ACETYLENE AS AN ILLUMINANT.

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Illumination is the combustion of carbon and hydrogen, which, when burning, heat unburned carbon particles to white heat. The poorer a gas is in carbon the more of it must be used to effect the same illumination, and, *vice versa*, the richer a gas is in carbon the less of it must similarly be used. Illumination is measured by candle-power, one candle-power being the amount of light produced by the burning of a standard candle, *i. e.*, a candle made of sperm, weighing six to the pound, and losing in weight by burning to the extent of 120 grains an hour. A standard gas burner is one that emits 16 candle-power of light, *i. e.*, as much as 16 standard candles, and to do this consumes 5 cubic feet an hour of coal gas. The cost of coal gas is about 25 cents per thousand cubic feet. The desirable qualifications of a flame are: 1. High candle-power; 2. Products of combustion few and innocuous, and 3. Temperature of the flame as low as possible. The desirable qualifications of an illuminating gas are that it shall: 1. Produce a desirable flame as just outlined; 2. That it shall be cheaper per candle-power of light than any existing illuminating gas; 3. That it can easily be made and transported, and 4. That it shall be safe and not be explosive when mixed with air, nor be poisonous when inhaled into the lungs. Does acetylene fill all these requirements? Let the facts in the case answer for themselves. Acetylene gas is a so-called fixed gas, *i. e.*, a single gas and not a mixture of several gases, while coal gas is a mixture of several gases, viz., hydrogen, 50 per cent.; methane, 33 per cent.; carbon monoxide, 13 per cent.; heavy hydrocarbons, 4 per cent., and enriched water gas as now generally used and delivered by the city gas companies contains hyrogen, 36 per cent.; methane, 23 per cent.; carbon monoxide, 19 per cent.; heavy hydrocarbons, 14 per cent.; nitrogen, 3 per cent.; carbon dioxide, 3 per cent., and oxygen, 1 per cent. As the poisonous constituent of illuminating gas is carbon monoxide, we note that the enriched water gas is more poisonous than ordinary coal gas. Acetylene in this respect is not as dangerous as goal gas as it is not poisonous to the same extent, but it has an unpleasant feature in that it possesses a disagreeable smell and nauseating effect upon the human body. It smells like garlic. The odor is, however, due to impurities resulting from process of manufacture, as chemically pure acetylene gas has not an unpleasant odor. It has besides the advantage over coal gas of waking the sleeper by upsetting his stomach and inducing vomiting. In this way persons who blow out the light and die, if coal gas is in the pipes, do not have the same chance if acetylene is served to them as an illuminant, for before enough has been breathed to destroy all their blood by precipitating the hemoglobin, their stomachs go back on them and require their presence on the floor. When they smell the garlic odor, they naturally leave the room and get out of danger.

Acetylene was first made by Sir Humphrey Davy in 1837, and again in 1862 by Woehler, and first studied in 1859 by Berthelot. It is easily liquefied at 100 atmospheres' pressure, and under 50 atmospheres' pressure at the freezing point of water. Its formula is C_2H_2, and it consists of 12-13 carbon and 1-13 hydrogen. Commercially, it was brought to public notice by Willson's work a few years since. He fused together Pocahontas coal dust and lime in an electrical furnace, and thereby formed the compound calcium carbide CaC_2. This can be made for about $20 per ton, and when this is thrown into water it decomposes instantly, and acetylene gas is liberated while slaked lime is precipitated. It is generated so very readily that by liberating it in a cooled, closed and mechanically strong receiver, it becomes liquid, and may be collected as a liquid at the other end of the apparatus. It can either be delivered in the liquid form, in strong cylinders, to private houses, and then with a reducing valve be merely supplied into the gas pipes, or it can be generated as wanted in some of the many apparatus recently devised and patented for that purpose. It has about thirteen times the candle-power of coal gas, *i. e.*, one thousand cubic feet of acetylene yield the same amount of candle-power as thirteen thousand cubic feet of coal gas. It requires a special gas burner, one with a much smaller aperture and which hence burns less. A correct acetylene burner burns one cubic foot an hour, and thereby yields as much light as three coal gas standard burners burning each eight cubic feet an hour. Estimating the cost of carbide of calcium at $20 per ton, which yields about ten thousand cubic feet of acetylene, the cost of acetylene would be about fifteen and a half cents per thousand cubic feet of 16 candle-power lighting capacity. If carbide can be made cheaper, which is more than probable, of course, the cost of the acetylene will be correspondingly reduced. The United States is estimated to consume annually 3,300,000,000 cubic feet of coal gas. To produce as much acetylene as would yield the equivalent of this in candle-power would require 300,000 tons of calcium carbide, and the Niagara Falls carbide plant can turn this out alone, most probably. Acetylene flames will very easily soot, *i. e.*, there will be incomplete oxidation, and carbon in the form of soot will be liberated in the room, and to prevent it the pressure must be maintained and the aperture not enlarged even in the slightest. The color of the flame is pure white, slightly blue white, though not as much so as the Welsbach light, and a candle or electric light or gas flame looks yellow and reddish when put alongside of it. It is too strong for the human eye, and must be reduced in glare by the use of opalescent or ground glass. It does not vitiate the atmosphere of the room as much as a coal gas flame, inasmuch as for the same candle-power product acetylene produces two parts of carbon dioxide, while coal gas produces