NASA TECH BRIEF

Marshall Space Flight Center

Laser-Actuated Holographic Storage Device

The problem:

The automatic selection of one out of thousands of pages in a holographic memory system is a formidable task. The attempts that have been made to fabricate high-vacuum tubes which would use photoemitted electrons, to selectively heat desired holographic locations, have failed because of cesium contamination of the storage device.

The solution:

A new laser-actuated storage device permits the automatic selection of holographic pages by using a laser beam.

How it's done:

The operation of the laser-actuated storage device is as follows. Constant power is applied to the conducting ground plane through a dc current between points A and B (see Figure 1). A uniform charge distribution is maintained over a useful portion of the storage medium through a corona-discharge chamber. In the presence of the uniform and continuous corona-discharge stream, the constant power bias is of sufficient magnitude to maintain the laser-actuated holographic storage device, at a temperature just below the thermal threshold of the storage medium.

The laser beam then is addressed to the desired location; absorption of the beam by the light-absorbing film increases the temperature locally at the desired holographic page address. The additional temperature increment causes the temperature to increase beyond the threshold of the storage medium; and a hologram is either written or erased, depending upon the specifics of a laser-beam modulation (see Figure 2). For example, if a deformable media such as microcrystalline wax is used, then the bias temperature T_o would be as shown. In the figure, the temperature T_o lies just below the temperature beyond which an abrupt change in viscosity occurs. It is desirable to bias thermally the laser-actuated device as close as possible to the "knee" of the viscosity-versus-temperature curve. In this manner, the temperature change (ΔT) necessary to effect an adequate viscosity reduction during the writing or erasing of a hologram, is held to a minimum. Since the laser beam supplies the energy requisite to the temperature change, a small temperature change means less energy is required from the laser.

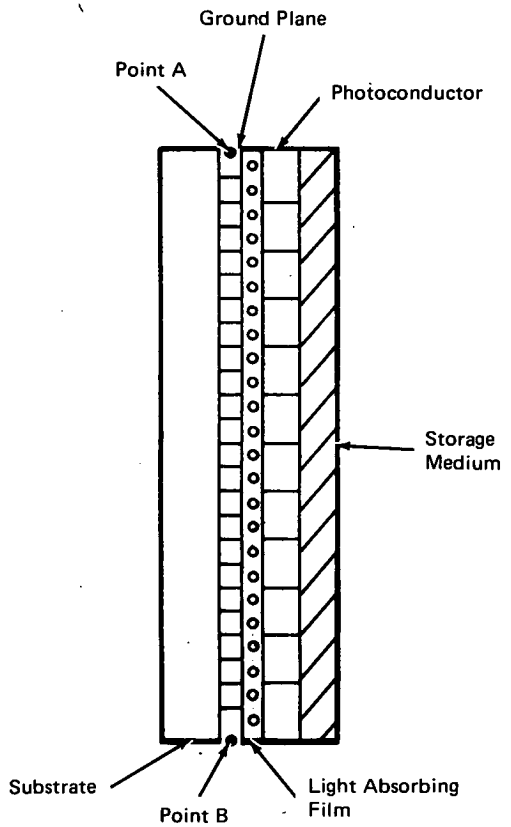

Figure 1. Laser-Actuated Storage Device

(continued overleaf)