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LIQUID EXPLOSIVE CONSISTING OF A NITROPARAFFIN AND N-DODECANE

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1 Claim. (Cl. 52—11)

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This invention relates to an explosive that is characterized by its great resistance to detonation by mechanical shock and by its sensitivity to detonation when subjected to explosive shock. More particularly it relates to a powerful explosive that is especially well adapted for military use and that is relatively safe to handle.

Perhaps the most powerful and brisant chemical explosive now known is a stoichiometric mixture of toluene, $C_6H_5CH_3$, and tetranitromethane, $C(NO_2)_4$, but the practical value of such a mixture is limited by the extreme caution with which it must be handled and by the sometimes unpredictable way in which it explodes prematurely because it is extremely sensitive to mechanical shock and any slight jar will cause it to detonate.

It is the general object of the present invention to provide an explosive of approximately the same power as a toluene-tetranitromethane mixture but one that is much safer to handle and that is highly resistant to detonation when subjected to mechanical impact. A further object is to provide an explosive that is very sensitive to explosive shock and that may be detonated readily by a blasting cap or like detonator. Another object is to provide a powerful explosive that is well suited for military purposes and that may be handled and stored with a maximum of safety. An additional object is to provide an explosive with the characteristics indicated that is relatively simple and inexpensive to make.

An explosive in accord with this invention and one that meets its objects may be made by mixing tetranitromethane $C(NO_2)_4$ or hexanitroethane $C_2(NO_2)_6$ and one or more of those paraffin hydrocarbons with the formula C_nH_{2n+2} preferably in stoichiometric proportions.

The range in percentage of either tetranitromethane of hexanitroethane required to make up an approximately stoichiometric mixture with a hydrocarbon of the above formula is narrow. For example when methane, the first member of the series, is used 89.09 per cent by weight of the whole should be tetranitromethane to make a stoichiometric mixture. On the other hand with the nth or highest possible member of the series, calculation shows that 87.5 per cent by weight of tetranitromethane is required in a stoichiometric mixture. For stoichiometric mixtures all of the intermediate members of the series require percentages of tetranitromethane that lie between the two values just given. In each case the balance of the explosive is made up of hydrocarbons with the formula C_nH_{2n+2}.

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Preferably I employ n-octane or n-dodecane from this series.

As a result of the data given above a satisfactory and approximately stoichiometric mixture of tetranitromethane and one or more paraffin hydrocarbons with the formula C_nH_{2n+2} will lie within the following range:

	Per cent by weight
C_nH_{2n+2}	13–10
Tetranitromethane	87–90

I have found that somewhat greater latitude in percentages will produce an explosive with very desirable properties although one that is not quite as powerful as mixtures falling within the tabulation above. Accordingly I also consider mixtures falling within the following range to lie within the scope of the present invention:

	Per cent by weight
C_nH_{2n+2}	40–10
Tetranitromethane	60–90

When hexanitroethane is used instead of tetranitromethane the percentage ranges given above for the latter apply also to the former. The amount of either required for a stoichiometric mixture is substantially the same.

The resistance to mechanical impact of an explosive prepared in accord with this invention is illustrated by the following data. A mixture of .161 cc. consisting of equal volumes of tetranitromethane and toluene was exploded with a threshold mechanical impact energy of .57 foot pound when placed in a closed circular chamber one-half inch in diameter and exposed to the impact across one end. Under the same conditions an explosive composed of equal volumes of tetranitromethane and n-octane required a threshold impact energy in excess of 52 foot pounds, or approximately 100 times as much.

The explosive power and the sensitivity to explosive impact of a reference mixture of toluene-tetranitromethane compared with mixtures embodying the present invention illustrates substantial similarity between them. The results of the data are given below in terms of grams of sand pulverized by explosion to finer than 50 mesh when .066 cc. of the various explosive mixtures are detonated by blasting cap charges of various weights in fractions of a gram. This information is summarized in the table below in which the column at the extreme left indicates the weight in fractions of a gram of each standard explosive cap charge used in the various tests. The column next to it indicates the number of grams of sand pulverized to 50 mesh fineness as a result of the explosion by these various charges of substantially stoichiometric mixtures of .066 cc. of tetranitromethane and toluene comprising 23 per cent by volume of toluene and 77 per cent by volume of tetranitromethane.

The three columns at the right labeled A, B and C express the grams of sand pulverized to the same fineness by the explosion of .066 cc. of a n-octane-tetranitromethane or n-dodecane-tetranitromethane mixture in the volumetric proportions indicated at the top of each column. The same amount of sand of the same initial mesh was used in each of the test explosions and all the explosions were made under the same conditions. While there is some disparity in the figures it will be evident from the similar amounts of sand pulverized that the paraffin hydrocarbon-tetranitromethane mixtures possess explosive properties very similar to those of the very powerful tetranitromethane-toluene mixture when the two are subjected to identical explosive shocks.

Blasting Cap Charge, in Grams	.23 Toluene, .77 TNM	A	B	C
		.3 n-Octane, .7 TNM	.24 n-Dodecane, .76 TNM	.2 n-Octane, .8 TNM
.10	8.34	7.87	----------	3.74
.15	9.92	8.39	9.88	4.35
.20	12.36	9.05	11.98	8.47
.25	10.94	10.25	11.90	9.08
.30	9.52	9.58	8.79	6.14
.35	10.84	7.12	9.82	4.45
.40	9.05	8.24	8.79	6.43

Preferred forms of explosive embodying the present invention are either approximately stoichiometric mixtures of tetranitromethane and n-octane (M. P.,—56.90; B. P., 125.6° C.), or tetranitromethane and n-dodecane (M. P.,—97°; B. P., 216.2° C.). It will be evident that one or more paraffin hydrocarbons of the series C_nH_{2n+2} may be used in an explosive, as for instance tetranitromethane and both normal octane and normal dodecane, to make up approximately a stoichiometric mixture. In the present application a stoichiometric mixture is one

that results in a reaction whose end products are water, carbon dioxide and free nitrogen.

The explosive described above is very powerful, highly resistant to mechanical shock, sensitive to explosive shock and is best suited for use as a high explosive for military and related uses.

I claim:

An explosive liquid mixture detonatable by means of a blasting cap consisting of between 13 and 10 percent by weight of n-dodecane and between 87 and 90 percent by weight of a compound selected from the group consisting of tetranitromethane and hexanitroethane, the mixture being sensitive to explosive shock, resistant to mechanical shock, and adapted for use as a high explosive for military purposes.

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