

so produced is mobile, and highly refractive, and, when sprayed into air, the conversion of the liquid into the gaseous condition absorbs so much heat that some of the escaping liquid is converted into a snow-like solid, which catches fire on applying a light to it, and burns until the solid is all converted into gas and is consumed.

"In my researches upon the luminosity of flame, I have shown that all the hydrocarbons present in coal gas and other luminous flames, are converted, by the baking action taking place in the inner non-luminous zone of the flame, into acetylene, before any luminosity is produced, and that it is the acetylene, which, by its rapid decomposition at $1,200^{\circ}\text{C}.$, provides the luminous flame with these carbon particles, which, being heated to incandescence by various causes, endow the flame with the power of emitting light. The acetylene, being in this way proved to be the cause of luminosity, one would expect that in this gas we have the most powerful of the gaseous hydrocarbon illuminants, and experiment at once shows that this is the case.

"Owing to its intense richness, it can only be consumed in small flat-flame burners, but under these conditions emits a light greater than that given by any other known gas, its illuminating value calculated to a consumption of 5 cubic feet an hour being no less than 240 candles.

ILLUMINATING POWER OF HYDROCARBONS FOR A CONSUMPTION OF 5 CUBIC FEET OF GAS.

	<i>Candles.</i>
Methane	5'2
Ethane	35'7
Propane	56'7
Ethylene	70'0
Butylene	123'0
Acetylene	240'0

"It is stated that the carbide can be made at about £4 a ton; and if this be so, it should have a great future, as a ton will yield 11,000 cubic feet of the gas. The lime left as a by-product would be worth 10s. a ton, and the gas would cost at this rate 6s. $4\frac{1}{2}d.$ per 1,000 cubic feet, and, in illuminating value, would be equal to London coal gas at 6d. a thousand. Its easy production would make it available for illuminating purposes in country houses, whilst its high illuminating value should make it useful for enriching poor coal gas."

A NEW ELEMENT IN THE NITROGEN GROUP.

Mr. A. E. Tuttle communicates to London *Nature*, the following concise abstract of an important communication made by Dr. Beyer to the *Société Chimique*, describing a new element which he has discovered in the residual liquors derived from the older process for the extraction of aluminum from red beauxite. The liquors in question consist chiefly of sulphate and carbonate of sodium; but there are also present considerable quantities of chromic and vanadic acids; and smaller quantities of molybdic, silicic, arsenic, phosphoric, and tungstic acids; together with alumina, magnesia and lime, and an acid of the new element. In order to isolate the latter, the vanadium and chromium are first removed, the former as the difficultly-soluble ammonium van-

adate, and the latter as hydrated sesquioxide. The filtered liquid is then saturated with sulphuretted hydrogen, and the sulphides, all of which are soluble in the alkaline liquid, are precipitated by hydrochloric acid. This precipitate exhibits a deep brown color, due to the new element. When dried, it presents a brown, earthy appearance, and burns readily with evolution of sulphur dioxide and formation of a bright brown powder. Concentrated nitric acid instantly causes ignition, and formation of a deep brown solution, from which a small quantity of a yellow precipitate of a compound of molybdic and arsenic acids is deposited. The brown liquid contains no tin, antimony or tellurium, but still retains traces of vanadium, molybdenum and selenium. These elements are best removed by calcination of the sulphides immediately after their precipitation with hydrochloric acid; when selenium is volatilized, treatment of the residue with ammonia and ammonium nitrate, which precipitate the last traces of vanadium as ammonium vanadate; and concentration of the filtered liquid, which causes deposition of ammonium molybdate. During the concentration two distinct crops of different crystals are obtained, the first, and most sparingly soluble, being cubic crystals of an olive-brown color; and the second, the much more soluble ammonium molybdate. The olive-brown cubic crystals contain the new element, together with a little molybdenum. The latter is readily removed by dissolving the crystals in dilute hydrochloric acid, and passing a current of sulphuretted hydrogen through the liquid heated to about 70°. The new element is not precipitated by sulphuretted hydrogen, in an acid solution. The filtered liquid is then allowed to evaporate in the air. At first it is bluish-violet in color, and contains the new element in a low state of oxidation; subsequently it becomes oxidized, and the color changes to lemon-yellow. The oxide in the latter stage possesses marked acid proclivities, and probably corresponds to the formula R_2O_5 . The acid itself is soluble in water, from which it is deposited in yellow crystals, which, at a red heat, fuse to a brownish yellow mass. Ammonia transforms the acid into a crystalline powder of olive color, presumably an ammonium salt, which readily dissolves in hot water and on cooling crystallizes from the solution in cubes. The solution is olive-green, and is precipitated by strong ammonia. The solution of the acid, after reduction with sulphuretted hydrogen in presence of hydrochloric acid, yields with ammonia, a voluminous deep violet-brown precipitate, which rapidly becomes crystalline. The precipitation is not complete, hence the supernatant liquid is colored violet. Caustic soda and sodium carbonate, likewise, incompletely precipitate it, owing to solubility of the precipitate in excess of the reagent with formation of a soluble salt. Chlorides of barium and calcium produce grayish-violet precipitates of the salts of those metals.

An especially interesting reaction is that with ammonium sulphide, with which, the highly oxidized yellow solution of the acid, yields a deep cherry-red coloration, due to a sulpho-salt. Acids precipitate from this solution a sulphide of the color of iron rust. Silver nitrate produces a green precipitate of the silver salt, soluble both in nitric acid and in ammonia, and if the solution in the latter solvent is effected at a moderately elevated temperature the, silver salt is deposited in crystals upon cooling. Magnesia mixture gives,

after standing a few minutes, a green precipitate analogous to ammonium-magnesium phosphate, and, owing to the slowness of the precipitation, the latter occurs in the form of relatively large crystals; moreover, the precipitation is complete after a short time, for the liquid, which at first is green, becomes colorless. A yellow precipitate is likewise afforded with a nitric acid solution of ammonium molybdate, as in the case of phosphoric acid. The chlorides of the new element appear to be volatile, for very considerable loss occurs on attempting to remove by ignition any admixed ammonium salts, for instance, from the solution obtained after removal of the vanadium as previously described. A yellow sublimate is produced having all the characters of a chloride of the new element, and which is readily soluble in water.

A sufficient quantity of the new element, in the form of any of its compounds, has not yet been accumulated to enable exact quantitative analyses to be carried out, but Dr. Bayer hopes shortly to have obtained the amount requisite for this purpose and for the determination of the atomic weight of the element. There appears to be little room for doubt that it will prove to be one of the missing elements predicted by Professor Mendeléeff in the nitrogen-phosphorus group. It exhibits characteristic spectroscopic lines in the green, blue and violet.

ARGON: A NEW CONSTITUENT OF THE ATMOSPHERE.

In a paper bearing this title, recently read before the Royal Society, Lord Rayleigh and Professor Ramsay described the results of their researches into the nature and properties of argon, the new constituent of the atmosphere.

The following abstract of this communication is taken from the *Engineering and Mining Journal*:

The separation of the unknown constituent was effected, as stated at the meeting of the British Association, by two different methods—absorption of nitrogen by red-hot magnesium, and a repetition of the experiment in which Cavendish removed the nitrogen by electric sparking in the presence of excess of oxygen and an alkali. An estimate was founded upon the data respecting the volume present in air, on the assumption that the densities of atmospheric and chemical nitrogen differ only on account of the presence of argon in the former, and that nothing but nitrogen is oxidized during the treatment with oxygen. According to this mode of calculation the density is 20.6. Calculation from the weight of a mixture of argon with oxygen gives, however, a density of 19.7. The most trustworthy results of a number of determinations of the density of argon prepared by means of magnesium, give the figure 19.9, which is the one practically accepted by the authors. By considerations drawn from the ratio of specific heats, the authors are led to regard argon as a monatomic gas, like mercury, and its atomic weight is therefore not twenty, but forty. Many attempts have been made to induce it to combine, but they have all as yet proved abortive. Argon does not combine with oxygen, in presence of alkali, under the influence of the electric discharge; nor with hydrogen, in presence of acid or alkali, when sparked; nor