governing the action of steam were not understood then as well as now; and from fancied difficulties connected with its passage to and from the cylinders, a slow reciprocation of the piston was deemed worth having at any sacrifice. Larger and larger wheels were therefore adopted as soon as the reaction succeeding Brunel's failure had set in, and some years since we arrived at the very general employment of an 8-ft. wheel for express engines. High wheels were early adopted by American builders. In 1849, several engines were placed on the New York and Erie Railroad, with two pairs of 7-ft. drivers; the cylinders, 14 in. diameter, having the enormous stroke of 32 in. Eight-feet drivers are still used on the Camden and Amboy Railway; strangely enough, with good engines. In France, Gouin and Co. built an engine, "l'Aigle" in 1854, with drivers 9 ft. 4 in. in diameter, with outside level cylinders 16½ in. in diameter, and 31½ in. stroke. Several engines with 8-ft. wheels may be met with on many of the French lines. Neither here nor elsewhere, however do these great diameters gain in favour, except for exceptional locomotives of great size; and the engines which prove their superior efficiency by doing most work, seldom have drivers much over 6ft. in diameter. Our friends at the other side of the Atlantic have been so thoroughly convinced, by practical experience, that the adoption of a large wheel is not only unnecessary, but positively injudicious, that the practice of "cropping drivers was at one time almost universal; engines with 7-ft. and 8-ft. drivers having these removed, and replaced by wheels a foot or two less, with manifest advantage.

The size of driver has really very little connection with the speed of an engine. There is no good reason whatever that a pair of pistons should not do their work as well, when moving at 1,100 ft. per minute as at half that speed. It is merely a question of wear and tear; and railway statistics prove that piston speed exercises little if any influence on expenses incurred for repairs. Indeed, it is not easy to see how it can. Some years ago, when locomotive construction was not so well understood as it is now, very considerable difficulty was experienced in keeping pistons fast on their rods. They worked loose continually, and every now and then smashed through a cylinder cover. But this occurred with the pistons of all sorts of locomotives, both slow and fast. Improved methods of valve setting, by providing a moderate amount of compression, quickly obviated the evil, and even had it not done so, we now understand how to forge the piston and rod in one piece, so as to render such a catastrophe impossible. We have ere now pointed out, that the pressure on the piston is no measure whatever of the strain on the crank pin especially in quick-working engines. The proper combination of the expansion of the steam with the momentum of the reciprocating parts, enables us to equalize these strains, reducing the danger of fracture to a minimum. The engine, indeed, if properly balanced, may, from this reason alone, run with less danger of accident at a high speed than at a low one, provided the principle of expansion is properly carried out.

Engines, with high drivers, are notoriously bad at a dead pull. It is urged, indeed, that under any practicable load which we can place on a single pair of drivers, a 17½ in. piston acting on a 12-inch crank, with 120 lbs. steam, will cause them to slip so long as they are under 10 ft. in diameter. We much doubt the truth of the assertion however, provided the rails are clean; and the engineers of express engines know but too well, what it is to struggle up an incline with a slightly abnormal load. The actual tractive power of an engine, with 4 ft. drivers is, *cæteris paribus*, just double that of one with wheels twice the diameter, and the former, will—speeds being the same—develop just half the horse-power of the latter per mile. It is a necessity, in fact, with the engine with high drivers, that it must run at speed to develop power with heavy loads; high wheels preclude speed; hence we find that express trains seldom weigh over 50 or 60 tons. Were smaller drivers employed, the same speeds could be obtained, while inclines, or an extra carriage or two, would present none of the difficulties which they do now.

It is quite possible to overcome this want of tractive force by adopting large cylinders. We question, however, that a recourse to this expedient is advisable. Engineers are well aware that the dimensions of the cylinders are generally a measure of the size of the engine, Although they do not necessarily entail an increase in the capacity of the boiler, still large cylinders require stronger framing, larger valves and heavier connecting rods, &c., than those of smaller diameter. These matters quickly swell the proportions of an engine to something very considerable; and we may, in consequence, determine without much hesitation, that weight in an efficient express locomotive is in direct proportion to the dimensions of the driving wheels. Now it does not require a very profound knowledge of railway matters to demonstrate that small engines are invariably more efficient, proportionally than large ones; and permanent way complains sadly of the usage which it meets with from engines with 12 tons on a single pair of driving wheels.

Speed really depends on boiler power, and the rapid reciprocation of the pistons is no real evil. Theoretically objectionable, practice proves, in the clearest manner, that working expenses are not increased by it to any appreciable extent. Immense driving wheels no longer enjoy the popularity they once did; and we much doubt that any engines are now being built with them. Indicator diagrams taken from an express engine, with 7 ft. 2 in. drivers at a speed of 63 miles per hour, are almost identical with those taken from a nearly similar engine, with drivers a foot higher, at sixty miles per hour. The indicator is after all, the real test of the good qualities of a locomotive as far as the action of steam is concerned; and we regard such a result as pretty conclusive evidence that nothing is to be gained by the use of a wheel much over 6 ft. in diameter. A rapid reciprocation of the pistons permits the use of a large blast-pipe, as the blast in the chimney is equalized, and rendered more effective, while it does not cut up the fire so much as an exhaust at comparatively distant intervals. Regard the matter as we may, we believe that there is no difficulty in proving that the most efficient engines ever built have had driving wheels of moderate diameter; and railway companies will find it good policy to return to their use.—*Mechanics' Magazine.*