

**HANDBOOK OF TECHNICAL GAS-  
ANALYSIS, CONTAINING CONCISE  
INSTRUCTIONS FOR CARRYING  
OUT GAS-ANALYTICAL METHODS  
OF PROVED UTILITY**

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Handbook of Technical Gas-Analysis, Containing Concise Instructions for Carrying out Gas-Analytical Methods of Proved Utility by Clemens Winkler & Georg Lunge

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BY  
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## TRANSLATOR'S PREFACE.

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EVERY one who has to make gas-analyses for technical purposes is aware that Professor CLEMENS WINKLER is the founder of technical gas-analysis as a distinct branch of analytical Chemistry. A few such processes were, of course, previously known and practised; but Winkler was the first to draw attention to the importance of this subject, to invent suitable apparatus, and to elaborate a complete system of qualitative and quantitative technical gas-analysis\*, containing a vast number of new observations and methods, along with a very complete description of the work already done in the same direction by others.

The field first opened out by Winkler has been very successfully cultivated by other chemists; and it is now quite usual, at any rate in Germany, to perform technical gas-analyses, not merely in chemical works, but for testing the efficiency of steam-boiler furnaces and such purposes. In England some of these processes have also been introduced; but they are not as yet known and appreciated to the same extent as abroad. Hence it may not be unwelcome to English chemists to have a translation of a short treatise, just published by Winkler, which is primarily intended for *teaching* purposes—that is, for the use of teachers and students in public laboratories—but which likewise serves as a guide and handy book to other chemists wishing to make themselves acquainted with the subject. This treatise is not intended, as was its predecessor, to furnish a complete enumeration of all apparatus hitherto proposed for technical gas-analysis, but merely to give representative examples of each kind of apparatus, embracing all the divisions of this branch of Chemistry. It may be confidently said that a person who has mastered the processes and apparatus described in this book will at once

\* Cf. WINKLER, 'Anleitung zur chemischen Untersuchung der Industrie-Gase,' Freiberg, 1877-79 (2 vols.).

comprehend and manage any other gas-analytical process or apparatus he may meet with or require for his special purpose. The scope of this book does not in any way embrace the methods of gas-analysis practised for purely scientific purposes, for instance, all those in which mercury is employed for confining the gases; but it will, for all that, have great interest for scientific chemists.

The selection which the Author has made from the large mass of material now accumulated, was evidently, to a certain extent, dictated by special circumstances. German sources were mainly used by him, as these far more than sufficed for the purpose which he had in view—that of furnishing a sufficient number of illustrations for all parts of his field. The Translator has been under a strong temptation to supplement the book by some other examples of apparatus; but this proved unmanageable, as the present treatise would thus have lost its character, as indicated above, and as then, with greater pretensions, it might perhaps have been more open than it is at present to the objection that the treatment of the subject was not sufficiently exhaustive. The Translator has therefore contented himself with adding a few notes where they seemed to be especially called for, and with describing two apparatus of his own construction which have been found very useful just for industrial purposes, and which seemed to supply a want. All the additions he has made are marked, the text being in other respects a faithful rendering of the German original.

The Translator must acknowledge the most valuable services of Dr. Atkinson in looking over the proofs and improving the style of the translation.

All the apparatus mentioned in this book can be supplied by Messrs. Mawson and Swan, of Newcastle-upon-Tyne, or by any other dealers in chemical apparatus.

It is hoped, then, that English chemists, gas-managers, engineers, factory inspectors, and others interested in technical gas-analysis, will receive this work with favour, and that it will be as widely employed and as useful as Winkler's works have been in his own country.

Zürich, August 1886.



## AUTHOR'S PREFACE.

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THE gases, those invisible products of industrial activity, have long been denied the attention which they have as much right to claim as the solid and liquid substances. Only during the last few years a change for the better has taken place in this respect; and this change dates from the time when the examination of gaseous mixtures began to develop into an independent branch of analytical Chemistry. Much is still left to be done, but at least a beginning has been made in the way in which we must proceed, lest our age might hereafter be taxed with a waste of material, unworthy of its intellectual progress. In the present day every factory of any size\* is more or less provided with apparatus for gas-analysis; but the most striking proof of the spread of technical gas-analysis is furnished by the continually increasing demand for young chemists familiar with its manipulation, and by its elevation to the rank of a special study taught at various Polytechnic Schools.

Under such circumstances the issue of a handbook of technical gas-analysis must appear justified; I even cherish the hope that it will prove fruitful in more respects than one. Unlike the 'Handbook for the Chemical Investigation of Industrial Gases,' published by me and completed five years ago, which treated this subject in a far more exhaustive way and with special regard to chemical manufactures, this present treatise is intended to sketch concisely a system of teaching, by means of which it is possible to learn

\* *I. e.* in Germany.—*Translator.*

the best and most approved methods of gas-analysis in a short time—a system of teaching which I have applied with complete success in the laboratory of the Royal Mining Academy for a number of years.

I have found the methods hitherto employed of estimating combustible gases either by explosion, or by burning them with the aid of wires heated by an electric current, to be unsuitable, or even untrustworthy. When employing water or aqueous solutions to confine the gases, analyses by explosion are always awkward; nor do they appear convenient, owing to the necessity of adding oxygen or detonating gas. The same inconvenience attaches to the employment of an electric current sufficient to produce a high degree of heat. On the other hand, where the results are to be really correct, the demand for a saving of time cannot be satisfied beyond a certain limit; and this must be specially said of the estimation of methane, which is burned with such difficulty.

Owing to the concise character of this book, the names of authors and quotations of authorities had to be omitted. The selection of the methods was made on the principle of not quoting anything but what I had actually tried myself.

The various Tables forming the Appendix (the last of which I owe to the kindness of Professor Leo Liebermann of Budapcst), will, I trust, be found acceptable.

CLEMENS WINKLER.

Freiberg,  
September 27th, 1884.

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