

It will be observed that all of these accelerations increase as the square of the number of revolutions per minute of the crank shaft, so that while in slow speed engines the inertia forces may not produce any very serious troubles, yet in high speed engines they are very important and in the case of such engines as are used on automobiles, which run at speeds of 1500 revs. per min., these accelerations are very large and the forces necessary to produce them cause considerable disturbances. Take the piston for example, the force required to move it will depend on the product of its weight and its acceleration so that if an engine ran normally at 750 revs. per min. and then it was afterwards decided to speed it up to 1500 revs. per min., the force

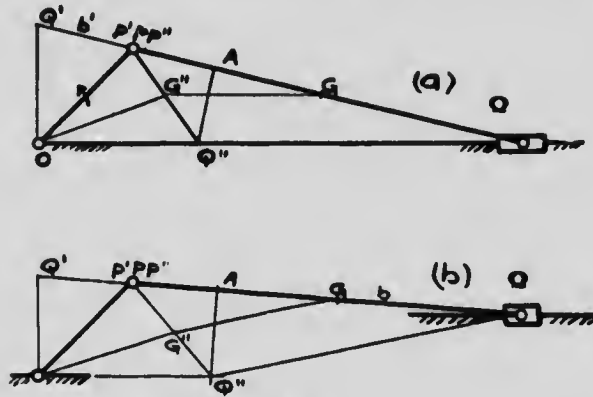


Fig. 142

required to move the piston in any position in the latter case would be four times as great as in the former case.

In the actual design of the steam engine, the calculations may be very much simplified by taking into account certain limitations which are imposed on all designs of engines. In the case of other machinery, these limitations being briefly that the angular acceleration of the fly-wheel must be comparatively small, i.e., the angular acceleration of the fly-wheel must not be great, and in fact, on engines the fly-wheels are made so heavy that α cannot be large.

To get a definite idea on this subject a case was worked out for a 10 in. $\times$ 10 in. steam engine, running at 310 revs. per min., and the maximum angular acceleration of the crank was found to be slightly less than 7 radians per sec., per sec. For this case the normal ac-

celeration of P is $r\omega^2 = \frac{5}{12} \times 1100 = 458$ ft. per sec., per sec., while