inches and at exit 23·5 inches, so that $u_3 \div u_2 = 1{\cdot}30$. Taking $k$ as ·95, then, from the triangle of velocities, $u_2 = {\cdot}560\, v_1$ ; ${}_2v_r = {\cdot}51\, v_1$ ; ${}_3v_r = k\left\{ {}_2v_r + (u_3 - u_2)\cos\gamma \right\} = {\cdot}638\, v_1$ ; $v_3 = {\cdot}155\, v_1$. The hydraulic efficiency, based on the energy of the jet, is ·933 ; the loss in the buckets is ·043 ; and the loss at discharge ·024. Tests on the wheel,[1] under a head of 248 feet, showed a maximum overall efficiency of ·81, which, as the efficiency of the jet was ·90, corresponds to ·90 measured on the energy of the jet. As windage and mechanical friction losses amounted to approximately ·040, the agreement between the calculated and measured efficiency is very close. The maximum efficiency was attained with a value of $u_2 = {\cdot}46\, v_1$. The corresponding velocity at the outer periphery of the bucket is $\cdot 56\, v_1$. It is to be expected that the best speed at the mean radius of the vanes will be somewhat less than that giving entry without shock at this point, since at the latter speed there will be impact on the back of that portion of each vane which lies outside this radius. Also, as the speed is reduced, the windage and mechanical losses are reduced. It may be taken that the best results are likely to be attained in practice when the speed of the outer periphery of the runner at entrance satisfies the conditions of the velocity triangle for entry without shock.

*Effect of Centrifugal Action.*

In an axial flow turbine centrifugal action tends to heap up the water towards the outside of the buckets. Thus, in Fig. 214, a particle of water entering at $P$ (in plan) tends to follow a path $P\,A$ instead of its actual path

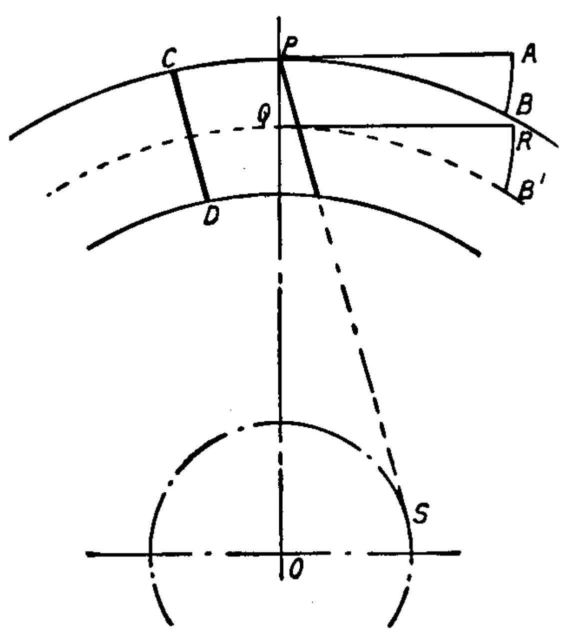


FIG. 214.

[1] "Proc. Inst. C. E.," vol. 213, 1921–22, Part I., p. 407.