A PRODUCER-GAS-DRIVEN AUTOMOBILE.

Various efforts have been made with a view to adapting producer gas to the internal-combustion gas engine as represented by the ordinary gasoline motor, but the inherent difficulties have been of such a character as to render the mechanisms evolved for this purpose commercially impracticable. The late Herr Capitaine evolved a special type of suction gas engine, but its utilization has been confined to boats, no attempt having been made to apply it to road vehicles. Recently, however, an interesting vehicle, in which the motor of the ordinary four-cylinder gasoline type derives its fuel from a small producer, has been invented by the Automobile Gas Producer Syndicate of Glasgow, and has been subjected to a series of trials in Scotland, the results of which have been highly gratifying. The vehicle in general appearance resembles the motor *char-a-banc*, which is so popular a public service vehicle in Great Britain, especially in the seacoast towns.

The engine develops 40 brake horse-power when running on gasoline, and but 30 brake horse-power when using producer gas. It is placed in the usual front position beneath the bonnet. The compression is approximately 115 pounds per square inch, which experiment has proved to be the most suitable with this new type of fuel. Both low-tension magneto and high-tension ignition with accumulators and coil are fitted, since both are found to answer equally well in firing the charges, the latter being used for starting and as a reserve. The normal speed is 900 revolutions per minute, the power being transmitted through the usual three-speed change gear and side chains.

The gas producer is placed immediately behind the engine, between the latter and the dashboard. It has been found possible to reduce its dimensions to a small compass. It extends the full width of the chassis, and is about 18 inches deep, while it extends from just below the top level of the dashboard to within about 12 inches of the ground. The grate area is about 12 square inches, and the fuel rests on a specially designed grid, upon which the water is sprayed in the center through a four-spray nozzle.

On a level with the fuel grid is a small airtight door secured in position by means of a crossbar and clamping screw, by means of which the fire is lighted and the clinker and ash removed. The upper part of the producer, which forms practically an integral part thereof, is occupied by the fuel hopper. This is charged through small openings in the top rendered airtight by means of special cone joints, it only being necessary to open these once a day—in the morning before starting out—since a single charge is sufficient for a full day's work. The air blast is forced into the bottom of the producer by means of a powerful rotary blower driven by chain from the engine shaft, while it is also fitted with a hand-operating device for the purpose of setting the fire going after lighting. In order to control the generation of the gas, as well as to reduce the temperature and dispense with the steam jet that is generally utilized in such plants for this purpose, variation in the quantity of fine pulverized water fed through the nozzle mentioned above is effected by a special pump. This is accomplished by an ingenious arrangement. There is a novel rotary plunger pump fitted and driven from the engine by a lay shaft, by which the water is forced from the tank into the center of the fire. This pump works automatically and has the most delicate adjustment, so that the temperature of the fire and the extent of the gasification is carried out according to the requirements of the engine independently of the driver, the pump practically fulfilling the function of a governor. It has been in the regulation of the air and water supplies that the greatest difficulties have been encountered, since in some of the early experiments, it was found that the speed of the water pump and air blast were too high, and that gas adequate for a 50-horse-power engine was being produced, whereas the engine only developed 25 horse-power. Consequently, about half the gas that was produced was unused and escaped as waste into the atmosphere.

From the producer bottom the gas escapes into a pipe conveying it downward through the hopper to a coke scrubber suspended beneath the frame of the vehicle; thence it passes through a second pipe into the mixing chamber, where it is mixed with the right proportion of air for combustion, the entry of the air being controlled through adjustable cocks, one of which is carried to the dashboard, so that the driver can supplement or decrease the air supply for this purpose. Thence the mixture passes to the throttle valve, controlled from the steering column, from which it is induced into the combustion heads of the engine cylinders through the inlet valves.

The engine control is very simple. On the steering column are three levers, the first operating the ignition, the second the injection of water into the producer, and the third the throttle valve; while the production of the gas, as already explained, is controlled automatically, so that the same degree of richness of the

gas is secured at all speeds and under all and varying conditions.

During the past year the system has been subjected to several severe and exacting tests to determine its suitability to heavy traction duties, and for the purpose of improving and removing various defects as they developed, which have been duly accomplished, so that now its commercial practicabilities are established. Recently a series of further experiments were carried out to ascertain the running costs and the economies possible to producer gas operation as compared with gasoline. In these latter experiments, although coke was originally selected as the fuel to be employed, anthracite pearls were subsequently preferred. The hopper has a capacity for some 640 pounds of fuel, while the fire is started with three pounds of charcoal. Within five minutes of lighting the fire, the car can be set in motion, and from that time no further attention to the producer is necessary. The distance covered upon the latest of these tests was 40 miles, at an average speed of from 10 to 11 miles per hour. For the run 145 pounds of fuel were used, the vehicle weighing with its passengers 4.9 tons. This represents a fuel consumption of approximately 0.74 pound of anthracite per ton mile. The coal cost \$3.54 per ton, so that the fuel running costs represented about 0.12 cent per ton mile, or about 24 cents for the 40-mile journey. The same vehicle working under precisely similar conditions with gasoline fuel cost about 1.34 cents per ton mile, the spirit at the time costing 28 cents per gallon. Under these circumstances it will be realized that running expenses with producer gas are considerably lower than with gasoline, in this instance a saving of 1.22 cents per ton-mile being effected. It must be pointed out, moreover, that the working conditions were not the most favorable to economical efficiency, since no modification was made in the movement or diameter of the inlet valves, which were of the type usually adopted in general motor practice. More satisfactory and economical consumption results would be available were the valves mechanically operated, and with about twice the inlet area to the explosion chamber. At the same time the results have been sufficiently conclusive to prove the suitability of the system to all-round automobile work, and various vehicles of this type are now in course of construction.

LIME BETON.

BY J. W. MOULTRIE.

Someone has said that the average American is a slave to fashion. While this, of course, is not true, there is a tendency in some quarters to overlook some mighty good things that other countries use with great success. A case in point is concrete. One hardly ever, nowadays, sees anything going into a batch of concrete, no matter for what use it is to be put, but Portland cement, broken stone or gravel, or both, and sand. We seem to have overlooked entirely the fact that, for some purposes, broken brick is an excellent substitute for broken stone or gravel, and good, well-burned lime for cement.

The writer was recently connected with the construction of foundations for a large monumental building, which was erected on a site previously occupied by a large power house. In taking out the old foundations, the drawings and specifications for which had been destroyed by the fire that burned the power station, it was found that most of the footings and bearing walls up to the superstructure, were of brick concrete. It proved to be a beautiful piece of work, and it seemed a pity to destroy it. This had to be done, however, but the task was by no means an easy one, the mass having become almost as hard as granite.

Lime concrete, or lime béton as the French call it, has been in longer and more general use than cement concretes. It was a first-class material when made with ordinary quicklime, and since hydraulic lime has been used it is better. It is a much cheaper composition than cement concrete, easier to work, and if the initial load be not too great, it is for many uses just as good. A good lime béton can be obtained by mixing mortar, stones, and gravel, or cinders, mortar, and good-sized stones, which makes the best composition. Such a composition is very popular in France. Probably one-half of the houses in Marseilles have been built of this material, and thousands of the older buildings, many hundreds of years old, are held together with ordinary lime. Walls built of quicklime béton must be laid up very slowly, but with hydraulic lime béton they can be erected as fast as the masons can work. The solidity of lime béton construction is shown by the sea walls and docks in Marseilles, where masonry of this kind can be seen both below and above sea water, the most difficult test to which a building material can be subjected.

The lime is weighed out to the cubic unit of sand, and the two dry-mixed until thoroughly incorporated. Water is added slowly with a sprinkler, and the plastic consistency tested by forming a ball with the hands, which should exude a slight moisture, and be-

ing laid aside should neither flatten nor crack open. Stones or other cheap material are mixed with the mortar, thus constituting the béton. Cinders, coke, and furnace slag are often substituted for stones in ordinary house and wall work. If broken stone is used, it is broken to from $\frac{3}{4}$ inch to $2\frac{1}{2}$ inches across. The proportions are usually two parts of stone to one part mortar for work under water; in air and above ground the proportion of stone may be increased.

The form, of course, is the same as for cement concrete, and the béton is usually placed in eight to twelve-inch layers and rammed. The surface is scratched and treated with a wash of thin mortar or grout before putting on the next layer.

In both France and Germany a light-weight béton is made of cinders. Buildings several stories high of this material are common, but when they exceed one story in height, they are reinforced with the usual steel rods. Several very large factory buildings have been built at Lyons of this béton.

Striking economies are effected in France by the free use of cheap local material, whatever it might be, and by the equally free use of lime where cement would probably be used in the United States.

THE LATEST INTERNATIONAL AERONAUTIC PRIZE.

On another page will be found a list of aeronautical prizes offered abroad for flights by aeroplanes or other heavier-than-air flying machines. Included in this list is the \$2,000 trophy and \$50,000 in cash prizes offered recently by M. Michelin. Of the latter sum, \$30,000 is to be given annually in ten \$3,000 installments to the winner of the trophy each year, while the remaining \$20,000 will go to the aviator who, within the next decade, makes a flight and carries one passenger from Paris, France, to the top of the Puy de Dome—a mountain 4,775 feet high, some 220 miles distant. In the course of its flight, the machine must circle around the Arc de Triomphe in Paris, and also around the cathedral at Clermont-Ferrand. The flight must be accomplished within six hours, which means that the aeroplane must have a speed capacity of nearly 40 miles an hour.

In donating the trophy and series of cash prizes, M. Michelin has provided for an annual international competition for these in any countries where there is an aero club belonging to the international federation. The rules governing the flight for this year will soon be issued by the Aero Club of France. They will provide for a flight of at least 2 kilometers ($1\frac{1}{4}$ miles) in a closed circuit having several turns. If a flight of the distance set is accomplished, the aviator who makes such flight will be declared the winner, unless some other aviator makes a longer flight under the same conditions before the end of the year. In this event, the cup and cash go to the aviator who covers the longest distance. The flight required in any one year is to be twice as long as that accomplished in the preceding year. Should the cash prize not be won during any year, it will be added to that given the following year. The winner of the trophy the tenth year will be declared the owner of the same, and a duplicate trophy will be given to the aero club which he represents.

The provisions in the deed of gift of this new aeronautic trophy, and its accompanying cash prizes, make both immediately available to be competed for in this country under the supervision of the Aero Club of America; and the officers of the club have already taken steps to secure a suitable course over which to hold this contest, as well as that for the SCIENTIFIC AMERICAN trophy, which, although offered over a year ago for a simple straight-line flight of one kilometer (3,280 feet), has not as yet been seriously competed for. Should no one lift this cup at the coming contest, the conditions will then be changed and made more difficult, so as to keep them somewhat in advance of the demonstrated state of the art, as was originally intended.

EXTERMINATION OF MOSQUITOES BY CACTUS PASTE.

Consul William Henry Bishop, of Palermo, Italy, transmits the following information relative to experiments made by the chief of the sanitary service at Gaboon, French Africa, with the cactus as a substitute for petroleum for the extermination of mosquitoes in warm climates:

The thick, pulpy leaves of the cactus, cut up in pieces, are thrown into water and macerated until a sticky paste is formed. This paste is spread upon the surface of stagnant water, and forms an isolating layer which prevents the larvæ of the mosquitoes from coming to the top to breathe and destroys them through asphyxiation. It is true that petroleum can do the same service, but in warm climates petroleum evaporates too quickly and is thus of little avail. The mucilaginous cactus paste, on the contrary, can hold its place indefinitely, lasting weeks, months, or even an entire year; and the period of development of the larvæ being but about a fortnight, it has the most thorough effect.