

case the engine does not explode at any time the forces acting on the rods and pins may be very much greater than during an explosion, because of the great forces required to move the parts.

Evidently, in such machines much damage might very easily be done by allowing the speed to become unduly high, and although the engine were doing no work it might easily be destroyed at this high speed.

The matter is well worthy of the careful study of the student.

COMPUTATION FOR AN ACTUAL ENGINE

This chapter will now be ended by a computation on an actual steam engine, partly for the purpose of explaining the method more fully and partly to give an idea of the magnitude of the various forces.

The engine selected is the high-pressure side of a vertical, compound, high-speed engine of about 125 h. p. The engine has a cylinder 11 in. dia. and 7 in. stroke and runs at 525 revs. per min., the piston, piston rod and crosshead weigh 161 lbs. The connecting rod is 18 in. long centre to centre, weighs 47 lbs. and has a radius of gyration about its centre of gravity of 7.56 in. The centre of gravity of the rod is 4.7 in. from the centre of the crank pin.

Taking the above data gives $\omega = 55$ radians per sec., the mass of the piston, etc., $m_c = 5$. For the connecting rod $m_b = 1.46$, $k_b = .63$ ft., $r_1 = 1.11$ ft., $r_2 = \frac{.63^2}{1.11} = .36$ ft. $m_1 = 1.46 \times \frac{.36}{1.11 + .36} = .35$, $m_2 = 1.11$.

The complete construction for the crank angle 36° , is shown in Fig. 147, where all the quantities have been clearly marked. In this case L remained fixed for all crank angles, being at a distance .44 in. from O on the same side as the piston. The results for this engine are set down in the accompanying table in which it is observed that at the head end of the stroke a force of 5262 pds. would be required to move the piston which would mean a net pressure on the piston area of over 55 pds. per sq. in., in other words, if the engine were driven with an effective steam pressure of less than 55 pds. at the beginning of the down stroke, then the piston rod would be in tension instead of compression for this position.

It is further to be noted that the disturbing effect of the connecting rod is much less marked than that of the crank and as far as its effect on the turning moment is concerned the connecting rod might be neglected. The total effect of all the moving parts, as given in the last column, is evidently very decided.