may not be out of place to describe it here. This machine, the weight of which is 96 tons, hauled a loaded freight train 1,800 feet long, weight 1,900 tons, and two locomotives (no steam on them), also a local freight train of 15 cars and one locomotive, a total weight of 3,800,000 lbs., and started this enormous weight on a grade of 1 to 125 without splutter, sparking or the least slip of the wheels. The draw bar pull, when this train was in motion, was over 60,000 lbs., say 30 American tons. At 12 miles per hour as speed of train, what amount of brake horse power this will represent can be seen from the following simple calculation: 5,280 feet per mile × 12 miles per hour = 63,360 feet ÷ 60 = 1,056 feet per minute × 60,000 lbs. draw bar pull = 63,360,000 lbs. ÷ 33,000 lbs. = 1,920 horse-power for electric locomotive when hauling this train, including weight of three locomotives in motion without steam in cylinders. If this train had been hauled by these three locomotives, each engine would have had to develop 640 horse power. Allowing 5 lbs. of coal per brake horse-power per hour, each engine would use 3,200 lbs. of coal per hour, or 9,600 lbs.; for three gas engines to do the same work would be guaranteed to develop 1,920 horse-power with less than 2,000 lbs. of common coal or culm. Further, the cost of attendance on the locomotive power would be three times that of electric locomotives and gas engines to run the dynamos. The best engines in existence run with about 1¾ lbs of coal per horse power per hour; marine triple expansion engines, from 2¼ to 2½ lbs.; engines in general use, from 3 to 4 pounds; the best locomotive high pressure compound, from 4½ to 5 lbs., while from 7 to 10 pounds per horse-power per hour is a common quantity.

Gas engines will no doubt in the near future not only develop power during each revolution, as some do now, but will be so far improved as to have an impulse on each side of the piston during one revolution, making four times the power for each revolution of those in common use now; they will then be applicable for all power purposes for which steam is now used, both at sea and on land, without carrying enormous reservoirs of highly heated water and steam under very dangerous pressures; while the gas generating apparatus takes up very much less room and is of not more than one-fourth of the weight of steam boiler, steam engine and fuel, and of less original cost per h.-p. developed. There are a number of gas engines in use that develop 500 h.-p.; some very extensive electric light power plants are run by gas engines, also mills and factories, so that the application of the gas engine to all general purposes such as stationary engines, is practically arrived at. The fact that the gas engine is vastly more economical of fuel than the steam engine is not the only consideration in its favor. The high economy is found in all sizes of gas engines. Small steam engines generally use from 10 to 12 lbs. of coal per horse-power per hour, against 1½ lbs. for the small gas engine; also the first cost of a small steam engine and boiler, their maintenance and operation, are more than three times that of the modern gas engine; so that the electric motor run by potential from steam power will not have the same chance of knocking out the steam engine as they would have if run by modern gas engines. Gas engines, kerosene and gasoline engines are all of the same class. The gas engine will ere long drive the trolley car off the roads. The gas engines direct on cars, or for other work working direct, must of necessity be cheaper in the production of power than a gas engine in a central station running a power generator distributed over wires and on to motors, by electricity. Even the supplying of gas for a trip of a known distance, confined in a tank under pressure, is now commonly done in Europe and found to answer fairly well. The horseless carriage is now largely before the public, and will be soon as common as other vehicles. Many great improvements are continually made, as the best mechanical engineers are now making a study of them. The lay-reader will understand that the engines now referred to are those in which the gas is produced from oil introduced into the engine in the form of oil and not in the form of gas.

The gas locomotive is even now within the bounds of practical probability, just as the electric locomotive has been. The gas engine locomotive would have important advantages over the electric ones. The builders of the electric locomotive seem to think that these engines are the rivals of steam, yet the gas engine may soon take the precedence of both of them, in fact, rival all other sources of artificial power.

It must be conceded that a very great advantage over steam power is found in an economical gas engine, as it does not depend on its economy for a large supply of water for condensing purposes, that can be only had in certain localities. The gas engine can be placed in the most suitable position for the distribution of its energy for every purpose. It is cheaper in first cost than any other method of developing power, as also in attendance and maintenance. There are several European firms that will build them to develop 1,000 horse-power with much less than 1,000 lbs. of coal for this power per hour. It ought, therefore, to be a question with all those requiring power for electric lighting, pumping and power distribution, to look into this very important matter, which appears to have escaped notice by large power users in Canada.

THE KANE-PENNINGTON MOTOR.

The description of the Kane-Pennington motor, by Mr. Killey, and our editorial comment thereon, were based entirely on the account of it given in the *American Machinist*, a journal which is usually very careful in its statements. THE CANADIAN ENGINEER sent a representative to Chicago and Racine to investigate the facts, and the result of his mission is to convince us that the ideal motor for horseless vehicles has not yet been invented, much less has the Kane-Pennington motor solved the problem of aerial navigation. It is true that one of these motors, weighing only 17 lbs., was attached to a bicycle and ran a mile in 58 seconds, and that this feat was performed more than once, but they never ran it for three or five miles at that rate simply because the cylinders would have heated, as would be expected. The fact is that the supposed production of a new species of gas within the cylinder, brought about by the so-called "ripening spark," is a mere fiction calculated to sell patent rights to those who may not analyze the claims of a new invention very closely. While the Kane-Pennington motor may prove to be a very good machine, we may fairly question, in view of the dissipation of their alleged theories, whether it is even the best of those already on the market.

That the *American Machinist* was misled by its investigator, is evident from the following quotations from an editorial in a subsequent issue: