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Identification of the Optical Signals by Means of a Lensless Fourier Hologram

In the paper it has been pointed out that the lensless hologram of the Fourier type, which was first described by G. W. Stroke [1] may be employed for identification of the optical signals represented in the form of a transparency, if a diffuse illumination is applied to the transparency being holographed. A filter of that kind is not required to be exactly positioned as it is the case for the Vander Lugt filter, where the filtering is performed in the Fourier spectrum plane.
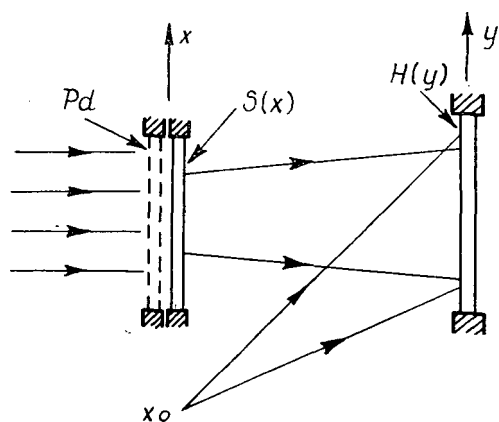

Fig. 1. Producing the Fourier hologram with the diffused illumination. Notation: P_d — diffusing plate, $S(x)$ — transparency with a registered signal, X_0 — reference point and $H(y)$ — registered hologram
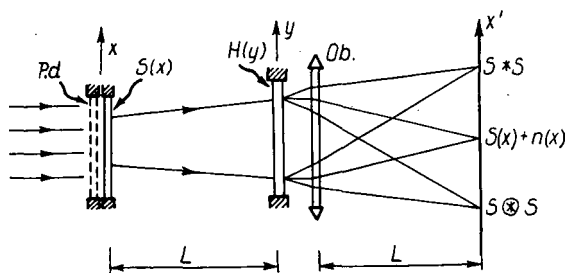

Fig. 2. Fourier hologram operation as a correlation filter. Notation: P_d — diffusing plate, $S(x)$ — transparency with a signal to be examined, $H(y)$ — hologram, Ob — objective, X — image plane, $S*S$ — correlation signal and $S*S$ convolution signal
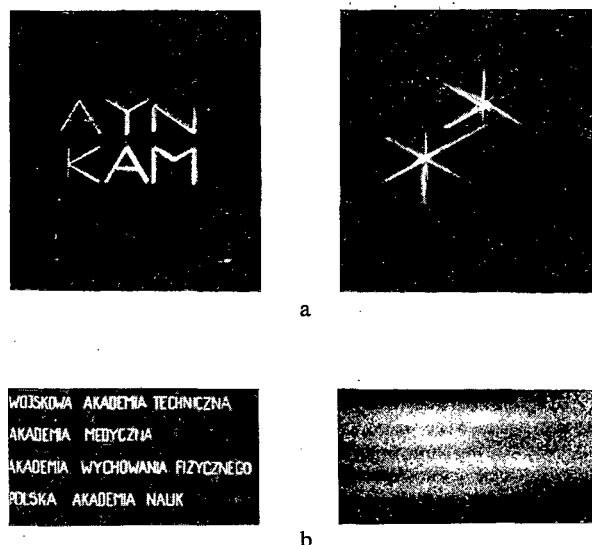

Fig. 3. Results of the filtration with the help of the Fourier hologram: on the left hand side signals to be examined, on the right hand side correlation signals a) for a letter A, b) for the word AKADEMIA

From the methematical relation it has been concluded that the hologram produced with the diffused illumination of the transparency is supposed to give at the optical signal output an autocorrelation of the signal for which the hologram has been made. This is confirmed by the experimental results (see Fig. 3).

References

[1] STROKE G. W., Appl. Phys. Lett. (1965), 201.
[2] VANDER LUGT A., J. Opt. Soc. Am. (1963), 1941.

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