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NASA TECH BRIEF

Marshall Space Flight Center

Ultrasonic Scanning System for In-Place Inspection of Brazed-Tube Joints

A miniaturized ultrasonic scanning system can be used for the in-place inspection of 0.635 through 1.59 cm diameter (1/4 in. through 5/8 in. diameter) brazed joints, with limited access clearances, in union, tee, elbow, and cross configurations. Tests performed on tube joints containing preplaced defects show that defects of 0.051 cm (0.020 in.) in diameter and larger can be reliably detected using this system.

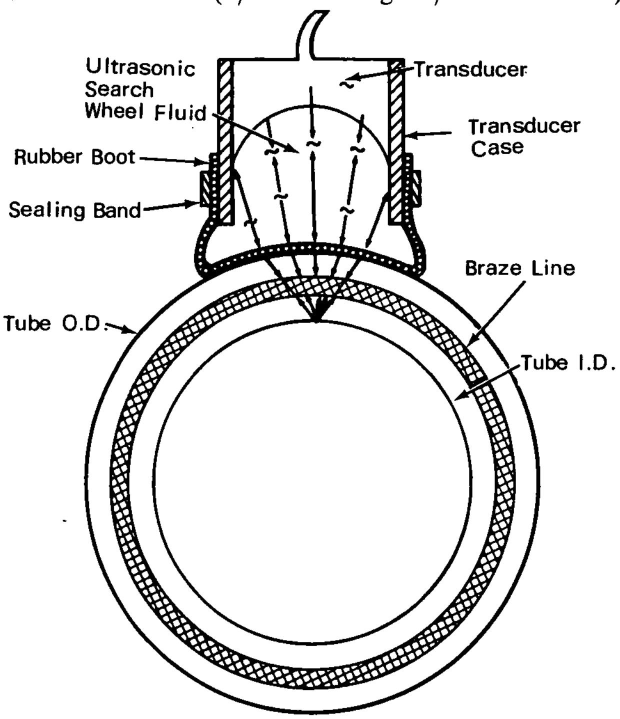

Figure 1. Transducer Position on Tube, Schematic

Figure 1 illustrates the basic principle of the ultrasonic technique employed. Ultrasonic energy from the transducer is focused into the tube under inspection. The transducer is sealed in a liquid-filled flexible rubber boot designed to conform to contour variations in the tube joint. The focused energy is transmitted through the liquid into the tube joint and is reflected from the inner or back surface of the tube wall. Because of a discontinuity in the path of the ultrasonic wave, a loss of ultrasonic energy from the back surface of the tube wall is an indication of a defective brazed area.

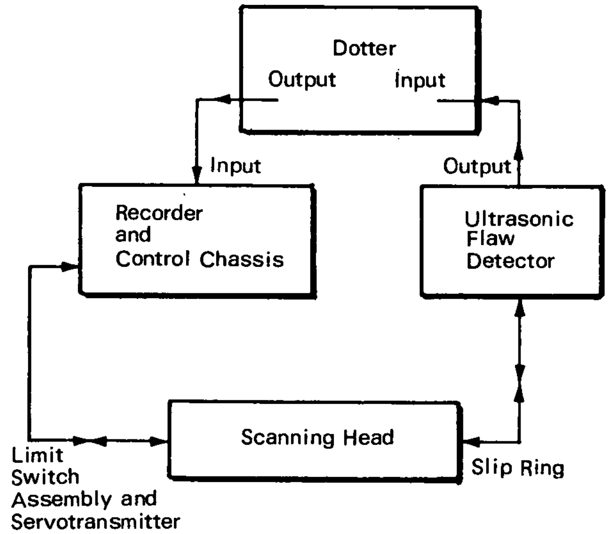

Figure 2. Scanning System, Block Diagram

The system incorporates a scanning head assembly which includes the boot-enclosed transducer, a slip ring assembly, a drive mechanism, and a servotransmitter. A commercially available ultrasonic flaw detector, a prototype recorder, and a special recorder accessory complete the system (Figure 2). The scanning head assembly provides the X-Y scan movement across the area under inspection. The drive mechanism revolves and translates the transducer along

(continued overleaf)

the tube, thus generating a continuous helix. One revolution of the transducer corresponds to one X-scan pass, and its translation along the tube is the Y-travel, as in conventional X-Y scanning modes. Transmit-receive signals flow between the transducer and ultrasonic flaw detector by means of the slip ring assembly.

The servotransmitter tracks the revolution of the transducer around the tube and synchronizes one revolution to one "X" pass of the recorder C-scan printout. The recorder, which provides a developed plan view (C-scan) of the braze-line conditions, is different from conventional facsimile recorders in that the drum containing the helically wound print wire rotates continuously in one direction, rather than reversing for each X-scan. With the special recorder accessory called the "dotter," the recording background is a series of low-intensity (brown) dashes, and braze-defect indications print out as dark (black) lines. The brown-dash background prevents the residue buildup associated with conventional C-scan recordings and provides increased resolution.

For each tube size, a front and rear alignment plate is used to position the joint under test in the center of the scanning head. To test a tube joint, the scanning is placed on a standard tube joint containing preplaced defects of known size, and the alignment plates are adjusted to locate the joint in the center of the head. The limit switches are adjusted for the required scan coverage; the transducer position is adjusted for proper focus; and the instrument is peaked to indicate a defective condition. The scanning heat can now accept and test tube joints of the same size as the standard joints.

Note:

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-TM-X-64558 (N70-42932), Development of Ultrasonic Scanning System for In-Place Inspection of Brazed Tube Joints

Patent status:

No patent action is contemplated by NASA.

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