3. Experiment Examples

3.1 Holographic Photography

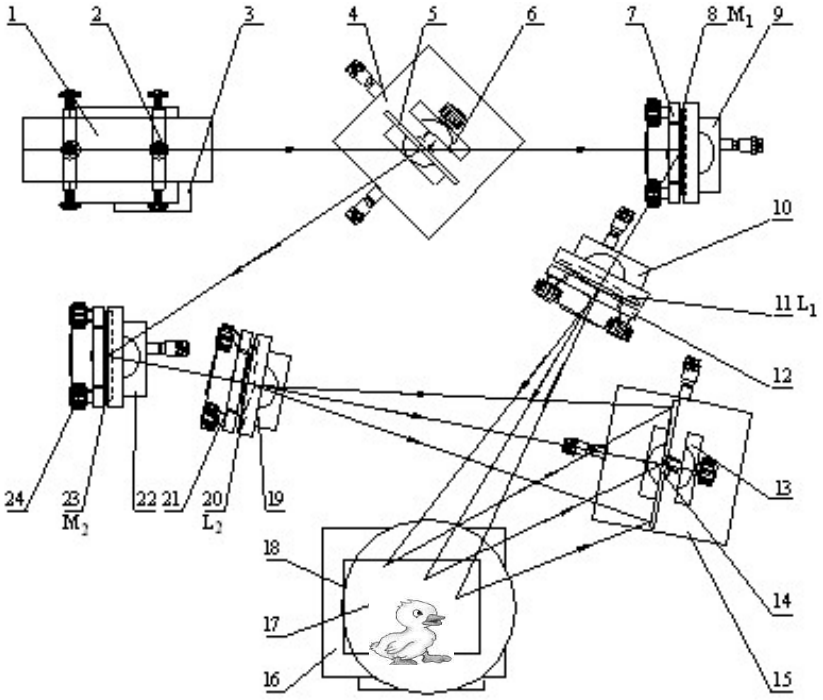

Figure 1 Schematic of holographic photography

1：He-Ne laser (LLL-2)
2：Laser holder（SZ-42）
3：Height adjustable base (SZ-03）
4：Universal base（SZ-04）
5：Beam splitter
6：2-D plate holder（LEPO-19）
7：Kinematic lens holder（SZ-07）
8：Plane mirror M_1
9：Universal base（SZ-04）
10：Height adjustable base (SZ-03）
11：Beam expander L_1（f‘=6.2 mm）
12：Lens holder（SZ-08）
13：Plate holder（SZ-12）
14：Holographic plate
15：3-D translation base（SZ-01）
16：Small object
17：Object loading platform（SZ-20）
18：Universal base（SZ-04）
19：Height adjustable base (SZ-03）
20：Beam expander L_2（f‘=6.2 mm）
21：Lens holder（SZ-08）
22：Universal base（SZ-04）
23：Plane mirror M_2
24：Kinematic lens holder（SZ-07）

1). Configure system setup according to Figure 1. Remove beam expanders L_1 and L_2, and align remaining components at identical height.

2). Align object and reference light paths with identical length and the two light beam intersected at the holographic plate at an angle of 30° to 40°.

3). Rotate mirror M_1 to let the object light incident on the center of the small object, while rotate mirror M_2 to make the reference beam hit the center of the holographic plate (replaced by a white screen for now).

4). Insert beam expander L_1 and move it back and forth until the object light illuminates the entire object; insert beam expander L_2 in the reference light path and move it back and forth until an intensity ratio of the object to the reference light falls within the range from 1:5 to 1:10.

5). Secure all the magnetic bases on the optical table. Turn off ambient light and then replace the white screen with a holographic plate for exposure. The exposure time is around 1-2 s. Develop and then fix the exposed holographic plate under the aid of a green safety lamp (refer to the user instructions of silver salt holographic plates, as attached at the end of this manual).

6). After washing and drying process, place the processed holographic plate to its previous location to observe the reconstructed real and virtual images.

3.2 Holographic Grating Fabrication

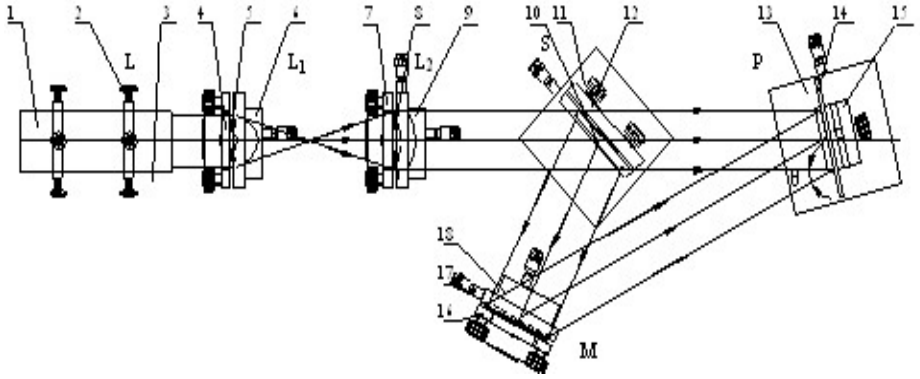

Figure 2 Schematic of holographic grating fabrication

1：He-Ne laser L (LLL-2)
2：Laser holder（SZ-42）
3：Height adjustable base (SZ-03）
4：Lens holder（SZ-08）
5：Beam expander L_1（f‘=6.2 mm）
6：3-D translation base（SZ-01）
7：Lens holder（SZ-08）
8：Collimating lens L_2（f’ =225 mm）
9：Universal base（SZ-04）
10：Beam splitter S（5:5）
11：Universal base（SZ-04）
12：Kinematic lens holder（SZ-07）
13：Universal base（SZ-04）
14：Holographic plate
15：Plate holder（SZ-12）
16：Kinematic lens holder（SZ-07）
17：Plane mirror
18：X-Z translation base（SZ-02）

1). Align the He-Ne laser to pass beam expander L_1 and collimating lens L_2 so that a collimated laser beam with expanded beam size is obtained.

2). Based on the required grating period d, derive the intersection angle between the object and the reference beams, θ, at the holographic plate ($d = \frac{\lambda}{2\sin\theta/2}$).

3). Based on the derived intersection angle, θ, configure the system according to Figure 2.

4). Repeat step 5) in sec 3.1.

5). After washing and drying process, place the processed holographic plate to its previous location to observe the He-Ne laser diffraction on a white screen. Alternatively, an optical goniometer can be used to measure the angle of mercury light diffracted by the fabricated grating, so that the grating period can be verified.