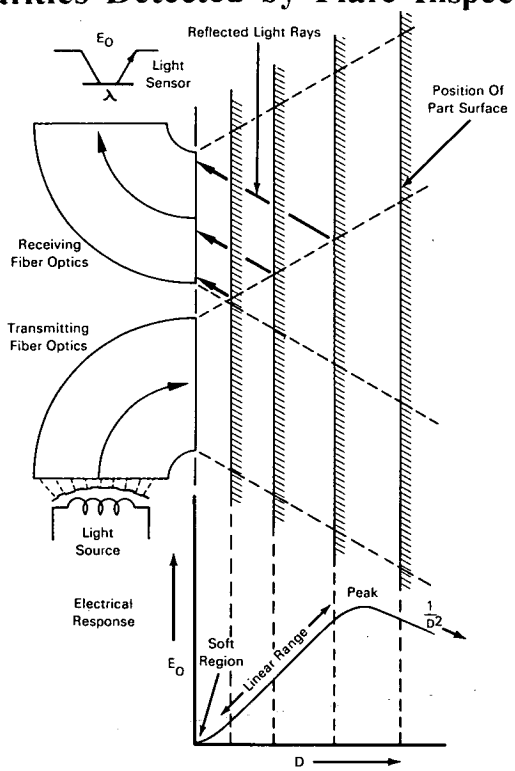
NASA TECH BRIEF

Surface Irregularities Detected by Flare Inspection Instrument



PRINCIPLE OF FIBER OPTICS DISPLACEMENT MEASUREMENTS

A fiber optics sensing device has been developed to detect surface irregularities in a specific tube flare. The portable device permits a large number of discrete dimensional measurements to be taken, scanned and read out with only one setup. High resolution measurement of distances down to minute units of length can be achieved. This instrument is intended to inspect a specific flare (MSFC Design Standard MC 146); however, the capabilities of the device could be expanded to include surface inspection of other kinds of tube flares, and surfaces (flat or curved) of other parts where precise inspection of conditions is required.

The inspection is accomplished through the use of fiber optics associated with a fixture consisting of male and female gauge pieces configured to embrace the interior and exterior lip portions of the flare to be inspected. The fiber optics consist of a number of discrete bundles of light pipes with the ends of the bundles arranged on the gauge in a pattern of measuring points. Each measuring point is composed of transmitting and receiving fibers. The transmitting fibers in each bundle lead to a common light source.

(continued overleaf)

The remaining fibers in the bundle are receiving fibers and lead to an independent light sensor, with one light sensor for each bundle. Light emitted from the transmitting fibers is reflected to the receiving fibers by the surface being inspected. The reflected light is transmitted through the receiving fibers and is emitted to a pick-off device. The amount of light being reflected is a measure of the distance between the surface being measured and the end of the bundle (see note 1) and is converted into an electrical signal proportional to that distance. (Scanning circuitry is provided to systematically activate and interrogate the fiber optics bundles.) Electronics are provided for activating the fiber optics, for activating the scanning functions, for receiving, amplifying and displaying the scanned data, and for determining the distance being sensed and the deviation from standard.

Notes:

1. Basically, the amount of light which strikes the receiving fibers is determined by the distance from the surface under inspection to the ends of the fibers. If this distance is zero, obviously no light will be received because the transmitting fibers are prevented from emitting light. As the distance increases, the amount of light increases until a distance of approximately twice the fiber diameter is reached. Beyond this distance the amount of received light falls off, becoming proportional to the reciprocal of the square of further increase in distance.
2. Documentation is available from:
   Clearinghouse for Federal Scientific and Technical Information
   Springfield, Virginia 22151
   Price $3.00
   Reference: TSP69-10152

Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D.C. 20546.

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