APPENDIX B.

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EXHAUST GASES FROM MOTORS.

Shortened Process of Analysis.

The CO , CO_2 , and O_2 are first determined by the usual gas-volumetric methods. I prefer to proceed as follows:—A known volume of the gas (about 50 cc.) is treated in succession with (1) caustic potash solution (50 grammes KOH plus 100 grammes of water); (2) alkaline pyrogallol solution (5 grammes pyrogallol, 50 grammes KOH , and 100 cc. of water); and (3) acid cuprous chloride solutions (used and fresh respectively), followed by the caustic potash solution. The proportions of CO_2 , O_2 , and CO respectively are thus ascertained.

Ethylene, hydrogen, methane, and nitrogen remain to be determined, and the usual gas-volumetric methods may be employed. As the result of a large number of analyses of motor exhaust gases from petrol engines, however, I have found that, for nearly all practical purposes, it is unnecessary to determine these constituents by direct analysis, and an important saving in time and trouble is effected. This remark applies to exhaust gases from ordinary kinds of petrol. The results are arrived at as follows:—

Ethylene is not tested for. I have never detected this gas, even in the worst exhaust gases examined. It may therefore be treated as entirely absent, or present in such minute proportion that ordinary gas-volumetric methods cannot detect it.

I have also found that the proportions of hydrogen and methane bear a definite ratio to the proportion of CO , viz.:—

Percentage of $\text{CO} \times 0.36 = \text{percentage of H.}$

Percentage of $\text{CO} \times 0.12 = \text{percentage of CH}_4.$

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These two gases are therefore determined by simple multiplication. The nitrogen is determined by difference, as in ordinary analyses.

The following analyses were made as above described :—

		1	2	3
By analysis.	CO	1·8	2·4	2·2
	CO ₂	5·6	11·0	11·8
	O ₂	10·6	2·2	0·6
	H	0·6	0·8	0·8
By calculation.	CH ₄	0·2	0·3	0·3
	N ₂	81·2	83·3	84·3
		<u>100·0</u>	<u>100·0</u>	<u>100·0</u>

The calculated results obtained, as above described, may be regarded as correct within the limits of error of an analysis by gas-volumetric methods.

The method should only be used for exhaust gases from petrol and where the conditions of use are more or less normal, as I have not, so far, made similar tests with other fuels.

Even in cases where a direct estimation of each constituent in petrol exhaust gases is necessary, the above method affords a useful check on the analytical results.