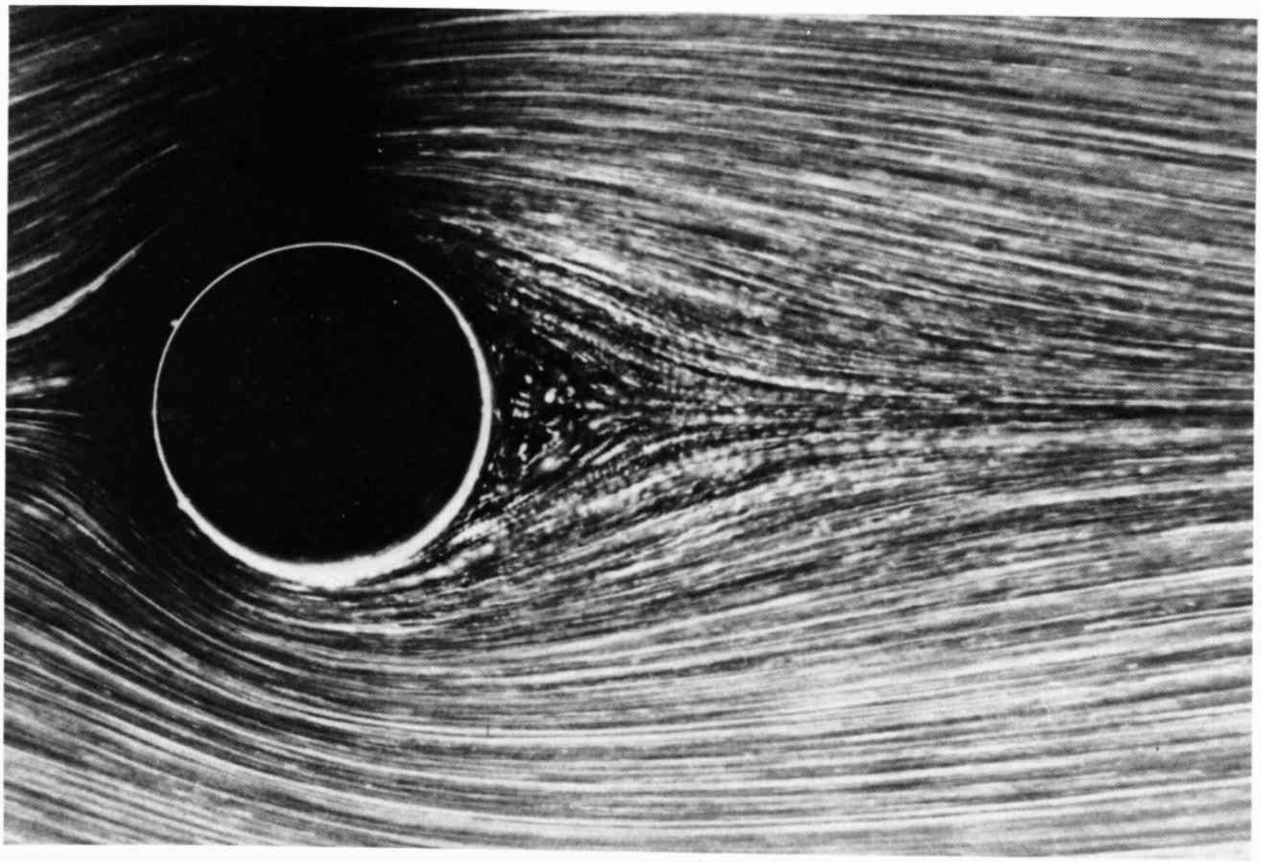
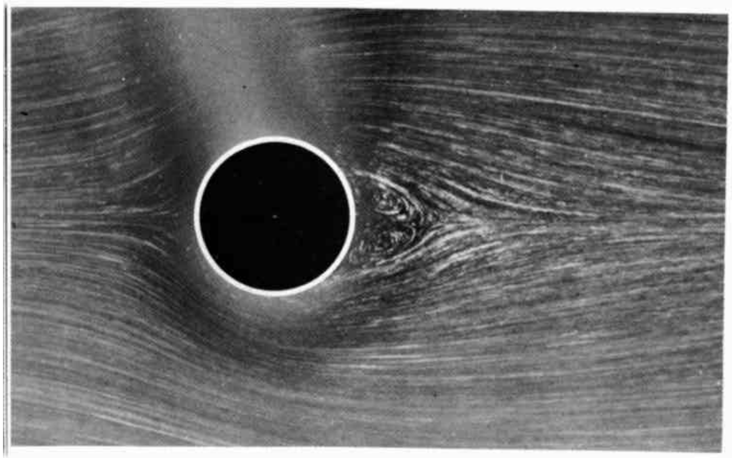
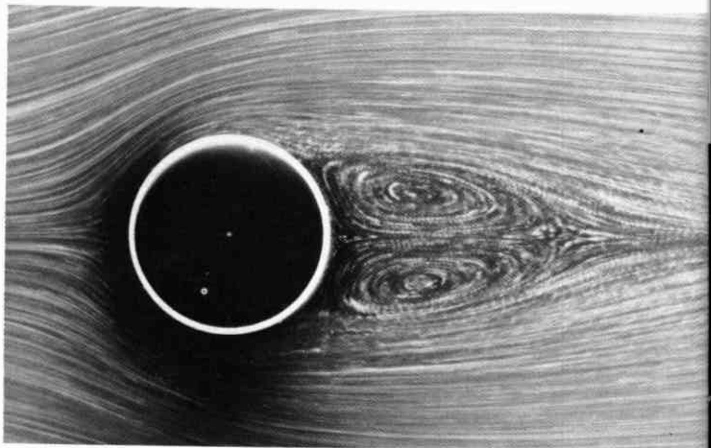


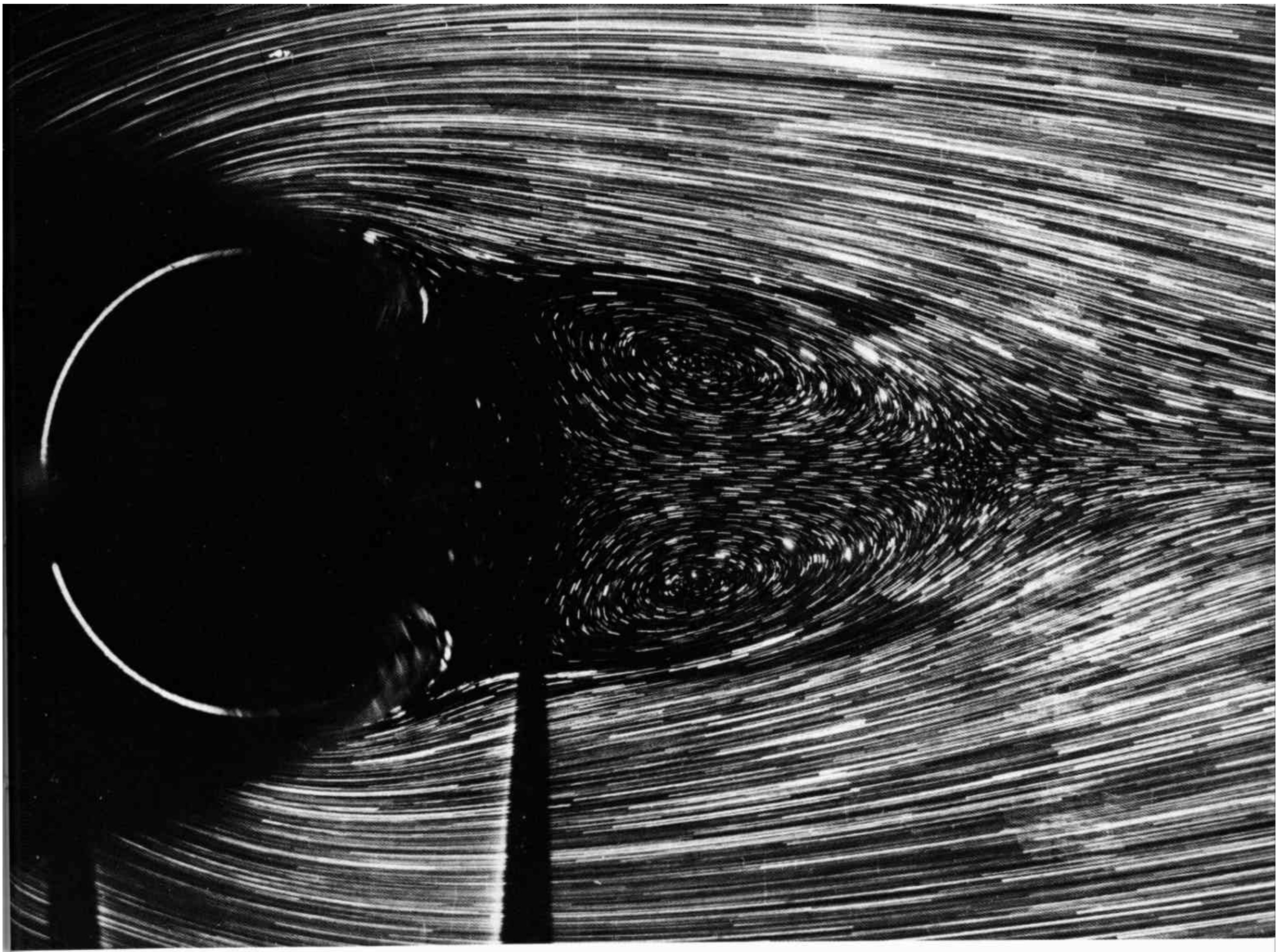
40. Circular cylinder at R**=9.6.** Here, in contrast to figure 24, the flow has clearly separated to form a pair of recirculating eddies. The cylinder is moving through a tank of water containing aluminum powder, and is illuminated by a sheet of light below the free surface. Extrapolation of such experiments to unbounded flow suggests separation at $R=4$ or 5, whereas most numerical computations give $R=5$ to 7. *Photograph by Sadatoshi Taneda*



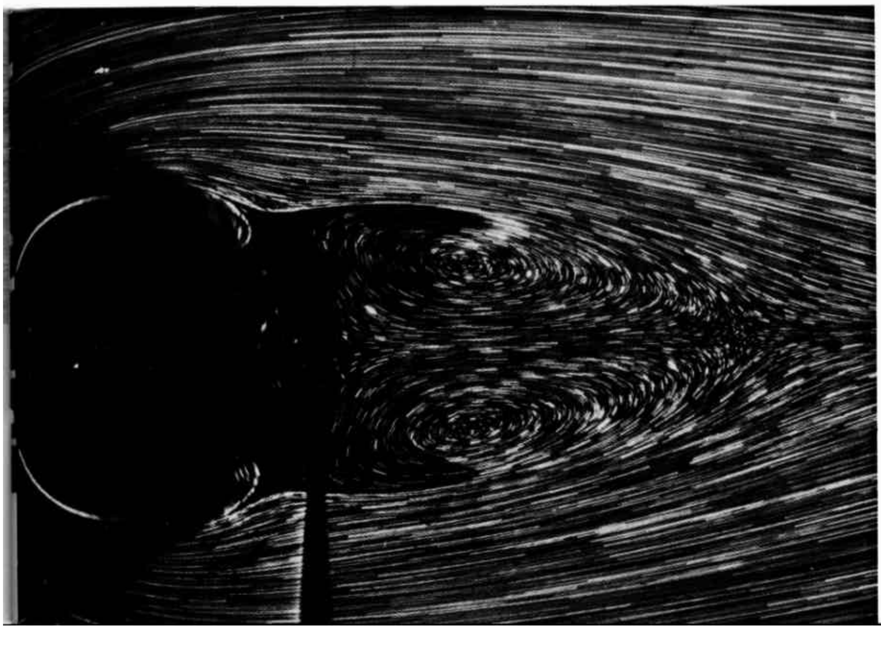
41. Circular cylinder at R**=13.1.** The standing eddies become elongated in the flow direction as the speed increases. Their length is found to increase linearly with Reynolds number until the flow becomes unstable above $R=40$. *Taneda 1956*a



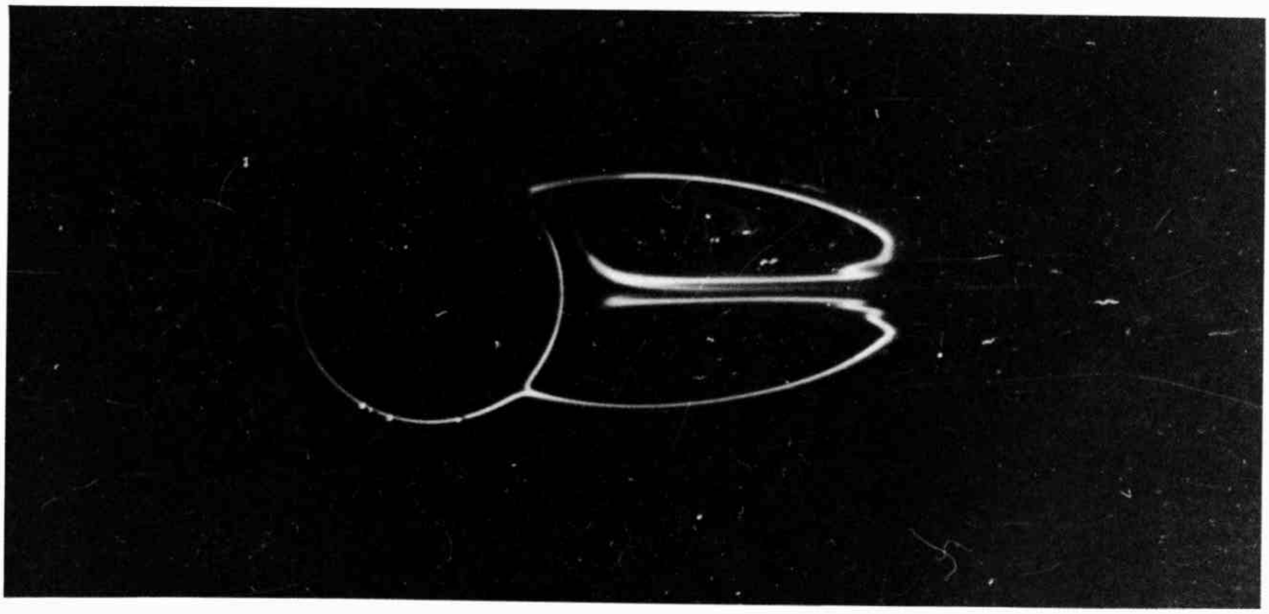
42. Circular cylinder at R**=26.** The downstream distance to the cores of the eddies also increases linearly with Reynolds number. However, the lateral distance between the cores appears to grow more nearly as the square root. *Photograph by Sadatoshi Taneda*



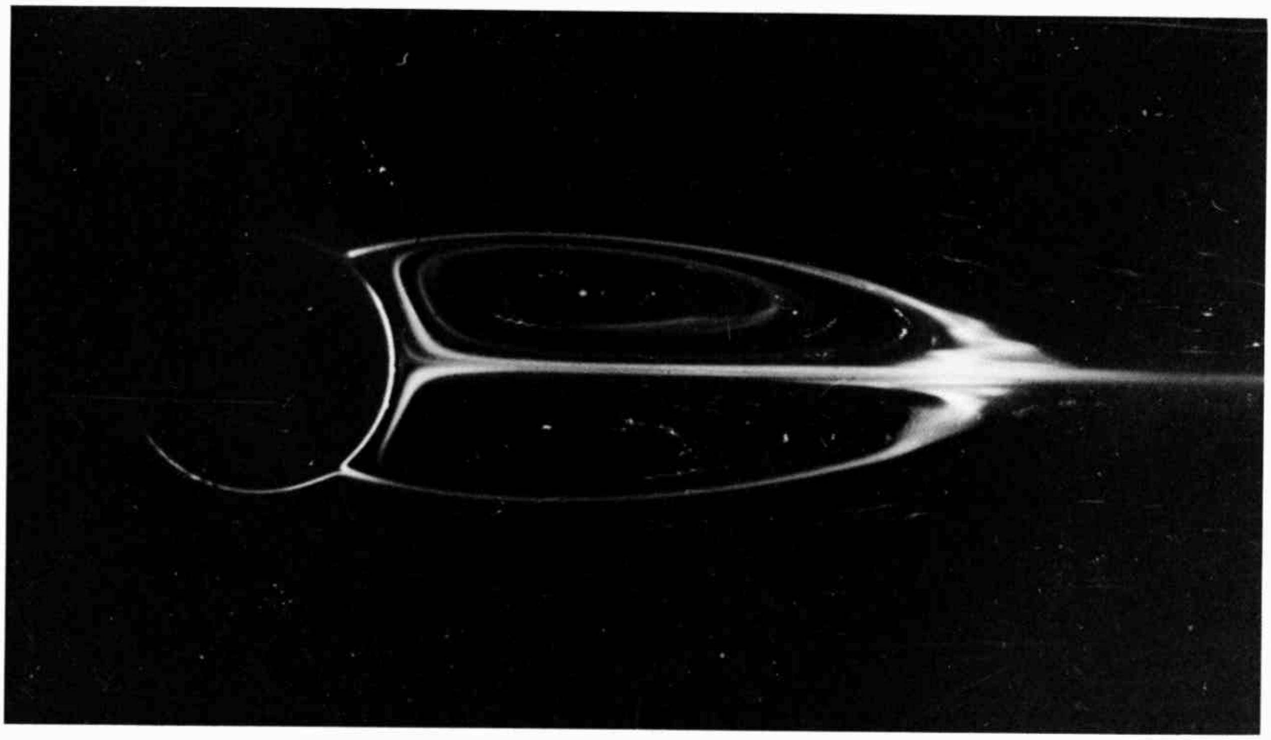
43. Circular cylinder at $R=24.3$**.** A different view of the flow is obtained by moving a cylinder through oil. Tiny magnesium cuttings are illuminated by a sheet of light from an arc projector. The two dark wedges below the circle are an optical effect. The lengths of the particle trajectories have been measured to find the velocity field to within two per cent. *Coutanceau & Bouard 1977*



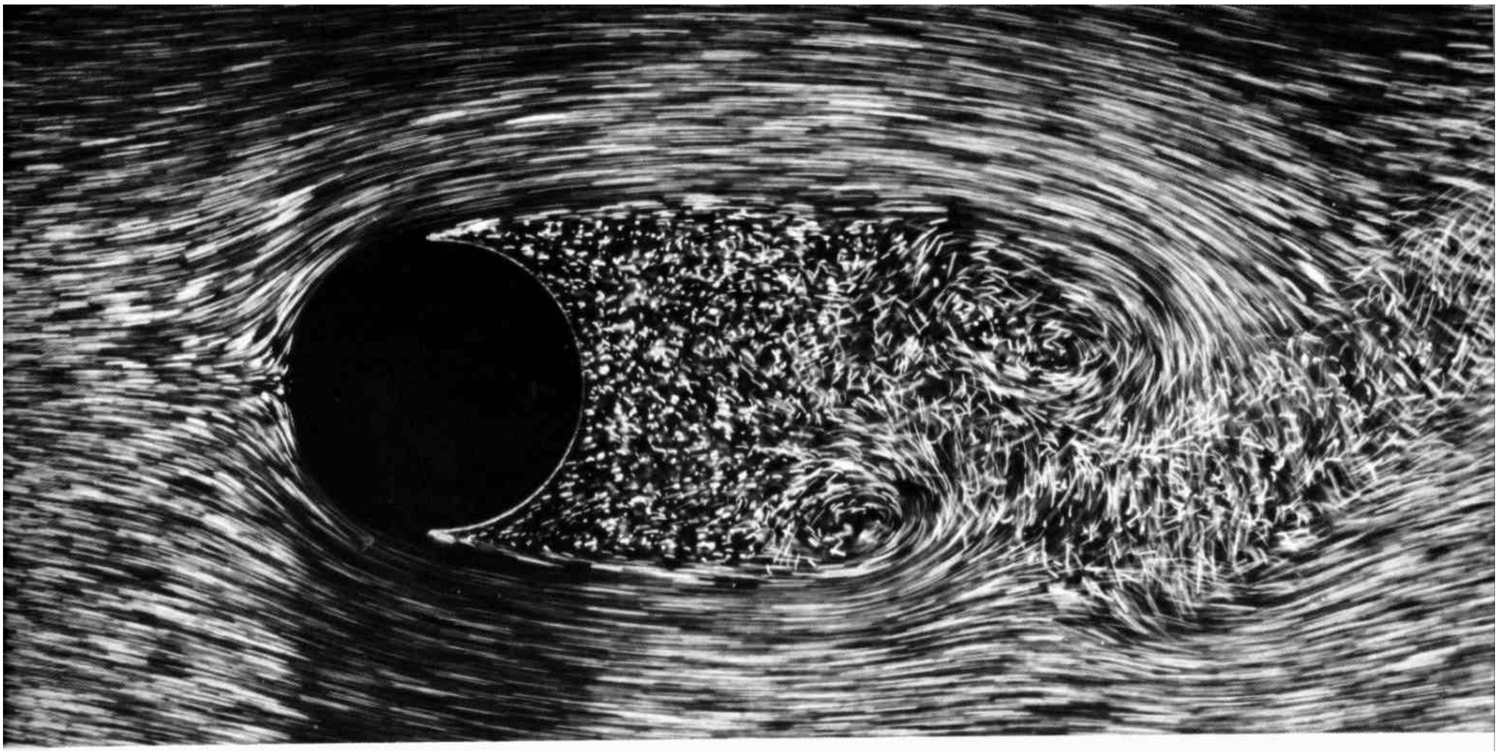
44. Circular cylinder at $R=30.2$**.** The flow is here still completely steady with the recirculating wake more than one diameter long. The walls of the tank, 8 diameters away, have little effect at these speeds. *Photograph by Madeleine Coutanceau and Roger Bouard*



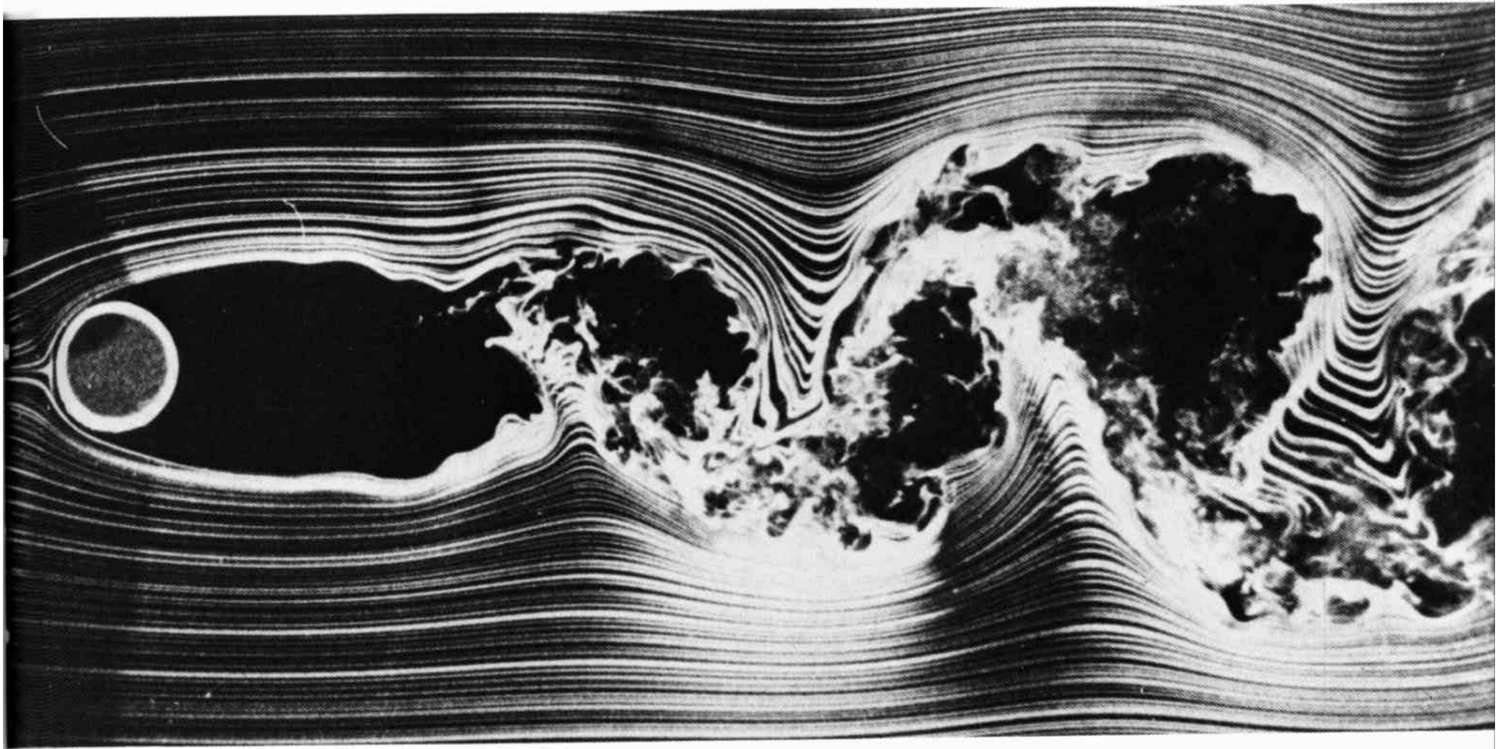
45. Circular cylinder at $R=28.4$. Here just the boundary of the recirculating region has been made visible by coating the cylinder with condensed milk and setting it in motion through water. *Taneda 1955*



46. Circular cylinder at $R=41.0$. This is the approximate upper limit for steady flow. Far downstream the wake has already begun to oscillate sinusoidally. Tiny irregular gathers are appearing on the boundary of the recirculating region, but dying out as they reach its downstream end. *Taneda 1955*



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*