the analysis of the escaping gases) that this depth of white hot carbon converts in its upward course through it a large portion of carbonic acid into carbonic oxide, in which form it escapes from the chimney, no provision being made to supply oxygen above the grate except by throwing open the fire-hole door.

The limits of this paper will not permit of any full comparison of the chemical constituents of Americal and Welsh Anthracite, but this table shows that the percentage of fixed car-

	Welsh.				Pennsylvania.			
	Pembrokeshire Lower Vein.	Kilgetty Vein.	Aman Valley Big Vein.	Swansea Valley Brass Vein.	Beaver Meadow.	Shenoweth Vein.	Black Spring Gap.	Nealeys Tunnel.
Carbon . .	94.18	93.27	92.55	91.11	92.30	94.10	80.57	89.90
Ash . . .	.98	1.21	.42	1.51	1.28	4.50	3.28	5.40
Hydrogen .	2.99	2.72	2.10	3.58 }	6.42	1.40	7.15	5.40
Oxy. & Nit. .	1.26	2.65	4.07	3.24 }				
Sulphur .	.59	.15	.12	.59				
Moisture. .			.10					
Total—	100.	100.	100.	100.	100.	100.	100.	100.

bon is practically the same, and that the only marked difference is, that American averages 3.61 per cent of ash, or more than three times the amount found in Welsh.

The lower evaporative duty of American is probably explained by its extreme density. A comparison averaged from the detailed figures given by Crookes and Rohrig shews the following results :—

	No. of specimens.	Specific Gravity.	Weight of a cubic yard in lbs,
American......	18	1.541	2.623
Welsh..........	3	1.318	2.223
Difference		.223	400

I do not find that any attempt has yet been made on American locomotives to carry out the neat and apparently effective contrivance described by Mr. C. H. Perkins in his paper on Anthracite at the Swansea Meeting,—viz.: the use for grates of hollow perforated tubes, through which the air required for combustion is forced under pressure of pan or steam jet. It is probable if applied by fan or blower to locomotive service and the exhaust steam, not then required for producing blast, otherwise utilised, a more economic result would be achieved than yet obtained in the use of Anthracite as a locomotive fuel.

The ash pans not being provided with air dampers it may be mentioned that the mechanical means for controlling the rate of combustion commonly in use, are, 1st. By variable exhaust pipe nozzle which is only partially successful as it demands from engineer-men more attention and judgment than can be ordinarily secured. 2nd. The free opening of the large fire-hole door which is not provided with damper or deflecting plate, and, 3rd. In same case the admission of air into smoke box at front end door through a movable grid plate, thus neutralizing the effect of the blast.

The life of a steel fire box burning Anthracite on the P. & R. Ry. averages 200,000 miles or only about 80 per cent of a steel box burning Bituminous, which under similar conditions averages 250,000 miles ; whereas the P. Ry says the difference is .60 per cent or a life respectively of six and ten years, and as the first cost of an Anthracite boiler is from 8 to 15 per cent in excess and cost of repairs heavier, rising in extreme cases to 33 per cent in excess, and the market price of the Anthracite being higher and its evaporative duty being less than Bituminous, a very natural query is—Why should it be used ?

The answer is—1st. Its complete freedom from smoke, its small amount of dust and the cleanliness of the dust are strong points in its favor for passenger train service. 2nd. It is but slightly, if at all, used by any railway not owning and working mines, and by them over a very limited geographical area, and, 3rd. As two-thirds of this fuel brought to market, is sold by by three railway companies, the so-called market price (controlled by a pool) is no indication of the actual cost of the fuel.

Ignoring the question of interest in capital invested, and accepted as data for comparison, Bituminous coal at $3.00 (12 shillings) per ton with a yearly consumption of 1,250 tons, Anthracite boilers costing 17 per cent in excess, having 40 per cent. less length of life, with 33 per cent. increase in cost of running repairs, and Anthracite having an evaporative efficiency of but .80 per cent. it would have to cost barely $2.49 (10 shillings) per ton to justify its use as a fuel of equal economy. In other words the comparative cost by weight of Anthracite must be not only .80 per cent. less than the cost of Bituminous, but in addition 7.7 cents per ton lower, so as on the average yearly consumption to leave on "fuel-sheet" an unspent balance of at least $112.00 to the credit of renewals and repairs of boiler.

My thanks are due to Mr. J. E. Wooten, General Manager of the Pennsylvania and Reading Ry., and Mr. Theo. N. Ely, Supt. Motive Power, Pennsylvania Ry. for information supplied by them embodied in this paper.—*Section G British Association, Montreal.*

J. DAVIS BARNETT.

A COMMISSION of five French medical men have reported on their investigations as to the real nature and action of the cholera poison. The substance of their report as it appears in the *Times* is as follows :—"The initial lesion of cholera takes place in the blood. It essentially consists in the softening of the hæmoglobin, which makes some globules lose first their clear shape, the fixity of their form, and the faculty of being indented. These globules adhere together, lengthen out—*en olive*—stick together, and in fulminating cases especially some are are seen which are quite abnormal, while others appear quite healthy. The entire loss of elasticity of the globule (which is shown by the preservation of the elliptic form when it has been stretched out) is, in our view, a certain right of the patient's death. To stretch out a globule you have merely to alter the inclination of a plate on which a sanguineous current has been established in the field of the microscope. The fluid column stops at one point, whereas the rest continues to flow. An elongation of the intermediary globules results, and then a rupture of the column. In the gap thus formed are some scattered globules. If these revert to their primitive form, the patient may recover. If they keep the elliptic form, we have seen death in every case, even if the patient's symptoms were not serious at the time of the examination of the blood."

A NEW perfect-combustion stove for domestic use has been invented by Mr. Henry Thompson, of Canonbury, England. Externally it resembles the ordinary register-stove, but in its internal construction it differs widely from it. A recess at the back of the Thompson stove is filled with coal at starting ; and behind the coal is a vertical hinged plate, which is so arranged as always to exert a gentle pressure on the coal and the body of the fire, tending to push the coal forward toward the bars. A slight stirring of the fire causes it to be loosened, and the fuel to be pressed forward to the front to replenish the fire. When the coal has been consumed, the vertical plate is pushed back, and a fresh charge of coal inserted. It will thus be seen that the coal at the back is undergoing a process of coking before being pushed forward. The gases evolved from it, instead of passing up the chimney and into the air in the form of solid carbon, are carried downwards by the draught produced by an ingenious but simple arrangement at the back of the stove, and are delivered beneath the grate. At this point they are drawn upwards through the incandescent fire, in which every particle of smoke is consumed. The waste products of combustion pass up the chimney in the usual way, but without the usual attendant results of smoke and soot.