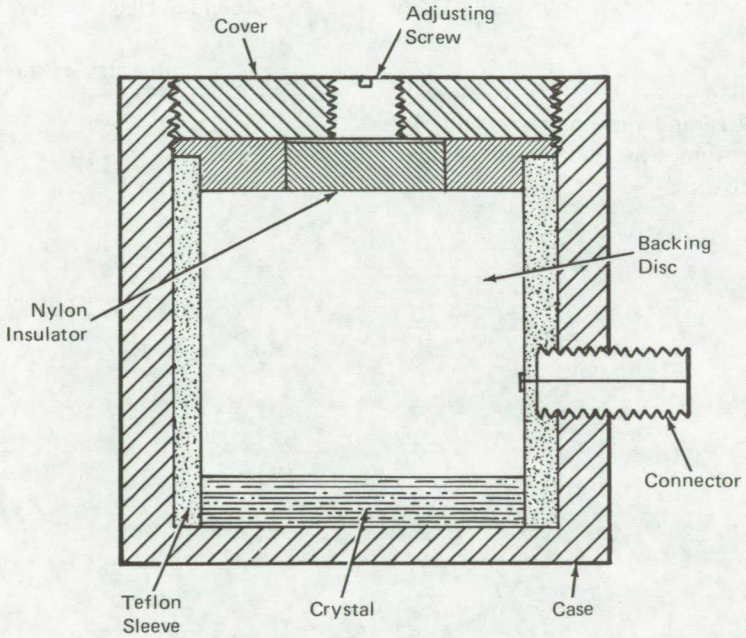
NASA TECH BRIEF

John F. Kennedy Space Center

A Sonic Transducer to Detect Fluid Leaks



TYPICAL TRANSDUCER DESIGN

The problem:

In order to detect leaks in or otherwise monitor moving fluid systems, elaborate chemical or spectrographic techniques are usually used. Time and expense could be saved by a simpler method which could operate at cryogenic temperatures and, if necessary, in a vacuum, but which would, at the same time, not disturb the system being monitored.

The solution:

A versatile ultrasonic detector for the measurement of fluid flow has been developed. The detector covers a wide frequency range and selectively detects spot frequencies or band frequencies for display and "finger print" analysis of gas flow or leakage.

How it's done:

The ultrasonic detector uses a set of contract transducers and band pass filters to detect and analyze the sonic energy produced by the flow or leakage. A sensitive transducer is clamped in direct contact with the item to be monitored. The transducer converts the sonic and ultrasonic energy created by the fluid flow or leak into electrical energy which is then amplified to be presented as an audible signal or to be displayed as a waveform. Tests show that the waveform differs for various conditions of flow and leakage, but at all frequencies tested the waveform is proportional to the flow rate when other conditions are constant. In most cases, the energy produced by flow systems is concentrated in a frequency range of 30 to 50 kHz. This leak detection

(continued overleaf)

system, however, monitors the 1 to 100 kHz range to get better sensitivity and, thus, more information about the flow system.

A typical contact transducer used in this detector system is shown in the figure. A thin disc of lead zirconate titanate, backed by a thick metal disc, is isolated from the surrounding case by a Teflon cylinder. Electrical contacts are made through the backing disc and through the case bottom. Firm contact between the crystal, the backing disc, and the case bottom is maintained by compressing the entire assembly with adjusting screws. Sensitivity and resonant frequency adjustments can be made by varying the degree of compression. A typical transducer has a minimum detectable output of about 5 μV and is part of a channel with an overall gain of about 85 dB.

Notes:

1. This transducer system may be of use in leak detection, wear analysis, and flow measurements in areas such as the automotive, petroleum, public utilities and other industries.
2. The following documentation may be obtained from:
   National Technical Information Service
   Springfield, Virginia 22151
   Single document price $3.00
   (or microfiche $0.95)

   Reference: NASA CR-124618 (N72-12210), Study to Develop Improved Methods to Detect Leakage in Fluid Systems

Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to:

Patent Counsel
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