the explosive packages.

The liquid component of the inner desensitizing slurry system is governed by criteria of non-reactivity

with the explosive, non-solvation of the explosive and an evaporation rate that will permit practical arming or drying times for the items. Any liquid which will meet these criteria can be used, for example 1,1,2-trichloro-, 1,2,2 trifluoroethane; 1,1,2,2 tetrachloro-, 1,2 difluoroethane; 1,1,2,2-tetrafluoro-1,2 dibromoethane; carbon tetrachloride and tetrachloroethylene. It has been found that halocarbons of a chain length of one or two carbon atoms containing at least one halogen substituent are preferred, such as Freon 113 or perchloroethylene. These halocarbons preferably have a boiling point between about 30° to 120°C.

In the outer protective gel, the principal requirement is that the gelled liquid will form a plug to prevent subsequent leakage if the container is perforated. Additionally, since the explosive packages will be disposed in this gelled liquid, the liquid must be compatible with the desensitizing slurry. By compatible is meant that there will be no reaction between the two liquids.

In addition, the liquid must be capable of forming a gel which will dissipate the force of bullets or shrapnel which hit the container in combat conditions and thus prevent detonation of the inner explosive packages. Also, since the packages themselves must be able to transmit the inner liquid vapor, the outer gel must not coat the containers so that vapor permeation is completely restricted. Any gellable liquid, either organic or inorganic, which meets these criteria may be used. It has been found that the same halocarbons as used in the inner gel can be used for the outer protective gel without adverse effect. Further, water can be used as the liquid in this outer protective gel.

The solid mixtures that may be desensitized by the inner gel compose two major classes. First, impact sensitive pyrotechnic or noisemaking compositions. This class is usually made up of sensitive explosives, such as mixtures of red phosphorous, potassium chlorate or perchlorate and ground glass. Any combination of a strong oxidizer, abrasive agent and pyrotechnic fuel can be used with this invention, so long as the proper criteria are followed in formulating the gels. Second, explosive mixtures composed of secondary explosives, such as RDX, and primary explosives, such as lead styphnate or lead azide, may be used. A number of secondary explosives may be used in place of RDX, for example, PETN or HMX, may be used as well as any common secondary explosive. The explosive packaging material used is selected for its nonreactivity and its ability to transmit the vapor from the liquid of the desensitizing slurry. For example, cotton duck may be used as well as certain films which are permeable to the liquid used in the desensitizing slurry, such as Alathon or Tyvek polyethylene film (both names are registered trademarks of E. I. Du Pont de Nemours & Co.). The thickness of the film may be varied to achieve diverse evaporation rates.

The method and composition of this invention which may be used to produce a safe desensitized explosive item having the properties desired, is set forth in the following examples. It is, of course, understood that these examples are meant to be illustrative and not restrictive of our invention.

EXAMPLE 1

INNER DESENSITIZING SLURRY

A. A 2 percent by weight gel of Bentone*, a gelling agent, in 1,1,2, trichloro-1,2,2, trifluoroethane was prepared in the following manner. 0.8 gram of ethyl alcohol was added to 2 grams of Bentone 38 and mixed to swell the gellant. The swollen gellant was then added to 98 grams of rapidly agitated 1,1,2, trichloro-1,2,2 trifluoroethane using high shear dispersion equipment, at ambient temperatures. A thickened halocarbon paste of about 63 ml. volume resulted after approximately 5 minutes of agitation.

B. A 2 percent by weight slurry of Cab-O-Sil M5**, a particulate thickening agent, in 1,1,2 trichloro-1,2,2-trifluoroethane was prepared by first slowly mixing 2 grams of the Cab-O-Sil with 98 grams of 1,1,2- trichloro-1,2,2; trifluoroethane to wet out the Cab-O-Sil. Then the slurry was stirred rapidly for about 5 minutes at ambient temperatures using a propeller-type mixer.

C. 3 parts by weight of B was stirred into one part by weight of A at ambient temperatures, using a propeller type mixer to form the inner desensitizing slurry of 2 percent 75/25 Cab-O-Sil/Bentone in 1,1,2 trichloro-1,2,2 trifluoroethane.

D. To 14 grams of the slurry from C, 5 grams of potassium chlorate was added under agitation, then 2 grams of red phosphorous was added, and mixing continued, at ambient temperatures, until the slurry was homogeneous.

E. One gram of cut Pyrex glass was added to a small polyethylene cup and dampened with 1,1,2,-trichloro-1,2,2-trifluoroethane. 3 grams of the slurry from D was dispensed volumetrically into the testing container. The slurry mixture was then dampened with 1,1,2 trichloro -1,2,2 trifluoroethane and heat sealed in a cup made of 4 mil polyethylene film, which was closed by a rigid polyethylene disk. On drying the bomblet consisted of 35.7% by wt. potassium chlorate, 14.3 percent by weight red phosphorous, 50 percent by weight pyrex glass and 2 percent by weight gellant. The bomblet was tested for safety and proper drying time by the use of standard tests.

*Bentone 38 is a product marketed and trademarked by N. L. Industries, Inc. It is a magnesium montmorillonite ammonium salt modified by two methyl and two octadecyl organic groups.

**Cab-O-Sil M-5 is a product marked and trademarked by Cabot Corporation. It is a pyrogenic silica having an average particle size of 0.012 microns and a surface area of 200 square meters per gram.

The polyethylene cup and disc used was made from Alathon A 3120 film (a registered trademark of E. I. Du Pont de Nemours Co.) marketed by Du Pont.

EXAMPLE 2

Using exactly the same procedure as in Example 1 but in place of the material of step D, enough RDX and lead azide were introduced into the slurry to form a final mixture containing 60 parts by weight of RDX to 40 parts by weight of lead azide.

A number of samples with varying percentages of gellant were obtained in the same manner as Examples 1 and 2 by varying the amount of slurry used in the final mixture.

EXAMPLE 3

OUTER PROTECTIVE GEL

Two grams of Alumagel (an aluminum di soap marketed under the trademark Alumagel by Witco Chemical Co.) were slowly added to 98 grams of 1,1,2 trichloro - 1,2,2 trifluoroethane with slow agitation at am-

bient temperatures. Stirring was continued, until the solid particles began to dissolve. The stirring was then discontinued and the slurry allowed to stand for about 2 hours, at which point a clear colloidal gel was formed. This gel was used as a means for protecting the items disposed in the outer container from inadvertent arming and from shock. This type of gel was tested using the procedures described herein.

EXAMPLE 4

OUTER PROTECTIVE GEL

1.5 grams of Alumagel were slowly stirred into 98.5 grams of perchloroethylene at ambient temperatures. A clear colloidal gel formed in about 2 minutes. This gel was used as described in Example 2 and tested using the same procedures.

Tests were run on samples of the desensitized composition of Example 1 to determine the proper gellant content for proper sensitivity coupled with practical evaporation times. These tests are standard tests used for explosives and the results obtained are reported in the following tables:

TABLE 1

EFFECT OF GEL FORMULATION AND PROCESSING ON BOMBLET MIXTURE SENSITIVITY

	[3]P.A. Impact Sensitivity Test Value, ht, inches		
	Freon 113 Wet Mixture		Mixture Dried in Cups
Material Tested	0.25 Kg wt	1 Kg wt	0.25 Kg wt
1. Control: No slurry — 2% Cab-O-Sil added dry with active ingredients (1) to Freon	1″	1″	1″
2. Freon slurry — active ingredients (1) added to 2% composite gellant (2) in Freon, to make up 2% gellant content, dry basis	4″	1″ 1″ (10consecutive explosions)	
3. Freon slurry — active ingredients (1) added to 2% composite gellant (2) in Freon, to make up 4% gellant content, dry basis		6″1″ (30 consecutive explosions)	
4. Freon slurry — active ingredients without glass added to 2% Bentone 38 gellant in Freon, to make up 10% gellant content, dry basis		13″	3″

NOTES:
1. Active ingredients are 35.7/14.3/50 potassium perchlorate (MIL-P-150)/red phosphorous stabilized (MIL-P-670)/cut Pyrex glass, U. S. Sieve granulation 14/30.
2. Composite gellant is 75/25 Cab-O-Sil M5 silica/-Bentone 38, a dispersion of 2% by weight in Freon 113.

[3]P.A. Impact Sensitivity test has been published by W. H. Rinkenbach and A. J. Clear, *Standard Laboratory Procedures for Sensitivity, Brisance and Stability of Explosives*, Picatinny Arsenal Technical Report No. 1401, 18 March 1944, Revised 28 February 1950.

(C) TABLE 2

CHEMICAL ANALYSIS OF MIXTURE SUSPENDED IN FREON 113 SLURRY

	Potassium Chlorate	Red P	Glass + Gellant	Total mix tested (dry basis)
Top sampling	34.37%	13.44	52.19	1.9162
Bottom sampling	33.43	14.28	42.29	1.9432
Original composition of mix	33.3	13.7	53	

NOTES:
1. The preparation containing 4% gellant solids basis was as follows:
   a. Add 2.25 grams of 2% Bentone 38 Gellant by weight in Freon to 6.75 grams of Cab-O-Sil M5 silica suspended in Freon. This composite gel weighs 9 grams and contains 0.18 grams of gellant solids.
   b. Blend 2.25 grams of Pyrex ground glass of 14/28 U. S. sieve mesh granulation with 1.606 grams of potassium chlorate (thru 60 mesh). Stir this mixture into the Freon composite pre-gel in (a).
   c. Finally stir in 0.643 grams of red P, stir with a polyethylene spoon and place in a container.
   d. After 10 minutes, scoop off the top of the container about 1.5 ml. of the wet mix onto the glassfrit of a porcelain funnel. Remove the center portion for impact testing, and sample 1.5 ml. from the bottom of the container.
2. The material prepared above was tested for PA Impact sensitivity:

Drop Weight	PA Impact Sensitivity value; Freon wet, ht.	Consecutive explosions; Dried Mix, ht.
2 Kg	1″	
1 Kg	6″	
8 oz		At 1″— 30 consecutive At ¼″ — explodes violently

From the results presented in Table 1, it can be seen that the mixture of Example 1 is desensitized when wet and explodes when dried. The difference in sensitivity between a control mixture using Cab-O-Sil alone and the mixture of our invention is quite evident from a comparison of the height necessary to cause detonation. The mixture of our invention requires a height of 4″ vs. only 1″ for the control using the more sensitive 0.25 kg. weight. It can also be seen that at 4 and 10 percent thickening agent-gellant content the height necessary for detonation increases substantially using the 1 kg. weight. Although the mixture is less sensitive using a 4 percent content the time necessary to dry and arm the mixture is prohibitive.

Table 2 shows that a relatively homogeneous mixture is obtained by the use of our invention. If the mixture were suspended in liquid Freon without the use of Benton 38 Cab-O-Sil M5 the solid components would be found almost exclusively in the bottom layer. Additionally, a number of rounds from M–1 and M–16 rifles were fired at container assemblies at a distance of 100 ft. These firings resulted in a number of direct hits. The container loaded in the manner of our invention did not detonate, it showed a markedly enhanced insensitivity to bullet impact.

Thus, it can be seen that the use of our invention, wherein an inner desensitizing slurry contained sensitive to detonation ingredients, is protected by an outer protective gel to provide additional safety in shipping, handling and deployment under battle conditions, forms the basis for an advance in the art.

We wish it to be understood that we do not desire to be limited to the exact details described, for obvious modification will occur to a person skilled in the art.

We claim:

1. A composite article of manufacture containing reversibly desensitized explosive composition comprising: a detonation sensitive explosive material, homogeneously dispersed in a non-aqueous slurry, said slurry consisting essentially of a mixture of a first liquid component non-reactive with said explosive material and having a boiling point between about 30° and 120°C, and a solid component, capable of thickening said first liquid component, consisting essentially of a mixture of

a finely divided, adsorbent, particulate thickening agent insoluble in said first liquid component and an inner gelling agent partially soluble in said liquid component, said composition being packaged in a container permeable to the vapor of the liquid component of the desensitizing slurry and wherein the container is enclosed in a protective gel comprising a second liquid and an outer gelling agent therefore.

2. The article of manufacture, of claim 1, wherein the particulate thickening agent is a silica of sub micron size, and said inner gelling agent is an organic ammonium salt of an acid clay.

3. The article of manufacture of claim 1, wherein said composite article is contained in a vessel impermeable to the vapor of the first liquid component of both the densensitizing slurry and the outer protective gel.

4. The article of manufacture of claim 3, wherein said outer gelling agent is an aluminum di-soap of the formula $(R\ COO)_2\ OH\ Al$ and wherein R is selected from the group consisting of aliphatic hydrocarbon radicals of seven to 22 carbon atoms and alicyclic hydrocarbon radicals of seven to 22 carbon atoms.

5. The article of manufacture of claim 4, wherein (RCOO) is a monobasic acid radical selected from the group consisting of lauric, myristic, palmitic, oleic, linoleic, napthemic, 2-ethylhexoic, stearic, and mixtures thereof.

6. The article of manufacture of claim 3, wherein said second liquid is selected from the group consisting of 1, 1, 2 trichloro-1,2,2 trifluoroethane; 1, 1, 2, 2 tetrachloro - 1, 2 difluoroethane; 1, 1, 2, 2 tetrafluoro - 1, 2 dibiomoethane,; carbon tetrachloride; and tetrachloroethylene.

* * * * *

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,738,276 Dated June 12, 1973

Inventor(s) Jean P. Picard, H. William Voigt, Jr., Lawrence W. Pell

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 9, lines 15-16, delete "The first liquid component of both the desensitizing slurry and the outer protective gel" and insert --both the first liquid component and the second liquid--. Column 10, line 9, change "naphthemic" to --naphthenic--; lines 11-12, delete "said second liquid is" and insert --both said first liquid component and said second liquid are--; line 15, change "dibiomoethane," to --dibromoethane--.

Signed and sealed this 19th day of March 1974.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents

FORM PO-1050 (10-69)

USCOMM-DC 60376-P69
★ U.S. GOVERNMENT PRINTING OFFICE : 1969 O—366-334.

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