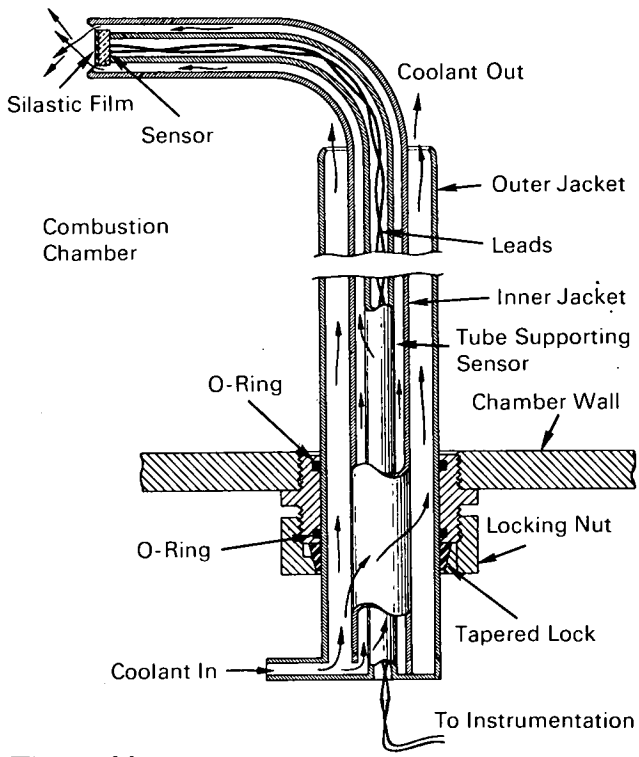
NASA TECH BRIEF

Heat-Resistant Pressure Probe with High-Frequency Response



The problem:

To design a pressure probe for measurement of fluctuations in the detonation-like pressure wave through an engine's combustion chamber. Such a wave is quite steep-fronted; the indicated transit time across a sensing area is roughly 3 μsec. The environment is severe; heat-transfer rates may exceed 50 Btu/in^2-sec—sufficient to burn through a 1-in. chamber in less than 1 sec. Vibration levels exceed 1000 g (peak) at frequencies above 2000 Hz. Temperatures of combustion exceed 2000°F, causing high levels of radiation. For protection from the heat of combustion, available probes consist of tubes through the wall of the chamber; pressure fluctuations transmitted through the gas content of the tubes are sensed by external sensors. Because high-frequency pressure transients are attenuated by the gas in the tubes, a frequency response of several hundred Hertz is about maximum.

The solution:

A novel probe, which has its sensor at its inner tip and in itimate contact with pressure transients. Recorded frequency responses have exceeded 10 kHz, an order of magnitude higher than earlier recordings. The face of the sensor is sprayed with water, permitting almost indefinite operation. The sensor's face bears a film of flexible opaque material, typically silicone rubber, to prevent the high radiation fluxes from heating the quartz crystal and thus changing its electrical characteristics.

How it's done:

The figure shows the device and its double-chambered cooling system. The sensor end of the inner jacket is so shaped that much of the water injected splashes across the face of the sensor, cooling both sensor and leads. The sensor is securely fixed to its supporting tube; it can be moved toward or away from the chamber wall by loosening the tapered lock and nut assembly.

Note:

Requests for further information may be directed to:

Technology Utilization Officer
NASA Pasadena Office
4800 Oak Grove Drive
Pasadena, California 91103
Reference: TSP70-10252

(continued overleaf)

Patent status:

No patent action is contemplated by NASA.

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