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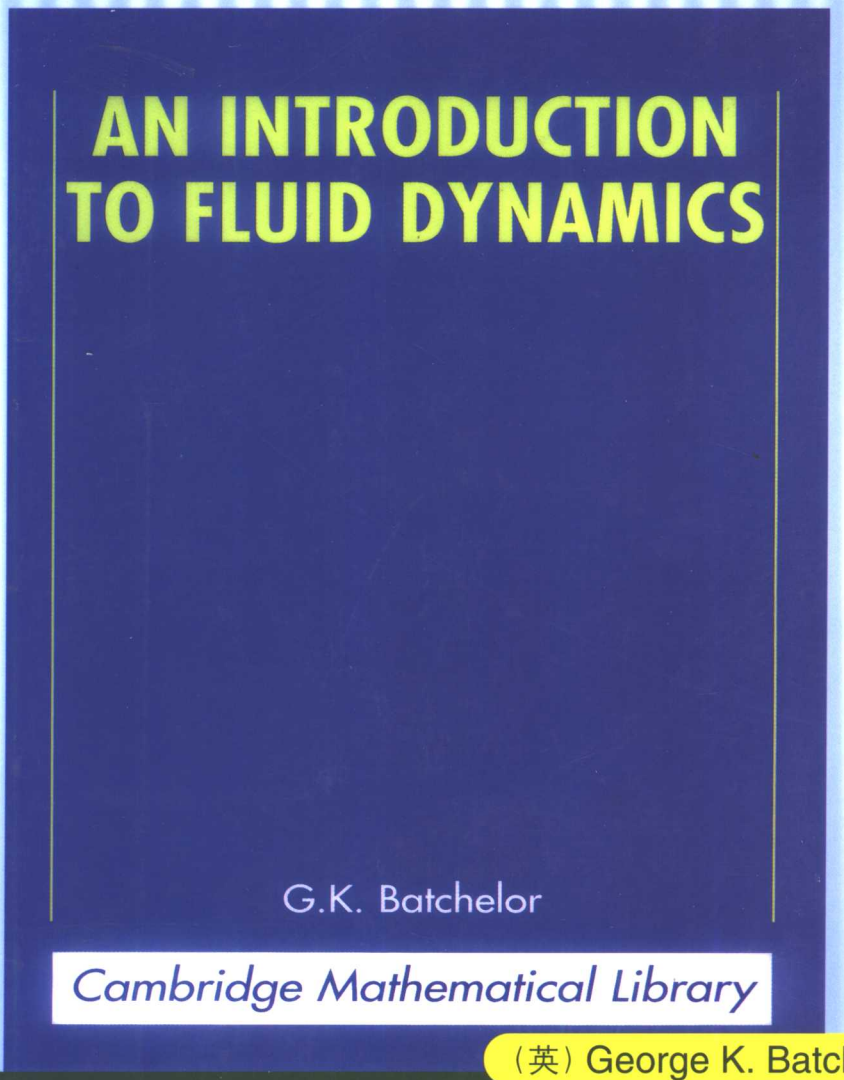

（英）George K. Batchelor 著

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China Machine Press

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An Introduction to Fluid Dynamics

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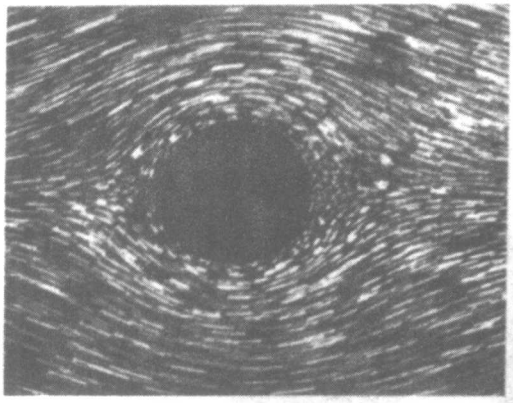

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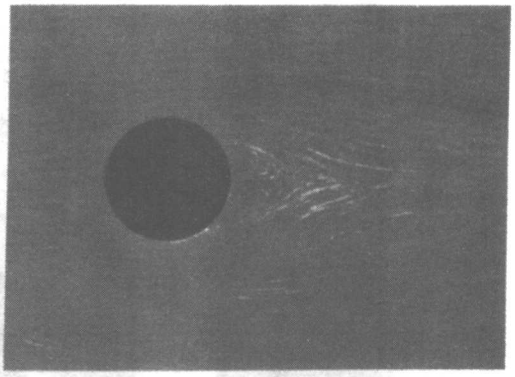

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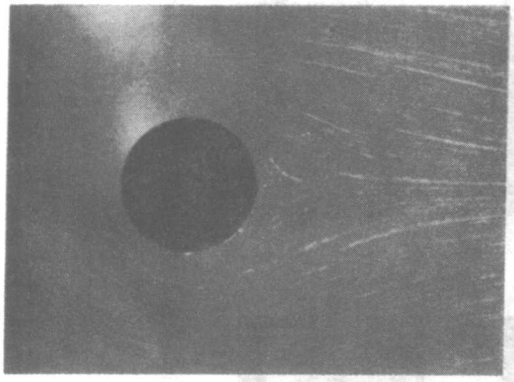

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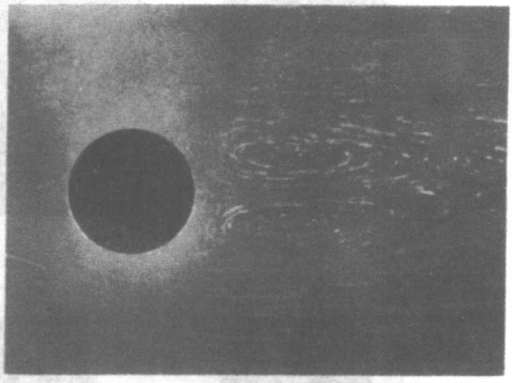
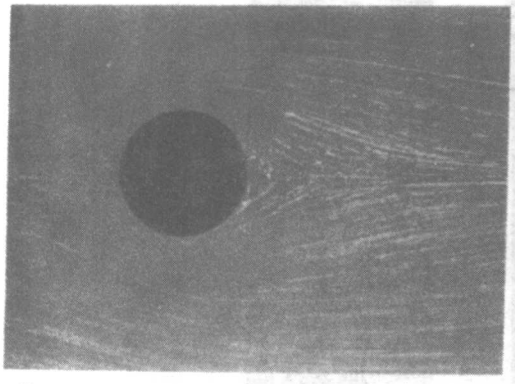
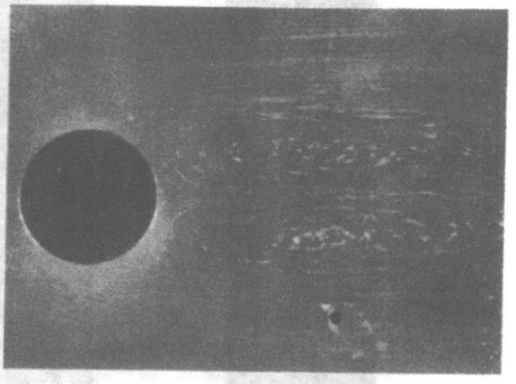


$R = 39{\cdot}0$



$R = 9{\cdot}10$



$R = 57{\cdot}7$

Figure 4.12.1. Streamlines of steady flow (from left to right) past a circular cylinder of radius a; $R = 2aU/\nu$. The photograph at $R = 0{\cdot}25$ (from Prandtl and Tietjens 1934) shows the movement of solid particles at a free surface, and all the others (from Taneda 1956*a*) show particles illuminated over an interior plane normal to the cylinder axis.

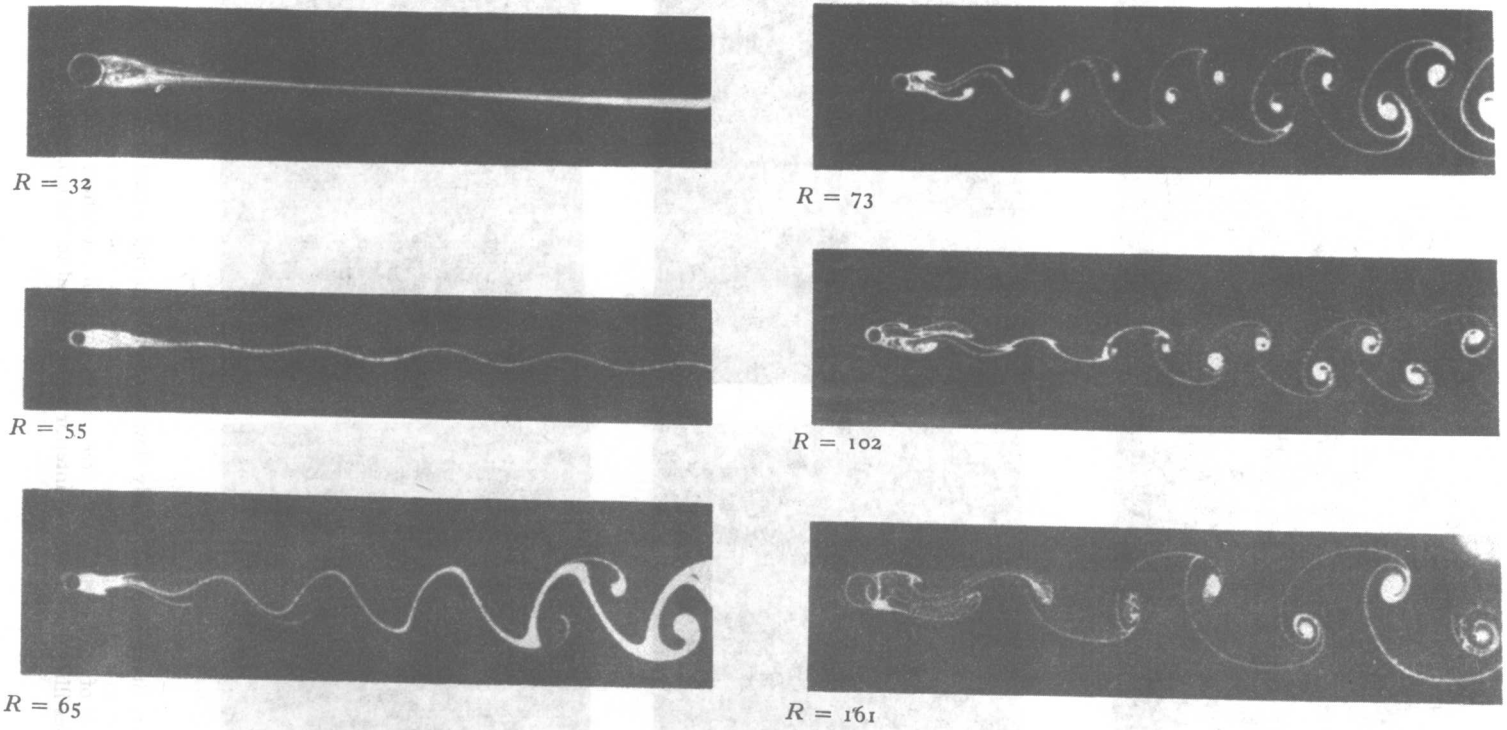


Figure 4.12.6. Streak lines in the wake behind a circular cylinder in a stream of oil. (From Homann 1936*a*.)

PLATE 3

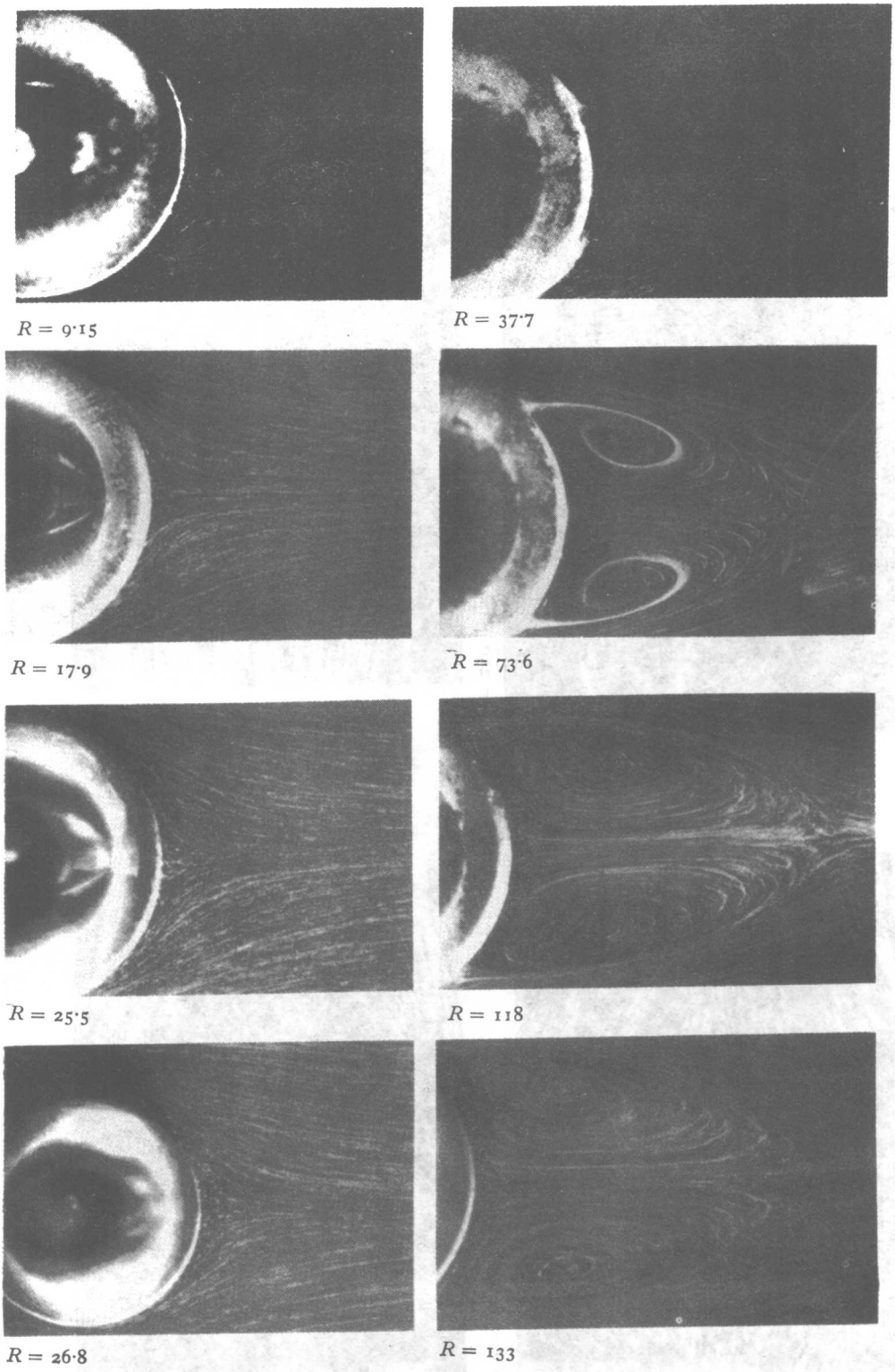
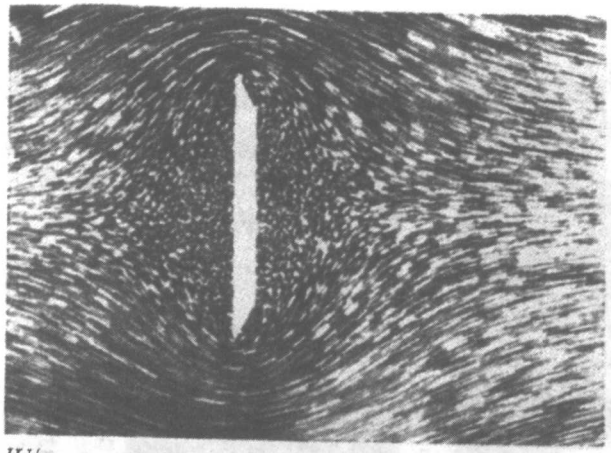
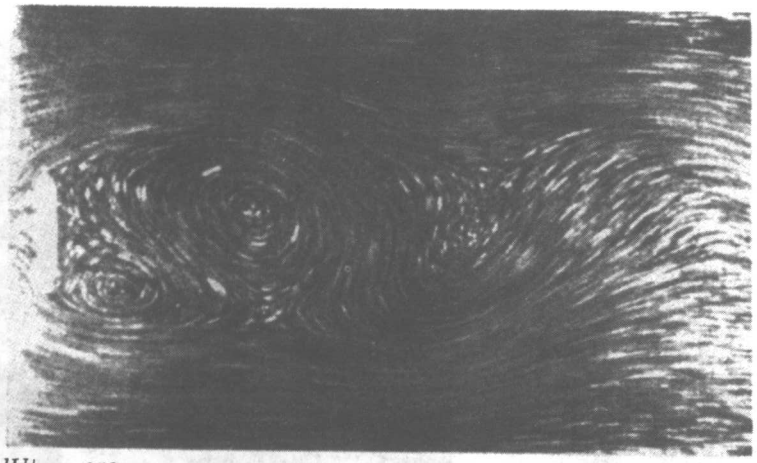


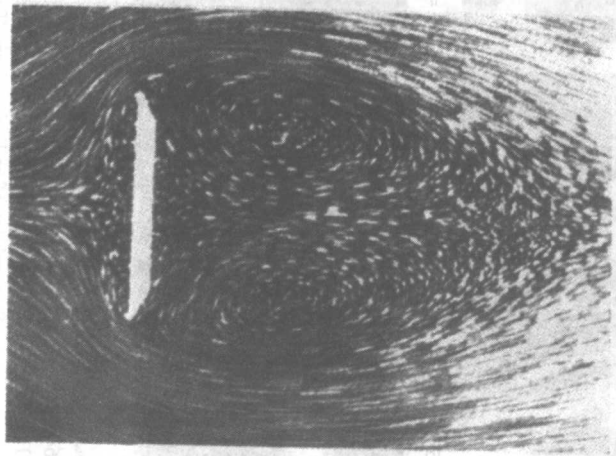
Figure 4.12.8. Streamlines, in an axial plane, of steady flow (from left to right) past a sphere of radius a (from Taneda 1956*b*); $R = 2aU/\nu$.



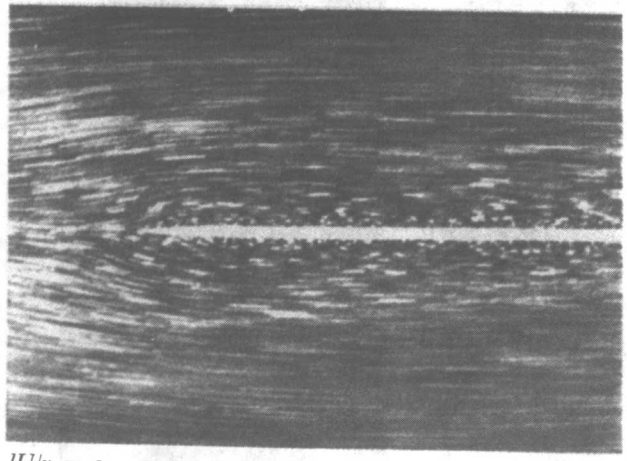
$lU/\nu = 0{\cdot}25$



$lU/\nu = 250$



$lU/\nu = 10$



$lU/\nu = 3$

Figure 4.12.10. Streamlines of flow (from left to right) past a flat plate of length l held broadside-on or edge-on. (From Prandtl and Tietjens 1934.)

PLATE 4

PLATE 5

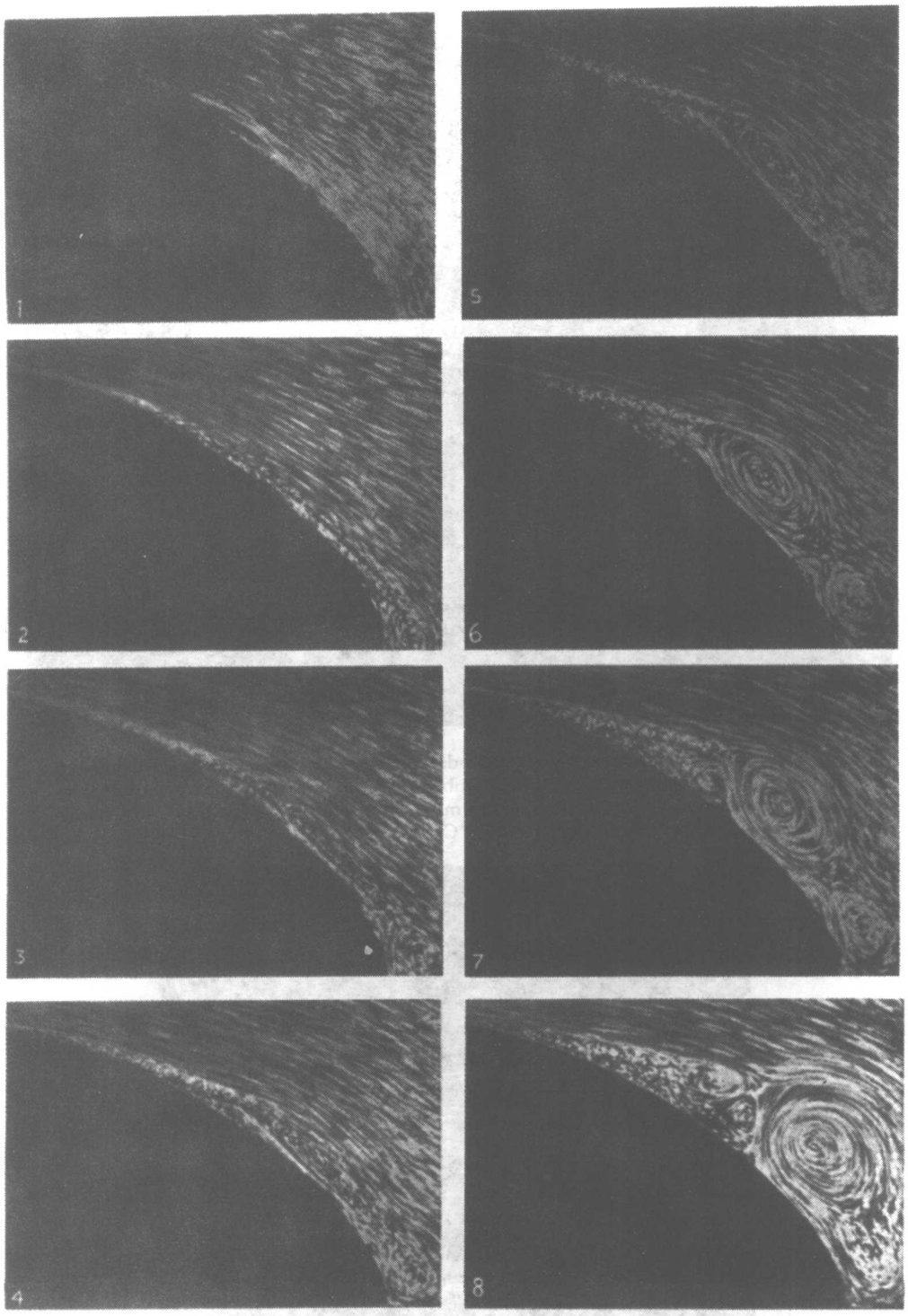


Figure 5.9.3. Stages in the growth of the boundary layer at the rear of a bluff body in motion after being initially at rest The flow is viewed relative to the body and is from left to right. (From Prandtl and Tietjens 1934.)

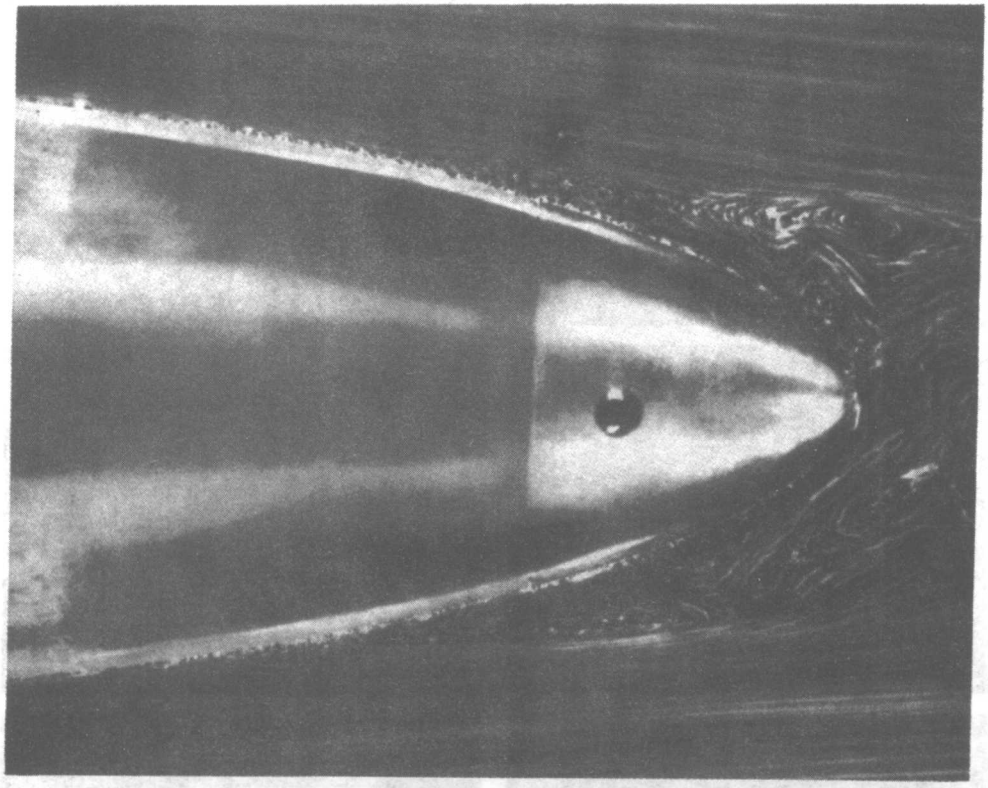


Figure 5.10.1. Separation of the steady boundary layer at the rear surface of a body of revolution in a stream of water. Reynolds number based on body length $= 1{\cdot}3 \times 10^5$. The motion was made visible by placing aluminium particles on the water surface which was also a plane of symmetry of the body. (From Clutter, Smith and Brazier 1959.)

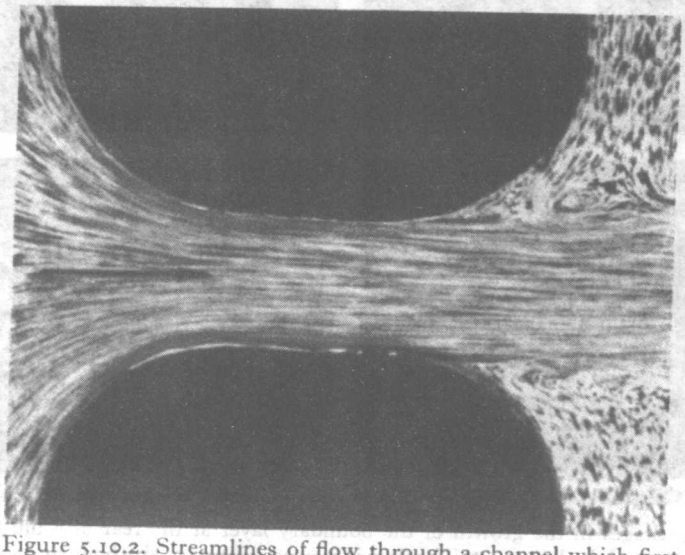


Figure 5.10.2. Streamlines of flow through a channel which first converges and then diverges. (From Föttinger 1939.)

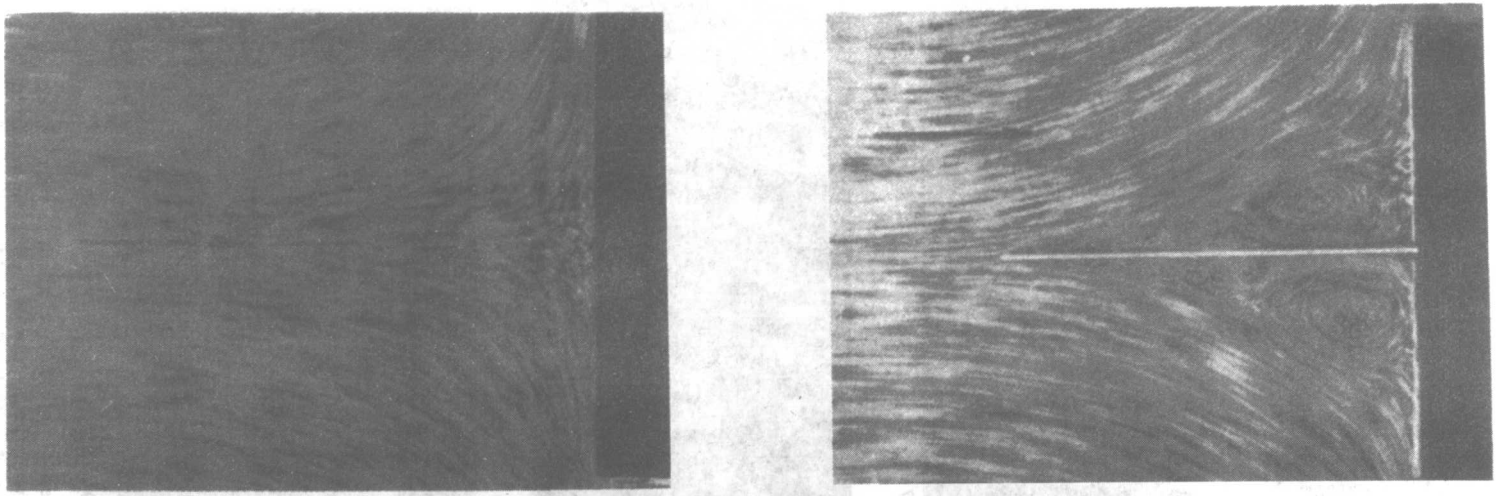
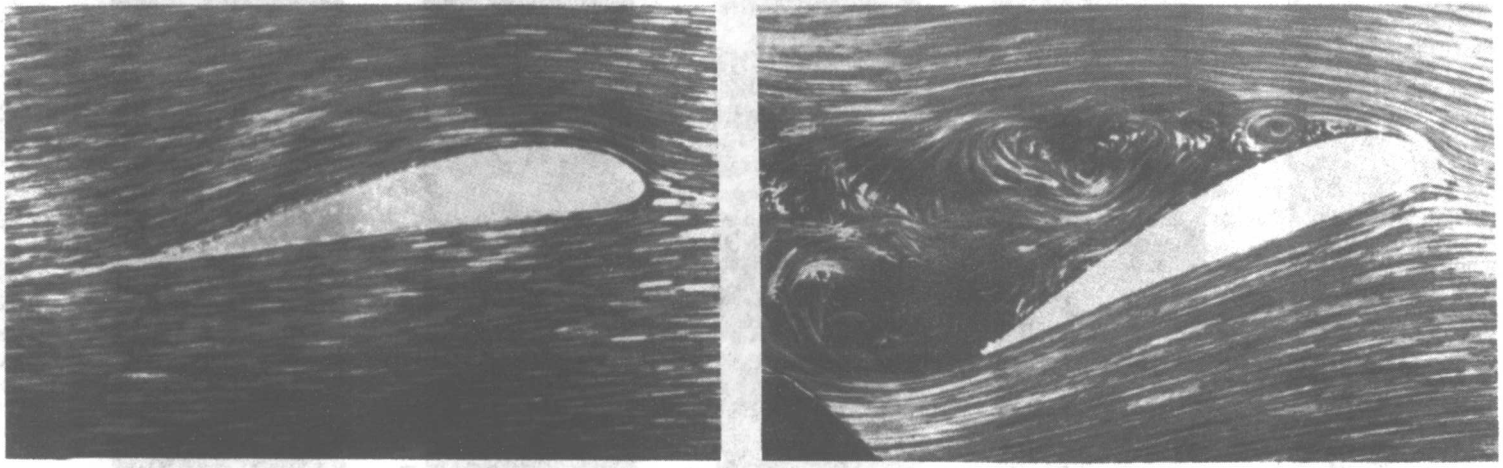


Figure 5.10.3. Flow toward a 'stagnation point' at a wall, without and with a thin plate at the plane of symmetry. (From Föttinger 1939.)

(*a*)



(*b*)

Figure 5.11.1. Flow from right to left past an aerofoil (*a*) aligned roughly with the stream, and (*b*) not so aligned. (From Prandtl 1930.)

PLATE 8

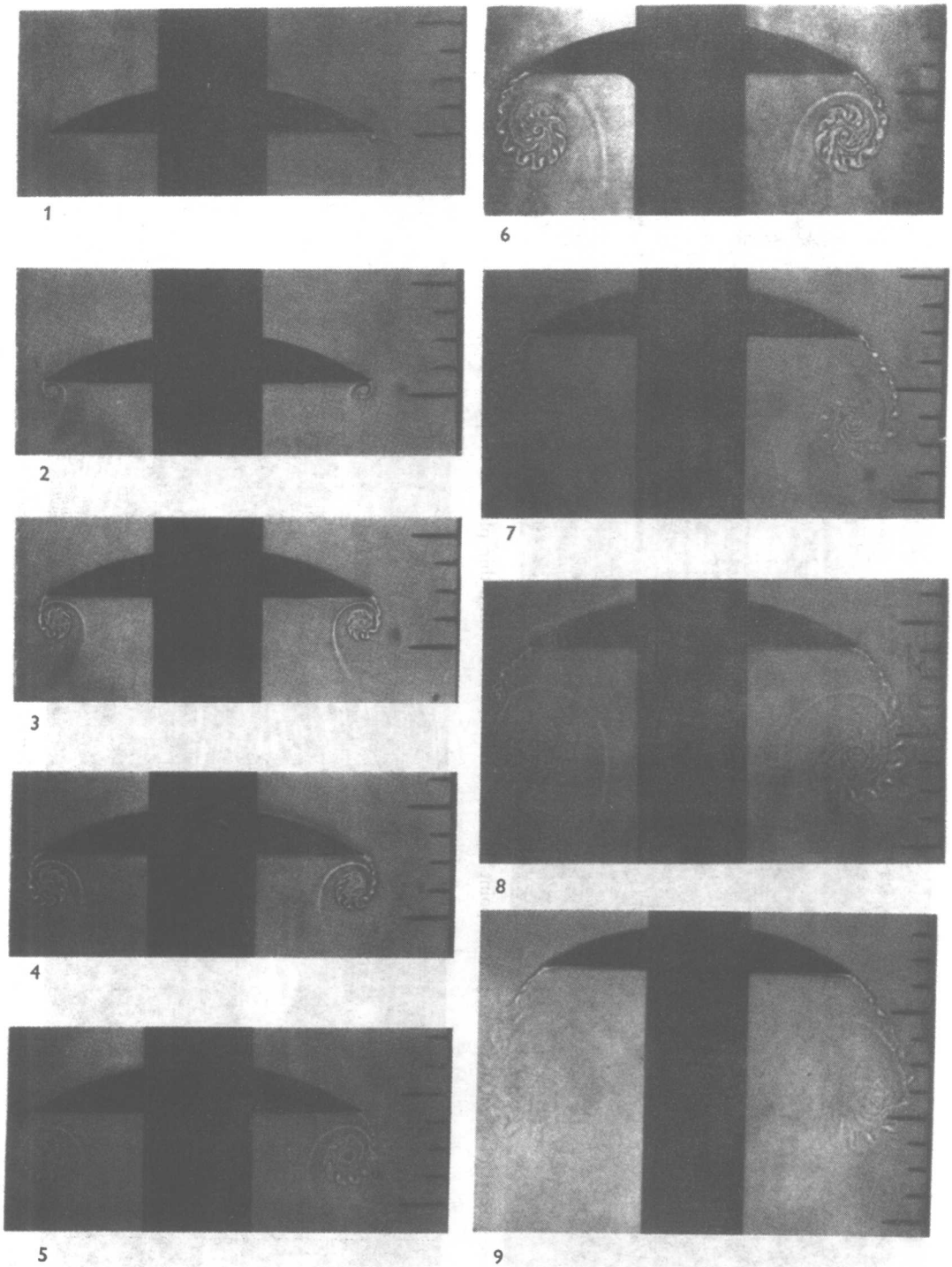


Figure 5.10.5. Sequence of shadowgraphs, taken at intervals of about $1{\cdot}1 \times 10^{-3}$ sec (with twice that interval between the last two), showing the position of vapour released from the surface of a two-dimensional body with a salient edge accelerating rapidly upwards from rest to a final steady speed of 731 cm/sec in air. The fixed scale marks on the right-hand side of each picture are at intervals of 0·63 cm. (From Pierce 1961. Crown copyright.)

PLATE 9

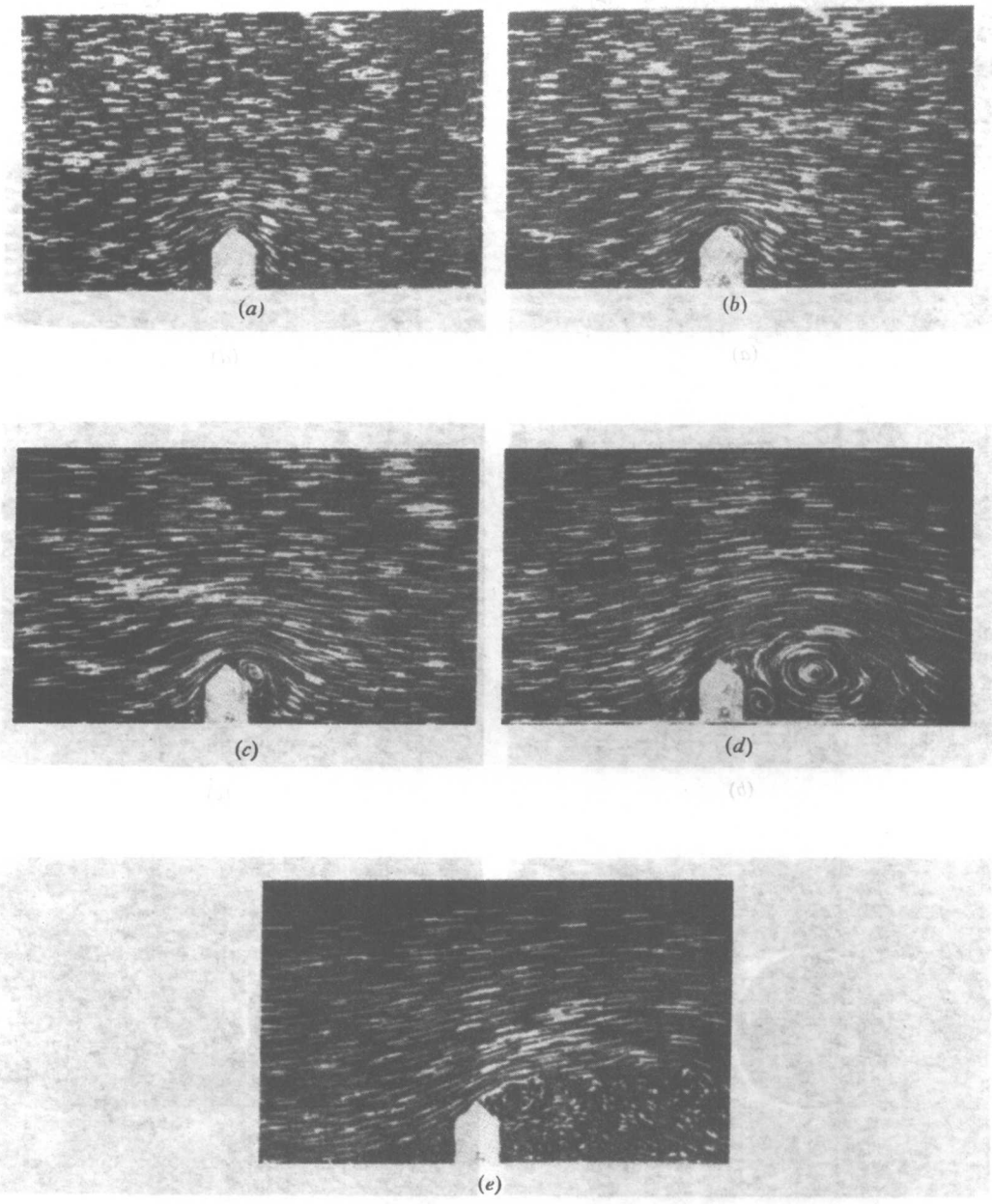


Figure 5.10.6. Stages in the development of flow past a model of a house from rest. Flow from left to right. (From Nøkkentved 1932.)

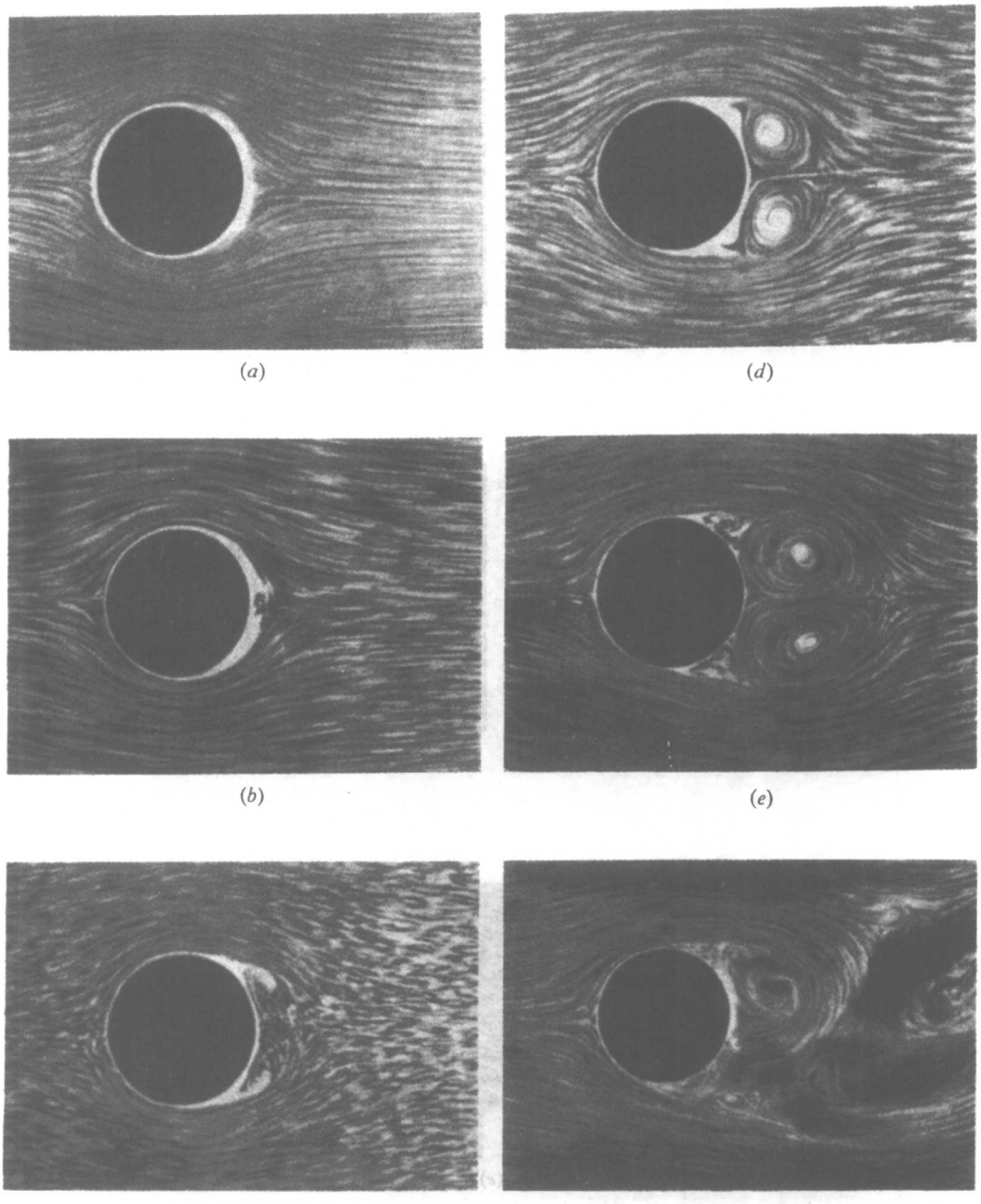


Figure 5.11.3. Stages in the development of flow (from left to right) past a circular cylinder from rest. The speed of the stream has been increased rapidly and then kept constant. (From Prandtl 1927.)

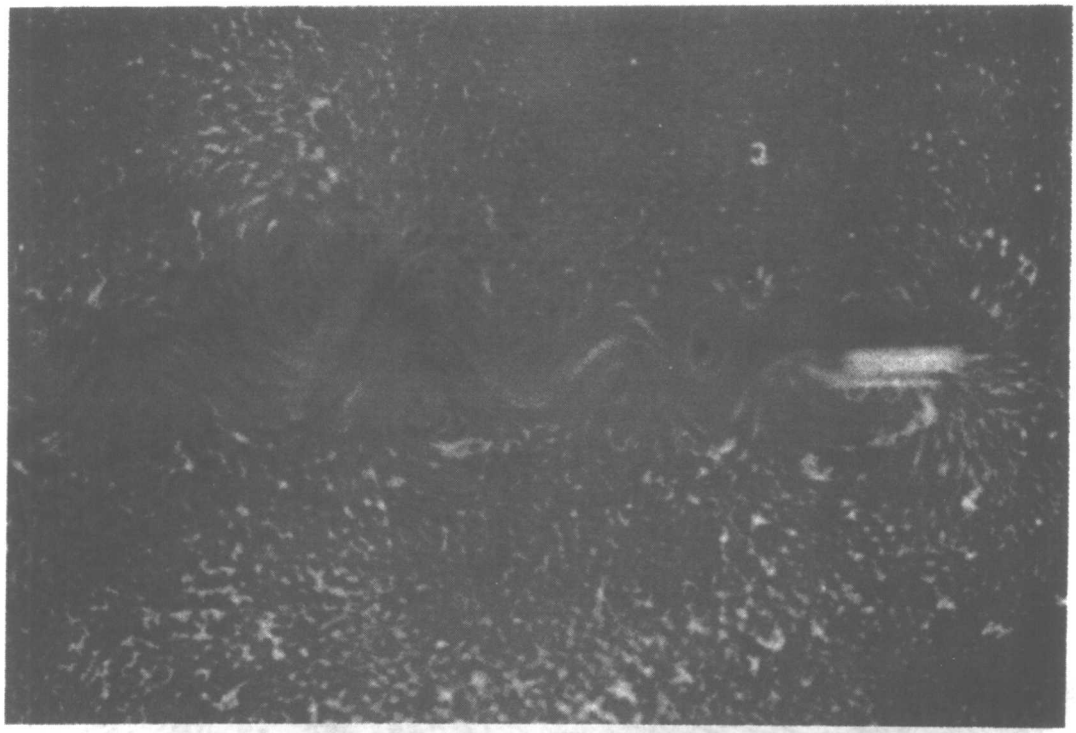


Figure 5.11.4. The 'vortex street' in the wake of a circular cylinder moving steadily, at $R = 1{\cdot}93 \times 10^3$. The motion was made visible by placing aluminium particles on a water surface, and the cylinder was moving relative to the camera (so that it appears as elongated) from left to right. (From Clutter, Smith and Brazier 1959.)

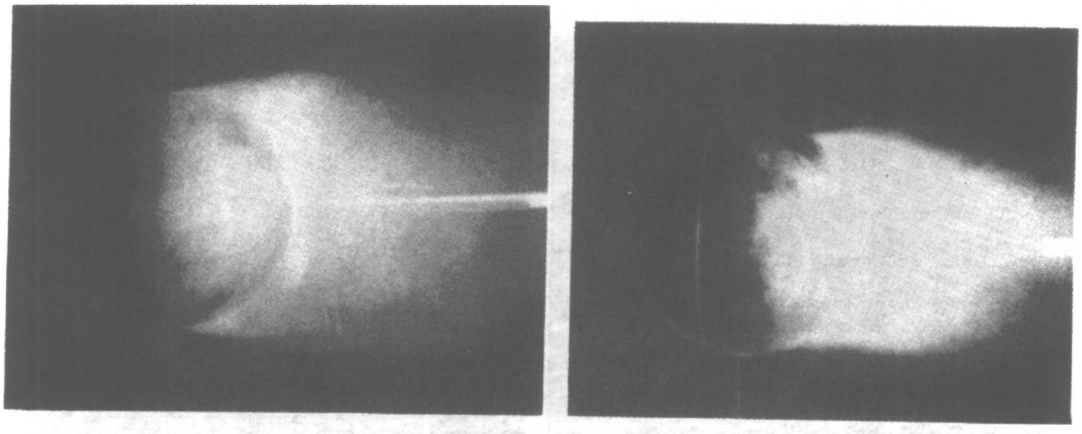
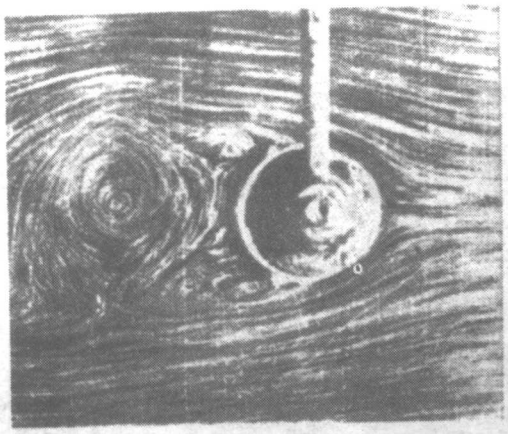
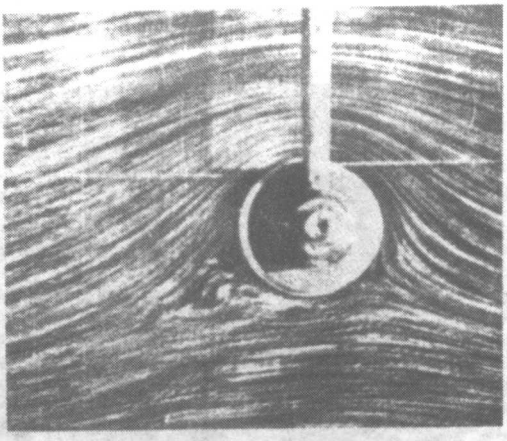


Figure 5.11.7. Smoke released at the rear of a sphere in a stream flowing from left to right. The second photograph shows the effect of disturbing the boundary layer with a wire. (From Wieselsberger 1914.)

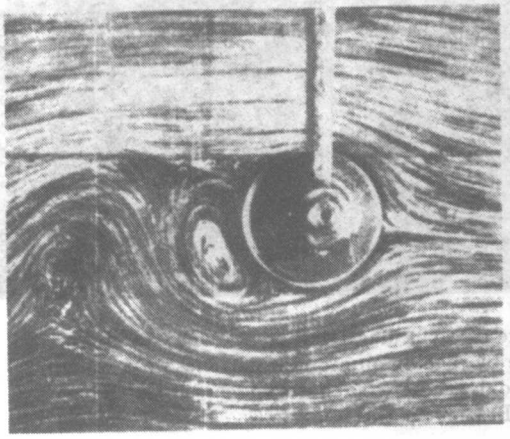
PLATE 12



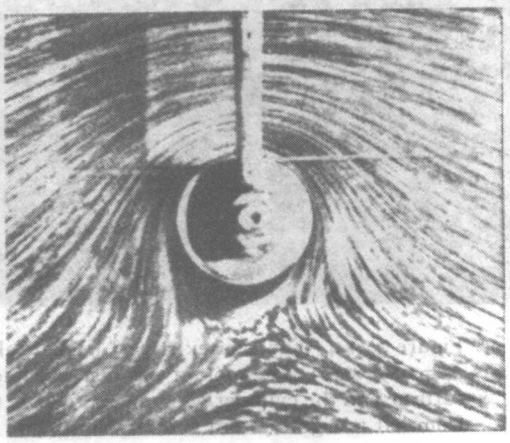
$a\Omega/U = 0$



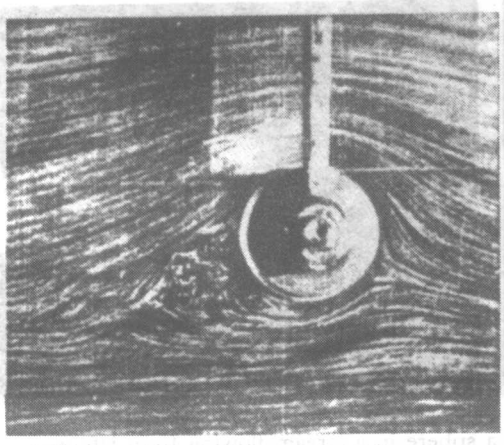
$a\Omega/U = 3$



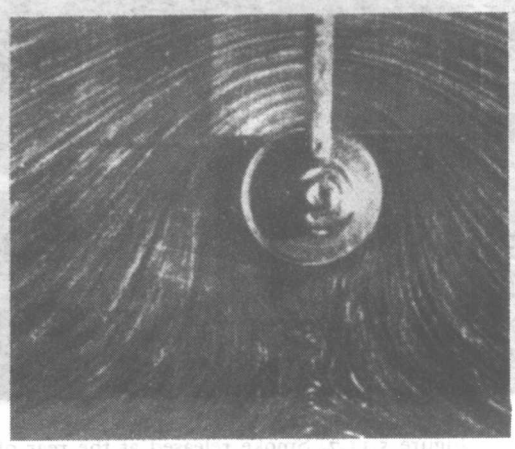
$a\Omega/U = 1$



$a\Omega/U = 4$



$a\Omega/U = 2$



$a\Omega/U = 6$

Figure 6.6.2. Photographs of the streamlines in flow due to a rigid cylinder rotating with anti-clockwise angular velocity Ω in a stream (from right to left) of uniform speed U at infinity. (From Prandtl and Tietjens 1934.)

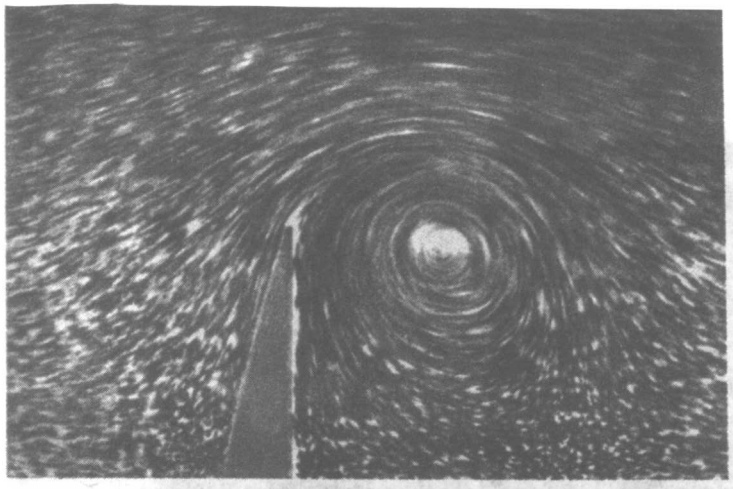


Figure 6.7.2. Flow from left to right round a salient edge of a body soon after the motion has begun. (From Prandtl and Tietjens 1934.)

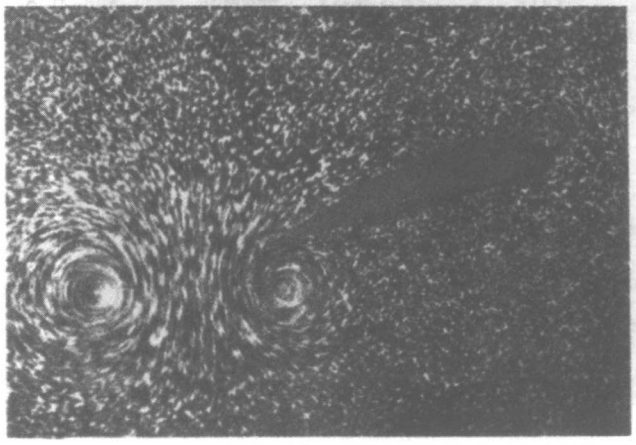
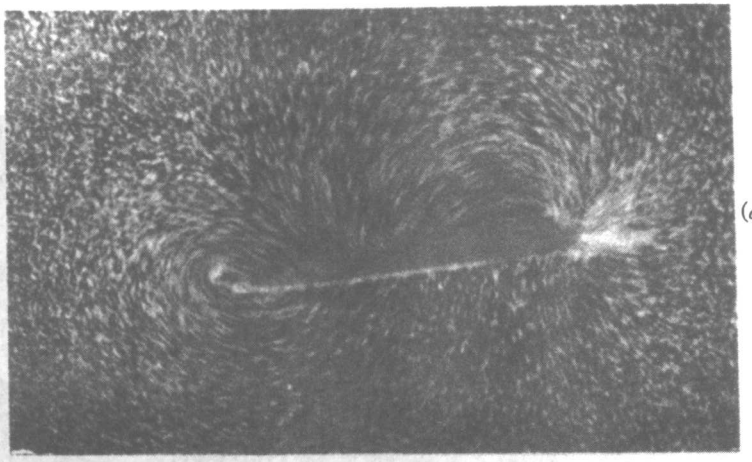
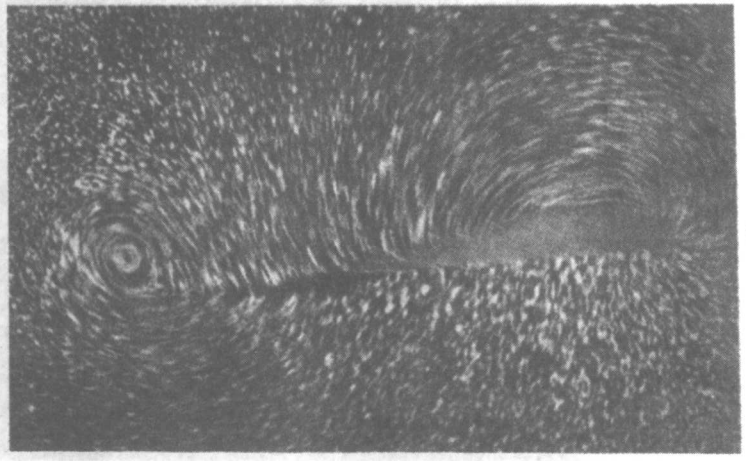


Figure 6.7.6. Vortices shed by an aerofoil which has been brought from rest to a steady motion suddenly and later stopped suddenly. (From Prandtl and Tietjens 1934.)



(*a*)



(*b*)

Figure 6.7.5. Streamlines of the flow due to a moving aerofoil, relative to the undisturbed fluid; (*a*) soon after the aerofoil has begun to move (from left to right), (*b*) after the aerofoil has moved steadily through about one streamwise length. The vorticity shed from the trailing edge is concentrated in a visible vortex. (From Prandtl and Tietjens 1934.)

PLATE 13

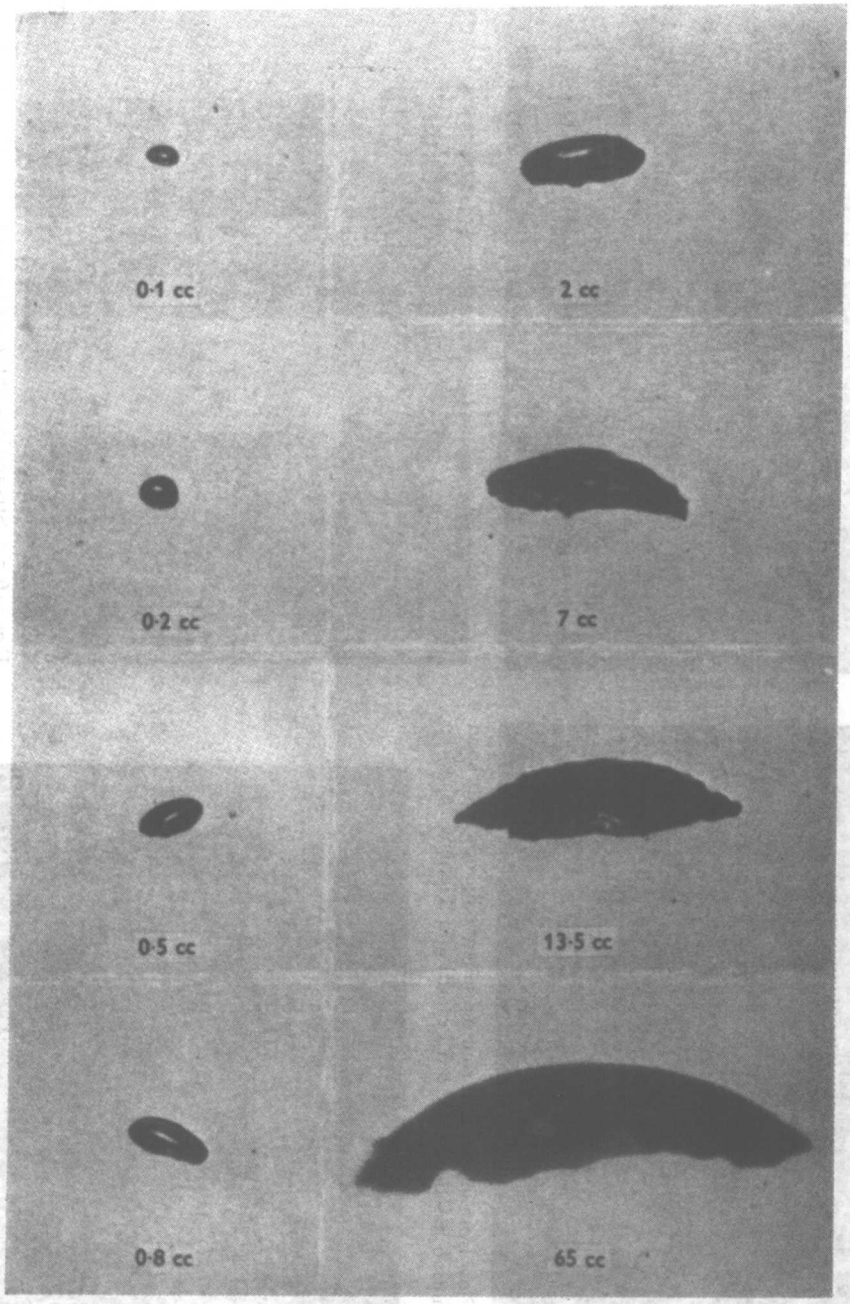


Figure 6.11.1. Air bubbles rising through water. The volume of the bubble is shown beneath each photograph. (From Jones 1965.)