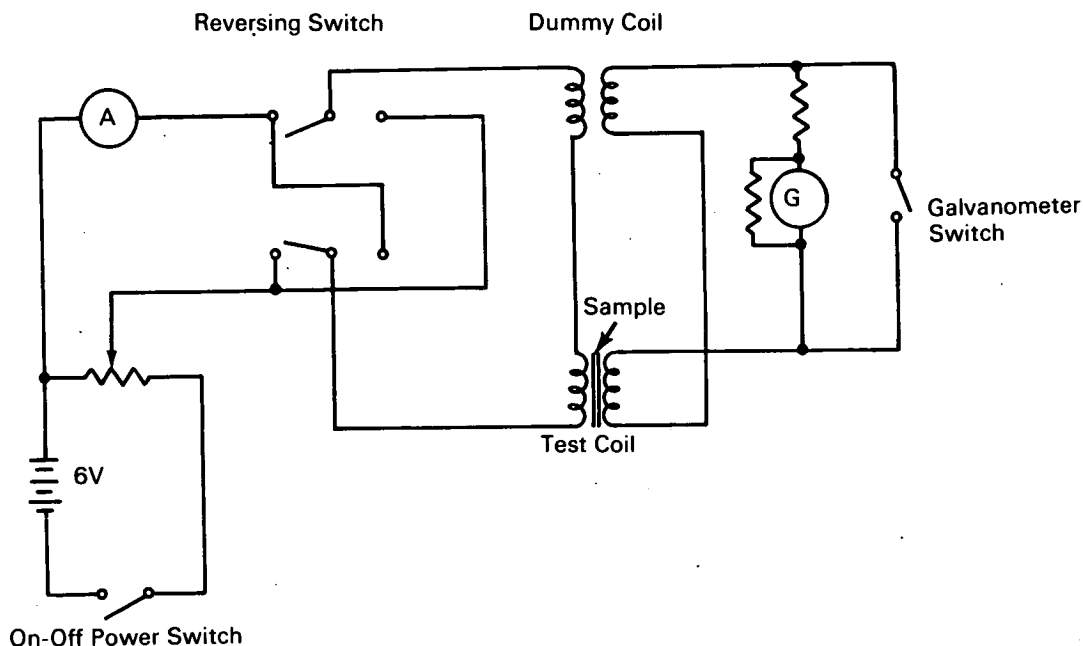


# NASA TECH BRIEF



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## Braze Joint Quality Tested Electromagnetically



### The problem:

To develop a nondestructive test method that would indicate the extent of braze alloy flow in engine injector sleeve-to-post joints. Ultrasonic scanning and radiographic techniques have proved troublesome due to system complexity and joint inaccessibility.

### The solution:

An electromagnetic method that detects the extent of gold/nickel braze alloy flow in an engine injector sleeve-to-post joint.

### How it's done:

By reversing a measured current through one side of a mutual inductor, an instantaneous but measur-

able voltage is induced in the other coil. When a magnetically permeable material is in the vicinity of the two coils, the secondary voltage is increased due to a more efficient coupling of the magnetic flux. The magnitude of the voltage increase is a function of the quantity, permeability, and geometry of the material inserted. The instant testing was aimed at holding the permeability and geometry of the material constant while measuring the effects of altering the quantity of material (braze alloy) present. The geometry effect is, of course, not entirely separable from the quantity of material present.

The sketch illustrates the test setup. Connecting the primary side of the test circuit to the common terminals of the switch provides for reversing the current

(continued overleaf)

in the test system without reversing the current through the ammeter. The test portion of the circuit is comprised of two identically wound mutual inductors and a microvolt detector circuit. The coil primaries are series connected with the power supply so that a current reversal produces twice the inductance of either coil (series aiding). The secondaries are series cross connected so that equal inductance in both coils produces opposing voltage with a net of zero (series bucking). When a magnetic sample is inserted into one coil, the resulting voltages are still opposed, but are of unequal magnitude so that a net measurable voltage is produced in the detector circuit. Using this dummy coil method, readings can be obtained on all samples related to a zero reference. This method also results in greater magnification of differences between samples because the mutual and self inductances of the coils are essentially negligible.

**Notes:**

1. This method could be used to measure magnetic braze alloy flow in any joints of nonmagnetic materials.
2. Inquiries concerning this innovation may be directed to:

Technology Utilization Officer  
Marshall Space Flight Center  
Huntsville, Alabama 35812  
Reference: B67-10333

**Patent status:**

No patent action is contemplated by NASA.

Source: R. D. McKown and D. B. Graves  
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