draws sufficient air and steam to combine with the carbon to keep up the supply of gas.

Fuel.—The fuel most suitable for donsumption in the semi-water gas producer is anthracite, owing to its freedom from sulphur, smoke and other impurities, and the product of a ton of coal is about 160,000 cubic feet of gas.

Of the different kinds of gas here mentioned, the illuminating gas is by far the richer, or higher in heat units, containing about 600 heat units per cubic foot.

The second in point of calorific value is the water gas, containing about 300 heat units per cubic foot.

The third is semi-water gas, containing about 150 heat units per cubic foot.

And the lowest in calorific value is the producer gas, containing about 110 heat units per cubic foot. This latter is due to the fact that the gas is obtained by a combination of oxygen and carbon, but to get the required volume of oxygen, we have to introduce four times the volume of nitrogen (as air is composed of one-fifth oxygen and four-fifths nitrogen) thereby producing a very weak or lean gas, as nitrogen has no value in heat or heat energy.

The principle upon which the producer operates is, that limiting the amount of air or oxygen admitted to the fuel to one half what would be required for complete combustion, or 1.33 pounds per pound of carbon, carbonic oxide gas is formed instead of carbonic acid gas (the latter being a product of complete combustion). As the steam passing through the incandescent bed of fuel is disintegrated, the oxygen combining with the carbon and the hydrogen remaining in the gas, very much increases its quality; owing to its high heat value and the quantity of air necessary being reduced and to the oxygen obtained from the disintegration of the steam, the nitrogen is reduced in like ratio.

In semi-water gas the heat value is increased to about 150 B.T.U. per cubic foot, and in straight water gas about 300 B.T.U. per cubic foot.

Illuminating gas, owing to its being made in air-tight retorts, is almost entirely free from nitrogen.

The following table gives an approximate percentage of the principal constituents of the four different kinds of gas:—

	Illuminating.	Water.	Semi-Water.	Producer.
Carbonic oxide..	5.7	42	25	23
Hydrogen..	46.5	48	19	2
Carbonic acid	3.1	6	6	3.6
Nitrogen.	3.7	5	49	63.5
Marsh Gas	35.7			7.4
Heat units, approx.	600	300	150	110