

## UNITED STATES PATENT OFFICE

2,011,578

EXPLOSIVE

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No Drawing. Application March 15, 1934, Serial  
No. 715,664

5 Claims. (Cl. 52—12)

(Granted under the act of March 3, 1883, as  
amended April 30, 1928; 370 O. G. 757)

The invention described herein may be manufactured and used by or for the Government for governmental purposes, without the payment to me of any royalty thereon.

5 The subject of this invention is an explosive.

This invention relates to an explosive composition in which ethylenedinitramine is an essential constituent. I have discovered that ethylenedinitramine is an explosive and that it possesses some unusual properties which render it of special interest for various purposes. Outstanding among these properties is its high degree of resistance to detonation by impact or shock as compared to other explosives having equivalent brisance or explosive strength. It is generally recognized that high explosives which have an especially high degree of brisance or shattering effect are commonly more susceptible to detonation by impact or shock than other high explosives having appreciably lower brisance. Thus nitroglycerine, pentaerythritetranitrate, trimethylenetrinitramine, tetranitroamine and tetryl which are among the most brisant high explosives which have found military or commercial use are all fairly sensitive to impact or shock. In fact they are so sensitive in this respect that they have not been used as bursting charges for shell or bombs but only considered for use in the form of small charges as boosters or initiators for the main bomb or shell charges. In the form of these small charges they are not subjected to as rough usage as are the explosives which are handled in large quantity and used as shell or bomb fillers.

35 I have found that ethylenedinitramine has brisance or strength comparable to the explosives above mentioned but possesses greater resistance to detonation by shock than any of the explosives mentioned. Actually it corresponds in resistance to shock more nearly to the class of relative insensitive explosives such as picric acid, TNT, etc., which have been used as bursting charges. In the standard drop test it required a 10 inch height of fall of a 2 kg. weight to cause detonation, this being exactly the same height of fall as was required for picric acid, but the dinitramine showed under test appreciably higher brisance or strength than either picric acid or TNT.

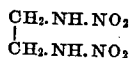
50 Another important characteristic of ethylenedinitramine is its relatively low ignition temperature. It explodes spontaneously when heated to a temperature of 180° C. thus corresponding closely to mercury fulminate and nitroglycerine in the ease with which it is detonated by heat. No

other explosive is known to me which has such high resistance to detonation by shock or impact and at the same time is so readily exploded by heat. Picric acid and TNT which, as mentioned above are comparable to the dinitramine in resistance to shock, do not explode spontaneously under heat until temperature of approximately 325° C. and 438° C. respectively are reached. Thus the ethylenedinitramine is an explosive which will withstand the shocks incident to transportation, handling, loading, etc., and yet will explode more readily under the action of initiators or detonators than the high explosives commonly used as bursting charges.

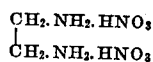
Ethylenedinitramine has been found to be substantially insoluble in water only 0.5 gram dissolving in 100 grams of water at 25° C. It has a high degree of stability, withstanding the standard 120° C. Vacuum Stability Test as well as tetryl which has sufficient stability that it has been widely used in both military and commercial detonators. I have found also that ethylenedinitramine is highly resistant to absorption of moisture from the air as indicated by the fact that when exposed to an atmosphere of 90% relative humidity at a temperature of 30° C. only, 0.01% moisture was taken up by the explosive.

The above highly favorable explosive properties, together with the fact that the raw material, ethylenediamine, from which the ethylenedinitramine may be derived, is now available commercially, makes possible the utilization of this explosive for various purposes. It may be used to replace tetryl in detonators and boosters or to replace picric acid or TNT in high explosive shell or bombs, etc.; its relative insensitivity to shock, ease of ignition by flame and great explosive strength makes it a favorable substitute for nitroglycerine or nitrocellulose in propellant powders. The unusual combination of the properties of both initiating or detonating agents and the more insensitive high explosives makes its field of application especially broad.

Ethylenedinitramine is represented chemically by the formula:



It is not to be confused with the compound ethylenediaminedinitrate which may be represented chemically by the formula:



This last named compound is explosive in nature

but it is highly soluble in water, very hygroscopic, relatively unstable and has much lower brisance or strength than the ethylenedinitramine which is described above.

- 5 As indicated by the above for ethylenedinitramine this explosive does not contain sufficient oxygen for complete combustion of the carbon and hydrogen in the compound. It therefore lends itself to admixture with relatively cheap  
10 oxidizing agents to provide explosives of various characteristics. Thus mixtures of the dinitramine with ammonium perchlorate or potassium chlorate or other active oxidizing agents provide a series  
15 of explosives which possess high brisance and evolve a much greater amount of heat and

greater quantity of gas than the dinitramine itself.

I claim:

1. A new explosive embodying ethylenedinitramine. 5
2. An explosive composition including ethylenedinitramine and an oxidizing agent.
3. An explosive composition having ethylenedinitramine as an essential constituent.
4. An explosive composition comprising ethylenedinitramine and ammonium perchlorate. 10
5. An explosive composition comprising ethylenedinitramine and potassium chlorate.

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