Demonstration of Steady Flow of Fluid.

By

Shuichi Hayashi

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The stream lines in two dimensional motion of viscous liquid were already studied experimentally by Hele-Shaw and others. The method used by them was to pass a series of streams of coloured liquid through a liquid contained between two pieces of glass plates separated at a small distance, the obstacle being placed between them. Lummer and Waetzmann[1] deviced an apparatus to demonstrate the forms of three dimentional flow of gases. But the photographs obtained by them were not so clear as those of Hele-Shaw. This is perhaps due to the mixing of air with tobacco-smoke at enterance into the wire gauze of their apparatus. The present writer, utilizing the method of Hele-Shaw, deviced an apparatus with which stream lines of running liquid as well as gaseous substance in the state of three dimensional motion were made clearly visible. The apparatus consists of a thin rectangular box with two rooms separated by a special bent partition as shown in Fig. 1. One of the flat sides is extended, and two series of small holes are pierced on this plate along the bottom of the box, each set belonging to the separate room, and the position of holes of the second series being thus little below the first one and coming between successive holes of the first series.

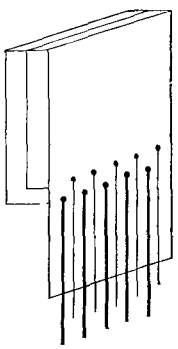

Fig. 1.

Two such boxes having exactly the same dimensions were prepared and they were placed

[1] Physik. Zs., **12**, 1135, (1911).

facing one another as shown by the dotted lines in Fig. 2, which shows the cross sections of an experimental apparatus used by the author. A liquid is led into the apparatus through the holes *a*, *b* and *d* simultaneously by rubber tubings from a reservoir, and a coloured liquid by the hole *c*, *e* being the outlet for the liquids. A wire gauze shown by double dotted lines is placed horizontally to render the flow uniform, and the flow is adjusted by the clips on the rubber tubings.

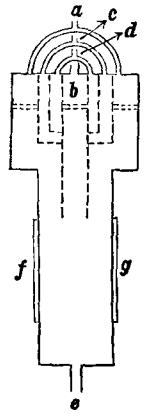

Fig. 2.

Now, when the water and a coloured water are sent through the apparatus the steady flow will soon be secured by adjusting the clips, and this may be observed through the glass window *fg*.

The same apparatus may be used for obtaining stream lines with gases. In this case, it is only necessary to open *a*, *b*, *d*, and connected *c* to a smoke chamber and *e* to a Bunsen water pump.

The writer also constructed a similar apparatus having circular cross section, and with these apparatus a good many interesting photographs of stream lines round various obstacles were taken. Fig. 3, Pl. I. illustrates stereoscopically the stream lines when a propellar is put in a steady running water in a circular tube, and Fig. 4 shows them when a sphere is put in a steady flow of air, while Figs. 5 and 6, Pl. II. represent the case when the sphere is uniformly rotated with different speeds.

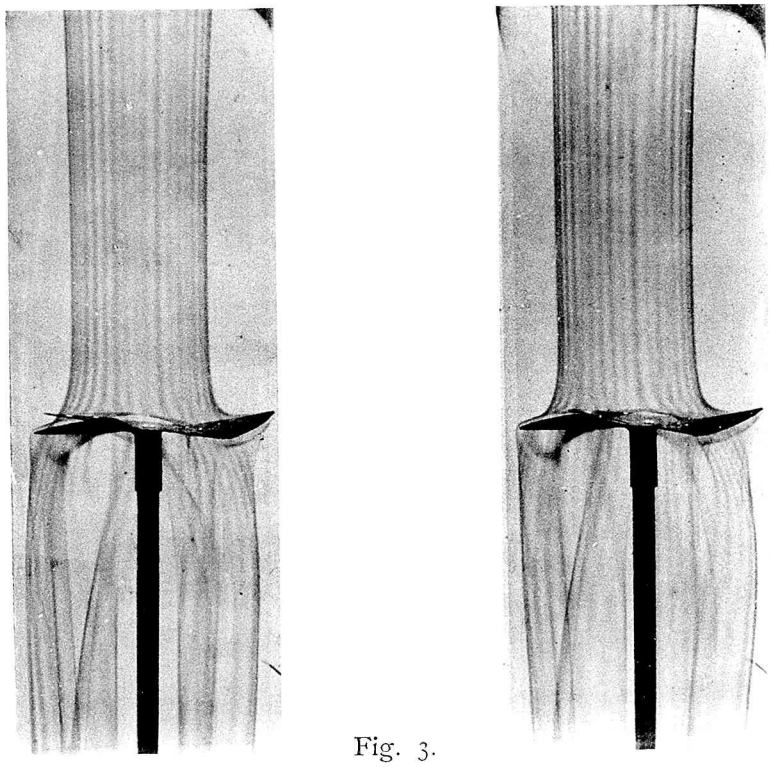

Fig. 3.

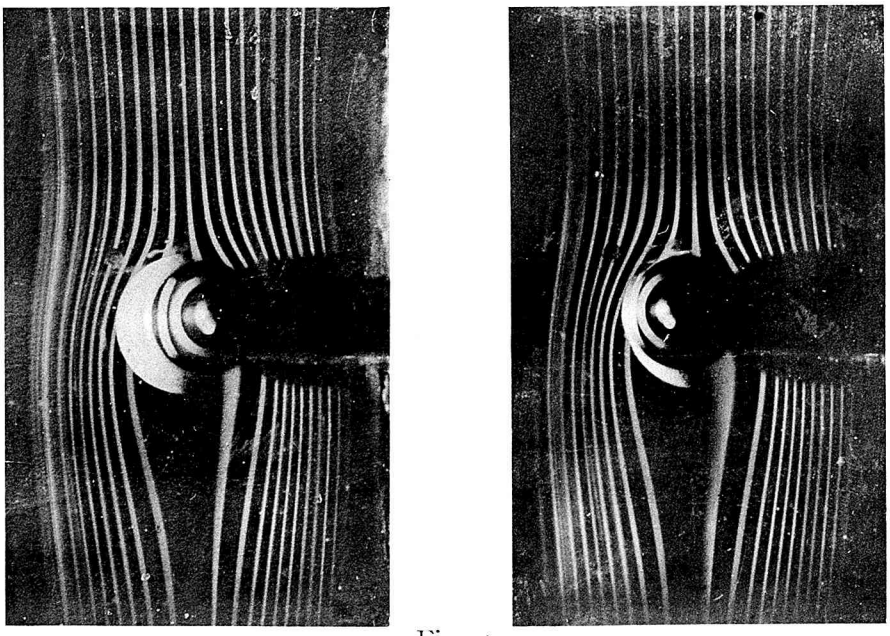

Fig. 4.

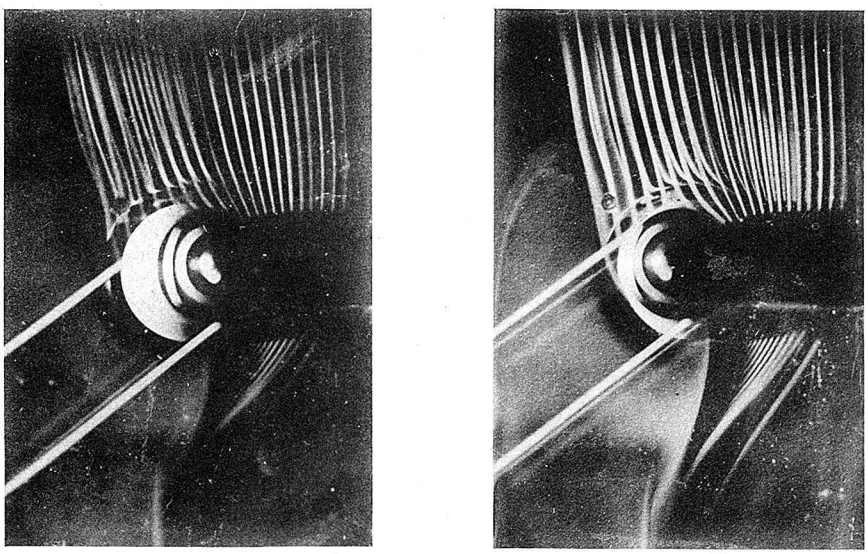

Fig. 5.

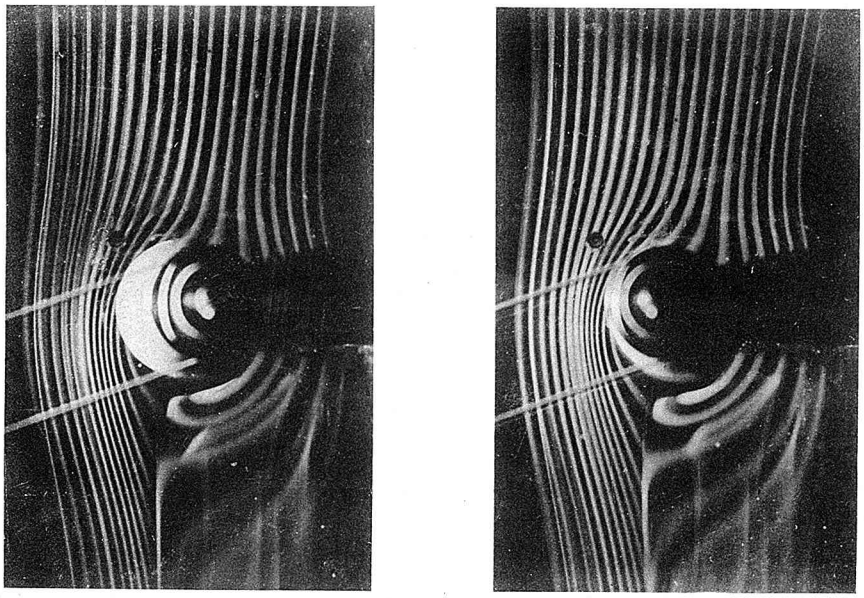

Fig. 6.