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The Repeatability and Accuracy of Producer Gas Analysis in the Bone and Wheeler Apparatus

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SUMMARY

An apparatus of the Bone and Wheeler type is described, and a procedure suitable for the analysis of producer-gas given. The performance of the apparatus has been investigated by the replicate analysis of a series of synthetic producer-gas mixtures, prepared to allow statistical examination of the results. The repeatability and accuracy of determination for all constituents was better than ± 0.1% except for carbon monoxide, where the repeatability was better than ± 0.1% but the determined values were lower than those calculated; the bias varied with concentration. Careful attention to the details of design of the apparatus, the reagents used, and the technique employed, was found essential.

(1) Introduction

During gas producer efficiency trials at a Sheffield steelworks,[1] the Gas Producer Department of the B.C.U.R.A. experienced serious difficulties in obtaining material balances, owing mainly, it was believed, to inaccurate gas analysis. To investigate this, Brzozowski[2] prepared a number of gas mixtures and calculated their composition from the purities and proportions of the constituents. The mixtures were analysed at a number of laboratories, which obtained widely divergent results. Individual laboratories found differences between duplicate determinations, i.e. repeatability, up to 1.97, 0.71 and 1.49% for carbon monoxide, hydrogen, and methane, respectively. Maximum differences between the determined and expected proportions of these constituents, i.e. accuracy, were -2.66, -0.87 and +2.06%. Such errors of analysis would be sufficient to cause serious miscalculation of material balances.

Shepherd[3,4] surveyed methods of analysis as applied to standard samples of natural gas and carburetted water-gas in the U.S.A. Most of the results were obtained with a constant-pressure (Orsat) type of apparatus, but at least one laboratory used a constant-volume (Bone and Wheeler) apparatus. Results from the various laboratories, and even