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2,992,595

USE OF ACETYLENE-ETHANE MIXTURE AS PROPELLANT AND EXPLOSIVE

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The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

This invention relates to the use of a hydrocarbon mixture as a propellant in a gun system and more particularly to the use of a mixture of acetylene-ethane as a high velocity propellant for projectiles or missiles.

More specifically, this invention relates to the use of a hydrocarbon mixture in which the energy of molecular disassociation is made available to the low molecular weight hydrogen gas resulting from this disassociation, to in turn act as a propelling gas. It is thought to relate to a chain reaction proceeding through intermediate steps, and in which a slight amount of oxygen in the order of 2% to 3% is provided for use as a catalyst for the initiation of the chain reaction.

Prior propellants utilizing liquid or gaseous hydrocarbons for missile propulsion have utilized the heat of combustion to provide the propelling energy and these combustion reactions necessarily provide a moisture residue as a product thereof. Additionally, they present such disadvantages as high chamber temperatures, and high molecular weights of the propellant gases. The instant invention obviates the formation of moisture or water products in the gun chamber and barrel. It advantageously provides reduced chamber temperatures for missile propulsion by "cool" gas pressures in the order of 1000° C., resulting from the rapid molecular disassociation of the hydrocarbon in molecular destruction or disassociation reactions.

Acetylene is used as one of the hydrocarbons of the mixture since the heat of formation thereof is such that upon decomposition there is provided sufficient heat for the ethane decomposition reaction to take place roughly according to the reaction equation: $C_2H_2 = 2C + 3H_2$. As heretofore stated, a slight amount of oxygen is used to act as a catalyst for the actual chain reaction which takes place. It is to be understood, however, that the oxygen is not provided for the purpose of combining in the end products as is generally the purpose in oxidation reactions as utilized in the combustion of hydrocarbon propellants of prior art explosives. An initiator capable of providing sufficient heat upon gun firing for initiation of the acetylene decomposition reaction may be utilized in lieu of the oxygen. The energies produced by the instant invention result not from the heat of combustion but from the heat of formation. It will become apparent as the description proceeds that another of the advantages provided by the instant mixture for propelling missiles from a gun lies in that it substantially obviates the necessity of purging the gun barrel of residue combustion products after each firing.

It is therefore a feature of this invention to utilize a hydrocarbon mixture of acetylene and ethane in which the energy possessed by the light gaseous products obtained from the rapid decomposition of the mixture into

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carbon, hydrogen and methane is employed to provide an improved propellant for a mass or for use as an explosive.

One object of the invention resides in the production or liberation of low molecular weight gases possessing a high order of propellant energy thereby to effect greatly increased projectile velocities.

In correlation with the preceding object, another object resides in providing chemical reactions which take place at relatively low temperatures and thereby cause substantially reduced gun erosion.

Another object of the invention resides on the provision of an efficient gun propellant charge of low cost which is effective to provide propulsion characteristics at least equivalent to propellant charges heretofore or now in general use, and which in certain gun applications provides improved performance over said prior applications, and more particularly wherein low temperatures are desired.

The propellant reaction of the instant invention may advantageously be carried out by introducing a hydrocarbon mixture of acetylene and ethane into an explosion chamber after projectile insertion therein, with the gas being introduced under a high pressure. The chamber is then sealed by closure of a valve in a feed line and ignition produced by a hot primer of a conventional type for applying sufficient heat to initiate the reaction. In the event that a slight amount of oxygen is introduced with the gas for the purpose of aiding the initiating of the reaction it is to be understood that the oxygen is introduced in such minute amounts as not to enter into the decomposition reaction to any appreciable extent.

It has been determined by test that proportions of the two gases to give a range of 42%-66% C_2H_2 provide highly satisfactory results. The balance of the explosive mixture is comprised substantially of C_2H_6 . Oxygen may be added in amounts of approximately 2%-3% at 100 p.s.i. to effect ignition of the mixture.

Obviously many modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

What is claimed as new and desired to be secured by Letters Patent of the United States is:

1. The method of propelling a projectile in a gun by introducing a mixture comprising 42 to 66% acetylene and the remainder ethane into the gun chamber after the projectile has been loaded into the barrel of the gun and initiating the decomposition of the mixture.

2. The method of claim 1 wherein said mixture contains 2-3% of oxygen.

3. The method of propelling a projectile in a gun by introducing a gaseous mixture comprising 42 to 66% acetylene and the remainder ethane into the gun chamber after the projectile has been loaded into the barrel of the gun, and initiating the decomposition of said acetylene.

4. The method of claim 3 wherein said mixture contains two to three percent oxygen.

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