

(b) *The effect produced by the connecting rod.*

This effect is rather more difficult to deal with on account of the nature of the motion of the rod. The resultant force acting may, however, be found by the method described earlier in the chapter, but in the case of the steam engine, the construction may be much simplified, and on account of the importance of the problem the simpler method will be described here. It consists in dividing the rod up into two equivalent concentrated masses, one at the crosshead pin the other at a point to be determined.

Referring to Fig. 146, the rod is represented on the acceleration diagrams by $P''Q''$ and the acceleration of any point on it or the angular acceleration of the rod may be found at once by processes already explained. Let I_b be the moment of inertia of the rod about its centre of gravity, k_b being the corresponding radius of gyration and m_b the mass, so that $I_b = m_b k_b^2$, and let the centre of gravity lie on PQ at distance r_1 from Q . Instead of considering the actual rod it is possible to substitute for it two masses m_1 and m_2 , which,

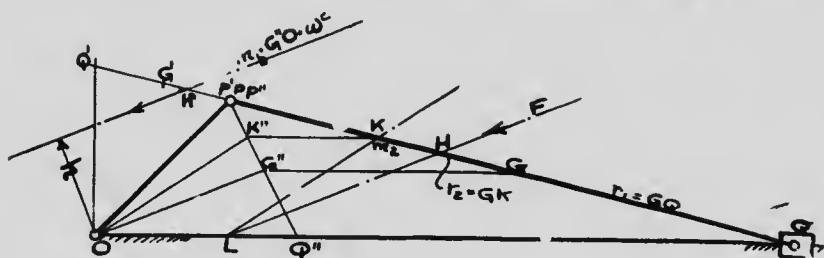


Fig. 146

if properly placed, and if of proper weight, will have the same inertia and weight as the original rod. Let these masses be m_1 and m_2 where

$$m_1 = \frac{w_1}{g} \text{ and } m_2 = \frac{w_2}{g}, w_1 \text{ and } w_2 \text{ being the weights of the masses}$$

in lbs. Further, let mass m_1 be concentrated at Q , it is required to find the weights w_1 and w_2 and the position of the weight w_2 . Let r_2 be the distance from the centre of gravity G of the rod to mass m_2 .

These masses are determined by the following three conditions:

- (1) The sum of the weights of the two masses must be equal to the weight of the rod, or $w_1 + w_2 = w_b$, or $m_1 + m_2 = m_b$.
- (2) The two masses m_1 and m_2 , must have their combined centre of gravity in the same place as before, or $m_1 r_1 = m_2 r_2$
- (3) The two masses must have the same moment of inertia