parts running away from one another and finally separating into drops; in which case, owing to the resistance of the air, the velocity, and therefore the energy, is almost wholly dissipated, and the fall becomes a veil of mist, swayed by the winds.

3. *Velocity of rivers.* — The velocity of rivers varies (1) with their slope — strictly the slope of the upper surface; (2) with the volume of water; (3) with the friction of the bottom and sides — which increases with the roughness of its surface, and the shallowness of the stream for a given volume; (4) with the degree of uniformity of the cross-section and uniformity of course, — for abrupt bends and shallowings increase friction. In other words, among rivers a large stream of considerable depth, having a width not a score of times greater than its depth, and a uniform cross-section and course, will be least impeded by friction of the sides and bottom, and will work most efficiently. Over a bottom of ordinary kind the velocity is greatest along the line of greatest depth; and in any given section the maximum plane of flow is at or near the surface, at about one tenth of the depth (Humphreys and Abbot), but varying between zero and two tenths. The retardation at surface is attributed by Professor James Thomson to the friction of the bottom and sides; the eddying masses of water are thrown off by this friction, which modify the velocity in all parts of the stream, but most at the surface.

The mean velocity is about four fifths of the greatest velocity; or better, according to Humphreys and Abbot, it is almost uniformly 0·955 of the velocity at mid-depth. The amount (in cubic feet) of water passing is equal to the product of the mean velocity into the area of the cross-section. When two streams unite without increase of pitch, the velocity is increased because the surface of friction is less than in the two flowing separately.

Humphreys and Abbot, in their Report on the Mississippi River (page 312), give the following formula for calculating the velocity of large rivers. It is applicable strictly to a limited portion of a large river without bends. It is as follows: $v = ([225 r_{\prime} s^{\frac{1}{2}}]^{\frac{1}{4}} - 0{\cdot}0388)^2$, in which v is the velocity sought; s, the sine of the slope; and $r_{\prime}$ the mean radius = area of cross-section, a, divided by $p + W$, or the length of the wetted perimeter (p) *plus* the width at surface. In the general formula, the sine of the slope $= s = \frac{h'}{l}$. l = length of a limited portion of the river. $h = h_{\prime} + h_{\prime\prime}$ = difference of level of the water-surface at the two extremities of the distance l, in which $h_{\prime}$ = the part of h consumed in overcoming the resistances of the channel supposed to be straight and of nearly uniform cross-section, and $h_{\prime\prime}$ = the part of h consumed in overcoming the resistances of bends and important irregularities of cross-section. In the equation for large rivers, above quoted, $h_{\prime\prime}$ is thrown out by the conditions.

When a river expands into a lake, the velocity of flow is diminished because of (1) the greater capacity of the lake for a given amount of length; (2) the decrease in slope; and (3) the increased surface for evaporation. There is little movement in the waters that lie below the level of the outlet.

4. *Periodicity in working-power.* — Rivers are periodical workers, owing to periodicity in the day, the seasons, and in the longer climatal cycles.