The following formulæ may be quoted:—

V = Velocity of water at surface in inches per second.

Velocity at bottom $= (V + 1) - 2\sqrt{V}$.

Mean velocity $= (V + 0.5) - \sqrt{V}$.

$= 0.8$ V in sluggish rivers.

In rivers heavily charged with detritus the velocity is less than in clear streams. Broadly speaking, in a normal stream say of 15 feet depth the bottom velocity will be about one-half that of the surface. Observations on the Elbe, the Danube, and the Paraná showed the bottom velocities to be 85 per cent of those of the surface.

Tidal Bore.—This phenomenon occurs in many localities in which tidal flow passes into a shallow or contracted channel. The conditions most favourable are a swift river, sand flats intersected by the river in advance of the same, outside a funnel-shaped estuary. Under such conditions a wave or wall of travelling water advances at high velocity up-stream. The in-rushing tidal water is skidded in passing the obstruction set up by the bottom of the stream or is checked by the impetus of the undertow of the outflowing land water, with the result that it wells up and travels as a roller inland. In embayments, such as those of St. Malo and Fundy, the tidal impulse is crowded into horn-shaped recessions of the coast-line. The waters cannot escape laterally, and are forced to pile themselves up, with the result that they bring about abnormal tidal range. At Granville the tidal lift is 37 feet; in the Bay of Fundy it is sometimes 60 feet, and the tidal current there runs at 10 miles an hour. The rise at Chepstow from the Bristol Channel at springs is 38 feet.

The bore in the Severn runs as a column of water 5 or 6 feet high along the banks and 3½ feet in the centre of the river. In the Seine at Tancarville there was formerly a bore in height 10 feet, in velocity 12 miles per hour. The training of the river has, however, greatly reduced this. Wherever, by deepening or other modification of channel section, the tidal flow meets a lesser obstruction in travelling up-stream, bore effects tend to