

XXVIII.—*The Illuminating Power of Methane.*

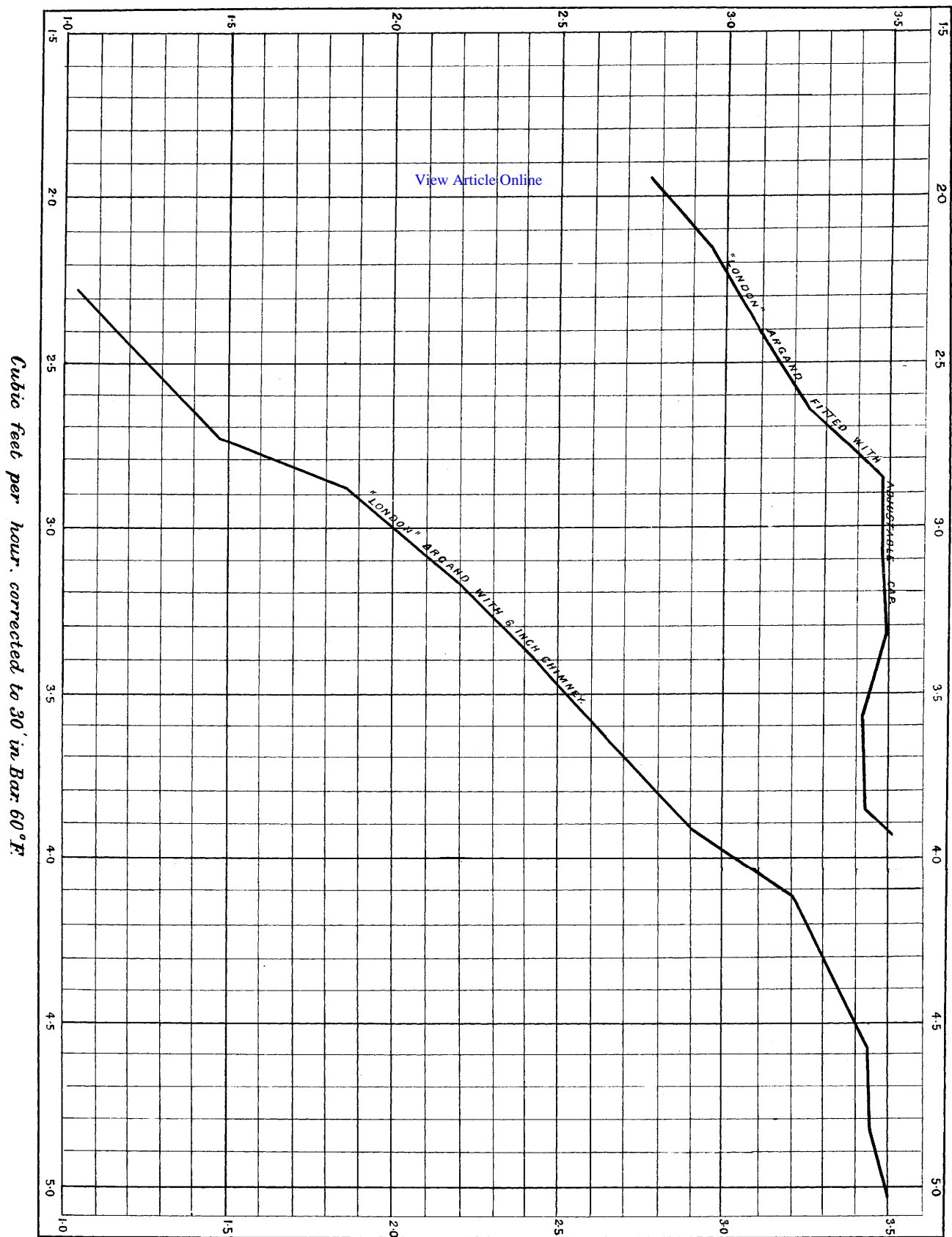
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It is generally understood that the methane (marsh-gas) flame is feebly luminous, but at present I am not acquainted with any published record of its illuminating power in terms of any standard. The recent description of an easy method of preparing pure methane by Gladstone and Tribe (*Chem. Soc. J.*, 45) tempted me to prepare sufficient quantities of this gas for the proper determination of its illuminating power. I find, however, that the apparatus described by them is not well adapted for the preparation of methane free from methyl iodide-vapour, for the first batches of gas I prepared with their apparatus were always found to be sensibly contaminated with this body, which made itself very evident on the combustion of the gas by irritating iodine-vapours in the products of combustion.

Instead of adopting special methods of purification, based upon other reactions of methyl iodide and involving complicated and cumbersome apparatus, it occurred to me that by a special disposition of apparatus Gladstone and Tribe's elegant method of preparation might be rendered complete in itself.

The vertical tube used by them as a scrubber is inefficient for the retention of the methyl iodide-vapour which escapes with each bubble of gas from the generating flask, for the copper-zinc in it soon loses the alcohol with which it has been moistened, and the impure gas is no longer "scrubbed," but simply passes through a column of dry copper-zinc. As it would not be convenient to keep the copper-zinc in the vertical tube always saturated with alcohol, I placed after the apparatus a series of three copper tubes, 12 inches long  $1\frac{1}{2}$  inches diameter, in a horizontal position, fitted with corks bored centrally for glass tubes and so arranged as to admit of a slight rotation. These tubes were filled with copper-zinc and as much alcohol as they would hold in the horizontal position. These tubes are succeeded by one of

Standard Sperm Candles per Cubic foot per hour.

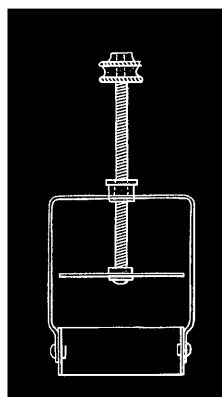
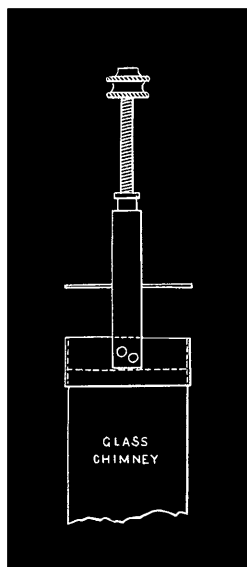


glass charged with glass beads and sulphuric acid to absorb the alcohol-vapour.

With this apparatus it is easy to prepare methane free from methyl iodide-vapour, but if I were arranging another apparatus I should dispense with the upright washing-tube altogether.

The methyl iodide used in these experiments was pure, boiling point  $42-43^{\circ}$  (uncorr.),  $= 2.2679$  at  $d_{15}^{15}$ .

The methane as prepared was collected in a small gas-holder made by Giroud of Paris, specially designed to replace a gasmeter in photometrical observations. Each division of the scale represents 5 c.c., and the total capacity of the holder is 5 litres. The outlet is directly connected with the burner of a good photometer provided with a Methven's standard burning 18-candle coal-gas which is known to give a uniform light of two candles. All the connections of the apparatus were arranged of small capacity in order to save loss of methane in the first displacement of air.



The burner used for the combustion of the methane was a London Argand with a 6-inch chimney, the top of which was provided with a metal cap capable of vertical adjustment by means of a fine-threaded screw. The object of this cap is the limitation of the air supply to the burner to the point at which the flame first begins to smoke. Some such arrangement is necessary with the Argand burner for low rates

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of consumption, as otherwise the excessive air supply is prejudicial to the development of luminosity.

The importance of this point is indicated by the annexed tables showing the light afforded per cubic foot by  $17\frac{1}{2}$ -candle coal-gas at various rates of consumption with and without the adjustable cap.

*17.5 Candle Coal-gas burning in a London Argand Burner: 6-inch Chimney, without Adjustable Cap.*

Rate of consumption. Cubic feet per hour.	Candles per cubic foot.
2.28	1.05
2.73	1.46
2.89	1.87
3.18	2.20
3.39	2.42
3.64	2.64
3.92	2.91
4.12	3.20
4.59	3.44
4.83	3.44
5.03	3.50

*With Adjustable Cap.*

1.95	2.77
2.16	2.96
2.39	3.09
2.65	3.25
2.86	3.47
3.05	3.47
3.32	3.49
3.93	3.51

Two samples of methane were tested photometrically with the following results :—

Rate of consumption per hour, corrected to 60° F. and 30' B. Cubic feet.	Candles observed.	Candles per cubic feet per hour calculated.
2.78	2.9	5.2
4.56	4.6	5.15

The luminous portions of methane flames obtained with Argand (flat flame and one-hole) burners were slightly yellow.

By sufficiently limiting the air supply of the Argand the methane flame smokes copiously. I hope to be able to extend these inquiries to other members of the paraffin series.