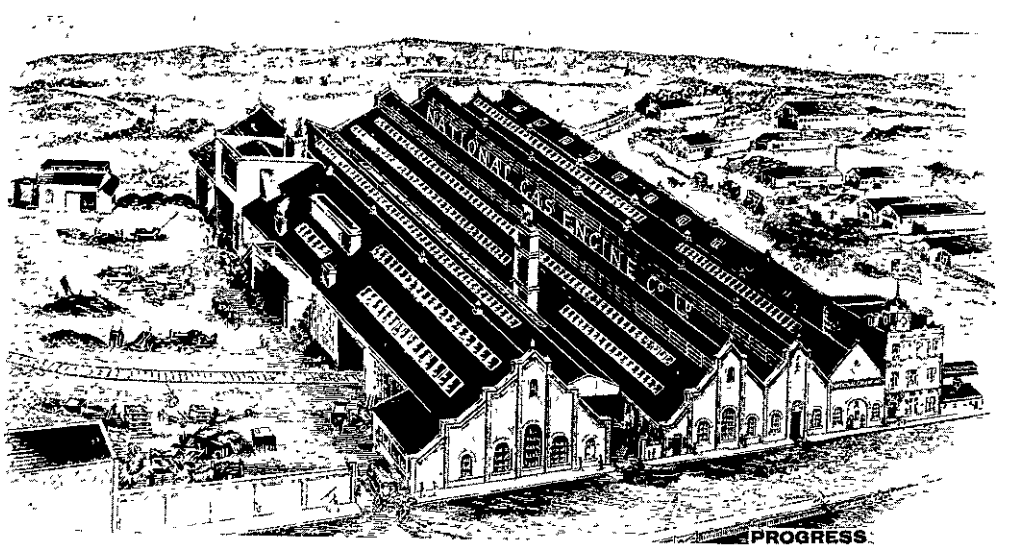
NATIONAL GAS ENGINES.

One of the most important engineering developments of recent years has undoubtedly been the introduction of suction producer-gas plant, which, owing to its increased economy in working, is creating what may be described as practically a revolution in gas-engine driving. Realising the future of the producer, the National Gas Engine Company have devoted considerable attention to its improvement, and their plant is at present amongst the best in the market. The great advantage of the suction producer over the older form lies in its very low first cost, the absence of a gas-holder, the ease of starting, and the long period of time during which the producer can run without any attention whatever. The cheap gas of the older pressure producer was not obtained without considerable attention to the plant; and consequently the power at which pressure plants began to be applied ranged much higher than those at which suction plants apply. It was rather unusual to associate pressure plants with any gas engine below 50 h.p.; whereas now engines of 30 h.p. and lower are often operated by suction gas. Where larger powers are required, suction plant presents many advantages over the pressure type; and the increase of power and dimensions is steadily proceeding. Suction plants are now made by the Company as low as 10 and as high as 300 h.p., and will soon be constructed to practically any power, in suitable units. The plant can be used in combination with a gas engine connected directly with it. The suction caused by the outstroke of the piston is then used to draw air through the fire in the gas generator, but the plant will work equally well if the air is supplied by a fan or blower. The gas is made by passing a mixture of superheated steam and air through incandescent fuel in the generator, the fire being made with small anthracite peas, or small clean coke. In special cases other fuel can be used. There is no external fire, and the gas is made as quickly as it can be consumed. An important feature of this plant is that it has been designed on the heat regenerative principle. All the air used for producing the gas is heated by waste heat from the body of the gas generator. The superheated steam required for making the gas is likewise produced by waste heat. The fuel which is to be converted into gas is also heated by waste heat before it reaches the combustion zone. Throughout the apparatus the loss of heat is therefore reduced to a minimum, and the efficiency is exceptionally high. When an engine works the suction plant, the engine itself governs the rate of gas production to suit its varying consumption. No surplus gas can then be made and as there is a partial vacuum in all parts of the plant, and in the piping while the engine is working, there cannot be any escape or waste of gas. The special feature of the "National" producer, which the Company claim gives it a marked advantage over suction producers, lies in the regulation of the water supply. This we learnt, is their own patent, and is applied only to the "National" engines. A large portion of the tools now running in the Wellington Works is driven by means of these producers. A 70 horse-power engine, driving the machinery in one of the large bays, is running under suction plant with gas produced at the rate of 2d. per 1,000 cubic feet. This is, of course, of a much lower quality than the ordinary town gas, but a careful computation has shown that with the suction plant, gas can be made for 7d. which will induce the same power as the town's gas at 2s. 4d. per 1,000 feet. It is estimated that when made the quantity of gas equivalent to 1,000 cubic feet of the ordinary town supply costs from 70 to 75 per cent. less than ordinary town gas at 2s 6d per 1,000 cubic feet, including fuel, labour, and repairs. The result is still more striking when the town gas is dearer. With any engine of good make, suitably adjusted to work with suction plant, the consumption of small anthracite is about 1 lb, and of suitable coke about 1¼ lb per b h.p. hour.

No visitor to the Wellington Works can fail to be struck with the extreme order and cleanliness which exist in every department, and the evident effort on the part of the management to provide every possible comfort and convenience for their employees. In the grounds outside the works a spacious dining hall has been built for the sole use of the workpeople. Each man is provided with a numbered can to hold his tea or coffee, and any victuals which he may wish cooked. This, on entering the works, he places on his numbered seat, and on the dinner bell sounding all he has to do is to go to his place, and there he finds whatever he has left, cooked, and ready for consumption. About 300 workmen have their meals here every day. Lavatories and all conveniences are provided; the hall is heated by gas, and there are also comfortable fires.—*Implement and Machinery Review.*

Professor Dewar states that the new chemistry has shown beyond question that we have on earth the same elements that are found in the sun.



WORKS OF THE NATIONAL GAS ENGINE CO., ASHTON-UNDER-LYNE, ENGLAND

Electric Light v. Gas: A Struggle.

It cannot be disputed successfully, the *Times* points out, that the improvement of the incandescent gas mantle puts electric lighting, from the standpoint of economy at any rate, in a secondary position. The comparative cheapness and efficiency of gas, used in that form of lighting, was chiefly demonstrated by its employment in public thoroughfares where the electric arc lamp was displaced for its more inexpensive rival. It now seems that the electric light will again come uppermost, and as regards cost, will be less. We are within view of an incandescent electric lamp more economical than the incandescent gas mantle under the most favourable circumstances. The "long flame" electric arc lamp is to demolish gas competition in the future.

A New Alloy.

According to the *Iron Age* two parts of aluminium and one part of zinc form an alloy to which the name of "Algene" has been given. The strength of this alloy is equal to good cast iron, and is superior to it so far as the elastic limit is concerned. It does not easily oxidise, and takes a fine polish. It melts at a low red-heat, and becomes very fluid, and it will then fill small places. While melting it great care must be exercised particularly when mixing the two metals. The alloy is not suited for articles which require the toughness possessed by bars, but there are many purposes for which it can be used with advantage. It has a tensile strength of about 22,000 lbs. per sq. in., and its specific gravity is 3.3.

FORCE AND POWER.

If we may judge by the articles which from time to time appear in the motor columns of the non-technical press, it is evident that the prevailing ideas regarding the meaning of the terms force, energy and power, are by no means exact. It is more than likely that many motorists are sufficiently interested in these matters as applied to automobiles to justify a short discussion thereon, with a view to eliminating any uncertainties that may exist in their minds.

In one of these pseudo-technical articles it was stated that the prime object of the change-speed gear of a modern car is to render it more powerful on the hills at the expense of its velocity, and that more power is required to start the vehicle from rest than to maintain it in motion on its top gear. To further illustrate these remarks, the case of a locomotive starting from rest with a heavy train is referred to as analogous, since the locomotive is said to develop more power when starting than when maintaining a velocity of sixty miles an hour on the level.

It is, in the first place, incorrect that the locomotive develops its maximum power when starting up with a heavy load. From indicator diagrams taken from the cylinders of locomotives, it is found that the maximum indicated horse power is obtained when travelling at sixty or seventy miles an hour with a heavy train in the rear, notwithstanding the fact that the engine is greatly assisted by the kinetic energy of the whole train, which at high speeds is considerable.

The actual power developed at starting (even with maximum boiler pressure and cut-off in the cylinders at seventy-five per cent. of the stroke) is less than half that which is obtained when travelling at full speed, owing to the fact that the locomotive is not geared down, the same ratio between engine and wheels obtaining at all speeds. The fact to be noted is that the horizontal force or pull exerted by the engine on the train is about three times as great at the period of starting as when running at full speed.

Before going further, it would be well to define, in as few words as possible, the exact meaning of the terms force, power, etc. Force, considered dynamically, is usually defined as that which changes or tends to change the state of rest or motion of any body. It is measured in pounds weight by engineers. Work is done when a force moves through space in the direction in which it acts. Work done is therefore the product of two factors—force in pounds weight and distance in feet—and is measured in foot pounds.

Power is the rate at which work is done, and is measured by the amount of work an agent is capable of doing in unit time.

The horse power, being the unit of power, is the rate of working of 33,000 foot pounds in one minute. Thus, if 33 pounds are lifted through a vertical height of 1,000 feet in one minute, one horse power is developed.

Energy is the capacity of an agent for doing work in virtue of its mass and the square of its velocity. It is therefore measured in foot pounds, being the product of half the mass of the body and its velocity in feet per second squared. This form of energy is kinetic.

It is quite evident, therefore, that the terms force and power are quite distinct, and they should never be confused. Force is a single measurable quantity, whereas power is a rate, and always involves time. The measure of a force remains the same whether it does its work quickly or not.

It would clearly be impossible for the locomotive to develop its 1,000 h.p. during the first twenty yards of its journey, since its pistons are moving comparatively slowly though the pressure behind them is probably greater than at any other period. The tractive force or horizontal pull on the draw-bar of the engine is at its maximum because the total load on the pistons in steam pressure is at a maximum, but this force is not performing its work fast enough to register maximum power.

In the case of a modern express locomotive, this tractive force when starting will measure about ten, or even twelve, tons, which will fall to about three tons when a speed of sixty miles an hour on the level is obtained, owing to the cut-off in the cylinders taking place at twenty per cent. of the stroke.

Further, it should be mentioned that the total horse power that would be necessary to propel a train weighing 300 tons at sixty miles an hour on the level is something over 1,500. With modern express locomotives, it is rare for more than 1,000 h.p. to be available. The deficit is made up by the kinetic energy stored in the whole train, which, as before stated, is its capacity for overcoming resistance, or doing work by virtue of its mass and velocity.