

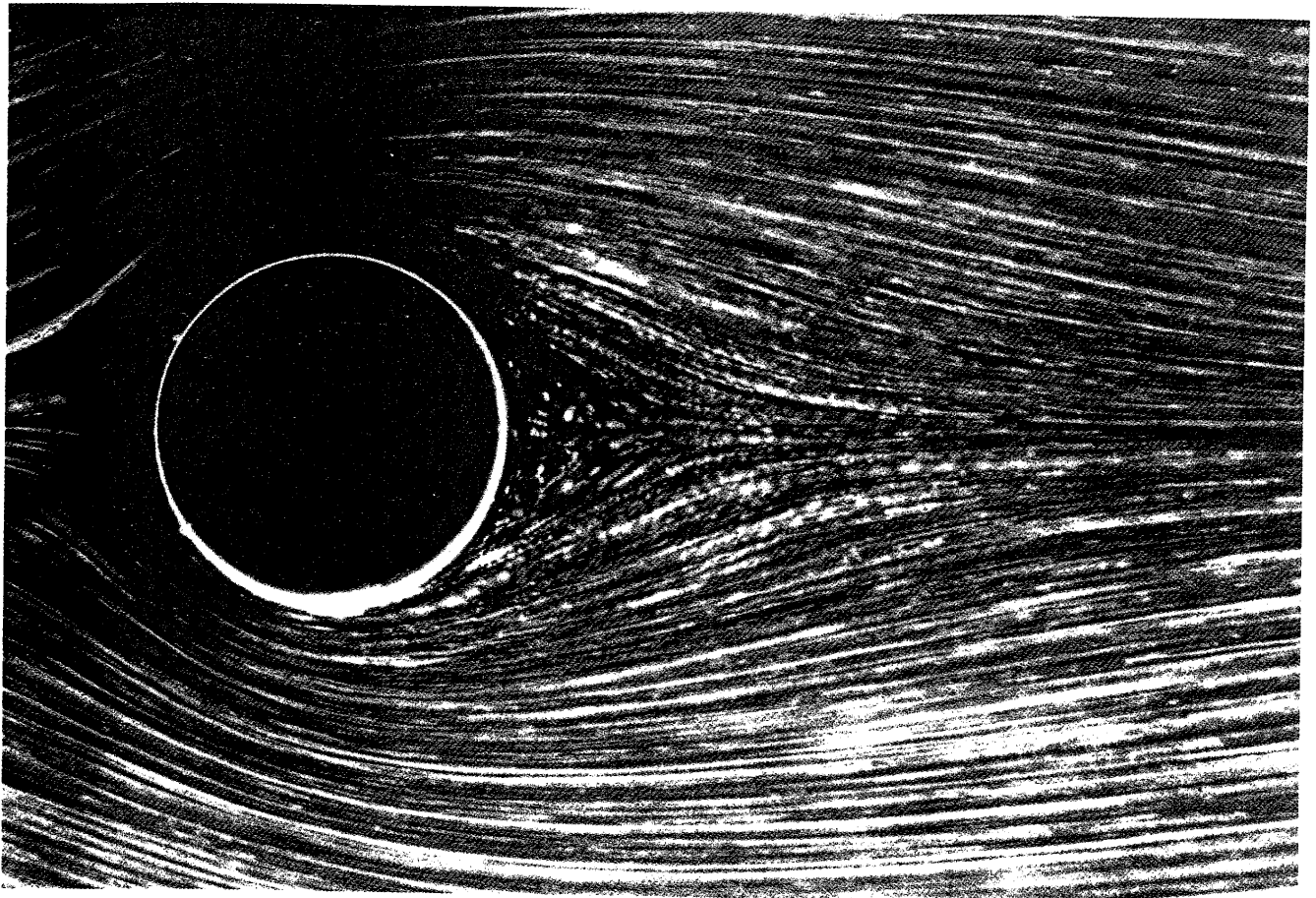
6. Uniform flow past a circular cylinder at $R=0.16$. That the flow is from left to right can scarcely be deduced from the streamline pattern, because in the limit of zero Reynolds number the flow past a solid body is reversible, and hence symmetric about a symmetric shape. It resem-

bles superficially the pattern of potential flow in figure 1, but the disturbances to the uniform stream die off much more slowly. The flow of water is shown by aluminum dust. *Photograph by Sadatoshi Taneda*



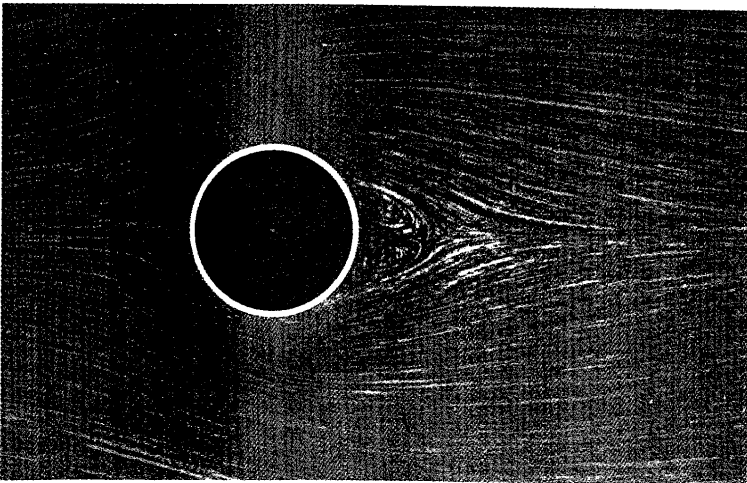
24. **Circular cylinder at $R=1.54$.** At this Reynolds number the streamline pattern has clearly lost the fore-and-aft symmetry of figure 6. However, the flow has not yet separated at the rear. That begins at about $R=5$,

though the value is not known accurately. Streamlines are made visible by aluminum powder in water. *Photograph by Sadatoshi Taneda*

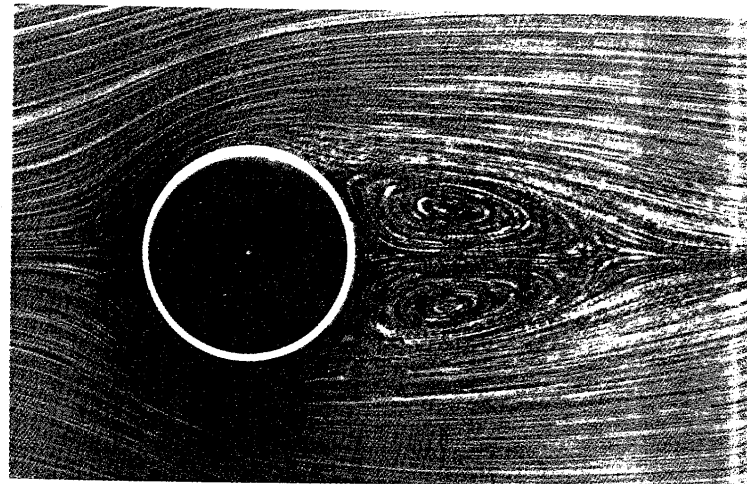


40. **Circular cylinder at $R=9.6$.** Here, in contrast to figure 24, the flow has clearly separated to form a pair of recirculating eddies. The cylinder is moving through a tank of water containing aluminum powder, and is illuminated

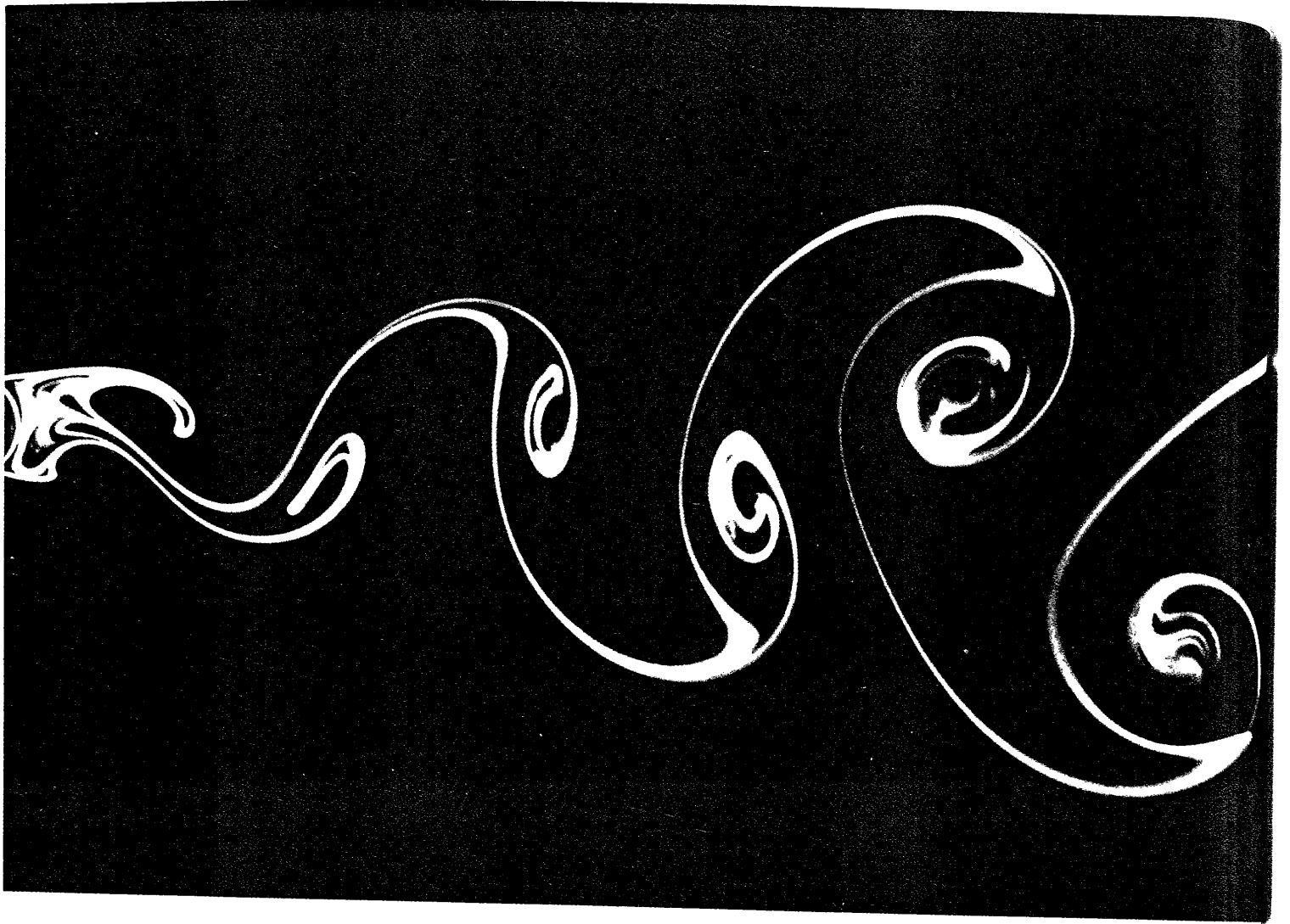
by a sheet of light below the free surface. Extrapolation of such experiments to unbounded flow suggests separation at $R=4$ or 5, whereas most numerical computations give $R=5$ to 7. *Photograph by Sadatoshi Taneda*



41. **Circular cylinder at $R=13.1$.** The standing eddies become elongated in the flow direction as the speed increases. Their length is found to increase linearly with Reynolds number until the flow becomes unstable above $R=40$. *Taneda 1956a*



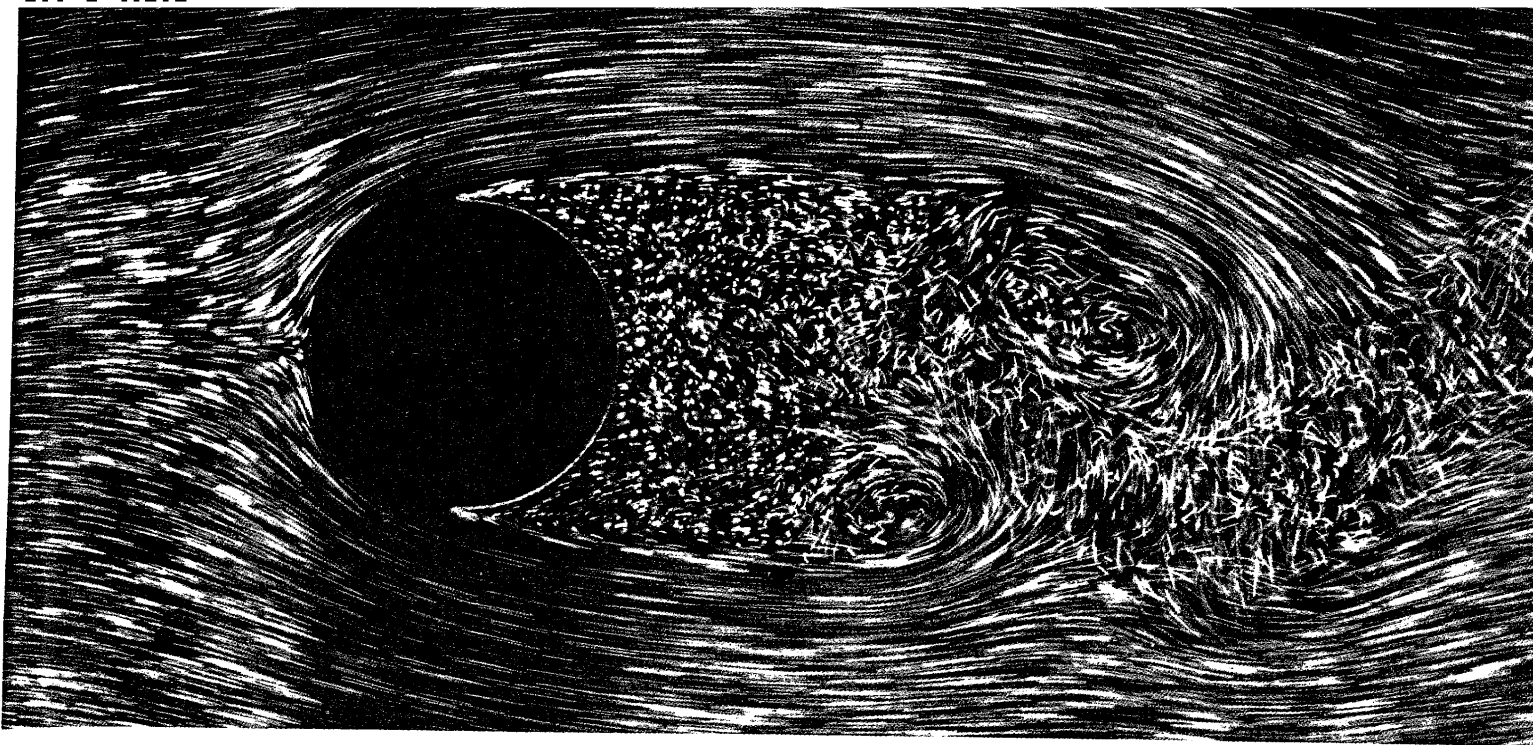
42. **Circular cylinder at $R=26$.** The downstream distance to the cores of the eddies also increases linearly with Reynolds number. However, the lateral distance between the cores appears to grow more nearly as the square root. *Photograph by Sadatoshi Taneda*



94. Kármán vortex street behind a circular cylinder at $R=140$. Water is flowing at 1.4 cm/s past a cylinder of diameter 1 cm. Integrated streaklines are shown by electrolytic precipitation of a white colloidal smoke, illuminated

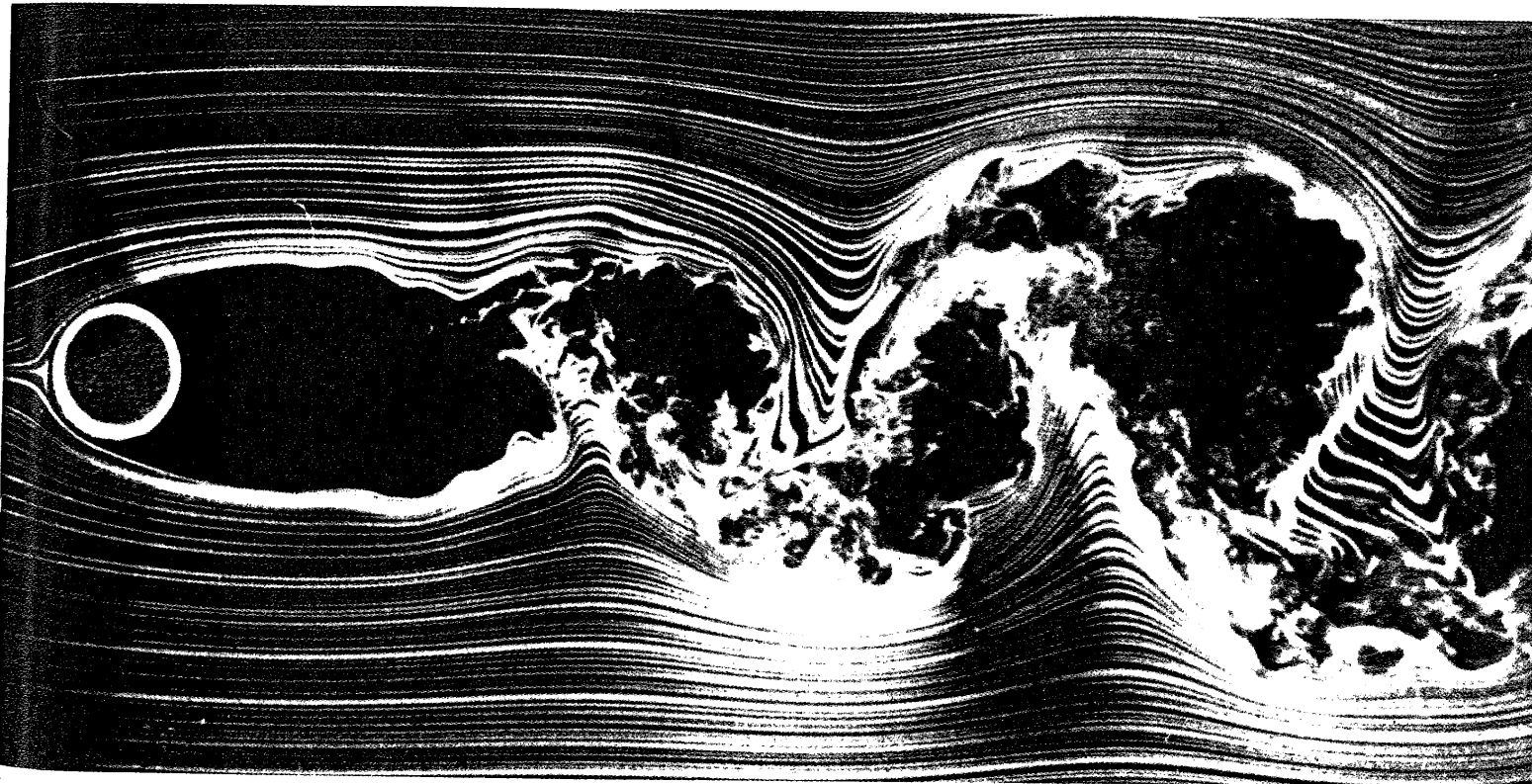
by a sheet of light. The vortex sheet is seen to grow in width downstream for some diameters. *Photograph by Sada-toshi Taneda*





47. Circular cylinder at $R=2000$. At this Reynolds number one may properly speak of a boundary layer. It is laminar over the front, separates, and breaks up into a turbulent wake. The separation points, moving forward as

the Reynolds number is increased, have now attained their upstream limit, ahead of maximum thickness. Visualization is by air bubbles in water. ONERA photograph, Werlé & Gallon 1972



48. Circular cylinder at $R=10,000$. At five times the speed of the photograph at the top of the page, the flow pattern is scarcely changed. The drag coefficient consequently remains almost constant in the range of Reynolds

number spanned by these two photographs. It drops later when, as in figure 57, the boundary layer becomes turbulent at separation. Photograph by Thomas Corke and Hassan Nagib