RECONSTRUCTION, IN WHITE LIGHT, OF INTERFERENCE-PATTERN IMAGES PRODUCED BY HOLOGRAMS OBTAINED BY DOUBLE EXPOSURE

I. S. Klimenko, E. G. Matinyan, and G. I. Rukman
Central Research and Testing Institute of the Defense Ministry
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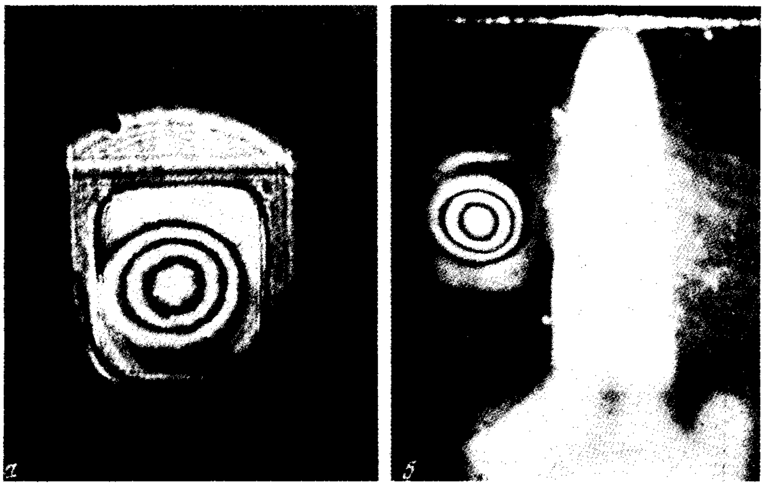
We observed the resconstruction, in white light from an extended source, of the images of interference pattern produced by doubly exposed holograms.

The objects for the holograms, which were recorded by the double-exposure method [1-5] in accordance with the Fresnel scheme, were glass plates and certain types of crystals. The hologram of the initial state was obtained as a result of interference between two homogeneous laser light beams. When the obtained hologram was illuminated by a broad laser beam, we could observe the interference pattern, which was a picture of equal-thickness fringes, in all sections of first-order diffraction beams.

In the case of reconstruction in white light, the interference pattern is observed visually in the direction of the first diffraction maxima, and constitutes a segment of a continuous spectrum cut up by dark bands. When the hologram is moved relative to the line between the eye and the source, a change (shift) takes place in the spectral coloring, but the band positions remain unchanged. A similar picture is observed also in reflected light. It must



Photograph of reconstructed image of interference pattern in cases when the light source is a laser (a) or a candle (b).

be noted that the observer sees the image of the interference pattern localized on the surface of the hologram. The figure shows by way of a comparison two interference patterns of a KDP crystal with a laser and a candle as sources.

The observed phenomenon agrees with the notion that moire patterns of the fringes are produced when two diffraction gratings with slightly different periods are aligned (the change of the period of the hologram-grating in the second exposure is due essentially to the fact that the plates are slightly wedge-shaped and the ends of the crystals are slightly rounded), as a result of which the diffracting properties of the gratings are slightly altered and the spectrum is accordingly distorted.

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OBSERVATION OF QUANTUM OSCILLATIONS OF CONDUCTIVITY IN THIN ANTIMONY FILMS

Yu. F. Komnik and E. I. Bukhshtab
Physico-technical Institute of Low Temperatures, Ukrainian Academy of Sciences
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The quantum size effect in thin films, consisting in the appearance of an oscillatory dependence of the kinetic characteristics of films on their thickness, is considered in a number of theoretical papers [1,2]. The first to report experimental observation of this effect in Bi film were Ogrin et al. [3]. The presence of quantized states in Bi films was confirmed in [4] with the aid of the tunnel effect. It must be noted that observation of a clear-cut dependence of the electric characteristics of thin films is hindered by the fact that the properties of thin films are not exactly reproducible, and that the characteristics exhibit a large scatter. This is due to the inflence of many often-uncontrollable parameters describing the condensation conditions and determining the scatter of the structural characteristics of the films, thus affecting in turn the scatter of their electric properties. Attempts to solve this problem by using many samples are quite hopeless in the case of antimony, since the expected period of the oscillations is in this case 30 Å (as against about 400 Å for Bi).

We investigated antimony films using samples of variable thickness. They were in the form of long strips (1 x 70 mm) with potential leads ("whiskers") every 2 mm. The thickness variation of the sample (by an approximate factor of 2) was effected by naturally varying the density of the molecular beam in space while the metal was being evaporated from a cylindrical crucible. The density distribution of the molecular beam was investigated by us in preliminary experiments. The film thickness (up to 300 Å) was determined with the aid of a plot we obtained for the optical density S of the Sb films vs. the thickness d by a method described in [5].

When the antimony is condensed on a substrate of room temperature, an amorphous phase is produced at first. When a thickness exceeding 100 Å is reached, crystallization in the film begins [6] and spreads from the thicker to the thinner region. According to our observations, the boundary of the crystallized region in a film of variable thickness corresponds to a critical thickness d_c = 80 - 90 Å, at which a transition occurs from a continuous layer of amorphous antimony to an island structure having no conductivity. The crystallization of the amorphous antimony is due to the production and growth of spherolites - polycrystalline for-