has been read before the American Association of Mining Engineers by Mr. F. P. Dewey. (Reprinted in *Iron* for 1883, vol. xxii., p. 376.) But as the facts there described relate only to American coals and coke, and as the experimental method used by the author differs in some respects from my own, I think it may be worth while to lay the results of my enquiries, though incomplete, before the Society.

The process adopted by Mr. Dewey for determining the actual density of the substance of coke consists in weighing small selected pieces of 20 to 40grms. in weight, first in the dry state, then in water, after extracting the air as completely as possible by the aid of the air pump and by boiling. A further weighing of the wet and saturated coke after removal from the water gives the weight of water absorbed, and consequently a measure of the porosity.

It appears to me that whilst this process presents some advantages, and certainly appears to have been carried out by Mr. Dewey with considerable care, it is liable to several sources of error. In the first place it might easily happen that the piece selected would not represent the average quality of the mass from which it was taken, and secondly the difficulty of completely extracting the air from a lump of 30 to 60 or more cubic centimetres in volume is so great that I doubt if it could ever be completely accomplished in this way.

My object has been two-fold. I wanted first to know the volume weight of coke as it occurs in bulk, and secondly the absolute density of the substance itself irrespective of porosity.

The accompanying tables give the weight of the bushel stricken (not heaped up) of the several varieties of coke mentioned. The weight was obtained in each case as the average of three distinct operations, the measure being emptied out and re-filled after weighing. To get as fair an average as possible the coke was weighed in three sizes: (1) large as it came from the retort or oven; (2) broken so as to pass through a two or three-inch ring or riddle; and (3) smaller lumps lin. in diameter without dust.

WEIGHT PER BUSHEL GAS COKE.

	Name of Coal.	Size of Coke.	Weights.			Mean.
1	Wharfedale.	Large.	29	29	28	28·6lb.
		2-inch.	30	31	31	30·6lb.
		1-inch.	33	35	31	31lb.
2	Aldyarko.	Large.	28	27	27	27·3lb.
		2-inch.	29	28	29	28·6lb.
		1-inch.	30	30	31	30·3lb.
3	Eckington.	Large.	30	31	32	31lb.
		2-inch.	33	33	32	32·6lb.
		1-inch.	31	33	33	33·3lb.
4	Mixture.	Large.	32	31	33	33lb.
		2-inch.	33	35	35	31·3lb.
		1-inch.	39	40	39	39·3lb.
5	Mixture.	Large.	32	32	29	31lb.
		2-inch.	29	32	30	30·3lb.
		1-inch.	32	31	33	33lb.

NOTE.—Nos. 1, 2, 3—No water used to extinguish. No. 4—Had been exposed to the weather. No. 5—15 hours in the retorts. No water used.

WEIGHT PER BUSHEL HARD COKE.

	Name of Coal.	Size of Coal.	Weight.			Mean.
1	Durham (Ord. Beehive).	Large.	31	32	31	31·3lb.
		2-inch.	35	35	35	35lb.
		1-inch.	31	35	31	31·3lb.
2	Durham (Weathered).	Large.	32	30	31	32lb.
		3-inch.	36	36	36	36lb.
		1-inch.	37	36	38	37lb.
3	Durham (Jameson).	Large.	27	29	32	29·3lb.
		3-inch.	32·7	31·2	32	32lb.
		1-inch.	31·25	—	—	31·25lb.
4	Durham (Simon-Carvés).	Large.	39	35·5	39	31·1lb.
		3-inch.	31·5	35·5	33·5	31·5lb.
		1-inch.	35·5	40·5	41	42·3lb.
5	Glamorgan.	Repeated.	38·5	39·7	39·5	39·2lb.
		Large.	39	38	40	39lb.
		2-inch.	41·5	41	41	41·2lb.
		1-inch.	41	41·5	41·5	41·3lb.

NOTE.—No. 3—Made by Messrs. Bell Bros. at the South Brancepeth Colliery, Durham, from a mixture of 3 parts Brochwel with 2 parts Busty Seam in an ordinary 11ft. beehive, exhausted according to Jameson's process. No. 4—Made by Messrs. Pease at their West Collieries, Crook, Durham.

In order to determine the absolute density, a mass of considerable size, or usually several lumps, selected from a heap, were taken and powdered to coarse powder. This was well mixed together and a portion of it removed and ground in a mortar to fine powder. It was then dried in a steam oven. After being placed with distilled water in the specific gravity bottle it was alternately heated and placed under the exhausted receiver of the air pump till all the air had been removed. Obviously air is expelled from the powder much more readily than from the same material in mass.

Although coke in lump floats in water the fine powder sinks instantly, but that it still contains air is shown by a comparison of the density determined without the use of the air pump with the result obtained after thorough exhaustion. In one experiment the density observed was 1·82 instead of 1·95, and in another experiment 1·76 instead of 1·80.

DENSITY OF COKE BY SPECIFIC GRAVITY BOTTLE
TEMPERATURE, 16° to 17° C.

	Expt. 1.	Expt. 2.	Mean.
Gas Carbon	2·028	2·010	2·019
Gas Coke	1·780	1·790	1·785
Welsh Foundry Coke....	1·860	1·870	1·865
Durham	1·920	1·900	1·910
Durham (Jameson)	1·957	1·961	1·959
Durham (Simon-Carvés)	1·800	1·810	1·805

DENSITY FROM THE BUSHEL WEIGHT.

Gas Coke (average)	3975
Hard Coke (average)	4100

NOTE.—The density of coke in the measure kind not mentioned, is given in Box's "Tables of Materials" as 353. The density of gas carbon is given by Mené as 1·883 (Smithsonian Collections, vol. xii, p. 27).

An interesting fact may be observed with reference to the two cokes produced by the processes of Messrs. Jameson and Simon-Carvés respectively, of which we have heard so much of late. The weight per bushel of the French coke is greater than that of the Jameson coke, but its density by the bottle is less. I thought at first that this must be a mistake, but on carefully repeating the specific gravity determination I came to the conclusion that it certainly was so in

the case of the samples in my possession. The French coke, as is well known, presents an appearance very different from that of the Jameson coke, or of coke made in an ordinary bee-hive oven, and its want of lustre may really be due to its containing a quantity of soft and sooty carbon. Whether high density is always associated with great strength and power to resist crushing, we do not yet know, and further information is desirable as to the behaviour of the new coke in the blast furnace.

I hope as time goes on to add to the facts collected in this paper. In the meantime I desire to express my best thanks to the gentlemen who have very obligingly assisted in these experiments. I am indebted for help to Mr. A. Dougall, of the Kidderminster Gas Works, to Mr. R. Dixon, of Messrs. Pease's West Collieries, at Crook, and to Mr. C. Ernest Bell, of Messrs. Bell Bros., and to Mr. Hugh Nettlefold, also to Mr. Henry Dewes, of the Mason College Laboratory for determinations of specific gravity.

DISCUSSION.

Mr. W. W. STAVELY: I am much interested in this question of the specific gravity of coke, and I had hoped that Dr. Tilden would have given us the specific gravity of coke produced from coal tar pitch. In the tar distilleries a certain kind of pitch, which is too hard for the purpose of making patent fuel, is redistilled in specially constructed fire brick ovens, and as a result there is obtained as distillate a dense oil used for rough lubricating purposes, and left in the retorts is a very hard dense coke. An analysis of this coke which I published some years ago showed it to contain about 97½% of carbon and but one tenth of a per cent. of sulphur. Some 50 to 60 tons per week of this coke are produced in this district and used in the iron works. On account of its density and hardness it will bear a much greater load in the furnaces than ordinary Durham coke. So intense is the heating power of this coke that for ordinary purposes, it requires to be mixed with gas coke.

Mr. ESCH EVANS: Permit me to direct attention to a method for determining the specific gravity of coke, by Dr. W. Thörner, which appears in *Engineering*, November 28th, 1881, p. 495. The author used several fluids, including alcohol and benzol; he found alcohol quite suitable for ordinary purposes, and cheaper, and more agreeable to work with than benzol.

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University of Glasgow.

Notices of papers and communications for the Meeting to be sent to the Local Secretary.

January 6th.—(1) Mr. Beilby will exhibit and describe "A new form of Gas Thermometer." (2) Mr. J. J. Coleman will exhibit and describe "A Gas Thermometer for taking Temperatures below Freezing Point." (3) Professor Dittmar will exhibit and describe "Schaeffer and Budenberg's Tension Thermometer." (4) Mr. J. Murrie will exhibit and describe "An Improved Thermometer for taking High Temperatures."

The opening meeting of this Section for session 1884-85, was held in the Rooms, 207, Bath Street, on Tuesday, 11th. November.

MR. E. C. C. STANFORD, IN THE CHAIR.

CHAIRMAN'S OPENING ADDRESS.

MR. E. C. C. STANFORD: In bidding you welcome to the opening meeting of this, the second session of the Scottish Section of the Society of Chemical Industry, I shall only detain you a few moments while I briefly refer to the past session. Our first meeting was not held until February 12th, of this year, and in my opening address on that occasion, I ventured to predict that our contributions to the Journal would not be blank pages; as a fact I find that in the four months thereafter, of 141 pages of printed contributions, those from this Section amounted to 52 pages, or over 36 per cent., which, considering the short length of our first session, is very satisfactory, and is a proof that we have redeemed our pledges.

The members of the Society of Chemical Industry now number 1,850, and we have at present, as members of this Section, 181. Of these, 96 have become members of the Society since the formation of this section. Twelve important papers were contributed to the Section, and one special meeting was devoted to discussion on "International methods of testing and sampling," in which the subject was most ably introduced by Mr. Tatlock, and the discussion is claimed to have added to the general knowledge of this fruitful source of disputes.

In the session commenced this evening, we have the following papers fixed:—

For this evening, "The application of Cooling to the recovery of certain Salts from solution." By Mr. C. J. Ellis.

December 2nd.—"On the Chromic Tanning Process." By Mr. W. J. A. Donald.

January 6th.—(1) Mr. G. Beilby will exhibit and describe "A new form of Gas Thermometer." (2) Mr. J. J. Coleman will exhibit and describe "A Gas Thermometer for taking Temperatures below Freezing Point." (3) Professor Dittmar will exhibit and describe "Schaeffer and Budenberg's Tension Thermometer." (4) Mr. J. Murrie will exhibit and describe "An Improved Thermometer for taking High Temperatures."

February 3rd.—(1) "Bromine Absorptions." By Professor Mills. (2) "On a new system of Cooling Oils for the extraction of Paraffin." By Mr. G. Beilby.

March 3rd.—"On the processes employed in Italy for the extraction of Oils, etc., from bituminous rocks in that country." By Mr. J. Murrie.

April 7th.—(1) Annual General Meeting: (2) "Notes on Destructive Distillation," by Professor Mills. (3) "Notes on the recovery of Ammonia from Blast-furnace and Producer Gases," by Mr. R. R. Tatlock.

Papers are also promised by Mr. Remmers, "On the use of Dialysis in manufacturing processes," and by Mr. Tervet, "On the fractionation of mineral oils," and I am trying to obtain a paper on the "Piccard Evaporator," which claims to distil 35 tons of water for one ton of coal expended as fuel.

At the opening of our last session we were awaiting the report of the Royal Commission on Technical Education. This has since appeared and in it the following paragraph occurs:—"The Englishman is accustomed to seek for an immediate return and has yet to learn that an extended and systematic education, up to and including the methods of original research, is now a necessary preliminary to the fullest development of industry, and it is to the gradual but sure growth of public opinion in this direction that we must look for the means of securing to this country in the future, as in the past, the highest position as an industrial nation." The truth of this proposition must be manifest to all. No one has had more experience on this Royal Commission than Sir H. Roscoe, and no one can speak with greater authority. It is therefore extremely en-