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METHOD AND FUEL FOR OPERATING JET ENGINES

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This invention relates to a method of supplying thermal jet engines with fuels of superior combustion characteristics, such as acetylene, without the attendant difficulties and hazards of handling such fuels.

It has been found that fuels having very high flame speeds (such as acetylene) are desirable for the operation of turbojets, ramjets and other air breathing jet engines since operation with such fuels results in higher than ordinary combustion efficiency, wider limits of stable combustion, freedom from flame blow out under conditions of high flight speed and high altitude, and easier starts. However, pure acetylene is a gas at ordinary temperatures and pressures, is chemically unstable and is otherwise difficult and hazardous to handle in the fuel systems of thermal jet engines.

This invention comprises operation of a thermal jet engine with a liquid hydrocarbon mixture containing a substantial amount of acetylene. The remainder of the fuel contains hydrocarbons and the fuel is of such composition that the vapor phase in equilibrium with the liquid contains a sufficient amount of hydrocarbon other than acetylene to dilute the acetylene to less than an explosive concentration. One fuel composition, for example, is a mixture of kerosene, butane and acetylene, with the butane being present in such proportion in the liquid phase that the equilibrium vapor phase comprises acetylene diluted to less than its explosive concentration. This invention also includes operation of a jet engine with such a fuel handled by means of a fuel system having no copper, silver, or other metals capable of forming explosive acetylides when coming in contact with the fuel.

The concentration of light hydrocarbon other than acetylene in the vapor phase in order to ensure non-explosive characteristics varies with the particular light hydrocarbon utilized. The vaporization characteristics of butane and propane are quite favorable for their utilization in this fuel. The stabilizing effect of these hydrocarbons is shown in the Bureau of Mines Report of Investigations 4196. These data indicate that the minimum amount of butane and/or propane in the vapor phase depends upon the concentration of acetylene and the pressure in the system. Increasing amounts of stabilizing light hydrocarbon are necessary with increasing temperature to which the vapor phase may be exposed.

At temperatures below about 80° F. and pressures of, for example, 100 p. s. i. g., a vapor phase composition of 70 volume per cent acetylene and 30 volume per cent propane is not explosive. In a mixture with kerosene, this composition of the vapor phase corresponds to a liquid phase of approximately 2.5 weight per cent acetylene, 6 weight per cent propane, and the remainder kerosene. When butane is used in the fuel composition, a vapor phase of approximately 75 volume per cent acetylene and about 25 volume per cent butane may be used. This corresponds to a liquid phase of approximately 3.8 weight per cent acetylene, 30 weight per cent butane, and the remainder kerosene. In the above fuel compositions, the kerosene content of the vapors was not included, for it is a negligible amount.

Generally, a fuel containing by weight 2–4% of acetylene, 5–30% of a hydrocarbon boiling in the range of minus 60–100° F. and 65–90% of a hydrocarbon boiling in the range 100–600° F. is within the scope of the invention.

Variation and modification are possible within the scope of the foregoing disclosure and the appended claims to the invention the essence of which is that a jet fuel containing acetylene in a safe combination has been set forth and methods for its preparation described.

We claim:

1. A jet fuel consisting essentially, in per cent by weight, of: 2–4% acetylene, 5–30% of a hydrocarbon boiling in the range of minus 60 to plus 100° F., and 65–90% of at least one hydrocarbon boiling in the range 100–600° F.

2. A jet fuel containing by weight per cent: about 2.5 acetylene, 6 propane and the remainder kerosene.

3. A jet fuel containing by weight per cent: about 3.8 acetylene, 30 butane and the remainder kerosene.

4. A method of operating a jet engine which method comprises supplying to said jet engine a fuel consisting essentially of the following: 2 to 4 weight per cent of acetylene, 5 to 30 weight per cent of a hydrocarbon boiling in the range minus 60 to plus 100° F., and 65 to 90 weight per cent of at least one hydrocarbon boiling in the range 100 to 600° F.

5. A jet fuel according to claim 1 wherein said hydrocarbon boiling in the range of minus 60 to plus 100° F. is butane.

6. A jet fuel according to claim 1 wherein said hydrocarbon boiling in the range of minus 60 to plus 100° F. is propane.

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