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NASA TECH BRIEF

Development of Detonation Reaction Engine

A new type of reaction engine has been designed and constructed that operates on the principle of a controlled condensed detonation rather than on the principle of gas expansion. This results in reaction products that are expelled at a much higher velocity than are the gaseous products resulting from a controlled burning as in a conventional engine.

In this reaction type motor the gas products that are expelled from the engine to produce thrust are generated by a condensed detonation reaction rather than by the burning of a propellant as in a conventional type of reaction motor. Reaction type motors, such as rocket engines in current use have generated thrust by burning propellant mixtures in a combustion or thrust chamber and then expelling the gaseous products which result from this combustion through a rocket nozzle. The development of conventional reaction type engines has progressed to a point where it is very difficult to obtain any significant increase in thrust from an engine without resorting to increasing the size of the engine.

The new type reaction engine is constructed of two basic sections consisting of a detonation wave generator section and a condensed detonation reaction section. A controlled shock wave is generated in the wave generator section and this shock wave is directed into the detonation reaction section where a condensed detonation is initiated that results in high density directional reaction products which are expelled from the engine to produce thrust.

The operation of the engine is as follows: Liquid hydrogen and oxygen or any other suitable liquid oxidizer/fuel combination are sprayed into a wave generator chamber and the vapor mixture is exploded by an electric spark. A shock wave is produced within the wave generator chamber and is directed into a detonation reaction chamber where it triggers a condensed detonation of the propellant mixture. Fuel and oxidizer are fed into the detonation reaction chamber at an angle such that an annular zone of fuel and oxidizer mixture is formed. This annular zone is progressively detonated by the shock wave generated in the wave generator chamber. The injection angle of the fuel and oxidizer introduced into the detonation reaction chamber, and the shape of the shock wave from the detonation wave generator chamber is such that a reaction in the detonation reaction chamber is produced which is similar to the reaction caused by detonation of a conventional shaped charge. The gaseous products that result from the detonation of the liquid fuel and oxidizer are squeezed or confined to the area of the annular zone. The temperature, pressure, and velocity of gases obtainable from such a reaction are considerably larger than those obtainable from a controlled burning of propellant in a conventional reaction motor.

Note:

Inquiries concerning this invention may be directed to:

Technology Utilization Officer
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Reference: B67-10652

Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D.C. 20546.

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Category 01