

into A by means of a capillary tube, and the combustions made as above described.

	Elliott. per cent.	Copper oxide apparatus. per cent.	Difference. per cent.
Hydrogen .....	32.5	32.7	0.2
Methane .....	17.0	18.8	0.9
Nitrogen .....	4.6	5.3	0.7

## THE ELLIOTT STANDARD PHOTOMETRIC LAMP.

BY E. C. UHLIG.

This lamp is designed as a secondary standard for the determination of candle power by the works men, it is intended for the guidance of the gas-maker in place of the unreliable jet photometer. It is of the well-known "student lamp" type of about 16 candle power, the light of which is reduced by means of a screen to 10 candle power and in the latest models to 5 candle power. The fuel burned is "Astral oil." It is furnished with a reservoir which will hold sufficient oil to burn 12 hours. These lamps have also been made with 24 hour reservoirs. The lamp is standardised against candles or against a standardised sample of gas which may be taken from a 5 cubic foot gas holder. When once standardised the lamp will maintain its candle power for 12 hours or even longer. The 5 candle standard permits of more accurate adjustment in this respect. It requires reasonable care in its use; the wick must be properly trimmed according to the directions given with the lamp, the oil must be clean, the burner kept clean particularly in the air holes. Observing all these precautions a careful operator will get results which agree very closely with those obtained with other standards.

The method of using the lamp is as follows: After cleaning, filling, and trimming, it is placed in position at the end of the photometer bar, at the other end of which the candles or standardised gas is burning. The lamp is lighted and allowed to burn about 15 minutes, then readings are taken and the usual corrections applied. The gas to be tested is then put in the place of the candles or standard gas and readings taken with the value of the lamp as standard. These readings may be taken as often as required during the day.

It has been found that this lamp varies very little each day from the value found on the first standardisation, generally the 10 candle power lamp will not vary more than 0.1 candle from day to day, while the variation of the 5 candle power lamp is even less. Any variation will be due mostly to a change in the quality of the oil used. It is good practice to reserve a quantity of oil for use in the lamp only, and not take oil from a receptacle in general use. Of course variations will occur due to wear particularly in the burner, but this can be corrected by occasional repair.

A test of this lamp was made by taking the candle power of gas delivered to two photometers, on one of which (60 inch) the lamp was used as a standard, on the other (100 inch) the standard was sperm candles. The lamp was 10 candle standard, and tests were made hourly on each photometer for 13 hours. The average results were as follows:—C.P. of gas by the lamp, 24.30. C.P. of gas by standard candles, 24.00.

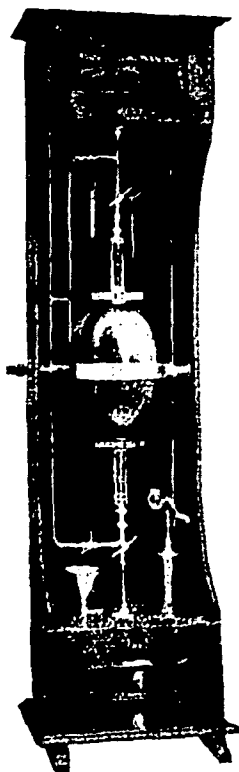
The following results with a 5 candle lamp are communicated. Elliott lamp against Hefner amyl acetate lamp. Hefner lamp adjusted to 1 standard candle.

Elliott lamp	= 5.02	candle power.
After 2 hours	= 5.01	"
" 3 "	= 5.01	"
" 4 "	= 5.01	"
" 6 "	= 5.00	"
" 8 "	= 5.00	"
" 7 "	= 5.00	"
" 8 "	= 5.00	"
" 9 "	= 5.00	"
" 10 "	= 5.00	"
" 11 "	= 5.00	"
" 12 "	= 5.00	"

## MOUNTED CUBIC FOOT BOTTLE FOR CALIBRATING VOLUMETRIC GAS TESTING APPARATUS.

BY E. C. UHLIG.

This consists of an oval copper vessel joined at the top and bottom with water tanks. These tanks are of wood,



metal lined, and are connected with each other directly by piping. At the bottom, there is a pump which enables the water to be forced from the lower to the upper tank. There is a funnel on the lower tank, through which water may be added, and a cock by which it may be drawn off. Immediately above and below the copper vessel are two small wooden shelves, which are fastened to the wooden back of the instrument, running from the upper to the lower tank and binding the whole together. The pipe leading from the copper vessel both above and below is all glass for about six inches, and on these glass portions are marked the upper and lower limits of the cubic foot. Six inches above the upper glass tube are a three-way cock and a small tube which permits of the escape of air. Above this is a valve by which the cubic foot may be shut off from the apparatus under test, and there is a similar valve below the copper vessel for controlling the flow of water from the upper tank to it. There is also a three-way cock connecting with the lower tank, the pipe and the vessel above.

This apparatus is standardised and certified by the Bureau of Standards at Washington, and by its means a cubic foot of air or gas can be passed through the outlet connection, and by repeating the operation any number of cubic feet may be passed.

## Scottish Section.

Meeting held at Glasgow on Tuesday, January 18th, 1910.

MR. D. J. PLAYFAIR IN THE CHAIR.

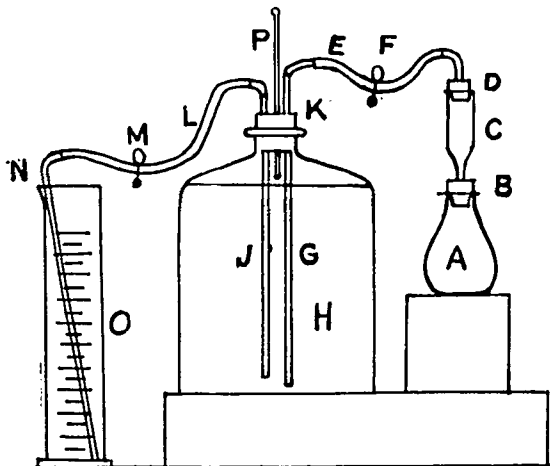
## EASY PROCESS FOR ESTIMATING WATER IN PETROLEUM.

BY R. WIGHTWICK ROBERTS AND ALFRED FRASER.

A large portion of Californian petroleum—or rather petroleum residues, for it has been freed from the lighter oils by distillation—that comes to the coast of Chile for use as fuel, contains quantities of water varying up to about 20 per cent. This water seems to form an emulsion with the heavier constituents of the oil, and, besides detracting from its calorific value, causes at times serious trouble by clogging the nozzles of the blowers.

As the estimation by distillation is difficult and often unsatisfactory, the attempt was made to determine the water by adding calcium carbide to the oil and measuring the amount of acetylene given off. The experiment was entirely successful. A number of concurrent tests were made (1) by taking two equal portions of the same

oil, adding a weighed quantity of water to one, treating both with carbide, and taking the difference in the amount of acetylene given off, and (2) by treating a portion of



oil with excess of carbide, till no more gas was evolved, adding a weighed quantity of water, and measuring the acetylene subsequently given off. The two tests gave an average of 580 c.c. (at 0°C. and 760 mm. barometric pressure), per gram of water in the sample; a number which agrees very closely with that obtained by P. V. Dupré (this Journal, Aug. 15, 1906, p. 780), in his somewhat similar experiments on the determination of moisture in cordite.

#### Apparatus.

In the apparatus shown in the accompanying sketch, A is an Erlenmeyer flask of about 300 c.c.; B is a perforated india-rubber stopper; C a cylindrical glass funnel with perforated stopper, D; H a bottle of about 5 litres capacity, with an india-rubber stopper, K, with four perforations, through two of which glass tubes, G and J, reach to the bottom of the bottle. G is connected with the funnel, C, and J with the long glass tube, N, by means of india-rubber tubes, E and L, with clips, F and M. The tube, N, dips into the graduated litre measure, O. Through another hole in the stopper, K, is inserted the thermometer, P, while through the fourth passes a glass tube with cock (not shown in the diagram), connected with a suction pump.

The bottle, H, is filled with a saturated solution of common salt, and, by blowing gently at D, the tube, N, is filled with the solution and the clip, M, is closed. The flask, A, is tared, and 17.24 grms. of the petroleum to be tested are weighed into it. If this is very thick, as is usually the case, about 20 c.c. of kerosene are added and well mixed with the thick oil. The clip, F, being open, and the measure, O, empty, a few fragments of calcium carbide are dropped into the funnel, C, then about 20 grms. of finely ground carbide are poured on the top of the loose fragments, the stopper, D, is quickly inserted, and the clip, M, opened. A few taps with the finger causes the finer carbide to fall gradually into the flask, A, which is gently shaken. The evolution of acetylene commences immediately, and this, passing through the tube, G, into the bottle, H, causes an equal bulk of water to flow into the measure, O. If there is a large quantity of water in the sample and the flask, A, becomes warm, it is immersed in a beaker of cold water to keep down the temperature and prevent the distillation of any gas from the oils. When the evolution of acetylene ceases, and no more is produced by a brisk shaking of the flask, A, after it has stood a minute or two, the reaction is considered finished. The measure, O, is now raised so that the water in it may stand at the same level as that inside the bottle, H, and allowed to remain so a minute or two for the levels to adjust themselves; then the reading of the thermometer, P, is taken, the

clips, F and M, are closed, the tube, N, is withdrawn, and the amount of water in the measure read off. The proper correction for temperature and barometric pressure having been made, each 100 c.c. of the reduced volume indicates 1 per cent. of water in the sample. The whole operation occupies from 15 to 20 minutes.

In the first tests that were made the saline solution was run from the tube, N, into a tared flask and weighed, and, its specific gravity having been taken, its exact volume was easily calculated. A correction was also made for the amount of acetylene dissolved by the oils in the flask, A. The saline solution in the bottle, H, was also first saturated with acetylene so that it could absorb no more from that given off by the sample.

Several tests may be made without refilling the bottle, H. To refill this the tube, N, is dipped into a large flask or beaker in which the saline solution has been collected from the various tests, the clip, M, is opened and also the cock of the glass tube which goes to the suction pump, and the solution sucked back into the bottle, H. This also prevents the acetylene polluting the air of the laboratory. We are indebted to Mr. J. Southward for his valuable help in carrying out the details of this investigation.

### Yorkshire Section.

Meeting held at Queen's Hotel, Leeds, on Monday, 13th December, 1909.

PROF. W. M. GARDNER IN THE CHAIR.

### A SIMPLIFIED FORM OF EUDIOMETER FOR GENERAL GAS ANALYSIS.

BY F. W. RICHARDSON AND A. JAFFÉ.

The illustration will suffice to show the simple modification of and addition to the ordinary nitrometer. The side flask with its stoppered thistle funnel and small reflux bulb, or the bulb made from an ordinary pear shaped separator, is exhausted of its air by means of a Geissler glass filter pump. Any small amount of residual air is now removed by means of the mercury columns of the eudiometer. In this manner a perfect vacuum can be obtained. The entire absence of air or gas of any kind is a desirable feature in a number of operations. By means of the side bulb *in vacuo*, the estimation of gases dissolved in water is easily done. The bulb, with the measured volume of water, is immersed in water at about 80° C. The gases are soon extracted and removed to the more remote tube, or laboratory vessel. Into this the usual solutions for removing the carbon dioxide and then the oxygen are admitted and these gases are calculated from the losses observed. A well boiled and cooled water was shaken vigorously with air until presumably saturated. In our eudiometer a rapid estimation of the dissolved gases measured at 0° C. at 760 mm. showed 0.64 per cent. of oxygen and 1.32 per cent. of nitrogen, the amounts observed by various authorities. Where the amount of gas dissolved in a water is very small, quite a large flask may be used for the extraction. We use a 500 c.c. flask and insert a perforated rubber cork bearing a stoppered glass tube. After producing a complete vacuum a known volume, about 400 c.c. of the water is allowed to enter the flask. At a temperature of about 80° C. the whole of the gases can now be extracted and transferred to the laboratory tube. If the perforated rubber cork containing the straight tube with stopper is inserted into a large pear-shaped separator with the terminal tube cut short, we are able not merely to estimate the dissolved gases in the water, but also to determine the amount of combined carbon dioxide. A few c.c. of normal sulphuric acid are allowed to enter by the bottom tap to liberate this carbon dioxide. That the estimation