

10th International Symposium on Display Holography
Saint Petersburg, Russia 28 June – 03 July, 2015

**«EXPERIMENTAL STUDY OF THE METHOD OF RECORDING COLOR
VOLUME HOLOGRAPHIC STEREOGRAMS ON DIFFERENT
PHOTOSENSITIVE MATERIALS ON THE BASE OF THE DIFFUSER WITH A
NARROW SCATTERING INDICATRIX OF LASER RADIATION»**

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Objective: Producing a new type of security holograms - multicolored holographic stereograms with a variety of security features on the photosensitive medium of large thickness

Tasks work

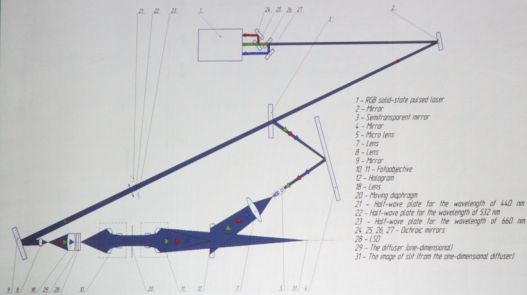
1. Reducing the time production of color holograms as a holographic stereograms.
2. Improve the image quality reconstructed from holographic stereograms.

Stages work

1. One-parallax and full-parallax holographic stereograms production by using one-step and two-step schemes with a diffuser with wide scattering indicatrix in a subject branch. Quality analysis of the obtained holograms.
2. Full-parallax holographic stereograms production by using two-step schemes without a diffuser in a subject branch. Quality analysis of the obtained holograms.
3. Recording of the holographic diffuser with narrow scattering indicatrix.
4. Full-parallax holographic stereograms production by using two-step schemes with a diffuser with narrow scattering indicatrix in a subject branch. Quality analysis of the obtained holograms.

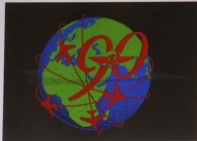
**1 Recording of the reflective monochrome and multi-color one – parallax holographic stereograms with a different visually observed effects
(using a diffuser with a wide scattering indicatrix in the subject branch)**

Optical scheme for the production of the reflective one – parallax monochrome and multi-color holographic stereograms by one-step scheme

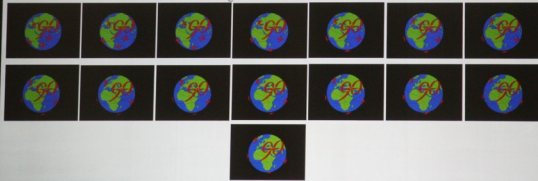


1.1 Production of the reflective multi-color one – parallax holographic stereograms with a motion effect

3-D model for the reflective multi-color one – parallax holographic stereograms with a motion effect



Number of the 15 color aspect angles for the reflective multi-color one – parallax holographic stereograms with a motion effect



1.2 Production of the reflective multi-color one – parallax holographic stereograms with a motion effect

Number of 15 aspect angles of RED component



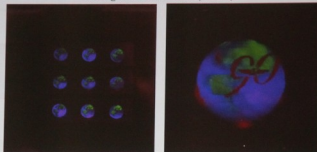
Number of 15 aspect angles of GREEN component



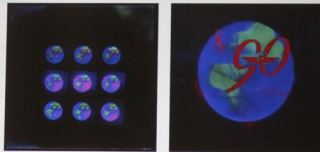
Number of 15 aspect angles of BLUE component



Photos of the images, reconstructed from the holographic stereogram «AeroFlot 90» (14 mm)



Photos of the images, reconstructed from the holographic stereogram «AeroFlot 90» (19 mm)



Video of images , reconstructed from the reflective multi - color one - parallax holographic stereograms (with 3D and motion - effects) (14 mm)



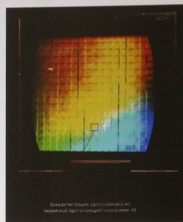
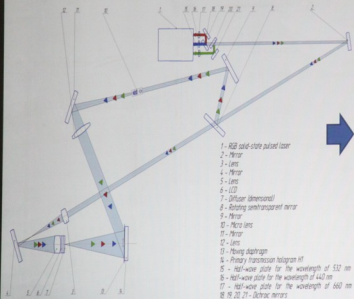
2 Production of the reflective multi-color full – parallax holographic stereograms

(step 1 – production of transmissive hologram H1)

(by using of diffuser with wide scattering indicatrix in a subject branch)

2.1 Scheme for the production of the reflective full – parallax multi-color holographic stereograms (step 1)

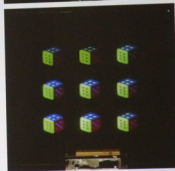
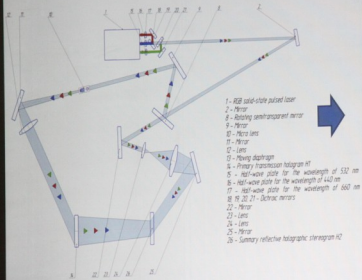
Photo of hologram H1 with selected area of one aspect angle



Production of the reflective multi-color full – parallax holographic stereograms (step 2 – production of master hologram H2)
 (by using of diffusor with wide scattering indicatrix in a subject branch)

2.2 Scheme for the production of the reflective full – parallax multi-color holographic stereograms (step 2)


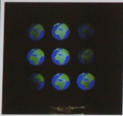
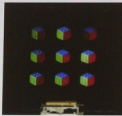
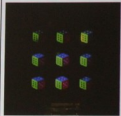
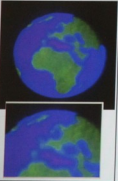

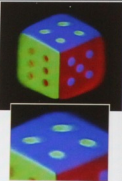
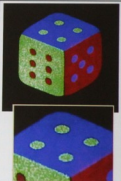
Photo of reflective full – parallax multi-color holographic stereograms



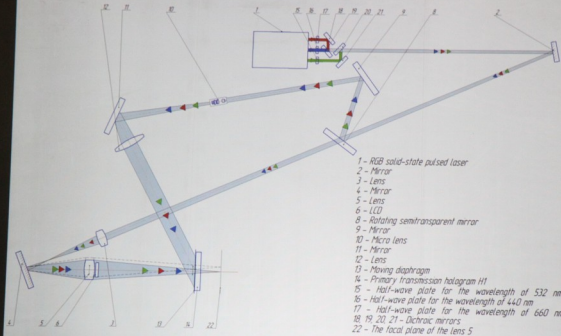
Video of images, reconstructed from the reflective multi-color full-parallax holographic stereograms (with 3D effects)



2.3 Disadvantages of the images reconstructed from reflective multi-color full – parallax holographic stereograms by dotted and distributed source

	Reconstruction by distributed source	Reconstruction by dotted source	Reconstruction by distributed source	Reconstruction by dotted source
Matrix of the full – parallax holographic stereograms				
Images, reconstructed from the one full – parallax holographic stereogram				

3. Production of the reflective multi-color full – parallax holographic stereograms
(step 1 – production of transmissive hologram H1)
(without diffusor in a subject branch)



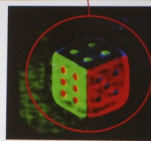
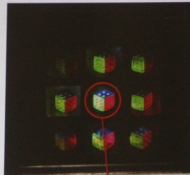
3.1 Photos of transmissive hologram H1, produced without a diffusor, and final holographic stereogram

Photo of hologram H1, produced without diffusor



Area of recording of one aspect angle on hologram H1

Photo of images, reconstructed from holographic stereograms



The increased image reconstructed from the holographic stereogram

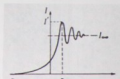
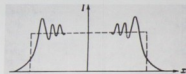
3.2 Technical and physical problems identified in reflective multi-color full-parallax holographic stereograms by a two-stage scheme (without the use of a diffuser in the subject branch - in the first stage)

The effect of "delineation" in the image, reconstructed from the final holographic stereogram

Increasing the brightness of the image near the contours of objects

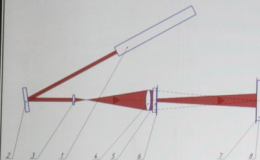


Explanation of parasitic diffraction pattern on the contours (edges) of image elements



4 Production of holographic diffuser with narrow indicatrix

The scheme for obtaining holographic diffuser with a narrow scattering indicatrix (1,5..2 deg)



- 1 - He-Ne gas laser
- 2 - Mirror
- 3 - Lens
- 4 - Lens
- 5 - Glass diffuser with wide indicatrix
- 6 - Diaphragm
- 7 - Diaphragm
- 8 - Holographic diffuser with a narrow indicatrix

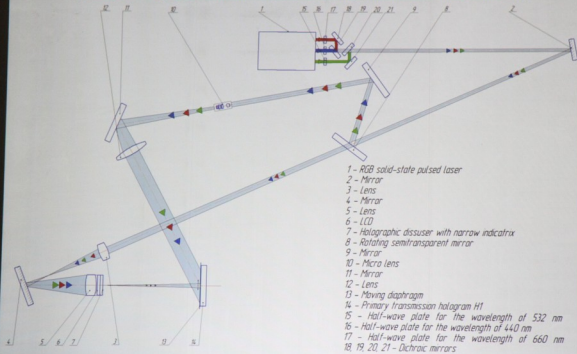
Photo of stand for production of holographic diffuser with a narrow scattering indicatrix



- 1 - He-Ne gas laser
- 2 - Mirror
- 3 - Lens
- 4 - Lens
- 5 - Glass diffuser with wide indicatrix
- 6 - Diaphragm
- 7 - Diaphragm
- 8 - Holographic diffuser with a narrow indicatrix

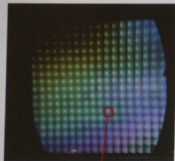
5 Production of the reflective multi-color full – parallax holographic stereograms (step 1 – production of transmissive hologram H1)

(by using of holographic diffusor with narrow scattering indicatrix in a subject branch)



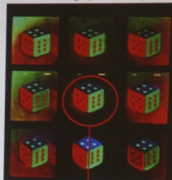
5.1 Photos of transmissive hologram H1, produced with a holographic diffusor, and final holographic stereogram

Photo of hologram H1, produced with using of holographic diffusor with narrow scattering indicatrix



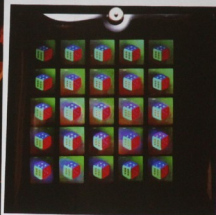
Area of recording of one aspect angle on hologram H1

Photo of images, reconstructed from reconstructed from holographic stereograms

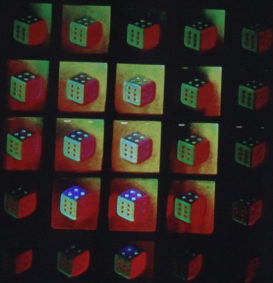


The increased image reconstructed from the holographic stereogram

5.2 Photo stand for matrix holographic stereograms (primary hologram H1 obtained using the diffuser with a narrow scattering indicatrix) and the final master - matrix holographic stereograms on photopolymer Bayfol - HX

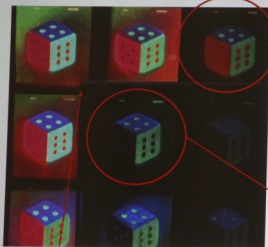


Video of images reconstructed from the reflective multi-color full-parallax holographic stereograms (with 3D effects)

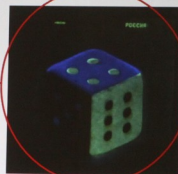
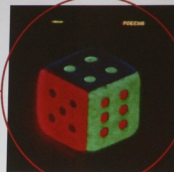


5.3 Improving the quality of microtext by spectral filtering the image using a color filter

A fragment of holographic stereograms matrix



Color blue - green filter «C3C - 22»



Conclusion

1. An optical schemes of the colored holographic stereograms production using a diffuser with wide emission indicatrix in a subject branch are obtained. Samples of the master - matrices of one - parallax and full - parallax holographic stereograms are obtained .
2. An optical schemes of the colored holographic stereograms production without diffuser in a subject branch are obtained. Samples of the master - matrices of full - parallax holographic stereograms are obtained. The problems of the quality reduction of holographic image are shown.
3. An optical scheme and the stand for holographic diffuser with a narrow radiation are obtained. Samples of holographic diffuser with a narrow radiation are produced.
4. An optical schemes for the master - matrices in the form of colored holographic stereograms using a diffuser with a narrow radiation in the subject branch are obtained. Master - matrices in the form of colored holographic stereograms are produced. It has been shown that when using the diffuser with a narrow radiation improves image quality, reconstructed with holographic stereograms of this type. It is shown that time of reception of this type holographic stereogram is reduced from 15 hours to 20 .. 5..7 hours (compared with holograms obtained using a diffuser with a wide emission indicatrix)