garlic or phosphorus. When exposed to air in lumps it absorbs moisture, and the surface becomes coated with a layer of hydrate of lime, which to a certain extent protects the rest of the substance from further deterioration. It is not inflammable and may be exposed to the temperature of a blast furnace without taking fire, the exterior only being converted into lime. When brought into contact with water or its vapors at ordinary temperatures, it rapidly decomposes, one pound when pure generating 5.892 cubic feet of acetylene gas at a temperature of 64° F. It is manufactured from powdered lime and carbon in the shape of ground coal, coke, peat or charcoal, these two substances being fused together in an electric furnace The lime and carbon, having been ground to a fine powder, is intimately mixed in a certain proportion and fed into a crucible or furnace, the lower part of which has a carbon plate which is attached to one of the dynamo terminals; the other terminal is connected to an upright carbon resembling the upper carbon of an arc lamp, but much larger, being about three feet long and 12 by 8 inches in cross section. An alternating current is delivered by means of transformers to the carbons at about 100 volts and 1,000 amperes. A small portion of the mixture is fed into the furnace, the upper carbon is raised about three inches to form an arc, and the mixture is fused by the intense heat which ranges from 3,500 to 4,000 deg. C., while that of the ordinary smelting furnace is only 1,200 to 1,500 deg. C. The carbon is gradually raised and fresh mixture fed in till a mass of molten carbide about three feet high is made, when the current is turned off and the carbide allowed to cool. The noise of the arc is said to be very peculiar, especially when the supply of mixture begins to fail.

To positively ascertain the cost of this product, the *Progressive Age*, of N.Y., sent three commissioners to T. L. Willson's aluminum factory at Spray, N.C., in March last, to investigate thoroughly, and their report is published in that journal under date of 16th April, 1896. The commission consisted of Messrs. Houston and Kennelly, well-known electricians, and Dr. Leonard P. Kinnicutt, director of the Department of Chemistry at Worcester Polytechnic Institute, who investigated thoroughly and took full charge of the factory during two separate days, making two runs of the substance and taking samples with them for testing in their own laboratories. Notwithstanding that the factory at Spray was only an experimental one, and the greatest possible output only one ton per 24 hours, and the fact that transportation of material was excessive, costing $3.05 per ton for coke and $4.55 per ton for lime, and estimating $11 per day for labor, including a superintendent at $4 per day, they figure the cost at $32.76 per ton. Messrs. Houston and Kennelly add a separate estimate for the production of five tons daily under more favorable circumstances, but with water power at $5 per year as at Spray, and figure the cost at $20.04 per ton. They add, "the cost of producing calcium carb. electrically, is evidently limited by the cost of lime, coke and electric power, no matter what the scale upon which the process is conducted. If we assume a perfect electric furnace, in which neither material nor energy is wasted, we know that one ton of carbide would require for its production 1,750 lbs. of lime and 1,125 pounds of pure coke. It has also been calculated from thermo-chemical data that 1½ electrical h.p. hours will be almost precisely the right amount of energy to produce one pound of carbide, or 3,000 h.p. hours per short ton of carbide. Consequently, if L is the cost of lime in dollars per ton, C the cost of coke per ton, and P the cost of an electrical h.p. hour, a theoretically perfect plant would yield carbide at a cost per ton, exclusive of labor and fixed charges, of 0.875 L+0.5625 C+3,000 P. For example, if lime (assumed pure) costs $2.50 per short ton, coke (assumed pure) cost $2 75 per short ton, and an electrical horse-power of 300 working days of 24 hours each costs $12 at furnace terminals (0 1667 cent per working horse-power hour), the limiting cost of carbide in a perfect furnace would be $8.73 per short ton. We may therefore summarize as follows: Calcium carbide by the electric furnace cannot be manufactured cheaper than $8.73 per short ton—for material and power—exclusive of electrode carbons, labor, depreciation, interest and other fixed charges. Owing to impurity of materials and departure from theoretical perfection in the electric furnaces, we found at Spray the actual cost of material and power, irrespective of electrode carbons, labor, etc., is 1.335 L+1.125 C+5122 P. Under favorable conditions such as we believe can be realized in particular localities, the total cost per short gross ton on a plant whose output is five tons daily, might be $20. Under the actual conditions existing at Spray during our tests, we find the total cost to be $32.76 per short gross ton, if the plant were worked continuously."

In the above lowest estimate of Messrs. Houston and Kennelly they place horse-power at $12, whereas Mr. Willson has secured water-power at Spray, and also in Canada, at a cost not exceeding $5 per h.p. On this basis, and assuming L at 2.50, C at 2.75, and P 5 00, the figures would amount to 2.18+1.55+2.08, or a total of $5.81. The cost of lime and coke, however, is placed at a very low figure, but it is evident that the true theoretical minimum price is between $5.81 and $8.73.

I have also the following estimates of cost at the Niagara Falls establishment, to produce one ton of carbide, at rate of 10 tons per day:

It requires	200 electrical h.p., 24 hours at $20 per year,	$10.95
"	1,440 lbs. coke, at $3.50 per ton	2.52
"	1,800 lbs. lime, at $4.50 per ton	4 05
"	Labor, depreciation, etc., etc..................	6.18
		$23.70

It is noticeable that this estimate is somewhat in excess of the theoretical values as laid down by Messrs. Houston and Kennelly, and may be improved on as experience is gained. I was informed that the first run of carbide manufactured at Niagara Falls early in May gave about 25 per cent. better results than their estimate, and that they hoped to improve still more as they gained experience and the men got used to their work.

Mr. Willson commenced to erect a factory at Merritton, Ont., in April, on the old Welland canal, where he has secured 1,500-horse power at locks 8, 9 and 10, and expects to turn out carbide at the rate of 7½ tons daily at the lowest possible cost. He has also secured a very large amount of power in the Province of Quebec, where he intends to manufacture not only for Canada, but for export to foreign countries. It is quite evident from the report of the Progressive Age commissioners, and from the experience of the Niagara Falls Company, that calcium carbide can be made and sold at a price to compete with ordinary gas and electric light.

It takes to produce 100 lbs. carbide, as shown theoretically 87½ lbs. lime and 56¼ lbs. of carbon: of the latter 37½ lbs. combine with the metal calcium and 18¾ lbs. combine with the 25 lbs. of oxygen of the lime, and escapes from the furnace as carbon monoxide, in accordance with the following formulæ:—

$$
\begin{array}{llll}
Ca\,O & +\,3\,C & =Ca\,C_2 & +\,C\,O. \\
87\tfrac{1}{2}\text{ lbs.} & +\,56\tfrac{1}{4}\text{ lbs.} & =100\text{ lbs.} & +\,43\tfrac{3}{4}\text{ lbs.} \\
Ca\,C_2 & & =Ca & +\,C_2. \\
100\text{ lbs.} & & =62\tfrac{1}{2}\text{ lbs.} & +\,37\tfrac{1}{2}\text{ lbs.} \\
C\,O & & =C & +\,O. \\
43\tfrac{3}{4}\text{ lbs.} & & =18\tfrac{3}{4}\text{ lbs.} & +\,25\text{ lbs.}
\end{array}
$$

Calcium carbide contains 62 5 parts of calcium and 37.5 parts carbon in 100, and when brought into contact with water acetylene is generated to the extent of 5 89 cubic feet of gas to each pound of carbide used; or by weight 100 lbs. of carbide and 56¼ lbs. of water evolve 40.63 lbs. of acetylene gas and form 115.62 lbs. of calcic hydrate (slacked lime) in accordance with the following formula:—

$$
\begin{array}{llll}
Ca\,C_2 + 2\,H_2\,O & = Ca\,O\,H_2\,O & + & Ca\,2\,H_2. \\
100 \quad + 56.25 & = 115.62 & + & 40.625.
\end{array}
$$

The acetylene gas so generated contains in 100 parts 92.3 parts of carbon and 7.7 parts of hydrogen, or in the 40.625 pounds generated from 100 lbs of carbide we have 37½ lbs. of carbon and 3⅛ lbs. of hydrogen.

Acetylene can be produced from carbide by the addition of water and distributed and stored in a gasometer, or the gas may be compressed into a liquid and kept in a suitable cylinder and drawn off as required for consumption, a reducing valve being adjusted to give the necessary pressure for burning. One cubic foot of liquid expands into 400 cubic feet of illuminating gas, so that a large supply may be stored in a very small space, but for experimental purposes and for a limited supply it is preferable to make the gas direct from carbide and store it in a gasometer. The pressure necessary to liquefy acetylene depends upon the temperature. At 67° it requires a pressure of nearly 600 lbs., and 32° 323 lbs, at 28.6° below zero 135 lbs., and at 1,160° below zero 15 lbs. We see that there is no danger of freezing it in any habitable place. As an illuminant acetylene surpasses in brilliancy all other known illuminants. When burned at the rate of five cubic feet per hour it gives 240 to 250 c.p., whereas the best coal or water gas rarely exceeds 22 candles for each five cubic feet burned per hour. Acetylene gas thus gives 10 to 12½ times the light of ordinary gas, or 1,000 feet is equivalent to 10,000 to 12,500 of ordinary gas. Acetylene is a commercially pure gas, containing 98 per cent. acetylene and 2 per cent. of air, the latter having slight traces of other substances. It is clear and colorless, with specific gravity of 0 91. When a light is applied to it in open air, it burns with a bright yellow but very smoky flame, on account of its extreme richness in carbon, but when confined and delivered under suitable pressure it gives an