At the head end the acceleration of the piston would be

$$\left(a + \frac{a^2}{b}\right)\omega^2 = \left(.29 + \frac{.29^2}{1.5}\right) \times 55^2 = 931 \text{ ft. per sec.,}$$

per sec.

At the crank end the acceleration would be:

$$\left(a - \frac{a^2}{b}\right)\omega^2 = \left(.29 - \frac{.29^2}{1.5}\right) \times 55^2 = 623 \text{ ft. per sec.,}$$

per sec.

At the time when the crank is vertical the result is:

$$\frac{a^2}{\sqrt{b^2 - a^2}}\,\omega^2 = \left[\frac{.29^2}{\sqrt{1.5^2 - .29^2}}\right] \times 55^2 = 173 \text{ ft. per sec., per sec.}$$

The angular acceleration of the rod, being determined by the length AQ'', is zero at each of the dead points but when the crank is vertical this velocity has nearly its maximum value, its exact value being $Q''A \,.\, \frac{\omega^2}{b}.$ When the crank is vertical a diagram will show that $Q''A = \frac{a\,b}{\sqrt{b^2 - a^2}}$, and the acceleration will be $\alpha_b = \frac{a}{\sqrt{b^2 - a^2}}\,\omega^2$.

For the engine already examined $\alpha_b = \left[\frac{.29}{\sqrt{1.5^2 - .29^2}}\right] 55^2$ $= 596$ radians per sec. per sec.

APPROXIMATE GRAPHICAL SOLUTION FOR THE STEAM ENGINE

In the approximate method already described, in which the angular acceleration of the crank shaft is neglected and P'' is assumed to coincide with P, it will be noticed that length $P''A = \frac{b'^2}{b}$, is laid off along the connecting rod, the length $P'Q'$ representing b', and PQ the length b, and then AQ'' is drawn perpendicular to PQ. This may be carried out by a very simple graphical method as follows: With centre P and radius $P'Q' = b'$ describe a circle, Fig. 143, then describe a second circle, having the connecting rod b as its diameter cutting the first circle at M and N and join MN, where MN cuts b locates the point A and where it cuts the line through O in the direction of motion of Q gives Q''

The proof is that PMG being the angle in a semicircle is a right