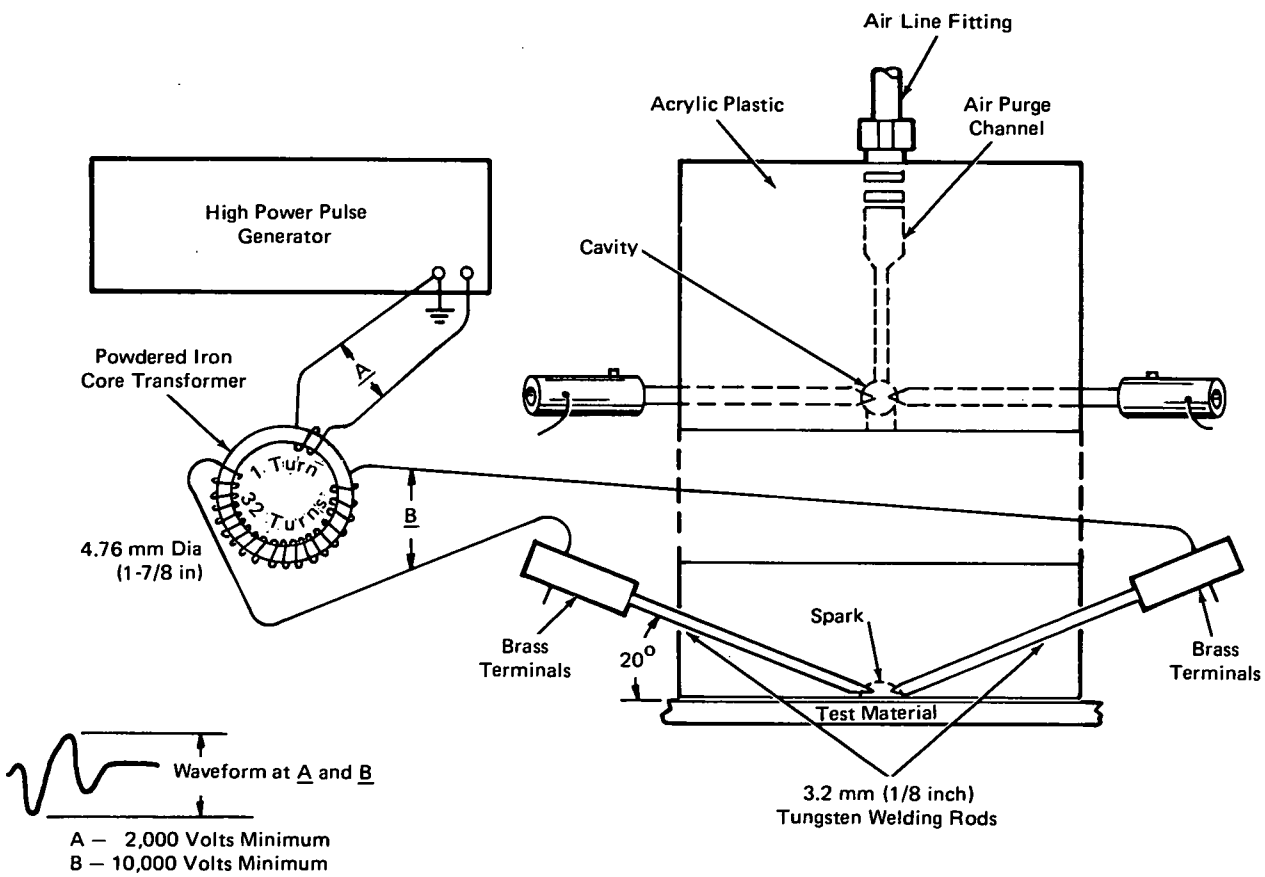
NASA TECH BRIEF

Marshall Space Flight Center

Spark Ultrasonic Transducer



Ultrasonic transducers used for nondestructive evaluation are usually of the crystal element type. A radio frequency pulse is applied to the crystal, causing it to vibrate. These ultrasonic vibrations are transmitted to the materials through liquid or paste couplant. In another method, force is applied to the crystal so that sufficiently intimate contact is made with the material to permit ultrasonic transmission. Because crystal transducers must be used with a couplant or coupling force, their application is limited to materials that are fairly smooth and not newly coated or porous. As a result of these disadvantages in using crystal type transducers, a spark ultrasonic transducer was developed which can induce ultrasonic pulses in materials without physical contact.

As shown in the illustration, a high power pulse generator feeds electrical pulses to the transducer through a step-up powdered core transformer. A 2000-volt minimum peak-to-peak pulse is required for the 1:32 transformer illustrated. (Another transformer operated successfully that had ten primary and fifty second-

(continued overleaf)

ary turns and a slightly larger core. No significant difference in operating characteristics was noted.)

The transformer raises the pulse voltage to that required for sparking. A minimum of approximately 10,000 volts peak-to-peak is required. The output of the transformer is connected to two sharp-pointed 3.2-mm (1/8-inch) diameter tungsten welding rods that have brass sleeve-type terminals. The rods are supported by a nonconductive block of acrylic plastic. (None of the materials is considered critical; other materials may be used to produce the same results.)

The chief advantage of this spark ultrasonic transducer is its ability to induce pulses of ultrasonic energy in solids without actually contacting the surface. No couplant material is required which might contaminate the surface. Also, stress is not applied to the surface of materials, which permits testing of fragile samples. Because surface smoothness and contour problems are relaxed, pulses may be induced in light porous materials, which would otherwise absorb the couplant of other transducers. In addition, because strong ultrasonic pulses are generated in air, complex light materials such as foams, composites, and insulations can be tested. The final important advantage is that the pulses are generated at a point rather than over a broad area as with crystal transducers. This means greater resolution is possible at lower frequencies, which makes scanning applications more attractive.

Note:

Requests for further information may be directed to:

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Patent status:

This invention is owned by NASA, and a patent application has been filed. Inquiries concerning nonexclusive or exclusive license for its commercial development should be addressed to:

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