

# Simple Oscillating Fluid Flow Transducer (Wiggle-wand Flapper)

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A simple, but effective, transducer, that can be used in various oscillating fluid flow (gas or liquid) applications where flow duration and direction are of interest, is the "wiggle-wand flapper". This relatively inexpensive device can be designed and fabricated for under \$100. The "wiggle-wand flapper" consists of two small pieces of sheet steel, typically 1/32 to 1/16 inch thick, welded or brazed together to form a simple cantilever beam. The base of the device can be drilled for attachment to a flow surface with small counter-sunk screws, or it may be cemented to a surface. A 1/32 or 1/16 inch strain gage is cemented on each side of the beam section, as close to the fixed end of the beam as possible.

An enlarged scale version of a typical flapper is shown in Figure 1. This particular "wiggle-wand flapper" was used to detect flow reversal in the intake ports of a large bore reciprocating engine as shown in the sketch in Figure 2. Smaller flappers with thinner beam sections have been employed between stages of a gas turbine compressor to detect flow reversal and have been mounted on the surfaces of various aerodynamic models to study flow distribution. Obviously, the flow obstruction of the flapper is a prime factor of concern in employing this device.

The strain gages are normally good for 200°F, although the use of heat-curing adhesives can extend their range up to 400°F with minimal extra effort and cost. A thin coating of silicone rubber sealant can be used to moisture-proof the strain gage installation.

Simple cantilever beam formulas and fluid mechanics principles are employed to select the size and length of the flapper elements. If the fluid properties are well known, or if calibration is possible, the device can be used for approximate quantitative measurements of fluid velocity. Its best merits, however, are for qualitative use, where the cost of hot film anemometers and other sophisticated flow measuring devices would be prohibitive.

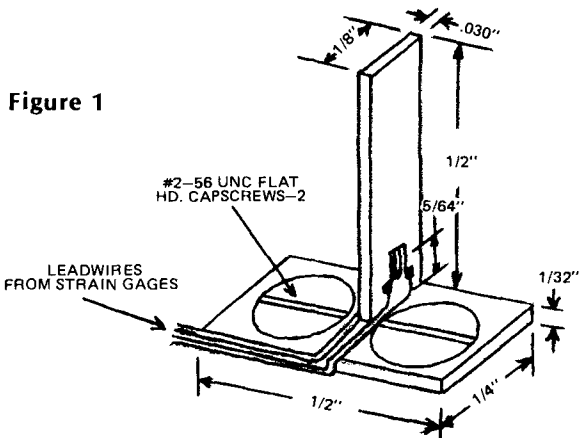
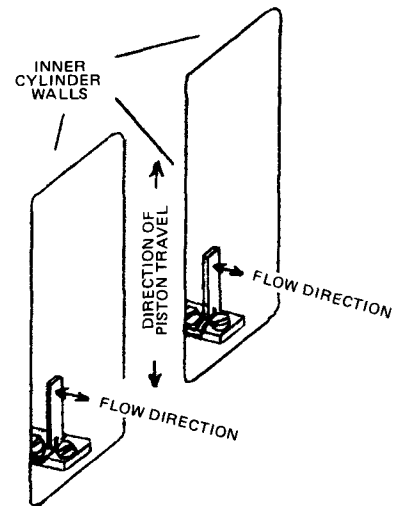


Figure 1

SIMPLE FLUID FLOW TRANSDUCER



FLAPPERS IN BOTTOM OF AIR PORTS

Figure 2

## Calibration Of A Force Washer

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A test was conducted to determine the accuracy of a 3/4" force washer. The force washer was calibrated:

- Between two flat plates (see Figure 1)
- Under the head of a 3/4" bolt (see Figure 2)

In addition, the 3/4" force washer was calibrated on 3/8" and 5/8" bolts. Adapters were used on the smaller bolts to center them in the force washer (see Figures 3 and 4).

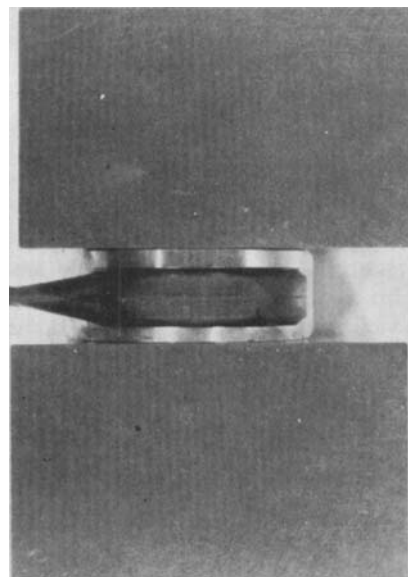


Figure 1