5.3 RECONSTRUCTING AND VIEWING THE HOLOGRAPHIC IMAGE

When the hologram plate is illuminated by a laser beam identical to the reference beam which was used to record the hologram, an exact reconstruction of the original object wave front is obtained. An imaging system (an eye or a camera) located in the reconstructed beam 'sees' exactly the same scene as it would have done when viewing the original. When the lens is moved, the image changes in the same way as it would have done when the object was in place. If several objects were present when the hologram was recorded, the reconstructed objects move relative to one another, i.e. exhibit parallax, in the same way as the original objects would have done. It was very common in the early days of holography to use a chess board as the object and then take photographs at several different angles using the reconstructed light to show how the relative positions of the chess pieces appeared to change.

A holographic image can also be obtained using a different laser beam configuration to the original recording object beam, but the reconstructed image will not match the original exactly. When a laser is used to reconstruct the hologram, the image is speckled just as the original image will have been. This can be a major drawback in viewing a hologram.

White light consists of light of a wide range of wavelengths. Normally, if a hologram is illuminated by a white light source, each wavelength can be considered to generate its own holographic reconstruction, and these will vary in size, angle, and distance. These will be superimposed, and the summed image will wipe out any information about the original scene, as if superimposing a set of photographs of the same object of different sizes and orientations. However, a holographic image can be obtained using white light in specific circumstances, e.g. with volume holograms and rainbow holograms. The white light source used to view these holograms should always approximate to a point source, i.e. a spot light or the sun. An extended source (e.g. a fluorescent lamp) will not reconstruct a hologram since its light is incident at each point at a wide range of angles, giving multiple reconstructions which will "wipe" one another out.

HOLOGRAPHIC NON-DESTRUCTIVE TESTING

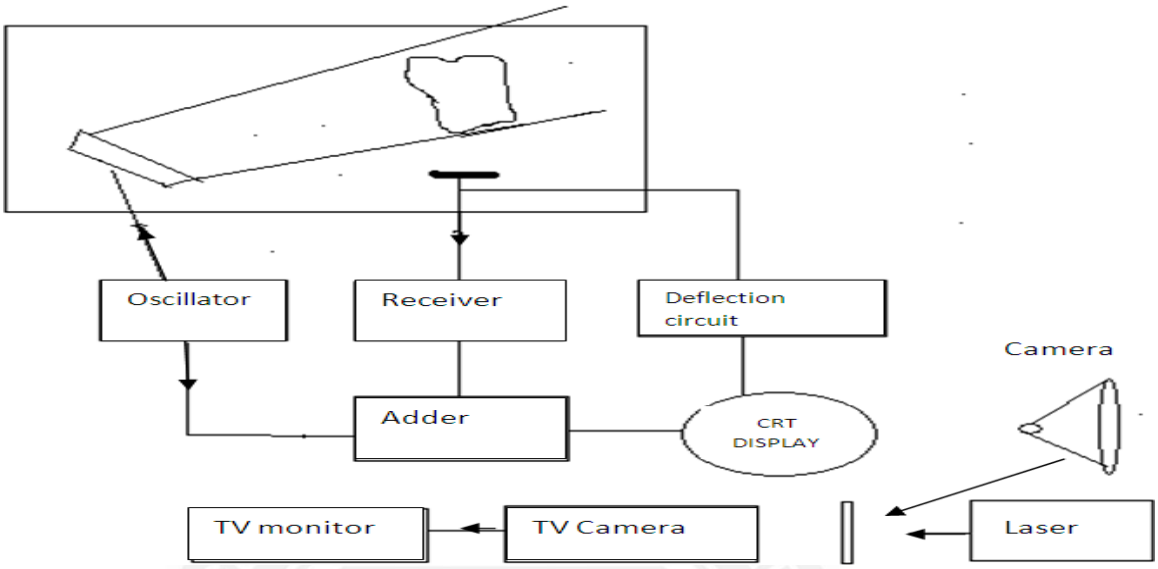

Figure 5.3.1 Material Removal Process

[Source: "Optical Fibre Communications" by J.M.Senior, Page:591]

A single large ultrasonic transducer which sends out ultrasonic waves towards the object under study and it scans the object. The scattered waves from the object from the object waves. A received transducer collects the scattered object wave and converts them into electrical signals. The reference electrical waves are given by the RF oscillator and these object to reference waves are made to interference by the electronic adder. The interference pattern is formed on the fluorescent screen of the cathode photographic film is developed.

The developed photographic film serves as a hologram. The hologram is illuminated by a low power laser like He- Ne laser which acts as the optical reference source. The T.V camera takes the videograph of the 3 D image of the object and it displays on the T.V monitor

Applications of holographic interferometry	
Field	Applications
Aerospace	Defects in honeycomb plates Testing of construction materials,

	Testing of welding methods Inspection of rocket bodies Flow visualization in wind tunnels Vibration modes of turbine blades
Automobiles	Testing of oil pressure sections Testing of welding methods Research in construction of automobile bodies Construction of engines
Machine tools and precision instruments	Measurement of deformations of machine parts, jigs and tools Measurement inside cylinders Measurements of stiffness (heat, static or dynamic) Analysis of construction of instruments and tools
Electrical and electronic industries	Vibration modes of turbine blades, motors, transformers, loudspeakers Testing of welding and adhesion Testing of circuit parts Analysis of audio equipments Leak test of batteries
Civil Engineering	Analysis of constructions Design of pipes Research in concrete.
Chemical industry	Measurement of mixed fluids. Tyre, rubber and NDT of tyres, plastics Testing of molded products Measurement of adhesion defects
Medicine	Measurement on living bodies Chest deformation due to inhalation Measurement on teeth and bones Testing materials for dental surgery

	Testing of urinary track Measurement on eyes, ears, etc.
Musical instruments	Measurement of vibration modes
Cultural articles and paintings	NDT and restoration.