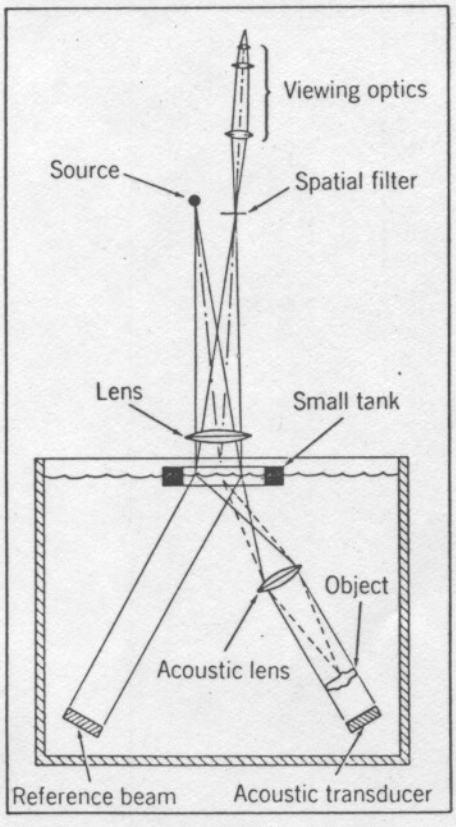
Ultrasonic holography finds hidden flaws inside products

Blind openings or ports and the innards of sealed assemblies are no longer immune to the probes of skilled product testers. By using ultrasonic holography, they can see voids, cracks, particle distribution, and bonds and non-bonds, and they can check the general internal structure or operation of metal and plastic parts, graphites, composites, and ceramics.

Introduced by Holotron Corp., Newark, Del., the new nondestructive testing technique is the first commercial application of this promising branch of holography. Holotron is owned jointly by Du Pont and Scientific Advances, Inc.

The operator can study the interior of an object being tested while he orients it to select the best viewpoint from which to check the location, depth, and relationship of several parts to each other in recesses that otherwise would be hidden from view. Motion within an object also may be watched.



Illuminated by a laser, the hologram generated in the small tank by the ultrasonic transducers is converted by the optical system into a visual image.

How it works. The object to be analyzed is submerged in a tank of water. Although the maximum field of view is about 5 in. wide, the tank accommodates larger objects; these can be tested by passing them through the field of view. The test objects can be several inches thick, depending on the degree to which they absorb and reflect light.

Four operating frequencies are available so the operator can choose the best balance of penetration, depth of focus, and fineness of detail for his particular purpose. Penetration thicknesses vary from less than an inch for materials such as foamed plastics to several inches for metals. Maximum resolution is 0.01 in.

A beam of very-high-frequency (usually 3 to 9 MHz) sound waves, called ultrasound by the company, is used to scan the submerged object. While passing through the object, the ultrasonic beam is altered by absorption, reflection, refraction, and scattering. When it emerges from the object, it carries information about the configuration and composition of the part.

This information, with the beam, is focused by an acoustic lens onto a detecting surface to generate an interference pattern, or hologram. Simultaneously, a laser illuminates the hologram to reconstruct the ultrasonic image carried in the original beam.

The reconstructed image then is focused by the optical system and displayed on a ground-glass screen, where the operator may view it directly, or onto a photographic plate for a permanent record. Snap-on film holders are available to hold 4 x 5-in. Polaroid or cut film. The ground-glass screen also may be replaced by a microscopic viewer or a television readout system.

While the pictures resemble X-rays, they contain additional information not seen by other forms of radiation.

Closer look at optics. The standard optical system includes an f/6 lens for depth of field and an f/1.2 lens for minimum energy losses. Specimens up to 10 in. thick can be viewed with the f/1.2 lens, while the f/6 lens penetrates objects up to 24 in. thick. (Thickness refers to the length of the specimen along the optical path.)

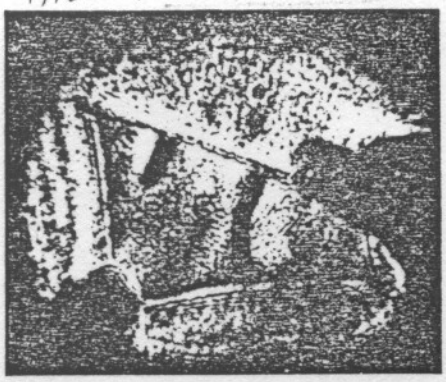


Image of brass wedge held by operator shows holes drilled into sides of part.

Daniel S. St. John, president of Holotron, describes the future commercial possibilities of holography in the field of nondestructive testing as "enormous." However, he finds it difficult to predict specific applications. Three-dimensional television has been discussed at the company, but St. John feels that highly sophisticated testing and inspection devices and information-storage systems have more immediate commercial significance.

Another possibility is inspection of objects in rapid motion with a pulse laser capable of stopping motion at the equivalent of a photographic exposure of one-hundred-millionth of a second. **(2.351; 1.27; 1.241)**

Lead-phosphate coating lubricates steel die

Designers of deep-drawn products such as automotive and aircraft parts, appliances, tanks, and agricultural equipment can expect to save both material and production time by adopting a new mill-applied coating developed by Youngstown Sheet & Tube Co.

The coating, which is called "duxtal," reportedly cuts the amount of die lubricants used, and can even do away with them altogether. It also lets the manufacturer save on parts cleaning, reduces scrap, improves surface finish, and resists rust.

Ductile. Youngstown describes its product as a lead-phosphate coating for hot- and cold-rolled sheet and for low-alloy steels in flat lengths and coils. Dry and ductile, it elongates with the surface during mechanical working. In continuous stamping operations, the coating is said to im-

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