to generate the steam required for operation, also, that with this system a gas holder, in which to store the gas, is required.

There is one serious objection to the pressure system which is not found in the other system. The whole producer is under pressure. If, then, there are any leaks between the producer and the engine, gas will escape. As has already been mentioned, this gas is very poisonous, and may cause the death of a careless operator. The suction producer is full proof in this respect, because the pressure in the system is less than atmospheric. If, then, there are any leaks in the system, all that can happen is that air will pass into the system through these leaks. While this will reduce the efficiency of the plant, it can do no other damage. The fact that no boiler or gas holder is required in the suction producer is a great point in its favour, because simplicity is the essence of good engineering, especially when we are dealing with a machine which is going to be put under the care of men who have no engineering knowledge or skill.

It takes only a few minutes to start up a small gas producer plant. The Highland and Agricultural Society of Scotland made some tests in Glasgow in 1905, to ascertain the time required to get an engine and producer plant to full working load, starting with the

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The following are the combined chemical and heat equations of the reactions that take place in the gas producer :—

$C + H_2O = H_2 + CO$

$1 + \frac{18}{12} = \frac{2}{18} + \frac{28}{18}$ (1) or 1 lb. C + 1.5 lbs. H_2O = .166 lb. H_2 + 2.33 lbs. CO. Now, to separate 1.5 lbs. of water into H_2 and O at the same temperature requires 11,500 B.T.U., and 1 lb. C burned to CO gives 4,400 B.T.U. ; therefore, to turn 1.5 lbs. water to water gas requires other 7,100 B.T.U., or the burning of $\frac{7.100}{4,400}$ = 1.61 lbs. of C to CO, according to the equation.

(2) 1.61 lb. C + 2 15 lbs. O = 3.76 lbs CO + 7.100 B.T.U. ; therefore, finally, by adding together equations 1 and 2 we get 2.61 lbs. C + 2.15 lbs O + 1.5 lbs. steam = .166 lb. H + 6.09 lbs. CO. Now, the heat in a lb. H = 69,000 B.T.U. ; therefore .166 lb. H_2 = 11,400 B.T.U.

also, 6.09 lbs. CO = 26,400 B.T.U.

∴ 2.61 lbs. C give a gas with 37,800 B.T.U.

1 lb. O gives a gas with 14,500 B.T.U. = the calorific value of the fuel.

Again, 1 lb. H_2 occupies 180 cu. ft., so .166 lb. H occupies 29 cu. ft.

1 lb. CO occupies 186 cu. ft., so 6.09 lbs. CO occupies 77.8 cu. ft.

or the gas from 1 lb carbon occupies 106.8 cu. ft. and has 14,500 B.T.U. ; therefore, the calorific value of our producer gas is 136 B.T.U. per cu. ft. In practice, 12.5 lbs. coal give 1,000 B.T.U., and, with coal at $6 per ton, 1,000 cu. ft. gas costs 1.74 cents. Lighting gas from the city mains costs about 60 cents per 1,000 cu. ft., and its calorific value is only four times as high as that of producer gas.