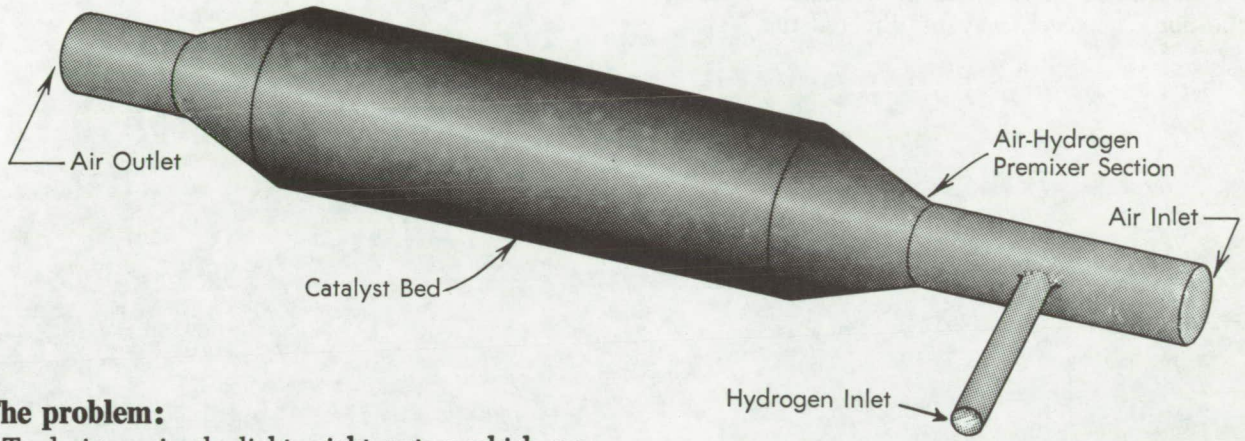
NASA TECH BRIEF

Ames Research Center

NASA Tech Briefs announce new technology derived from the U.S. space program. They are issued to encourage commercial application. Tech Briefs are available on a subscription basis from the National Technical Information Service, Springfield, Virginia 22151. Requests for individual copies or questions relating to the Tech Brief program may be directed to the Technology Utilization Office, NASA, Code KT, Washington, D.C. 20546.

Hydrogen Eliminator



The problem:

To design a simple, lightweight system which converts vented hydrogen into water and operates at low temperatures.

The solution:

Hydrogen is mixed with sufficient air to ensure that a flame cannot be maintained and then passed through a reactor containing palladium catalyst; reaction takes place at relatively low temperatures.

How it's done:

Hydrogen in air is flammable over the range of four to seventy-five percent hydrogen by volume. The ignition temperature is near 811°K at atmospheric pressure, and thus the burning of hydrogen in air requires an ignition source, either electrical or catalytic (platinum wire). However, hydrogen greatly diluted with air can be oxidized on a catalyst bed containing platinum or palladium; enough excess air is required to carry away the heat of reaction from the catalyst bed and to keep the outlet gas temperature at some acceptably low value. If the outlet gas is to be below 811° K, then the hydrogen content must be less than five percent at the inlet, which is marginally combustible without a catalyst.

The compact unit shown in the diagram is less than 30 cm in length, and contains a catalyst bed 38 mm in diameter and 75.2 mm long. The bed is a spiral winding of palladium-treated asbestos with a corrugated steel spacer for gas passage. The hydrogen is premixed with air by a propeller-type baffle upstream of the bed.

The unit was tested by measuring the air and hydrogen flow rates and the inlet and outlet temperatures. The quantity of hydrogen reacted was then computed from the heat of reaction of the hydrogen and oxygen (in air). A typical operating point is:

Hydrogen flow	1.45 liters/min
Air inflow	57 liters/min
Air inlet temperature	301°K
Air outlet temperature	479°K

(continued overleaf)

This document was prepared under the sponsorship of the National Aeronautics and Space Administration. Neither the United States Government nor any person acting on behalf of the United States Government assumes any liability resulting from the use of the information contained in this document, or warrants that such use will be free from privately owned rights.

A heat balance shows that 85 percent of the hydrogen was reacted; of course, heat losses lower the measured outlet temperature and thus the true percentages of hydrogen reacted must be somewhat larger than 85 percent.

Notes:

1. The hydrogen reactor may also be used as a water-recovery device in water-electrolysis systems. Since the catalyst bed reacts with hydrocarbons in air, the device may have a wide range of applications for air purification.
2. No additional information is available. Specific questions, however, may be directed to:

Technology Utilization Officer
Ames Research Center
Moffett Field, California 94035
Reference: B72-10208

Patent status:

No patent action is contemplated by NASA.

Source: Raymond J. Kiraly of
TRW, Inc./Mechanical Products Div.
under contract to
Ames Research Center
(ARC-10408)