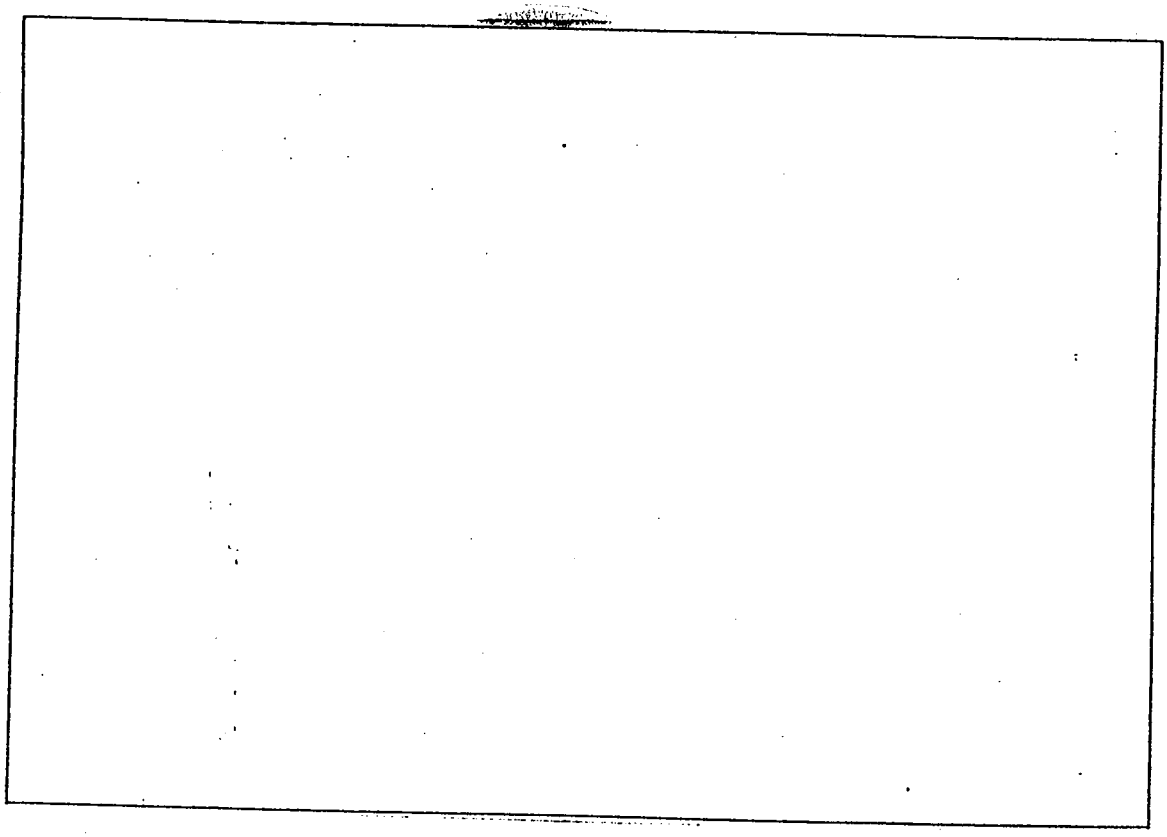
SINGLE BEAM REFLECTION HOLOGRAM
(for 4 by 5 and 8 by 10 inch Holograms on the EXPERIMENTAL TABLE)



SKETCH THE SET UP IN THE BOX ABOVE

PARTS LIST

1. LASER
2. SHUTTER
3. SPATIAL FILTER
4. 8 by 10" MIRROR in GOALPOST CONFIGURATION with TWO MAGNETIC BASES and RIGHT ANGLE CLAMPS
8. WELL-FIXTURED DIFFUSELY REFLECTING OBJECT
6. 4 by 5" PLATEHOLDER ASSEMBLY (if necessary)
7. 10 by 12" MIRROR in GOALPOST CONFIGURATION with TWO MAGNETIC BASES and RIGHT ANGLE CLAMPS (optional)
8. BAFFLES

ALIGNMENT AIDS:

9. CLEAN GLASS PLATE
10. GNOMON
11. OFFITIAL RULER

APPROPRIATE OBJECTS

The objects themselves must be stable and reflective. Paper, most food, and thin-walled hollow plastic things are constantly moving. Paper could be dry-mounted to something thicker; hollow things could be filled with sand or something similar. Plaster or clay could be used, but should be well-cured.

Solid metal objects are stable but may sometims be too reflective, and only specular highlights may come out due to the harsh point source lighting of the **SPATIAL FILTER**. A dulling spray may be necessary.

Green, blue and black objects will not come out due to poor reflectivity of the red beam. When in doubt, look at the **Object** under **Laser Light**. Yellow, orange, red, white, silver and gold work quite well. The favorite permanent spray paint for peak holographic performance is **Krylon #1401 Bright Silver**, as its pigment is small particles of aluminum, which not only is highly reflective, but preserves the polarization of the incoming beam to a certain degree.

Objects may be temporarily colored by hair sprays that will reflect well but may not stick to everything. They are usually carried at venues that cater to alternative culture*.

SET UP STEPS

1. Send the Beam from the **LASER** held in its usual position at the end of the **ISOLATION TABLE** to the center of an **8 by 10" MIRROR** held between two **MAGNETIC BASES** in the GOALPOST manner. Check for the **OFFICIAL BEAM HEIGHT** with the **OFFITIAL RULER** at the **MIRROR**.

2. Direct the Beam from **MIRROR (4)** diagonally across the Table to the opposite corner. Check for the **OFFICIAL BEAM HEIGHT** with the **OFFITIAL RULER** at the last **MIRROR** and tilt **MIRROR (4)** if necessary.

3. If the **OBJECT** is to be mounted on its back on the **Tabletop** or stood upright (See the **Handout, SBR Variations**) another **LARGE MIRROR** on a GOALPOST needs to send the beam downwards. One edge of a **GLASS PLATE** is laid on the **Tabletop** to reflect the undiverged beam back to the **Laser** to verify that the beam is incident in the vertical plane only. The **Magnetic Bases** of the GOALPOSTS are manipulated like shuffling feet to rectify the illumination.

3a. If the object is like the **Waffle Iron** or is mounted on a **KINEMATIC PLATEHOLDER**** it can be placed on the GOALPOST Arrangement instead of the **MIRROR**. Use a **Glass Plate** as

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*. For instance, **The Alley**, at 858 West Belmont Avenue, Chicago, 312-525-3180.

. See the **Handout, KINEMATIC PLATEHOLDER, in press.

described above on the **Object Holder** to make the **Reference Beam** purely vertically incident. Note that the top of the **Object** is at the bottom of the arrangement for Top-lit reconstruction.

4. Insert the **SPATIAL FILTER (3)** with a **10X Microscope Objective** after the **SHUTTER (2)**. Leave about two inches clearance further downbeam from the shutter for more components to be added in later setups. Center the Spread Beam on a **TARGET CARD** after the **MIRRORS** at the far end of the **TABLE**. Clean the beam with the **Pinhole***.

5. Block STRAY LIGHT, especially any that might come from behind the **PLATEHOLDER** that could act as a second REFERENCE BEAM! Usually a piece of cardboard or the cover from a **MIRROR** leaning up against the **Laser** will shade the **Holographic Plate** from the laser spot on the **SHUTTER**.

6. Expose, process and evaluate the hologram. Use the **DEMONSTRATION HOLOGRAMS** as exposure guides for color control and brightness.

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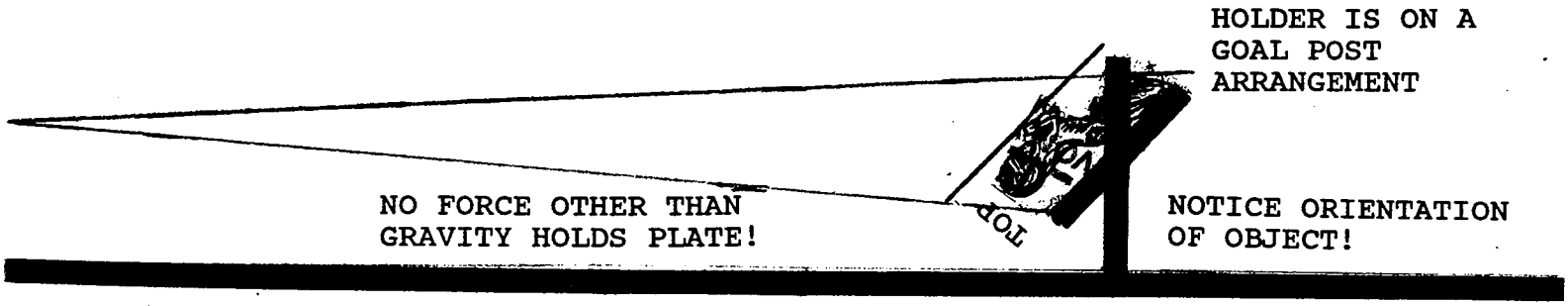
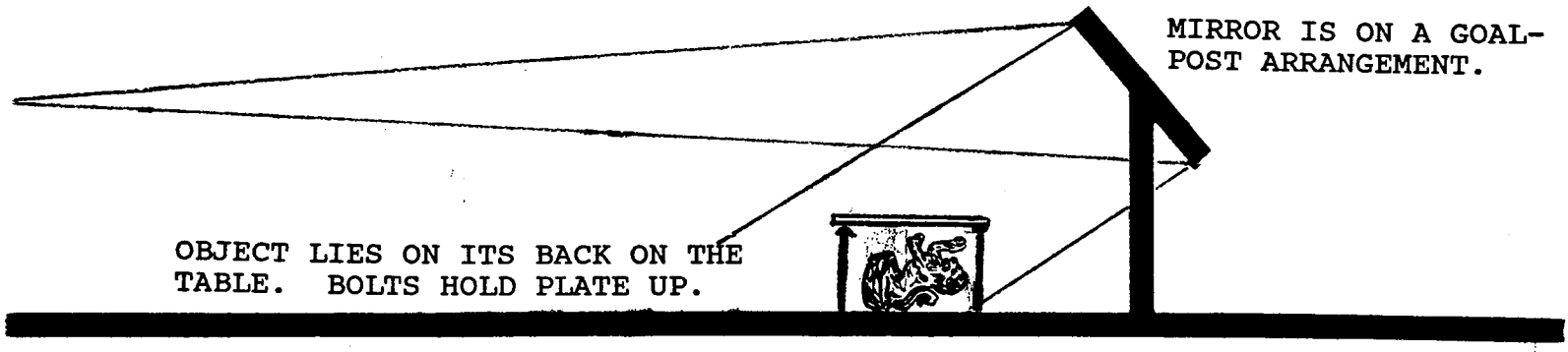
*. See the **Handout, SPATIAL FILTERS**.

sbr VARIATIONS





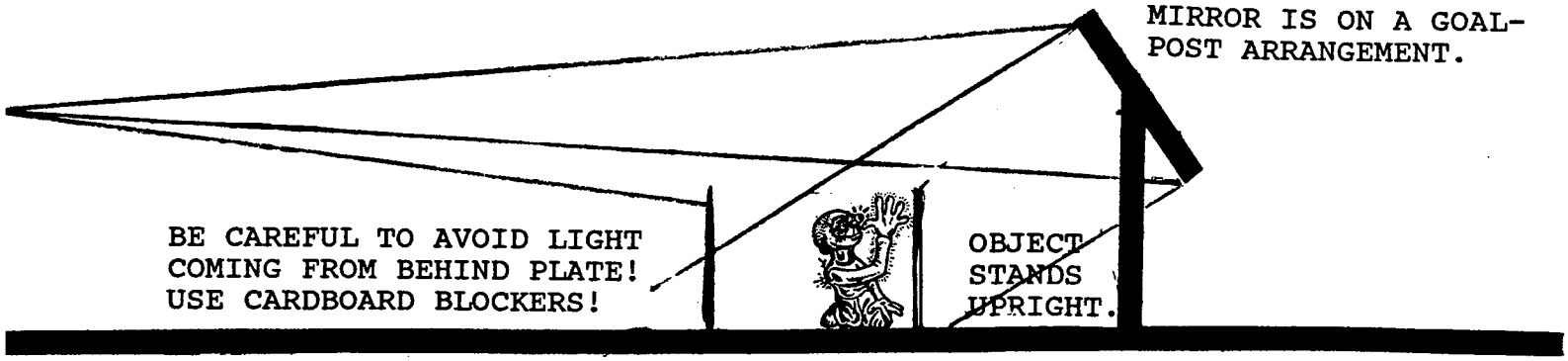
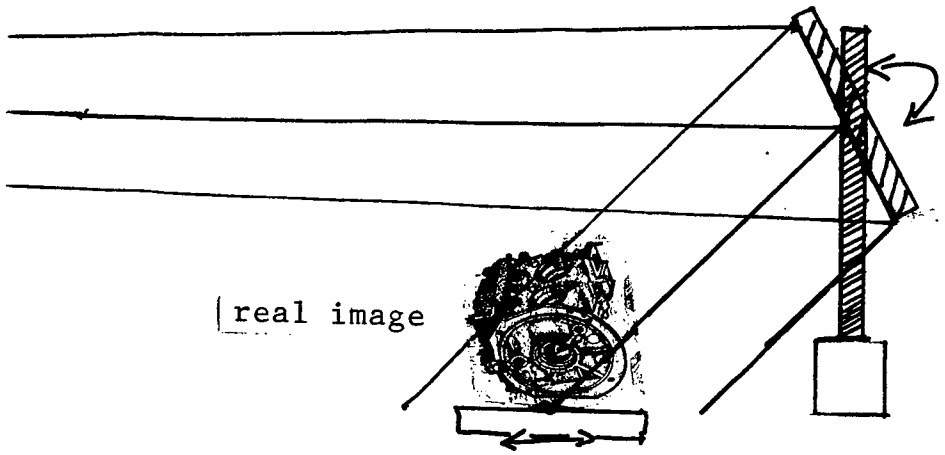


PLATE HELD AT BOTTOM. DANGER! THE TOP OF THE PLATE MAY END UP FLAPPING IN THE BREEZE! THE BOTTOM OF THE HOLOGRAM MAY COME OUT, BUT NOT THE TOP!

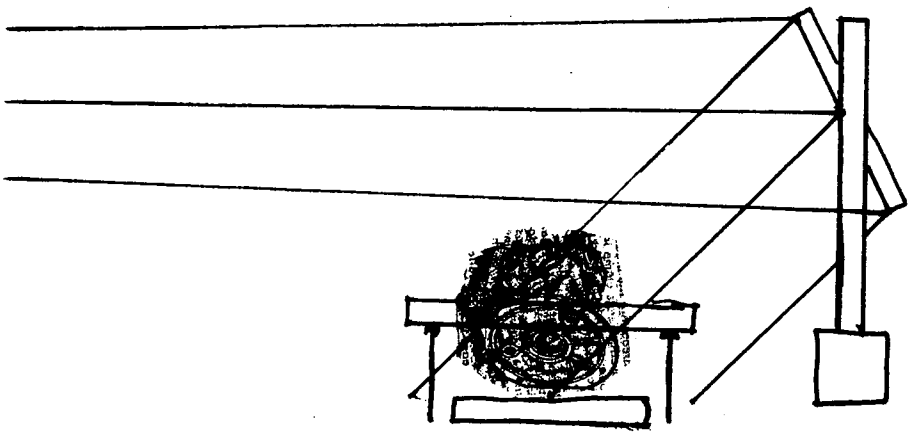
OBJECT MAY BE FIXTURED SIDEWAYS, SO THAT A HORIZONTAL BEAM ACTS AS A VERTICAL ONE! JUST THINK ABOUT LOOKING AT THE FIRST FIGURE AS A TOP VIEW INSTEAD OF A SIDE ONE!

image plane SBR

A bright, low noise reflection hologram that reconstructs well under laser illumination is a must! The non-image side may need to be painted black or the hologram should be placed on something black.



STEP I: May need to chase hologram back and forth to find the best replay of the real image.



STEP II: Find appropriate level for copy hologram by screwing bolts into table with line up plate on them.

BEWARE of shadows cast by edge of plate or tape on the edge.

PLAN AHEAD! Master may need to be trimmed to fit!

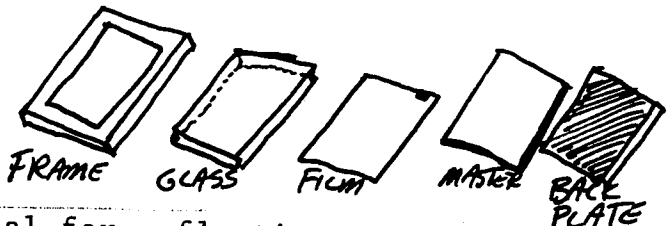
STEP III: Expose and develop just like you would for hologram of regular object.

CONTACT COPYING OF REFLECTION HOLOGRAMS

As long as the master (H1 or H2 as made above) is bright under laser illumination, the copies will be successful!

STEP I: Find reference angle for master lying on table in contact print frame on table.

STEP II: Assemble glass-film-master sandwich in the contact print frame.



STEP III: Expose and process as usual for reflection holograms.

CAUTION! MAKE SURE THAT YOUR POLARIZATION VECTORS ARE PROPERLY ALIGNED!

EW 2/13/89

"Pseudoscopic" Moldmaking Handy Trick for Denisyuk Holographers

by
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On 17 May this year, I gave an impromptu talk to a gathering of holographers in the evening at the Museum of Holography. No one at the time appeared to know how I managed to make a two-color reflexion hologram showing a red real-image hand in front of a dark green virtual image statuette, using only a HeNe laser and one sheet of Agfa 8E75HD film (it did in fact take many preparatory experiments before I made the hologram). The hologram created quite a degree of interest when on exhibition in Eindhoven, Holland and later in the "Laser '79" exhibition in West Germany. There were of course two tricks involved, and I will explain them separately. Firstly, how did I manage to make a real image hologram of my hand without using a pulse laser? A further interesting point about the way I did it is that it was much easier to make a real image than a virtual one, which is of course quite the reverse of general experience.

This was how I did it: I made a "pseudoscopic mold" out of plaster of Paris. I added 420 cubic centimeters of ice-cold water to one kg of "dental grade" plaster of Paris and mixed it well while wearing rubber gloves. After precisely one minute I removed the gloves and quickly poured the mix into a square polythene container. At this moment the mix had a putty-like nature and was stiffening rapidly. I pushed my left hand in so that the fingers were half immersed at the back of the hand and held it steady while with my other hand I removed any bits of plaster which overlapped and formed what industrial molders would term a "re-entrant angle." A "re-entrant" angle prevents a solidified object being removable from a rigid mold and for holographic purposes prevents light from reaching the inner areas of the mold behind the re-entrant angle (it also imprisons the hand. My first experiment was to put both hands in plaster at the same time. I had so many re-entrant angles that I could pull neither hand out and was effectively handcuffed in a plaster of Paris block. It created some considerable laughter when my wife watched me having to smash the block on the pavement outside in the street to free myself).

I found that 10 minutes was enough for the block to set hard enough to be able to remove my hand without deforming the mold. It was slightly painful because the mold trapped small hairs from the skin, but these hairs did add to the final realism of the hologram (I have tried using more modern molding material but its inherent surface reflectivity was very inferior and reacted badly when I tried to improve it with a light coat of white spray paint).

A peculiar problem I found with plaster of Paris was connected with the need to dry out the excess water. I could either obtain holograms from the mold when it was freshly made and full of water or when it was well dried, but not obtain good holograms during the many days it took to dry out. I put this down to an irregular contraction process occuring of the order of ½ a wavelength of red light during the 20 or so seconds of time needed with my HeNe laser. One can judge if the drying process is complete by weighing. One kg of the original powder should finish up weighing 1.2 kg. when dry.

When my mold was dry I squeezed my hand back into it tightly and sprayed black paint all over it and the mold. After a few minutes I removed my hand and left the mold looking like a white shadow on a black background (see picture). To actually use this pseudoscopic object, I placed it close up to the film upside down and exposed it to a single beam in a simple Denisyuk arrangement. The resultant hologram is then viewed on the same side as that which faced the pseudoscopic object.

Now to deal with the trick of obtaining two colors using only a HeNe laser. Firstly I had to use a processing system which would roughly reproduce the original red illumination in white-light viewing (such as Steve Benton's system in *holosphere*, July 1978, p.4).

The procedure I contrived was as follows. Firstly, to expose the hologram to the pseudoscopic hand for an exposure time three times longer than would usually be sufficient. Without further treatment to develop the latent image, I then soaked it in a solution of 12 per cent triethanolamine and blotted the film on a fresh and new piece of unfolded or uncreased blotting paper, pressing evenly over the back of the hologram. The much-increased exposure time was needed because I found the latent image was apparently much weakened by this triethanolamine swelling treatment. The blotted film was left in a dark room at 25°C for an hour before making a second exposure. Since I required an ordinary virtual image on the second exposure, the emulsion side was positioned the opposite way round and upside down with respect to the first exposure. The object was then placed in a predetermined position with respect to the film. The exposure time was then in the second case only 2/5 of what it would normally have been, because the emulsion had been sensitized both by the triethanolamine and probably also by the first exposure.

After developing and bleaching as usual, the triethanolamine was completely removed and therefore the gelatin contracted to its usual thickness, decreasing the wavelength of the viewing light for the second exposure but leaving the viewing light of the first exposure in the red. The result was an interesting superposition of a real-image red hand in front of a virtual green figurine. In my experiments I did not find that reversing the order of exposing by first leaving the emulsion swollen and later unswollen gave as good a result.

(Continued from previous page)

who wants to work in integral holography directly must be willing to acquire their own printer. BUT when you do,BUILD TWO, one for the commercial jobs that will pay the rent and meet the rising cost of living, and one you can rearrange to suit your own vision as an artist.

Sharon McCormack is a holographic stereographer and is a member of the San Francisco School of Holography.

Answer:
Integral holograms do not yet have the elegant finished look of a well-executed plate hologram. The integral system, making use of movie film, has great possibilities for innovative imagery.

I enjoy the integral process and have worked consistently for myself and clients. "For My Father" and "Self-Portrait as a Smearing Carpenter" are two 360° integrals that regardless of all drawbacks I feel are finished pieces and am proud of.

I am still very interested in integral holograms. Recently I changed format to the "minigram." This system improves image quality, cleans up the packaging and makes holograms more accessible.

Abe Rezny is an independent commercial/artistic holographer.

Answer:
Everything is a viable art form – the problem, as with holography, is expressing one's identity and concerns successfully.

Integral holography is a tenuous art form because its difficult technology limits access and often results in an overemphasis of technology.

You can say it in 3D and with mystery.

"Inches" from serigraph laser scan calligraphy. c1979 by Peter Van Riper.

Peter Van Riper is an artist who has worked extensively with lasers and holography, among other media.

"In fact, telephone systems will become so intelligent that phones will function like computers. And perhaps, by 2029, what science writer Isaac Asimov calls the ultimate communications system – holographic projections with two way-sensory circuits – will be unveiled." *Business Week*, Sept. 3, 1979.

Holographic techniques were used in the design of a new Hi-Fi speaker system being marketed by Rank Hi-Fi, Inc., *20 Bushes La., Elmwood Park, NJ 07407.*