67. *Diffraction of Falling Drop by a Glass Cylinder.*

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If we make a drop of water fall on a glass rod supported horizontally, the drop is broken into splashes at the collision with the glass surface. The figure made by these splashes on a sheet of paper laid horizontally below the rod consists of a row of spots arranged perpendicular to the axis of glass rod. In order to elucidate the mechanism of this phenomenon, we studied photographically the motion of the falling drop and its splashes made by collision with the glass rod, by making use of moving film.

The apparatus used in this experiment is shown in Fig. 1.

Fig. 1.

E.C. : Electric condenser,	p. : Paper for making spots,
S.G. : Spark gap,	C. : Camera,
O.C. : Optical condenser,	S. : Shutter,
d. : Dropper,	D. : Drum,
G.C. : Glass cylinder,	F. : Film,
W. : Glass window,	M. : Motor.

The lens of the camera is set at the conjugate focus of the spark gap with respect to the optical condenser. The camera is focussed on the splashes. As a light source we use an electric spark obtained by the intermittent discharge of the electric condenser connected parallel with the spark gap. Although we used mostly drops of ink in order to get distinct marks on the paper as well as the photograph simultaneously, we can use water as well for taking photograph only.

We take cinematograph varying the velocity of collision, the size of the drop and the position in which the falling drop collides with the cylinder.

At first the following three cases are investigated.

Case 1. The drop strikes against the cylinder nearly tangentially.

Case 2. The drop strikes against the cylinder nearly at its uppermost point.

Case 3. The drop strikes against a position between the two above described.

In these cases the drop weighs 0.08 gram and the falling height is 25 cm. ; the velocity of collision is about 220 cm. per sec. Some photographs of each case are shown in Figs. 2, 3 and 4 respectively.

Next, we investigate the case where the drop weighs 0.037 gram and the height is 25 cm. Some photographs of it are shown in Fig. 5.

Lastly, we investigate the case where the drop weighs 0.08 gram and the height is 25 cm. ; the velocity of collision is about 310 cm. per sec. Some photographs are shown in Fig. 6. In order to illustrate the mode of diffraction and the trajectories of splashes, a number of photographs in Case 1 are superposed in a figure as shown in Fig. 7. From this figure, we see that the small particles, which have detached themselves already, fall describing parabolic trajectories, whereas in the transient state in passing from cord-shaped splashes to small particles the trajectory of each element of liquid is not parabola on account of its surface tension. The form of the trajectory depends also on the magnitude and direction of momentum at the collision.

We have used the cylinder 0.93 cm. in diameter in cases shown in photograms, while we have obtained nearly the same diffraction pattern by changing the diameter of cylinder.

Within the range of our experiments, the variation of the velocity of falling drop has little effect on the mode of diffraction.

The smaller the drop, the larger the part of the drop which remains adhering to the surface of the cylinder. If the falling drop collides with the cylinder nearly tangentially, most part of the drop falls near the line just below the cylinder. The nearer the middle point of cylinder the drop strikes, the greater are the amount of diffraction and the volume adhered to the cylinder.

From these experiments, we find that the splashes are made by a kind of diffraction, but not reflection. The diffraction of water drop may be explained as due to the action of forces composed of the adhesion between glass and water, the surface tension of water drop and the ærodynamical pressure of the air carried with the drop. This experiment may probably throw some light on the mechanism of the diffraction of water drop by a plane net, which was always reported.

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

Fig. 6.

Fig. 7.

The largest black circular spot shows the glass cylinder with diameter of 0.93 cm.