

Fig. 3. Experimental setup for visualizing water vortex.

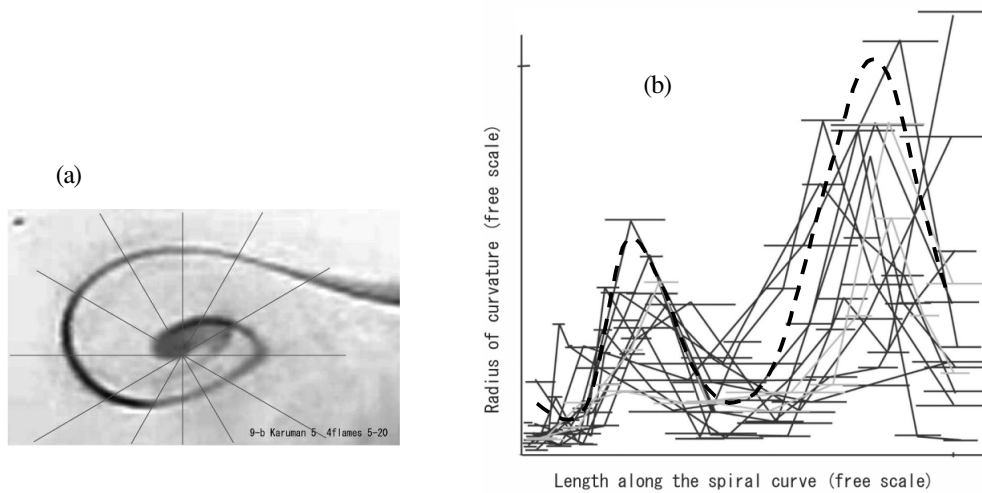


Fig. 4. (a) A visualized vortex, (b) $R(l)$ curves for visualized vortices behind a moving cylinder, where two gray curves are obtained from the vortex shapes visualized by TANEDA (1988). The dashed line indicates a common feature of these curves.

and Fig. 4(b) shows the measured curves of $R(l)$ for ten such vortices. These curves are rather scattered, but seem to have a common feature, i.e. they have two or more humps. The dashed line in this figure is drawn according to the impression of the authors. This feature is easily understood from the visualized vortex (Fig. 4(a)). It has an elliptical shape compressed in the up-and-down direction, hence the curvature is large at the right and left ends and the function $R(l)$ acquires a few humps. This type of spiral is called here an elliptic spiral.

Next, three spiral patterns were chosen from the monuments and crafts produced in ancient ages, as shown in Figs. 5(a), 6(a) and 7(a), and the present method was applied to obtain characteristics of the curves. Results of measurements are shown, respectively in