MARCH, 1923. Vol. XLVIII., No. 564.

THE ANALYST

PROCEEDINGS OF THE SOCIETY OF PUBLIC ANALYSTS AND OTHER ANALYTICAL CHEMISTS.

ANNUAL GENERAL MEETING AND ORDINARY MEETING, HELD FEBRUARY 7, 1923.

THE Annual General Meeting of the Society was held at the Chemical Society's Rooms, Burlington House, W.1. The President, Mr. P. A. Ellis Richards, F.I.C., was in the chair.

The minutes of the previous Annual General Meeting were read and confirmed.

Messrs. Glass and Roberts were appointed scrutators of the ballot papers for the election of officers and Council for 1923.

The Hon. Treasurer presented the accounts of the Society for 1922, which were adopted, and votes of thanks were passed to the Hon. Treasurer and the Hon. Secretaries.

Messrs. Marreco, Houseman and Brandon, chartered accountants, were appointed auditors of the Society's accounts for 1923.

The President delivered his Annual Address. Mr. O. Hehner proposed that a hearty vote of thanks be accorded to the President for his address and for his services in the chair, and that his permission be asked to print the address in THE ANALYST. This was seconded by Mr. E. M. Hawkins, and the motion was carried.

The scrutators having reported the result of their examination of the ballot papers, the President announced that the Officers and Council for 1923 had been elected in accordance with the Council's nominations, as follows:—

President.—P. A. Ellis Richards.

Past-Presidents serving on the Council (limited by the Society's Articles of Association to eight in number).—Leonard Archbutt, A. Chaston Chapman, Bernard Dyer, Otto Hehner, Samuel Rideal, Alfred Smetham, E. W. Voelcker, and J. Augustus Voelcker.

Vice-Presidents.—F. W. F. Arnaud, F. H. Carr, and G. W. Monier-Williams.

Hon. Treasurer.—Edward Hinks.

Hon. Secretary.—E. Richards Bolton.

Assistant Hon. Secretary.—R. G. Pelly.

Other Members of Council.—H. Ballantyne, S. F. Burford, S. Elliott, B. S. Evans, E. M. Hawkins, Harri Heap, H. F. E. Hulton, Andrew More, A. E. Parkes, W. R. Schoeller, G. R. Thompson, and J. F. Tocher.

An Ordinary Meeting of the Society followed the Annual General Meeting, Mr. P. A. Ellis Richards, F.I.C., President, being in the chair.

Certificates were read for the first time in favour of:—Messrs. Joseph John Backes, A.R.C.Sc., A.I.C., D.I.C.; Samuel Gordon Stevenson, A.I.C.; Richard William Sutton, B.Sc.Tech. (Manch.), A.I.C.; Laurence Barnett Timmis, M.Sc.Tech. (Manch.), A.I.C.; Alfred Edward Johnson, B.Sc. (Lond.), F.I.C., A.R.C.S.I.; Ernest Victor Jones, F.I.C.; and Francis Kenelm Donovan, B.Sc. (Lond.).

Certificates were read for the second time in favour of:—Messrs. George Henry Appleyard, F.I.C.; James Walter Black, B.Sc. (Lond.); Arthur William Starey, A.R.C.S., B.Sc. (Lond.), A.I.C.; and John Matthew Wilkie, B.Sc. (Lond.), F.I.C.

The following were elected members of the Society:—Messrs. Henry Aldous Bromley; Walter Horace Clulow; William Plenderleith Lewellen Hope, B.Sc. (Edin.), A.I.C.; Robert Faraday Innes, F.I.C.; Osman Jones, F.I.C.; Alan West Stewart, D.Sc. (Brux.), A.I.C.; and William Heaton Thorns.

The following papers were read:—"Notes on the Examination of Preserved Meats, etc.," by Osman Jones, F.I.C.; and "Titanium in Nile Silt," by E. Griffiths-Jones.

Obituary.

ROBERT GEORGE GRIMWOOD.

ROBERT GEORGE GRIMWOOD died in Guy's Hospital, after three days' illness, on Christmas Eve, 1922, at the age of 49. He received his early education at Marlborough College, Holloway, and at the Public Day School Company's School at Kentish Town. In the year 1891 he entered Finsbury Technical College, and, having completed his course there, passed the examination for the Associateship of the Institute of Chemistry. He then became assistant to Mr. W. J. Dibdin, and while with him his work was largely associated with the analysis of water and building materials, and he also helped in the conduct of experiments upon the treatment of sewage and trade effluents.

He was joint author with Mr. W. J. Dibdin of the following papers, read before the Society of Public Analysts:—"Analyses of Mortar" (ANALYST, 1896, **21**, 197), and "The Detection and Estimation of Minute Quantities of Sulphuretted Hydrogen in Coal Gas" (ANALYST, 1902, **27**, 219). He was a Member of Council of this Society during the years 1915 and 1916.

In 1892 he became a gas examiner to the London County Council, and in 1897 was appointed a superintending gas examiner; he was also for some years Honorary Secretary to the "Association of Gas Examiners to the County of London," and took a leading part in all negotiations with the London County Council.

He was elected a Fellow of the Institute of Chemistry in 1900, and always took a very lively interest in the work of that body. He served on the Committee of the London Section for three years from 1920, and, at the time of his death, was a member of the Public Appointments Committee. Practically his last public work was associated with the Institute, for he represented it upon a joint committee, of which he was subsequently chairman, appointed by the Council of the Institute and the Board of the Institute of Physics to enquire into and report upon the qualifications of gas examiners.

In August, 1905, he joined the staff of Mr. Otto Hehner, who in April, 1919, took him into partnership, this association being still in force at the time of his death.

As regards his later chemical work, he will be best remembered by his contributions to the analysis of glycerin. He read a paper before the Society of Chemical Industry on "The Analysis of Crude Glycerin by the International Standard Methods, 1911. Determination of Organic Residue" (*J. Soc. Chem. Ind.*, 1913, 1039T.). In July, 1921, he became a member of the British Committee on the Analysis of Crude Glycerin, and he prepared for this Committee two papers, one dealing with the "Estimation of Water in Glycerin and the effect of Glycol upon it," and the other on the "Estimation of Organic Matter."

Besides being an able chemist, his manipulative skill being of a very high order, he was also a bacteriologist of no mean attainments.

Robert George Grimwood was a man with a certain amount of reserve, but, to those whose privilege it was to get beyond that reserve, there was revealed a man of far-seeing powers, capable of concentration of action, and, above all, a true friend.

He was laid to rest in Seal Cemetery, Sevenoaks, on Thursday, December 28th, his widow and son and other relatives, together with several of his professional friends, attending the funeral.

ARTHUR J. CHAPMAN.

Annual Address of the President.

I HAVE, at the commencement of my address, to congratulate the Society on another year of prosperous existence. Our meetings have been well attended, and, in addition to an interesting series of papers, we have, in most cases, had the advantage of a valuable discussion, during which much additional information has been elicited to our mutual benefit.

We regret the loss by death during the year of ten members, whilst nine have resigned. We have gained twenty-six new ordinary members and one honorary member, bringing our total up to 458.

The names of the deceased members are Alfred Hill, Edward William Taylor Jones, Alfred Ashby, Lionel William Stansell, Horace Fabian Cheshire, Frederick Thomas Harry, Frank Hughes, Robert George Grimwood, Frank Edwin Weston, and Frederick William Skevington.

Alfred Ashby studied medicine at Guy's Hospital, obtaining his F.R.C.S. in 1871, and graduating M.B. (London) the following year. During his long career he held various appointments, both as medical officer of health and as public analyst, and up to the time of his death he remained Public Analyst for Grantham, Newark and Reading. Although primarily a medical man, Dr. Ashby took a very keen interest in analytical chemistry, and published many papers in our Journal. His charming personality and genial manner will be long remembered by those whose privilege it was to know him.

Edwin William Taylor Jones, who died on February 19th last year at the age of seventy-six, was an original member of the Society of Public Analysts, and for two periods served us as Vice-President. He held the appointments of Public Analyst for the County of Stafford, the Boroughs of Wolverhampton, Kidderminster, Walsall, Newcastle-under-Lyme, and Stoke-on-Trent, and was also Official Analyst for the County of Stafford and certain of the other Boroughs under the Fertilisers and Feeding Stuffs Act. He contributed many papers to our Society, and joined actively in the discussions which took place at the meetings, and although of recent years his age and distance from London compelled him to discontinue his attendance, he always took a personal interest in our proceedings.

Alfred Hill, in addition to being one of the founders of this Society, was the oldest surviving English Public Analyst, having been appointed in the year 1860 as Public Analyst for Birmingham, combining with it the position of Medical Officer of Health. In 1885 he was elected President of our Society, and the early volumes of THE ANALYST, from 1877 to 1888, contain various papers contributed by him. He retired professionally in 1903, at the age of seventy-six, but remained a Member of our Society until his death last February, at the age of ninety-five. His loss will be keenly felt by many of the older members who could claim him as a personal friend.

Lionel William Stansell, also one of our older members, passed away on the 22nd of May last. In his early days he was assistant to Mr. Otto Hehner and Dr. Adams, and on the decease of the latter succeeded him as Public Analyst for Kent and several Kentish boroughs. He served on the Council of this Society, and on several occasions contributed papers that have been published in our Journal.

Frederick Thomas Harry, who died from pneumonia in the autumn of last year, was chief assistant to Mr. A. Chaston Chapman for many years. His loss is keenly felt by those of us who had the privilege of his friendship.

Horace Fabian Cheshire, who passed away very suddenly in November, received his early training at the Royal School of Mines. He was a man of wide scientific attainments, being well known in Sussex as a lecturer on Agriculture and Natural History, and also as an authority on the game of chess. For 41 years he held the appointment of Public Analyst to the Hastings Corporation.

Frank Hughes held an important position in the Government Laboratory, Cairo.

Robert George Grimwood, who worked for many years with Mr. Otto Hehner, finally succeeding him in certain of his public appointments, was a fairly regular attendant at our meetings, and often took part in the discussions. He served on the Council during 1915 and 1916.

Frank Edwin Weston was head of the Chemistry Department of the Regent

Street Polytechnic, and the author of several treatises on general and applied chemistry.

By the decease of Charles Edward Cassal, in his sixty-fourth year, the Society loses a former Vice-President and Honorary Secretary. Although at the time of his death Col. Cassal was not a member, he had been previously very closely connected with the work of our Society, having served for three periods on the Council, in addition to holding the offices mentioned. Born in London in 1858, and educated at University College, where he studied chemistry under Williamson and Graham, he was in 1879 appointed Demonstrator of Hygiene and Public Health under Professor Corfield. He held appointments as Public Analyst for the Royal Borough of Kensington, for the Borough of Battersea, for the parts of Kesteven and Holland in the County of Lincoln, and was also Joint Public Analyst for the City of Westminster. Although always a great fighter on any subject in which he was keenly interested, and one of the strongest supporters of the position of the Public Analyst, to the many of us who knew him personally he was ever a true friend. His readiness in debate and skill in oratory gave added interest to all he had to say, and his loss has been felt deeply by all members of the profession.

THE ANALYST, the official Journal of our Society, still maintains its high standard of excellence, thanks to the indefatigable care and unsparing work devoted to its production by our Editor, Mr. C. A. Mitchell, to whom the Society is so greatly indebted. Our Publication Committee are always receptive of suggestions for improvement of the Journal, and, *inter alia*, have this year carefully considered the question of inclusion of Law Reports on cases of general interest not only to Public Analysts, but to all analytical and consulting chemists. The Committee feel that the adoption of this scheme will meet the wishes of the Society and will be of general interest. May I express the hope that members will assist the Committee by sending to the Editor from time to time brief accounts of any such legal cases of which they may have personal knowledge?

Another comparatively new feature in our Journal is the inclusion therein of all Orders issued by the Ministry of Health and other Government Departments that have a bearing on the work of Public Analysts and other Analysts in consulting practice. The Departments have undertaken to forward in future copies of these to our Editor as soon as issued, and thus members of our Society can have this information in an easily accessible form.

During the session thirty papers have been read at the meetings, and the following is a list of those which have appeared in THE ANALYST during the year 1922:—

"The Estimation of Small Quantities of Antimony in Copper and Brass." By B. S. Evans.
"The Inks of Ancient and Modern Egypt." By A. Lucas.
"Note on the Occurrence of Struvite in Canned Shrimps." By C. S. Purcell and C. H. Hickley.
"The Separation of Aluminium from Beryllium." Part III. By Hubert T. S. Britton.
"Notes on the Analysis and Use of Red Squill in Rat Poisons." By C. L. Claremont.

"The Quantitative Separation of Nitro-body Mixtures from Nitroglycerin." By William Dickson and W. C. Easterbrook.
"The Estimation of Aldehydes and Ketones by means of Hydroxylamine." By A. H. Bennett and F. K. Donovan.
"The Theobromine Content of Cacao-beans and Cocoa." By Raymond V. Wadsworth.
"The Value of Fish Scales as a means of Identification of the Fish used in Manufactured Products." By R. E. Essery.
"Demonstration of the Use of a Universal Indicator." By Francis H. Carr.
"The Examination of B.P. Ointments." By Norman Evers and G. D. Elsdon.
"Note on the Liver Oil of the Tope." By A. Chaston Chapman.
"Note on the Examination of Foods for the presence of Sulphites." By A. Chaston Chapman.
"The Testing of Foodstuffs for Vitamins." By J. C. Drummond and A. F. Watson.
"The Constants of Indian Beeswax." By O. D. Roberts and H. T. Islip.
"Inadequacy of 'A.R.' Test for Alkalis in Calcium Carbonate." By William Singleton and Howell Williams.
"Certain Tropical Oilseeds." By E. R. Bolton and D. G. Hewer.
"Investigation of Atkinson's Process for the Estimation of Potassium in the presence of Sodium, Magnesium, Sulphates and Phosphates." By S. J. Watson.
"A Tropical Milk Supply." By Alexander Bruce.
"Studies in the Titration of Acids and Bases." By J. L. Lizius and Norman Evers.
"The Sulphuric Acid Reaction for Liver Oils." By J. C. Drummond and A. F. Watson.
"Graphites and other Pencil Pigments." By C. Ainsworth Mitchell.
"The Estimation of Meconic Acid in Opium." By H. E. Annett and M. N. Bose.
"The Application of Artificial Daylight to Laboratory Purposes (Sheringham System)." By S. H. Groom.
"The Use of the Daylight Lamp in Volumetric and Colorimetric Analysis." By William Singleton.
"The Composition of Cows' Milk in the Sudan." By A. F. Joseph and F. J. Martin.
"The Action of Natural Waters on Lead. Part I., Effect of Various Saline Constituents. Part II., The Action of Moorland Waters on Lead." By John C. Thresh.
"The Estimation of Morphine." By J. R. Nicholls.

The total number of papers and notes published in THE ANALYST during 1922 is 44. The number of pages of printed matter has increased to 544, as compared with 530 last year, whilst 515 abstracts of papers published in other Journals have also appeared. These abstracts, covering as they do every branch of analytical chemistry, constitute one of the most useful features of our Journal.

As regards reviews of new works, 54 have appeared during the year, and I think it will be generally agreed that these have maintained the high reputation for fearless and helpful criticism that have always distinguished them.

I am sure my audience will agree with me that in spite of the multiplication of chemical publications our Journal still possesses a very distinct character of its own. Not only should we receive all papers on food analysis, with which branch we have been identified since the initiation of our Society, but also contributions relating to biochemical work in connection with food products—such, for example, as the paper by Messrs. Drummond and Watson included in the preceding list. Another branch of our science that is occupying increasing space in THE ANALYST is forensic chemistry, and in this there are no other Societies to compete with us.

Our "Notes from Reports of Public Analysts" are not only proving of great utility to those of us holding public appointments in this country, but are forming a link with Public Analysts abroad, some of whom have already contributed abstracts of their reports.

As far as the Analytical Research Scheme is concerned, matters have been lying rather dormant during the war, and the years immediately following, but I am glad to see that it shows signs of resuscitation, as three fresh investigations have just been commenced in addition to those already in hand.

A matter of considerable importance to all practising chemists is the supply of satisfactory and economical glassware and porcelain. The Special Purposes Committee of the Institute of Chemistry have devoted considerable time and labour to an endeavour to ensure such a supply.

They feel that efforts should be made, especially by chemical and mechanical research in connection with the industry, towards further general improvement. From an inspection of basins and crucibles recently made in England and reported on after submission to very severe tests, the Committee conclude that substantial progress has been made, and that this ware now compares favourably in reliability and price with that obtainable from Berlin.

It is highly satisfactory to note from the same Committee's Report that British manufacturers of "fine chemicals" are now able to produce about 2000 substances, and are making every endeavour to extend their list. The quality of these British analytical reagents, in the vast majority of cases, is found to be excellent, and the prices show decided improvement.

Last year your President, Mr. Smetham, referred in his Address to the exception taken by Public Analysts to the encouragement by the Ministry of Health of "rough sorting methods" employed in dealing with informal or test samples taken in connection with the administration of the Sale of Food and Drugs Acts. We have not had long to wait for a sequel to this suggestion. In the early part of the year several Public Analystships became vacant, and when the Local Authorities concerned advertised the conditions of the new appointments, your Council noted with great concern that the remuneration offered showed in several instances a decided decrease on that paid to the previous holder of the office. A particularly flagrant case was that of the County of Middlesex, which in the past had been a good appointment adequately paid. From the terms of the advertisement and from enquiries instituted by your Council it was found that the intention of the County Authority was to introduce a system of rough sorting methods on the lines referred to above for the bulk of the samples, and then to submit to the Public Analyst only those articles that were obviously suspicious. Such a method of procedure is intrinsically wrong, as it can in no sense guard the interest of traders and the public generally in the way intended by the Legislature in framing the Acts concerned. Only obvious and glaring forms of adulteration would be detected by the "rough sorting methods," and the more skilful forms of food and drug sophistication would escape notice.

The remuneration offered the Public Analyst in this case was inadequate, even if the ordinary range of samples had been submitted, but this inadequacy was intensified by the fact that only doubtful samples, obviously involving more time and work, were allotted to him.

Your Council carefully considered the whole situation thus created, and, in conjunction with the Institute of Chemistry, sent letters of protest to the Authorities concerned. As a further outcome, a small joint sub-committee of this Society and the Institute has been elected to consider and, if necessary, act at once in the event of any further unsatisfactory appointment of a similar character being advertised.

So many matters of this kind have recently arisen that the Public Appointments Committee of the Institute, most of whose members are representatives of our Society, have recently devoted a considerable amount of time to a reconsideration of the duties and appointments of Public Analysts. In this connection they have entirely revised the pamphlet issued in 1914, and having brought it up to date, it is to be issued by the Institute and our Society acting conjointly.

It is proposed to bring this to the notice of Government Departments and Municipal Authorities, as well as the general public, many of whom are still woefully ignorant as regards the work and duties not only of Public Analysts, but also of analytical and consulting chemists generally.

The Great War played some part in educating the mass of public opinion in this matter at the time, but already one finds that facts are being forgotten. Only the other day I heard the remark made that "Chemistry is of course important to a country like ours, as without its aid we cannot hope to win another war." From further conversation it was evident that the speaker, a man of culture and some specialised scientific knowledge, had very little idea of the function played by chemistry in daily life, commerce and manufactures.

It behoves us, therefore, as chemists to do all we can both to make the public realise the value of our work and to maintain the dignity of our profession. It is the custom of us British to say very little about ourselves and our work, and this is probably a virtue in which we may take a modest pride; but do not let us carry it to excess by praising the progress of chemistry in every country but our own. The chemists of England have done as much, or more, than those of any other land to raise their science to the heights to which it has attained.

In July of last year a Circular was issued by the Ministry of Health to Local Authorities expressing the opinion that it was undesirable that a prosecution should be based upon the results of an isolated test showing a deficiency of fat in the case of a particular milk supply when other previous tests of the same supply had proved satisfactory, and the suggestion was made that in such cases prosecutions should be instituted only when a series of tests had shown repeated default.

The Councils of your Society and of the Institute of Chemistry felt very strongly that the instances in which the fat content of milk falls below the fixed limit are so rare and unusual that the action of the Ministry in the issue of this Circular constituted a dangerous menace to the public health in the administration of the Sale of Food and Drugs Acts. In fact, cases have been reported to the Councils wherein certain Local Authorities have acted upon this Circular, and cases of undoubted adulteration have escaped any form of penalty. After consultation, I, as your President, in conjunction with Mr. A. Chaston Chapman, as President of the Institute of Chemistry, wrote a letter of protest to the Ministry of Health embodying these views.

In his reply, the Secretary of the Ministry, whilst admitting the facts contained in our letter, laid stress on the point that the advice given in the Circular was limited to those cases in which a milk vendor held a good record for a number of years, and whose milk, after constant testing, had given uniformly satisfactory results.

This reply does not, in my opinion, prevent the danger of the advice contained in the Circular being misapplied, and, therefore, does not affect our original contention.

A very interesting Memorandum has been issued during the year by the Association of Public Analysts of Scotland. This deals generally with the administration of the Food and Drugs Acts, and, whilst pointing out how very inadequately the public is protected against the use of impure food and drugs, suggests various remedies for the defects in administration. A comprehensive outline of this Memorandum has already appeared in the July number of our Journal, and with the conclusions contained in it I am sure our members will agree.

On May 1st of this year the centenary of the birth of Pasteur will be commemorated in the town of Strasbourg, where he commenced his career as a professor. A statue facing the University will be erected, and on the date mentioned an Exhibition designed to illustrate the advances made in various branches of science as the result of Pasteur's discoveries will be inaugurated by the President of the French Republic.

An influential British Committee has been formed to promote its success and to express the sympathy of this country with the projects of the French Committee.

During the year our relations with cognate societies have been, as in the past, most friendly, and in this connection I may perhaps mention that we are inviting any members of the Medico-Legal Society who would care to do so to attend our next meeting, at which a paper will be read that will probably prove of considerable interest to them. There is some prospect of a Biochemical Institute being formed in the near future, and should this take place we shall have another body with whom we might have much in common.

With the Institute of Chemistry many matters of mutual interest have been discussed, mainly by means of the Joint Committee of the two bodies to which reference has already been made.

Last month we were able to accept the kind invitation of the Nottingham

Local Section of the Society of Chemical Industry to visit them and hold a joint meeting for the purpose of a general discussion on the detection and determination of small quantities of arsenic. When the idea of a joint meeting was first mooted it appealed to all of us as a most happy suggestion. Where two societies such as ours are working on almost, but not quite, parallel lines, there are bound to be times when our interests converge so nearly that they may be said to practically coalesce. The detection and estimation of small proportions of arsenic appeals alike to the industrial chemist and the analyst, and any new facts that can throw light on this subject are welcomed equally by members of both Societies.

The meeting was very well attended, and those of us who were able to be present very much appreciate the kindness and hospitality shown us by our Nottingham friends.

The discussion was opened by Mr. A. Chaston Chapman, F.R.S., President of the Institute of Chemistry, who gave us a comprehensive historical survey of the usual methods adopted. Mr. J. M. Wilkie read a paper, and Messrs. Trotman, Dyer, Richmond, Monier-Williams, Webster, Thorne and others contributed to a discussion that was full of interest. Many modifications of the Marsh-Berzelius and the Gutzeit methods were described, and both the acid-zinc and the electrolytic processes found warm supporters, but I do not think sufficient evidence was adduced to make any of us discard the particular one which we individually prefer.

I might perhaps refer to one small matter of domestic interest to ourselves, and that is the innovation made this year as regards the printed list of nominations for Council. The members themselves were invited to suggest any names they desired for consideration by the outgoing Council with a view to their inclusion in the voting list, and the names so sent in were submitted to the Council at their December meeting.

In conclusion, I should like to express my deep appreciation of the loyal assistance I have received from the Council, the body of members generally, and especially from the Officers—Mr. Mitchell, our Editor, to whom I have already referred, Messrs. Hinks, Bolton and Pelly—who have done so much to help in securing the harmonious working of the business of the Society.

The Estimation of Formaldehyde and Acetaldehyde.

By E. W. BLAIR, B.Sc., D.I.C., A.I.C., and
T. SHERLOCK WHEELER, B.Sc., A.R.C.Sc.I., A.I.C.

(*Read at the Meeting, December* 6, 1922.)

In investigations on the action of oxygen and of ozone on various hydrocarbons the authors found it necessary to devise accurate methods of estimating solutions containing mixtures of formaldehyde, hydrogen peroxide, formic acid and a trace of ozone. An account of the methods used is given below.

The routine method chosen for estimating pure solutions of formaldehyde was that given by Romijn (ANALYST, 1897, **22**, 221; see also *Chem. Zeit.*,

25, 740; B. **31**, 1979; **34**, 2817); this was found to be rapid and accurate for pure dilute solutions—containing, say, 100 mgrms. per litre—if the quantity of acids and alkali used were carefully controlled. More delicate methods—*e.g.* colorimetric methods—are very much more tedious.

In some experiments acetaldehyde was present, however, and iodoform was produced when applying the above method of estimation. Attempts to estimate both aldehydes by weighing the iodoform, after noting the amount of iodine absorbed, were not satisfactory. By adding acetaldehyde to known solutions of formaldehyde, estimated by Romijn's method, it was found that the potassium cyanide method gave an accurate estimation of the formaldehyde, if the titrations were made as described by Sutton (*Volumetric Analysis*, 10th Ed., p. 391). The dilution to 500 c.c. recommended by him is too great, however, and dilution to 50 c.c. is quite sufficient; for dilute solutions *N*/100 thiocyanate solution should be used.

It was then sought to estimate the acetaldehyde by applying the amount of formaldehyde, as found by the cyanide method, to the iodimetric titration, but this did not give constant results for acetaldehyde. Finally, Ripper's bisulphite method (ANALYST, 1901, **26**, 131) was used to obtain an iodine figure for both aldehydes, and the cyanide figure for formaldehyde applied to it to determine the acetaldehyde present.

Accurate results were in this way obtained, and the methods were sufficiently rapid to be suitable for routine work.

In experiments on the action of ozone on hydrocarbons, solutions were obtained containing a trace of ozone, formic acid, formaldehyde, and hydrogen peroxide. These substances were estimated *seriatim* as follows:

(1) Formic acid was estimated in an aliquot part by titrating with *N*/100, alkali methyl red or phenolphthalein being used as indicator. A blank titration was also done.

(2) Ozone was estimated in the neutralised solution by adding a 5 per cent. neutral solution of potassium iodide, acidifying with 5 per cent. hydrochloric acid proved free from chlorine, and immediately titrating the iodine liberated with *N*/100 thiosulphate solution. It was found that the small quantity of hydrogen peroxide present only slowly liberated iodine under these conditions.

(3) The hydrogen peroxide cannot of course be estimated with permanganate in presence of formaldehyde. Also it must be removed before formaldehyde can be estimated, since in alkali solutions it oxidises formaldehyde to formic acid with evolution of hydrogen. Kingzett's method (*J. Soc. Chem. Ind.*, 1880, 792; ANALYST, **9**, 36) was finally used. An aliquot part of the solution was neutralised, and 5 grms. of pure potassium iodide were added and shaken until dissolved; this destroys ozone. Fifty c.c. of sulphuric acid (1:2) were then added, and, after standing 5 minutes, the solution was diluted with 2 volumes of water, and the iodine set free titrated with *N*/100 thiosulphate solution. The method is accurate, provided an excess of sulphuric acid is used as indicated, and the mixture allowed to stand for 5 minutes before titrating. Allowance must be made for the

iodine set free by the ozone. It is necessary to carry out a blank with the sulphuric acid and potassium iodide.

(4) To estimate the formaldehyde, the same procedure was repeated with the same quantity of solution as in (3) to destroy both ozone and hydrogen peroxide. The iodine set free was not titrated, but the diluted solution was just neutralised, with thoroughly cooling, first with 10 per cent. and then with 1 per cent. sodium hydroxide solution. The quantities required were known from experience. Twenty-five c.c. of *N*/10 iodine solution were then added, and the formaldehyde estimated by Romijn's method. As before, an allowance must be made for the iodine set free in the previous reactions.

Attempts were made to estimate the hydrogen peroxide, which was always less in amount than the formaldehyde, by adding an excess of alkali and measuring the hydrogen evolved, or by estimating the formic acid formed by the interaction of the formaldehyde and the hydrogen peroxide. The remaining formaldehyde, which was always in excess, was then estimated as usual. The method was accurate but slow.

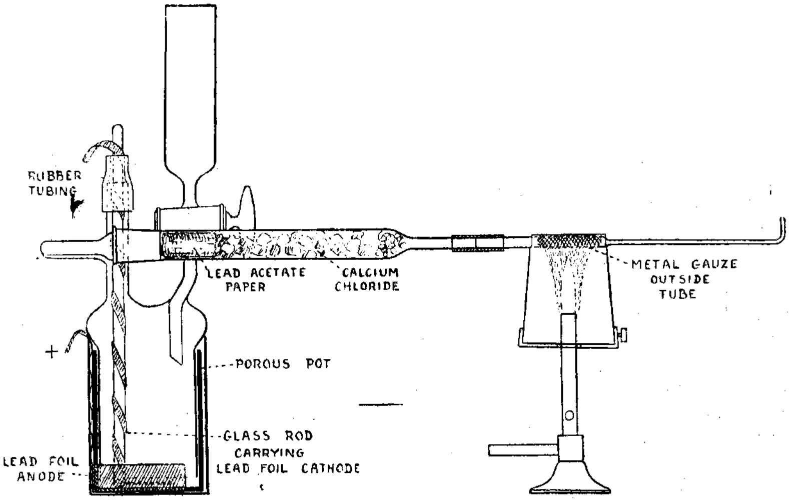
Main Laboratory,
R.N. Cordite Factory,
Holton Heath, Dorset.

Electrolytic Apparatus for the Estimation of Arsenic.

By G. W. MONIER-WILLIAMS, M.A., Ph.D., F.I.C.

(*Read at the Joint Meeting of the Society and of the Nottingham Section of the Society of Chemical Industry, at Nottingham, January* 17, 1923.)

The apparatus is a modification of that used in the Government Laboratory, lead electrodes being used in place of the platinum ones employed by Thorpe (*cf.* H. J. S. Sand and J. E. Hackford, *J. Chem. Soc.*, 1904, **85**, 1018). The porous pot is thin-walled, little more than 1 mm. in thickness. The anode is a strip of lead foil, and the cathode a disc of lead foil about 2·5 cm. in diameter. The anode chamber is made as narrow as possible, consistent with the free escape of the oxygen formed during electrolysis. The central glass vessel and tap funnel are blown in one piece, as shewn in the diagram, and the usual calcium chloride tube is connected by means of a ground glass joint. The hard glass tube for reception of the arsenic mirror was originally of 1 mm. internal diameter, but subsequently it was found that a tube of 2 mm. internal diameter gave better results. It is connected with the calcium chloride tube by a short piece of rubber tubing. It is of advantage to wrap a small piece of metal gauze round the part of the tube exposed to the flame. This assists in distributing the heat and prevents the tube from collapsing. A sharper arsenic mirror can be obtained by wrapping a small piece of filter paper round the tube with its end dipping into water. This is particularly advantageous when working with quantities of arsenic of the order of $\frac{1}{1000}$ mgrm. It is possible that unless the issuing gas be rapidly cooled after leaving the heated portion of the tube, slight re-combination to AsH_3 may take place. In one experiment in which the narrow part of the tube was wrapped round with asbestos paper for a distance of $\frac{1}{2}$ inch from the shoulder, thus extending the heat gradient, the mirror obtained was of not more than half the usual intensity. In my experience, both arsenious and arsenic acids are completely reduced to AsH_3 by a lead cathode, but while in the former case 20 minutes is sufficient, in the latter a somewhat longer time is required.



The current used is one of 5 to 6 ampères, the potential difference between the electrodes being 7 to 9 volts, giving a steady hydrogen flame at the outlet about 3 to 4 mm. high.

The great advantage of this apparatus is that foodstuffs of the most varied character can be tested without preliminary treatment. The use of a reducing agent appears to be unnecessary when lead electrodes are used. The addition of 1 to 2 c.c. of amyl alcohol assists in preventing frothing and in promoting a steady evolution of hydrogen. It is advisable to assure oneself that the set of standards obtained in the ordinary way is applicable to the particular foodstuff under investigation, as different substances may show slight variations in the character of the mirror obtained. A blank test is first run with 20 c.c. of sulphuric acid (1 in 8 by volume) in the cathode compartment, and acid of the same strength in the anode compartment in amount just sufficient to cover the anode. A convenient weight of the foodstuff is then introduced through the tap funnel. With many foodstuffs it is not possible, owing to their consistency, to introduce them through the funnel. In such cases the substance may be mixed direct with the acid in the porous pot, and the cell filled with hydrogen from a second unit acting as a hydrogen generator. When the whole of the air has been replaced by hydrogen the auxiliary generator is disconnected and the electrolysis started. With this arrangement is is advisable to use a glass tube in place of a glass rod to carry the lead foil cathode, with a small side opening in it above the surface of the liquid in the pot, so as to allow of the free flow of hydrogen through the apparatus.

After the porous pot has been used for some time it can be cleaned by igniting it in a muffle.

The statement that all foodstuffs can be tested direct needs some qualification. The presence of large amounts of phosphoric acid or phosphates, such as are present in certain baking powders, appears, in some way, to inhibit the formation of AsH_3. The conditions under which this occurs are not clear and are at present under investigation. Phosphates, in the quantities usually present in foodstuffs such as milk and milk powders, do not interfere with the test.

Iron, either in the ferric or ferrous condition, acts as an inhibiting agent when no organic matter is present, but curiously enough, the addition of organic matter has been found, under certain conditions which are at present being investigated, to neutralise the effect of the iron, the mirrors being fully equal to those obtained from substances containing no iron. The small quantities of iron present in many foodstuffs do not appear to have any effect.

While it is possible that cases will be met with in which it is necessary to destroy organic matter or to distil, prior to testing, I have not yet found any foodstuff, apart from phosphate baking powders, in which this procedure is necessary. A point in favour of the electrolytic method is that, while sensitive to $\frac{1}{1000}$ mgrm. As_2O_3, it eliminates to a great extent the personal equation, and enables one to carry out occasional arsenic estimations without the constant practice which is necessary where the zinc and acid method is used.

Note.

The Editor wishes to point out that the pages of the Journal are open for the inclusion of short notes dealing with analytical practice and kindred matters. Such notes are submitted to the Publication Committee in the usual manner.

THE COMPOSITION OF NATIVE MALAY SUGAR (*PULA MALACCA*).

THE sample of sugar which we have had the opportunity of examining is prepared in Malay from the juice of the coconut palm (*Cocos nucifera*).

The method of preparation employed by the natives is very similar to that used in Ceylon and described by Browning and Symons (*J. Soc. Chem. Ind.*, **35**, 1138). A native climbs the palm, cuts off the flower spathe and collects the juice in bamboo buckets, these buckets being first inverted over a smoky fire, presumably to sterilise them. The juice is boiled down over a wood fire in iron pans, and when thick enough to crystallise it is ladled out in coconut shells into moulds made from the leaves of the coconut palm.

The sugar consists of dark brown granular pieces, cylindrical in shape, the average weight being 13·5 grms.; the base is flat and about 1 inch in diameter. The sugar has a pleasant characteristic taste.

The composition of the sugar resembles that mentioned by Bourquelot in his note on commercial Indian sugar (ANALYST, 1904, **39**, 330).

The composition of the sample we examined was as follows:—Moisture, 6·07; ash, 2·92; dextrose, 3·29; and cane sugar, 88·22. Total, 100·50 per cent.

On treatment with phenylhydrazine, crystals of osazone were obtained, which, when examined microscopically, were identified as glucosazone.

The composition of the ash was as follows:—Silica, 4·32; ferric oxide, 1·80; alumina, 24·20; calcium carbonate, 17·41; magnesium carbonate, 5·30; sodium sulphate, 2·45; sodium chloride, 14·25; calcium sulphate, 24·44; and sodium and potassium carbonates (by difference), 5·83.

We are indebted to Mr. L. Okell, F.I.C., of Singapore, for the sample of sugar and description of its preparation.

HAROLD LOWE.
ALBERT HOULBROOKE.

LABORATORY: ASSAY OFFICE,
CHESTER.

Notes from the Reports of Public Analysts.

The Editor would be glad to receive the Annual or other Reports of Public Analysts containing matter of interest to the Society. Notes made from such Reports would be submitted to the Publication Committee.

COUNTY BOROUGH OF SALFORD.

ANNUAL REPORT OF THE BOROUGH ANALYST FOR 1921.

DURING the year 1921 the number of samples submitted for analysis was 1476, of which 1364 were taken under the Sale of Food and Drugs Acts. Of these 119 (8·7 per cent.) were returned as adulterated, the higher figure, as compared with 1920 (6·3 per cent.) being mainly due to adulterated samples of whiskey and borax.

MILK.—Of the 899 samples examined, 80 (8·9 per cent.) were adulterated. The average composition of all the samples examined was: Fat, 3·59 and solids-not-fat, 8·94 per cent. Many of the adulterated samples were artificially coloured or dirty. The vendors of the coloured samples agreed to discontinue the practice. Nine samples contained potassium nitrate, 4 containing 50 parts and the rest 25 parts per 100,000. They were all obtained from one farmer, who had made the addition with the object of destroying objectionable odours, and was under the misapprehension that the addition could not be detected. The proportion of sediment was estimated as described in previous reports (ANALYST, 1921, **46,** 403), and those giving a sediment exceeding 5 volumes per 100,000 (12 out of 396 samples) were regarded as adulterated, although this is still too lenient a standard. In every instance attention was directed to the matter, and suggestions for improvement were made, with the result that such improvement was invariably noted.

CEREAL FOODS.—Seven of the 16 samples of rice examined were faced with a talc-like substance. The amount of mineral matter in the unfaced samples varied from 0·30 to 0·46 per cent., and the amount of facing from 0·18 to 0·22 per cent. Three of six samples of ground rice were free from added mineral matter; the other three had been prepared from faced rice and yielded from 0·54 to 0·74 per cent. of ash.

DRUGS.—Of 168 samples examined 19 were returned as adulterated (*viz.* borax, tincture of iodine and saltpetre). The single sample of saltpetre contained 20 parts of lead per million. Seventeen of the 59 samples of borax contained arsenic in amounts ranging from 25 to 450 parts per million expressed as arsenious oxide. A sample of "pure medicinal borax" contained 1½ grains per lb. The previous informal sample having been similarly impure, the vendor, a qualified pharmacist, was fined one guinea.

Preservatives.—Of ten samples of preservatives used for keeping meat, five were found to contain from 0·1 to 3 grains of arsenic (as arsenious oxide) per lb. The use of this preservative was immediately stopped, and the wholesale dealers, and later the manufacturers, were made acquainted with the facts. Samples subsequently taken have shown great improvement.

G. D. Elsdon.

Legal Notes.

Under this heading will be published notes on cases in which points of special legal or chemical interest arise. The Editor would be glad to receive particulars of such cases.

LEAD IN LIME WATER.

A summons was heard at Old Street Police Court on January 9, 1923, against C. T. Hines, a pharmacist, for the sale of lime water containing one-sixth of a grain of lead per gallon.

Mr. H. Hawley, Analyst to the Borough of Stepney, gave evidence that he had found the sample to contain 2·4 parts of lead per million. Although he agreed that it might be possible for a certain amount of lead to be dissolved from glass, the quantity would be by no means so large as he had detected. He also agreed that the B.P. appeared to allow for the possible presence of lead in calcium hydroxide.

Dr. Thomas, M.O.H. for Stepney, stated that in his opinion such a quantity of lead in lime water would be injurious to babies. He agreed that it would take six months at the rate of 1½ ozs. per day for the baby to receive one-sixth of a grain of lead, but lead was a cumulative poison, and only excreted to a very small degree.

On the application of counsel for the defence, the case was adjourned until February 6 for an independent analysis to be made at the Government Laboratory.

At the adjourned hearing on February 6 the report from the Government Laboratory was read. This showed that the referred sample contained 1·6 parts of lead per million.

Mr. A. More, of the Government Chemical Staff (who had made the analysis), agreed that common glass might contain lead, and while the particular bottle that he examined was free from lead, he could not say whether the other bottles into which the sample was divided were also free from lead. In making the ordinary qualitative tests for lead he would use test tubes, but in this particular case he had used a Nessler cylinder on a white slab as specified in the B.P. He said that it was conceivable, though unlikely, for the lead to be present in a more soluble form than the lime.

Mr. Glyn-Jones, for the defence, submitted that the quantity of lead found was very small, that when authorities intended to take proceedings they should take all precautions to insure that no lead gained admission after the sample had been taken, and that these precautions had not been taken. There was no absolute proof that the lime water when sold did contain lead, and the prosecution had not proved that the lime water, when tested by B.P. tests, had given the reaction for lead. It might be said that the analyst could use whatever test he pleased; but the B.P. had set up the standard. If the analyst got a reaction by another test, could it be said that the article was not up to B.P. standard? Even assuming that the magistrate did not agree to this, they had the fact that the lime water only contained a very small quantity of lead; and though Dr. Thomas had said at first that such a quantity would be dangerous, he had modified that statement when pressed. Mr. Glyn-Jones then called Dr. Stone, who said that he did not agree that lime water containing one-fifth grain of lead per gallon would certainly cause derangement in a short time. In the opinion of competent authorities, by far the greater portion would be excreted either by the kidneys or in the fæces. The fact, too, that the lime water was given in milk would greatly counteract any harm that might be done. He could not deny that an appreciable quantity of lead would be dangerous.

The magistrate, Mr. Clarke Hall, said that in giving judgment in a case of this sort a certain amount of common sense had to be exercised. He felt bound to say that the suggested explanation for the presence of lead did not meet the case. What he had to consider was that both analysts agreed that there was an appreciable quantity of lead present. Another point that had been raised was the nature of the tests; he was satisfied that the tests were true. The third point was that, assuming there was this quantity of lead, it was so small that it would not injure the child. The counsel's question to Dr. Thomas had materially lessened the value of that witness's evidence, but, at the same time, both medical witnesses agreed that an appreciable quantity of lead was dangerous. He was bound to assume that the sample of lime water was not pure, and so to some extent would injure the child. The prosecution had therefore made out their case. There was no attempt on the part of the defendant to make money, and the lead was there through no fault of his, and he had served the sample perfectly honestly. There was no moral guilt attaching to the defendant, and it would not be fair to convict him. The defendant would pay £5 5s. costs.

DEFICIENCY OF QUININE IN QUININE MIXTURE.

In this case, heard at the Marylebone Police Court on January 9, 1923, A. S. Thompson was summoned under Section 7 of the Sale of Food and Drugs Act, for selling a compounded drug ("Mist. Quinin.") deficient in quinine sulphate to the extent of 72 per cent. It was explained that this case arose out of tests recently made by the St. Pancras Borough Council to see whether prescriptions were being made up correctly in accordance with the London Insurance Pharmacopœia. The article supplied contained only 0·42 grain, instead of 1·5 grains of quinine sulphate, in half-an-ounce of the mixture.

The Magistrate, after hearing the evidence, said that he was satisfied that the deficiency was the result of a mere slip, and that there was no intention to defraud. He dismissed the summons on the defendant's paying four guineas costs.

Scottish Board of Health.

BOTULISM AT LOCH MAREE*.

In August, 1922, two women and six men, ranging in age from 22 to 70, partook of some 12 small sandwiches between them—and in six days not a single one of those eight persons was alive. No other persons in the hotel were affected. The clinical symptoms of these fatal cases (which are given in detail) were exactly similar to those described in outbreaks of meat poisoning in Belgium, Germany and America, and corresponded with those produced by a specific anaerobic bacillus, *B. botulinus*, discovered by van Ermengem in 1896.

The sandwiches were made of potted "wild duck," and one of them, which had been buried by an inmate in the house of one of the victims, was recovered and sent to Mr. Bruce White for bacteriological examination, together with the original glass jar, to which a very small quantity of the duck paste was still adhering, and used and unopened jars of similar pastes.

Bacteriological Examination.—From these specimens cultures were made under both aerobic and anaerobic conditions. No organisms associated with ordinary outbreaks of food poisoning were found. The *Salmonella* group was absent. Further experiments were then made with the anaerobic cultures, and it was found that those made from the sandwich, the wild duck container, and one of the ham and tongue containers, which had been placed inside the wild duck container for transit, were terribly pathogenic when injected into mice, whereas all the other cultures were non-lethal to mice.

Among the cultures giving positive lethal results was one of an anaerobic Gram-positive, sporing bacillus which had been isolated from the wild duck paste, which had proved deadly to the mice. The symptoms produced in animals by it coincided with those described for animals suffering from botulism, and the identity of the bacillus with *B. botulinus* was established by means of a series of experiments with botulinus anti-toxin. For example, two mice were injected with a broth culture of the wild duck bacillus, and another two were similarly injected, but were also given botulinus anti-toxin. The next morning the first two were dead, whereas the second two remained unaffected.

The other wild duck jars sent for examination, which were full of material, proved perfectly sound, as did the other varieties of paste.

The Making of the Meat Paste.—An inspection of the London factory where the wild duck paste had been prepared was made by Dr. MacFadden (Ministry of Health), Mr. Bruce White and Dr. Scott, and evidence as to the methods used was given at the public enquiry at Dingwall.

The various meat stuffs were boned and weighed, and then cooked in large open pans for an hour or two at about the ordinary boiling point, after which they were reduced to a paste in a machine, the usual flavouring materials added, and the mass placed in open tin containers about 2ft. square and some 3 inches in depth. These tins were then put into steam retorts and sterilised at about 237° to 240° F., for 2 hours. The retorts were next allowed to cool, and the meat taken out and stirred with a wooden stirrer, after which the whole mass was put into a filling machine which drove the paste into the glass containers. After the rubber bands had been affixed and the lids clamped down by hand, the containers were

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* *Report of the Circumstances Attending the Deaths of Eight Persons from Botulism at Loch Maree (Ross-shire).* By G. R. Leighton, O.B.E., M.D. Pp. 47. H.M. Stationery Office, Imperial House, Kingsway, London, W.C.2., and 23, Forth Street, Edinburgh. 1923. Price 2s. 6d. net.

heated for 40 minutes in another retort at 210° F., and were finally tested to see that a good vacuum had been produced. In the case of game, such as wild duck, the paste was heated for 50 minutes at 214° to 216° F.

While it must be accepted that this particular firm of manufacturers took every reasonable precaution, it is questionable whether all makers of this class of food follow the same methods or take the same care. In some cases the label does not accurately describe the contents of the container. An immense number of very young calves is used for this purpose. Other manufacturers use chilled or frozen veal from abroad, mutton at certain periods of the year (on account of its colour), and pork or pork fat. To these are added spices and flavourings of different kinds, and it is probable that, in many cases, the amount of flesh of the particular bird, the name of which appears on the label, is not very large.

In the opinion of the trade it is not practicable to heat glass containers to a temperature above the boiling point, on account of the large proportion of breakages, although the general public seem to prefer their food in glass containers, the fact remains that these cannot be sterilised with the same safety as a tin.

Some Inferences which may be Drawn.—It is probable that during the last 10 to 15 years there have been a certain number of isolated cases of deaths in Great Britain from botulism, which have not been diagnosed. One may infer that in the future such cases will be recognised, and there will thus be created an apparent increase in the number of cases from botulism.

Bacteriological researches point to the conclusion that, whereas a given temperature in the processes used in a factory may be sufficient to destroy both bacillus and toxin of one variety of *B. botulinus*, it does not follow that it will be sufficiently high to have the same effect upon all varieties of the organism.

As regards the question of treatment in cases of botulism, the prognosis is not good. The percentage of deaths in known outbreaks varies from 50 to 100 per cent. Since 1900 there have been 39 outbreaks in California, with a total of 130 cases and a mortality of 94.

Experimental work has indicated that if a polyvalent botulinus anti-toxin could be given to the patient at the same time as, or *very shortly after*, the toxin was taken, the patient would recover. It has not yet been determined after what lapse of time the administration of a dose of anti-toxin would fail to be of service. As, however, the anti-toxin treatment is the only one offering a reasonable hope of success, steps have been taken to place it within the reach of as many people as possible.

In general, the ordinary methods of cooking have a protective influence. Some of the cases of botulism in America have been associated with such canned products as asparagus, French beans, and spinach, which, in that country, are frequently eaten raw, as taken out of the container. Here the same product would be cooked again before being eaten.

Preventive Measures: (A) The Bacteriological Problem.—There are two types of *B. botulinus*, known as A and B respectively. Type A is highly resistant to heat, since its free spores require to be boiled for 5 hours, or to be heated for 40 minutes at 105° C. (equal to 220° F. or 3 lbs. of steam pressure); or to be heated for at least 6 minutes at 120° C. (250° F. or 15 lbs. pressure), before they are killed (see *Botulism and Home Canning*, Minna C. Denton, Washington, D.C.).

Type B, known as *B. botulinus* (Boise strain), was shown to be the cause of four deaths in Boise, Idaho, U.S.A., in 1919. Its spores survive 10 lbs. steam pressure for 15 minutes, or 100° C. for one hour. Its toxin is destroyed by heating to 75° C., or for 10 minutes at 73° C. It has been shown by K. F. Meyer, University of California, that *B. botulinus* is an organism which has a very widespread natural distribution in the soil. It was isolated, for example, from numerous American and European soils, including 5 out of 64 samples from different parts of England.

(B). THE MANUFACTURING PROBLEM.—Sterilisation of glass containers at such a temperature as would be sure to destroy certain pathogenic spores does not appear to be commercially practicable, but it is not too much to require that the final sterilising process should be of such a character as to destroy such spores. The tin container of good quality has every advantage over the glass one for the purpose.

In California regulations as to sterilisation have been made. Thus, olives must be heated at 240° F. for 40 minutes; spinach (in 84 oz. tins] at 252° F. for 60 minutes; and spinach in 24 oz. containers at 252° F. for 40 minutes.

It is quite possible that in the light of further research in this country similar regulations may have to be made here.

HOME PRESERVED PRODUCTS.—It has been established that peas, beets, radishes, asparagus, carrots, parsnips, and string beans, brought in the open market in San Francisco, have shown the presence of spores of *B. botulinus* (K. F. Meyer), and that the spores may occur on cherries, apricots, and olives which have been pecked on the trees by birds (Dickson and Burke). Hence, wherever the bacillus, by some means or other, has got into the soil, its spores may be found on any vegetable product grown in that area.

The importance of these facts, so far as Scotland is concerned, lies in the results of the investigation, made under the direction of Dr. J. F. Tocher, into the disease known as "grass sickness" in horses. It has been shown that *B. botulinus* is associated with this condition, and that the disease is spread over a number of areas on the East Coast of Scotland, from Fife northwards, and seems to be extending. There is, therefore, an increasing danger of contamination of food stuffs with *B. botulinus*. Hence, it is important to emphasise the great necessity for thoroughly sterilising all vegetable products preserved in the home for future consumption. Any fruit or vegetable which shows the least sign of having been spoiled or decayed should be rejected.

Ministry of Health.

SALE OF MILK UNDER SPECIAL DESIGNATIONS.*

"CERTIFIED"—"GRADE A (TUBERCULIN TESTED)"—"GRADE A"—"PASTEURISED."

GENERAL.

1. Under section 3 of the Milk and Dairies (Amendment) Act, 1922, the designations "Certified Milk," "Grade A Milk," "Pasteurised Milk" and other similar designations may only be used where a licence to sell milk under those designations has been granted by the Minister of Health or with his authority. Licences are required in the case of either Certified, Grade A (Tuberculin Tested), or Grade A Milk, both by the farmer who produces the milk and by every dealer who sells it. In the case of Pasteurised Milk a licence is required by the person who pasteurises it and by any other dealer who sells the milk.

Licences, expiring annually on the 31st December, are granted by the appropriate Licensing Authority as stated at the beginning of each numbered paragraph below, subject to the conditions

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*Memo. 77/Foods. H.M. Stationery Office, 1923. Price 2d.

and upon the payments set out below. Separate licences are required for the use of each designation and separate fees are payable.[†]

Separate licences are required for each district[§] in which milk is retailed, and a separate fee is payable for each establishment. If a retailer wishes to sell milk in one district from a licensed establishment in another district, he can obtain a supplementary licence from the Authority for the first district for an additional fee of 2s.

CERTIFIED MILK.

2. The Licensing Authority for the producer is the Minister of Health. The fee is £5. The Licensing Authority for any other dealer is the District Council.[‡] The fee is 5s. in respect of each establishment.

The conditions under which licences are granted for the sale of "Certified Milk" are as follows:—

(i) A herd book or register of all the animals in the herd (showing additions and removals) must be kept and all the animals must be suitably marked for purposes of identification.

(ii) Every animal in the herd must have passed the tuberculin tests specified in the Appendix to this memorandum, before the licence is granted, and thereafter at intervals of six months. Every animal reacting to the tests must forthwith be removed from the farm.

No animal may be added to the herd unless it has passed the tests.

Tuberculin must not be used except for the purposes of the required tests.

(iii) An examination of the herd must be made once in every three months by a Veterinary Surgeon nominated by the Minister. Any animal certified as showing evidence of any disease which may injuriously affect the milk must immediately be removed from the herd and information as to its disposal given to the Minister.

Before a licence is issued the farm will be inspected and a satisfactory number of points must be obtained on the inspection report card.

(v) The milk must be bottled on the farm immediately after production, for delivery to the consumer.

(vi) Every bottle must be closed with a suitable tightly-fitting disc and covered with a suitable outer cap overlapping the lip of the bottle and so fastened as to form a secure seal. This cap must bear the name and address of the producer or of the farm where the milk is produced, the day of production, and the words "CERTIFIED MILK."

The words "produced from cows which have passed the tuberculin test" may be added, but no other matter may be inserted except with the consent of the Minister.

(vii) The milk at any time before delivery to the consumer must not contain Bacillus Coli in 1/10 c.c. and must not contain more than 30,000 bacteria per c.c.

(viii) Accurate records must be kept by every producer and distributor in such a way that they can conveniently be checked. The producer's records must show the quantities of the milk produced and sold and the names and addresses of the purchasers. The distributor's records must show the quantities purchased and sold and the names and addresses of the persons from whom the milk is purchased and to whom it is sold otherwise than by retail.

(ix) Every facility must be given at all times to any person authorised by the Licensing Authority to inspect the premises, processes of production, equipment, methods and records, and to take samples of the milk (free of charge).

[†] The only exceptions are that a producer holding a "Certified Milk" licence may sell milk produced in accordance with the conditions of the licence as "Grade A (Tuberculin Tested)" or "Grade A," and the holder of a "Grade A (Tuberculin Tested) Milk" licence may sell milk produced in accordance with the conditions of that licence as "Grade A," in each case without any further licence or the payment of any further fee.

[§] *I.e.* Borough, Urban District or Rural District.

[‡] Or Town Council or Metropolitan Borough Council as the case may be.

GRADE A (TUBERCULIN TESTED) MILK.

3. The Licensing Authority for the producer is the Minister of Health. The Licensing Authority for the distributor is the District Council.*

The conditions as to the tuberculin testing of the herd which are set out in paragraph 2 (ii) of this memorandum must be complied with. The conditions (including those as to fees) set out in paragraph 4 below with regard to the issue of licences for the sale of "Grade A Milk" also apply, except that the milk must not be pasteurised, and that the designation, "Grade A (Tuberculin Tested)" is to be substituted for "Grade A" wherever those words occur.

GRADE A MILK.

4. The Licensing Authority for the producer is the Council of the County or the County Borough (as the case may be) in which the milk is produced. The fee is £1 1s. Where a producer bottles his milk and retails it at or from the place of production and has no separate retailing premises, this Authority will grant a single inclusive licence to cover distribution as well as production, the fee for which is £3 3s. In other cases the Licensing Authority for the distributor is the District Council.* The fee is £2 2s. in respect of each bottling establishment. A fee of 5s. is payable in respect of each establishment where the milk is received already bottled and from which it is distributed intact.

The conditions under which licences are granted for the sale of "Grade A Milk" are as follows:—

(i) A herd book or register of all the animals in the herd (showing additions and removals) must be kept and all the animals must be suitably marked for purposes of identification.

(ii) An examination of the herd must be made once in every three months by a Veterinary Surgeon nominated by the Licensing Authority. Any animal certified as showing evidence of any disease which may injuriously affect the milk must immediately be removed from the herd and information as to its disposal given to the Licensing Authority.

(iii) If tubercle bacillus is at any time found in the milk the producer must arrange for bacteriological examinations of the milk to be made so that the diseased animals may be identified and removed from the herd.

(iv) The milk must be despatched from the farm in an unventilated sealed container, bearing a suitable descriptive label with the address of the farm, the day and time of production (morning or evening), and the words "GRADE A MILK."

(v) The distributor must deliver the milk to the consumer either:—

(*a*) in the vessels in which he has received it, the seals being unbroken; or

(*b*) in bottles† filled on the distributor's premises.

Every bottle must be closed with a suitable tightly-fitting disc and covered with a suitable outer cap overlapping the lip of the bottle and so fastened as to form a secure seal. This cap must bear the name and address of the distributor, the day of production, and the designation "GRADE A MILK" (or "GRADE A MILK (PASTEURISED)" as the case may be) and no other matter except with the consent of the Licensing Authority.

Until the milk has been bottled it must be kept entirely separate from all other milk.

(vi) The milk at any time before delivery to the consumer must not contain *Bacillus Coli* in 1/100 c.c. and must not contain more than 200,000 bacteria per c.c.

(vii) The milk may not be treated by any artificial heating process other than pasteurisation carried out in accordance with the conditions specified in paragraph 5 below, and if it is so pasteurised it must be sold as "Grade A Milk (Pasteurised." It must then conform to the standard as regards bacterial content specified in paragraph 5 (iii) below for pasteurised milk.

(viii) Accurate records must be kept by every producer and distributor in such a way that they can conveniently be checked. The producer's records must show the quantities of the milk produced and sold and the names and addresses of the purchasers. The distributor's records must show the quantities purchased and sold and the names and addresses of the persons from whom the milk is purchased, and to whom it is sold otherwise than by retail.

(ix) Every facility must be given at all times to any person authorised by the Licensing Authority to inspect the premises, processes of production, equipment, methods and records, and to take samples of the milk (free of charge).

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* Or Town Council or Metropolitan Borough Council as the case may be.

† Where the milk is being delivered in large quantities (*e.g.* to a school or hospital) cans holding two gallons or more may be used instead of bottles. Each can must be closed by means of a tightly fitting cover and suitable seal.

PASTEURISED MILK.

5. The Licensing Authority is the District Council.* The fee is £1 1s. in respect of each pasteurising plant. A fee of 5s. is payable by any dealer in respect of each set of premises at or from which milk which has been pasteurised by some other dealer is sold as "Pasteurised Milk."

The conditions under which licences are granted are as follows, subject to the temporary relaxations stated in the footnotes to conditions (i) and (iii) respectively:—

(i) The milk must be retained at a temperature of not less than 145° and not more than 150° F. for at least 30 minutes, and must then be immediately cooled to a temperature of not more than 55° F.†

(ii) The milk must not be otherwise treated by heat and must not be pasteurised more than once.

(iii) The milk at any time after pasteurisation and before delivery to the consumer must not contain *Bacillus Coli* in 1/10 c.c. and must not contain more than 30,000 bacteria per c.c.‡

(iv) Every vessel used for distributing the milk must be suitably labelled with the day of pasteurisation and the designation "PASTEURISED MILK."

(v) Every facility must be given at all times to any person authorised by the Licensing Authority to inspect the premises, equipment and methods, and to take samples of the milk (free of charge).

APPENDIX.

I—TUBERCULIN TESTS FOR CERTIFIED MILK AND GRADE A (TUBERCULIN TESTED) MILK.

1. The producer must arrange with a Veterinary Surgeon nominated by the Minister to carry out the tests and to give the certificate and report specified below.

The producer must send all such certificates and reports to the Ministry (unless they are sent direct by the Veterinary Surgeon) within seven days of the date of the test and, in the case of an animal intended to be added to the herd, before it is added. The producer must within the same period send a declaration that every animal in the herd which is reported as reacting to the test has been removed.

2.—(*a*) The tests are to be carried out with fresh tuberculin of a satisfactory make. The name of the manufacturers of the tuberculin used and the quantity injected in each case should be stated on the test report sheet. The actual instructions supplied with the tuberculin used must be adhered to.

(*b*) The temperatures of all animals should be taken on three occasions at intervals of three hours shortly before the injections are made. The average of all temperatures within the physiological limits should be noted. Any animal persistently showing a temperature which is abnormal when compared with this average should not be included in the test, but should be tested as soon as its temperature becomes normal. No animal which has been injected with tuberculin within the previous three months may be included in the test.

(*c*) The hypodermic and ophthalmic tests should be applied simultaneously.

(*d*) After the injections, the temperature should be taken every three hours, beginning at the sixth hour and continuing until the eighteenth hour. If the temperature of any animal has shown little variation, but at the eighteenth hour shows distinct signs of rising, its temperature should be taken again after a further period of three hours. The result of the eye test should be recorded up to the eighteenth hour.

(*e*) The taking of the temperature may *only* be entrusted to an assistant if the assistant acts under the immediate personal supervision of the Veterinary Surgeon.

(*f*) (i) A certificate should be given on the official form. The results observed in respect of each animal should be entered separately, the description of each animal including a reference to the identification mark or number (see paragraphs 2 (i) and 4 (i) of this memorandum).

(ii) All temperatures, including the average specified in (*b*) above, and all changes noted in the eye should be reported on the form.

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* Or Town Council or Metropolitan Borough Council as the case may be.

† *Until the* 1*st July*, 1923, any process of Pasteurisation (including the flash process) capable of effecting the necessary reduction of bacteria will be permitted. The condition as to immediate cooling must be observed.

‡ *Until the* 1*st January*, 1924, no test for *Bacillus Coli* will be imposed, and the maximum bacterial content permitted will be 50,000 per c.c.

II—GENERAL VETERINARY EXAMINATION FOR CERTIFIED GRADE A (TUBERCULIN TESTED) AND GRADE A MILK.

1. The producer must arrange with a Veterinary Surgeon nominated by the Licensing Authority to make a personal veterinary examination of the entire herd and to give the certificate and report specified below.

The producer must send all such certificates and reports to the Licensing Authority (unless they are sent direct by the Veterinary Surgeon) within seven days of the date of the examination. He must also within the same period remove from the herd any animal certified as suffering from any of the diseases specified below or from any other disease likely to affect the milk injuriously and inform the Licensing Authority how that animal has been disposed of.

2.—(*a*) The Veterinary Surgeon should make particular examination for any of the following diseases:—(i) Tuberculosis of the udder; (ii) Indurated udder; (iii) Enlargementof supra-maxillary lymphatic glands; (iv) Tuberculosis in any form with emaciation; (v) Chronic cough with definite clinical symptoms of tuberculosis; (vi) Anthrax; (vii) Foot and mouth disease; (viii) Mastitis; (ix) Abscess of the udder; (x) Retained placenta.

(*b*) A certificate should be given on the official form specifying any clinical evidence of disease. The description of the animals given on this form should in every case include a reference to the identification mark or number (see paragraphs 2 (i) and 4 (i) of this memorandum).

MINISTRY OF HEALTH, WHITEHALL, S.W.1.
January, 1923.

This memorandum sets out in general terms the main provisions of the Milk (Special Designations) Order, 1922, *and the Milk (Special Designations) Amendment Order,* 1922 *(S.R. and O.* 1922, *Numbers* 1332 *and* 1357). *In any case of doubt reference should be made to the terms of the Orders. Copies of these two Orders (price* 3*d. and* 1*d. respectively) and further copies of this memorandum may be purchased through any bookseller or directly from H.M. Stationery Office.*

CONDENSED MILK.

(SUMMARY OF NEW REGULATIONS.)

The Minister of Health is about to make regulations as to the labelling and composition of condensed milk. The principal provisions of the regulations will provide for:

I. LABELLING.—1. Every tin of condensed milk must bear a label specifying its description (*e.g.* full cream, unsweetened), and stating the equivalent volume of milk (or skimmed milk) contained in the tin.

2. Every tin of condensed skimmed milk must be labelled "Unfit for Babies."

3. The name and address of the manufacturer of the condensed milk must appear on the label.

4. Any instructions as to dilution placed on a tin of condensed milk must be quantitatively accurate.

II. COMPOSITION.—Condensed milk must contain not less than the following percentages of milk fat and milk solids:

	Milk fat Per cent.	All milk solids Per cent.
Full cream, unsweetened	9	31
Full cream, sweetened	9	31
Skimmed, unsweetened	—	20
Skimmed, sweetened	—	26

III. GENERAL.—The Regulations will come into operation on the 1st August, 1923, and will apply to all condensed milk intended for sale for human consumption whether produced in this country or imported from abroad.

Copies of the draft Regulations can be purchased from H.M. Stationery Office, Imperial House, Kingsway, W.C.2., either directly or through any bookseller (price 2d.).

MINISTRY OF HEALTH, WHITEHALL, S.W.1.
13*th February*, 1923.

ABSTRACTS OF PAPERS PUBLISHED IN OTHER JOURNALS.

Food and Drugs Analysis.

Composition of Milo and Feterita (Sorghum) Kernels. J. L. Bidwell, L. E. Bopst and J. D. Bowling. (*U.S.A. Dept. Agric., Bull. No.* 1129, Nov. 27, 1922.)—Since the grain sorghums, which have been cultivated for some 30 years in the United States, are now being used in increasing quantities for human food and various industrial purposes, as well as for cattle feeding, an investigation into the physical and chemical characters of milo and feterita has been carried out in continuation of previous work on the kafir kernel (*Bull.*, No. 634). The percentage chemical composition is shown in the following table:—

Kernels	Ash	Ether extract	Protein	Crude Fibre	Nitrogen free extract	Starch	Pentosans
Kafir	1·80	4·10	12·70	1·80	79·60	61·90	3·30
Milo	1·89	3·47	13·99	1·93	78·72	68·52	3·93
Feterita	1·79	3·06	16·69	2·22	76·24	64·16	3·38

A comparison of the brans (*a*), horny endosperms (*b*), starchy endosperms (*c*), and kernels (*d*), with corresponding corn parts shows:—(*a*) a higher ether extract and ash, (*b*) lower fat content, and, in the case of feterita, a higher proportion of protein, (*c*) great similarity, and (*d*) in the case of milo grain a considerably lower ether extract. Although the grains have considerable commercial possibilities they were not found suitable for malting purposes. D. G. H.

Bulgarian Soya Beans. A. Zlataroff and I. Trifonow. (*Zeitsch. Untersuch. Nahr. Genussm.*, 1922, **44**, 214–215.)—The following are the average results of the analyses of nine samples of Bulgarian soya beans:—Moisture, 10·91; proteins, 36·76; fat, 18·57; crude fibre, 3·94; ash, 4·75 per cent. Macedonian papuda beans (*Phaseolus radiatus*) are often mistaken for soya beans, which they resemble in appearance; these papuda beans contain only about 21 per cent. of proteins and 2 per cent. of fat. W. P. S.

The Seeds of Afzelia Africana. A. Diedrichs and B. Schmittmann. (*Zeitsch. Untersuch. Nahr. Genussm.*, 1922, **44,** 215–216.)—The seeds of *Afzelia africana* are contained in a thick-walled pod, and each seed is provided with a cup or envelope (arillus) and resembles an acorn and cup. The pods contain from 6 to 11 seeds. A sample of the kernels contained:—Moisture, 8·74; proteins, 21·31; oil, 19·32; carbohydrates, 37·42; crude fibre, 8·92; and ash, 4·19 per cent. The oil, which had a bright yellow colour, had acid value, 4·19; refractometer value at 40° C., 74·0; saponification value, 229·1; iodine value, 74·1. The arillus contained:—Moisture, 6·41; proteins, 1·77; oil, 54·08; carbohydrates, 34·34; crude fibre, 2·96; and ash, 0·44 per cent. Oil extracted from the arillus was brick-red in colour, and had: Refractometer value at 40° C., 54·6; saponification value, 210·2; and iodine value, 55·7. W. P. S.

Composition of Soya Bean Oil. W. F. Baughman and G. S. Jamieson. (*J. Amer. Chem. Soc.*, 1922, **44**, 2947–2952.)—Complete analysis of oil expressed in the laboratory from the mammoth yellow variety of soya beans gave the following results: Sp. gr. 25°/25°, 0·9203; $n_{\mathrm{D},}^{20}$ 1·4736; iodine value (Hanus), 128·0; acid value, 0·5; saponification value, 189·5; acetyl value 17·0; Reichert-Meissl value, 0·16; Polenske value, 0·26; unsaponifiable matter, 0·6; saturated acids, 11·5; unsaturated acids, 83·5; and iodine value of unsaturated acids, 148·7. The fatty acids were separated by distillation and precipitation of the bromine and other compounds and identified, the percentages found being as follows:—Linolenic, 2·3; linolic, 51·5; oleic, 33·4; palmitic, 6·8; stearic, 4·4; arachidic, 0·7; and lignoceric, 0·1. Full details are given of the methods used. T. J. W.

Composition of Sunflower Seed Oil. G. S. Jamieson and W. F. Baughman. (*J. Amer. Chem. Soc.*, 1922, **44**, 2952–2957.)—The oil examined was expressed from seed grown in south-eastern Missouri, and was of a pale yellow colour, with a pleasant odour and a mild flavour. Determinations of the physical and chemical characteristics gave the following results:—Sp. gr., 25°/25°, 0·9193; $n_{\mathrm{D},}^{20}$ = 1·4736; acid value, 2·3; saponification value, 188·0; iodine value (Hanus), 130·8; acetyl value, 14·5; Reichert-Meissl value, 0·27; Polenske value, 0·25; unsaponifiable matter, 1·20; saturated acids, 7·1; and unsaturated acids, 86·6 per cent. The following iodine values were obtained: Unsaponifiable matter, 124·8; saturated acid fraction, 5·0; unsaturated acids, 147·9. Complete analysis by the usual methods gave the following amounts of fatty acids: Oleic, 33·4; linolic, 57·5; palmitic, 3·5; stearic, 2·9; arachidic, 0·6; and lignoceric acid, 0·4 per cent. T. J. W.

Oil of Hibiscus Cannabinus. J. Dekker. (*Pharm. Weekblad.*, 1922, **59**, 1296–1299.)—A sample of the seeds of *Hibiscus cannabinus* from Nigeria yielded 21·76 per cent. of a light yellow oil with the following characteristics:—Specific gravity at 15° C., 0·9091; acid value, 1·6; saponification value, 189·2; Hehner value, 95·3; Reichert-Meissl value, 0·5; iodine value, 89·7. *Fatty Acids*:—M. pt., 34·5 C.; solidification point, 29·5 C.; and neutralisation value, 171·9. The oil had a faint characteristic odour and a neutral taste, and, as the analysis shows, closely resembled arachis oil.

Estimation of the Mixture of Arachidic and Lignoceric Acids in Arachis Oil by means of Magnesium Soaps. A. W. Thomas and C. L. Yu. (*J. Amer. Chem. Soc.*, 1923, **45**, 113–128.)—At 25° C., 100 grms. of 90 per cent. alcohol dissolve 0·007 grm. of magnesium stearate, 0·006 grm. of magnesium lignocerate, or 8·60 grms. of magnesium oleate; the linolate behaves similarly to the oleate, and the arachidate to the stearate or lignocerate. These differences in solublilty are greater than those shown by the lead salts. On the basis of these results, the following method is suggested for the estimation of arachis oil. The reagents are prepared as follows: (1) 50 grms. of potassium hydroxide, purified by alcohol, are dissolved in 1 litre of purified alcohol and filtered. (2) 50 grms. of magnesium acetate are dissolved in 100 c.c. of water, the solution being heated to boiling and filtered, and 3 volumes of 95 per cent. alcohol added to 1 volume of the filtrate. (3) 20 c.c. of glacial acetic acid are dissolved in 80 c.c. of 95 per cent. alcohol; this reagent is stable, only slight esterification occurring in a month.

About 10 grms. of the oil, accurately weighed, are saponified in a 300 c.c. Erlenmeyer flask by being heated for half an hour under a reflux condenser with 50 c.c. of the alcoholic potassium hydroxide solution and 50 c.c. of 95 per cent. alcohol, the warm soap solution thus obtained being neutralised to phenolphthalein by addition of the alcoholic acetic acid. After just sufficient alcoholic potassium hydroxide to give a permanent pink colour, and 25 c.c. of the alcoholic magnesium acetate have been added, the mixture is heated just to boiling point and left overnight in a refrigerator at about 10° C. The insoluble soaps are then separated and washed with 30 c.c. of 90 per cent. alcohol which has been used to rinse out the soaps adhering to the flask. The bulk of the magnesium soaps is transferred to the Erlenmeyer flask and the residue removed by 100 c.c. of boiling 5 *M* hydrochloric acid, the soaps being decomposed by boiling for about 5 minutes. After a few minutes cold water is poured slowly into the flask so as to produce shreds of solid acid, which are filtered off, washed free from magnesium and chlorine ions, and transferred to a 150 c.c. beaker. The flask is dried at 80° to 100° C., 60 c.c. of 90 per cent. alchohol being heated in the flask in three portions, which are poured over the filter paper and dissolve the acid residue; the filtrate is collected in the beaker containing the bulk of the acids. The covered beaker is left overnight in a thermostat at 20° to 25° C., the crystals forming being separated and washed twice with 10 c.c. of 90 per cent. alcohol and then with 70 per cent. alcohol at about 20 ° C. until 10 drops of the washing liquid give no turbidity with water. The filtrate and washings from the 90 per cent. alcohol are collected and accurately measured. The residue is transferred into the original beaker and dissolved with small portions of absolute alcohol, the solution being poured carefully over the filter paper and the filtrate caught in a weighed dish or a 50 c.c. beaker. The original beaker and filter paper are washed quantitatively with another small portion of absolute alcohol, the solvent being evaporated and the residue dried to constant weight at 80° C. This weight is corrected for the total amount of the mixture of arachidic and lignoceric acids dissolved in the filtrate and washings of 90 per cent. alcohol; at 20° (25°) C. this correction, per 100 c.c. of alcoholic solution, is 0·099 (0·172) grm. for a weight of 0·6 grm., or 0·054 (0·117) grm. for a weight of 0·05 grm. of acid mixture obtained, the correction for an intermediate weight being found by interpolation. The mixed acids thus obtained melt at 71° to 73° C. are free from ash, show a zero iodine value, and have a mean molecular weight of about 340. When recrystallised from 60 c.c. of 90 per cent. alcohol, they melt at 75° to 76° C., or above. Six samples of crude arachis oil of different origins were found to contain 5·23 to 5·48 per cent. of the mixed acids; a crude oil from Canton contained 5·17 per cent.; and various refined samples 4·79 to 5·13 per cent. When applied to certain mixtures containing arachis oil the method yields satisfactory results.

T. H. P.

New Qualitative Tests for Rape and Tung Oils. A. W. Thomas and C. L. Yu. (*J. Amer. Chem. Soc.*, 1923, **45**, 129–130.)—About 10 grms. of rapeseed oil are treated as in the method proposed for the estimation of peanut oil (preceding Abstract), the washed insoluble magnesium soaps being boiled with 100 c.c. of 5 *M* hydrochloric acid for a few minutes until a clear, oily layer forms. After being cooled, the cake of fatty acid is filtered off and washed with warm water until free from magnesium and chlorine ions. The cake is dissolved in 60 c.c. of 90 per cent. alcohol in a covered 150 c.c. beaker, which is left overnight in a thermostat at 20° or 15° C., any crystals of insoluble acids being then filtered off and the filtrate and washings evaporated to dryness. The melting point, or acid value, or, preferably, iodine value of the dry residue is determined. When treated in this way, two samples of genuine rapeseed oils yielded about 25 per cent. of the final acid product having m.pt. 35° C., mean molecular weight about 328, and iodine value 70 to 72, the corresponding constants for erucic acid being 32° C., 338·45, and 74·99. That the acid separated consists of erucic acid may be confirmed by its reduction to behenic acid with the aid of an active catalyst in a suitable solvent.

In the case of tung oil, the mixture containing the insoluble magnesium soaps, precipitated as described, is filtered while almost boiling, the precipitate being washed with hot 90 per cent. alcohol and decomposed with dilute hydrochloric acid, preferably in absence of air. The liberated acid, which has the strong odour characteristic of tung oil, is soluble in cold 90 per cent. alcohol and melts at about 44° C. After contact with the air for 1 to 2 days, it absorbs oxygen and gradually changes to a dark brown, resinous mass, this change occurring far more rapidly if the temperature of the acid is raised. The one sample of tung oil examined yielded about 20 per cent. of this acid (elæomargaric). T. H. P.

New Test for Acrolein and its Bearing on Rancidity in Fats. W. C. Powick. (*J. Ind. Eng. Chem.*, 1923, **15**, 66.)—The test depends on the formation of a coloured condensation product between acrolein and phloroglucinol in the presence of hydrochloric acid and hydrogen peroxide:—Two drops of dilute acrolein solution and 1 drop of 3 per cent. hydrogen peroxide solution are mixed and, after about one minute, 5 c.c. of concentrated hydrochloric acid are added, followed by 5 c.c. of a 1 per cent. phloroglucinol solution (in ether). The acid layer is immediately coloured red when the mixture is shaken. This acid solution shows a fairly narrow absorption band in the yellow-green portion of the spectrum. In the absence of hydrogen peroxide the red coloration is not obtained, whilst when an excess of acrolein is present the condensation product separates as a purple precipitate. The test differs from the Kreis test in the use of hydrogen peroxide and in the spectroscopic examination. It is to be noted that the colour yielded by rancid fats in the Kreis test is spectroscopically identical with that obtained with acrolein is the test described above, and that this colour and spectrum are apparently characteristic of the condensation product. Whilst a number of other substances, such as vanillin, eugenol, cinnamic aldehyde, old turpentine, and certain non-rancid cottonseed oils give a red coloration in the absence of hydrogen peroxide, the spectra of these colours show general absorption throughout the green-blue-violet part of the spectrum, but no localised band as in the case of rancid fats and of acrolein in the presence of hydrogen peroxide. It appears, therefore, that the same substance is responsible for the Kreis test in rancid fats as is formed by the action of hydrogen peroxide on acrolein, and that this substance is different from the reactive substance in certain non-rancid cottonseed oils. The Kreis test, when followed by spectroscopic examination, may consequently be used to distinguish rancidity in this class of oil. W. P. S.

Detection of Geraniol in Apples. F. B. Power and V. K. Chesnut. (*J. Amer. Chem. Soc.*, 1922, **44,** 2938–2942.)—In a previous paper (*J. Amer. Chem. Soc.*, 1920, **45,** 1509) the authors have shown that the odorous constituents of apples contain the amyl esters of formic, acetic, caproic and caprylic acids, together with a large proportion of acetaldehyde. Some of the choicer varieties of apple possess a distinct rose-like odour, and the alcohol fraction obtained by hydrolysis of the distillate from the parings of such apples has a more pleasant odour than pure amyl alcohol. By the extraction of 36·85 kilos. of parings from McIntosh apples 0·3641 grm. of a yellowish oil was obtained possessing a distinct odour of amyl alcohol, in addition to that of a more fragrant substance, and this oil, on oxidation, gave reactions for citral, lævulinic acid, acetone and valeric acid. These reactions, in conjunction with the odour of different fractions obtained, indicate the presence of geraniol, which is probably contained in many varieties of apple, but in greater quantity in those having its distinctive odour. During the progress of this work it was shown that the odorous constituents of apples were present in largest proportion in the parings of the fruit. The methods employed are described in detail. T. J. W.

Confirmation of the Presence of Linalyl Esters in Peaches. F. B. Power and V. K. Chesnut. (*J. Amer. Chem. Soc.*, 1922, **44,** 2966–2967.)—By oxidation with chromic acid of the alcoholic fraction obtained on the hydrolysis of peach extract the authors have obtained products giving the reactions for citral, acetone and lævulinic acid (see previous abstract), thus confirming their former results (ANALYST, 1922, **47,** 26). Linalool, on treatment with chromic acid, is converted into geraniol which, on further oxidation, yields the above products.
T. J. W.

Examination of a Venezuelan Jaborandi. O. F. Black, J. W. Kelly and W. W. Stockberger. (*Amer. J. Pharm.*, 1923, **95,** 4–7.)—A species of *Pilocarpus* growing in Venezuela is known locally as *barrachera*, owing to its poisonous action upon animals which have eaten the leaves of the shrub. Specimens of the plant have been provisionally classified as *Pilocarpus heterophyllus*, a species discovered about 1857 by Wright in Cuba. Extraction of the finely powdered leaves with 95 per cent. alcohol containing 1 per cent. of hydrochloric acid, neutralisation of the extract with ammonia, concentration *in vacuo*, and extraction of the residue (after addition of ammonia) with chloroform, yielded 0·25 per cent. of a brown amorphous mass, from which about 0·04 per cent. (calculated on the leaves) of a nitrate identified as pilocarpine nitrate was prepared. Hence, the Venezuelan species contains not only a smaller percentage of total alkaloids than *Pilocarpus jaborandi* (0·72 per cent.), but also very much less pilocarpine than that species (0·67 per cent.). It is therefore doubtful whether the Venezuelan plant can be used as a source of pilocarpine.

Biochemical, Bacteriological, etc.

Vitamin A Content of Lard Obtained from Hogs Fed with a Control Ration. M. G. Mallon and M. Clark. (*J. Biol Chem.*, 1922, **54**, 763–766.)—Fat obtained from two hogs which had been fed on a diet containing a large proportion of yellow maize and clover pasture for six months before being killed, was finely divided and filtered at a low temperature, after which it was kept for 3 months in cold storage. The lard was then mixed with a basal diet consisting of purified maize starch, casein and a salt mixture, the control diet containing 5 per cent. of butter fat replacing an equal proportion of the lard. In all cases 0·6 grm. of yeast treated for removal of vitamin *A* was fed separately to the experimental rats daily. The total fat in the two diets was 30 per cent., and the groups of animals fed on each diet attained the same weight and were in equally good condition at the end of 2 months, but a few days later the rats fed with the entire lard diet suddenly developed xerophthalmia and showed a loss of appetite and weight. Two of these animals died, and the remainder were supplied with 0·5 grm. of butter fat daily for 3 days, after which their condition rapidly improved. The control animals maintained their healthy condition throughout the experiment. The result obtained indicates that the lard derived from hogs fed upon a diet containing vitamin *A* does not contain sufficient of this substance to prevent xerophthalmia when supplied to rats in large amount. T. J. W.

Comparison between the Chemical and Physiological Characteristics of Pepsin and Rennin. F. Fenger. (*J. Amer. Chem. Soc.*, 1923, **45**, 249–255.)—A number of samples of pepsin and rennin, isolated and prepared by various methods, have been investigated chemically and physiologically. Both are found to be proteins, but of widely divergent properties. Pepsin is coagulated by heat and has colloidal properties, so that it may be purified by dialysis. Rennin, however, is a decomposition product of protein of the acid-albumin type, is not precipitated by boiling, and diffuses readily through parchment membranes. Proteolytic or peptic activity does not appear to be a part of the true physiological character of the milk-curdling enzyme. Pepsin is able to digest 25,000 times its own weight of freshly coagulated and disintegrated egg albumin in 2½ hours at 52° C., and rennin to coagulate more than 2,000,000 times its weight of fresh milk in 10 minutes at 40° C. Both enzymes are present in the stomach of the suckling calf, but only pepsin in that of the adult hog. T. H. P.

Biochemical Differentiation of Bacteria. H. W. Smith. (*Amer. J. Hygiene*, 1922, **2**, 607–655.)—The author has summarised the work of a large number of investigators upon the relative toxicity to bacteria of various electrolytes and non-electrolytes, dyes and solutions of varying P_H values, and upon the sensitiveness of bacteria to the action of sodium hydroxide solution and to peptic digestion. The different theories advanced in explanation of the mechanism of "Gram staining" are discussed, and the correctness of Benian's conclusion that Gram-positivity is due to a physical condition of the cell membrane rendering it impermeable to the iodine-dye compound is indicated. In addition to the results obtained by other workers, the author has carried out experiments with about 20 different organisms, and has obtained results showing that Gram-positive and Gram-negative bacteria are equally susceptible to the toxic action of copper chloride, cobalt nitrate, nickel nitrate and antimony potassium tartrate, but that the Gram-negative group are slightly more sensitive to mercuric chloride and potassium arsenite, whilst members of the same group are slightly more sensitive to the action of ethyl alcohol, acetone and phenol than are the Gram-positive bacteria. On the other hand, the Gram-positive organisms are more susceptible to the growth-inhibiting property of dyes, such as crystal violet and brilliant green, with the exception of the genus *Neisseria* which, although Gram-negative, is dye-sensitive. Determination of the optimum P_H value for growth showed that this ranges between 7·8 and 6·0 for over 60 species of bacteria and other organisms, only the Gram-positive bacteria growing most readily in alkaline media. The whole of the results obtained are summarised as follows:

	Gram's reaction	Optimum P_H value of media	Weak electrolytes (dyes)	Non-Electrolytes	Sodium hydroxide Catalysis	Peptic digestion	Spore formation
Group I.	Negative	Acid	Resistant	Sensitive	Sensitive	Sensitive	Very rare
Group II.	Positive	Alkaline	Sensitive	Resistant	Resistant	Resistant	Common

This division of the bacteria into two groups agrees closely with the classification into Families, Genera, etc., according to the morphological, cultural and other characteristics. An extensive bibliography and numerous diagrams illustrating the experimental results obtained by the author are provided. T. J. W.

Efficiency of Substances Inhibiting the Action of Invertase. E. H. Harvey. (*Amer. J. Pharm.*, 1922, **94**, 797–801.)—Sucrose solution was mixed with compressed yeast, and to 50 c.c. portions of the mixture were added 5 c.c. of 1 per cent. solutions of various antiseptics, and the liquids then kept at 23° C. At hourly intervals the progress of inversion of the sugar was estimated by removing portions of the liquids and, after filtration, determining the polarimetric reading. Further investigations were carried out by submitting the mixture of sucrose solution and yeast to the action of ultra-violet radiation generated by a disruptive spark discharge between iron terminals situated 6 inches above the surface of the liquid, which was continually agitated. After treatment for 20 minutes, the liquid was allowed to stand and the polarimetric reading was taken at intervals of one hour. The results obtained showed the relative invertase-inhibiting power of the agents tested to be in the following decreasing order:—

Mercuric chloride, sodium hypochlorite, ultra-violet radiation, salicylic acid, cresol, sodium bisulphite, formaldehyde, phenol and benzoic acid. In most cases the effect produced was one of gradual retardation, but with mercuric chloride and sodium hypochlorite inversion ceased within the first hour. T. J. W.

Water Analysis.

Barium in the Harrogate Waters. A. Woodmansey. (*Lancet*, 1923, **204,** 22.)—When taken in small doses barium has a stimulating action on muscular tissue, and its presence in purgative waters therefore prevents enervation. It is, therefore, a valuable constituent of the Harrogate waters in which it occurs. The following amounts have been found in three important Harrogate springs:—Old sulphur spring, 6·91; chloride of iron spring, 3·51; and magnesia spring, 3·97 parts per 100,000. Notwithstanding the insolubility of barium sulphate, a small amount of sulphate is found in these three waters, co-existing with the barium. For example, the old sulphur spring contained 1 part of barium sulphate per 140,000, and the chloride of iron spring 1 part per 190,000. (See also ANALYST, 1921, **46,** 125.)

Contamination of Water Samples with Material Dissolved from Glass Containers. W. D. Collins and H. B. Riffenburg. (*J. Ind. Eng. Chem.*, 1923, **15,** 48–49.)—Considerable quantities of mineral substances, particularly silica and alkalis, may be dissolved by water stored in glass bottles of poor quality. In one instance, mentioned by the authors, distilled water, after storage for fifteen months in a glass bottle, contained 142 parts of silica and 22 parts of alkalis per million, together with smaller amounts of other glass constituents. The suitability of a bottle for use in storing water samples may be determined by testing the alkalinity of water which has been kept in the bottle for one month; a much shorter period serves in the case of very poor quality glass. With glass of good quality water will not dissolve in one month sufficient of the glass constituents to affect the mineral analysis to any appreciable extent. W. P. S.

Agricultural Analysis.

Modified Test for Sour Soils. N. M. Comber. (*J. Agric. Sci.*, 1922, **12,** 370–371.)—An aqueous solution of potassium salicylate is more convenient as a test for sourness in soils than an alcoholic solution of potassium thiocyanate (*cf.* Carr. ANALYST, 1921, **46,** 511). When a 5 per cent. solution of the salicylate is shaken with soil which yields iron to neutral salt solutions, *i.e.* which is sour, there is developed in a few minutes a red colour; in other soils there is only a yellowish-brown colour. The test is delicate and well adapted for the use of persons not in contact with a laboratory. H. E. C.

Flocculation of Soils. III. N. M. Comber. (*J. Agric. Sci.*, 1922, **12,** 372–386.)—Phosphates of iron and aluminium are the only insoluble substances of a number examined which in suspension show abnormal flocculation by lime;

the flocculation is, however, only abnormal when a certain excess is reached, which supports the idea that abnormal flocculation is caused, both with these substances and with soils, by the coagulation of emulsoid matter. Absorption of the lime is by the soil colloids not by unweathered minerals, since lime absorbed by soils can be removed by dilute acids which do not decompose the mineral. The ignition of soil destroys its colloids which bind the particles together, henc exposing a larger surface to acid, which is found to dissolve more of the iron an aluminium from soil after ignition than before. Partial ignition (5 minutes has a varying effect on the base-absorbing power as shown by the Hutchinson-McLennan method; subsoils which contain no organic matter, and from which the absorbed bases have been removed by dilute acids show a decreased lime-absorbing power; untreated subsoils containing no organic matter but absorbed lime show an increase, and soil containing organic matter shows a marked decrease. These observations agree with the view that lime reacts with the colloid surface, forming a precipitate which binds the particles. An almost neutral suspension for experimental work may be easily prepared by extracting soil with dilute acid, washing, agitating with excess of lime water, filtering with the aid of the pump and thoroughly washing with hot water; the wet soil will then give good clay suspensions.

H. E. C.

Organic Analysis.

Purification of Methyl Alcohol by means of Sodium Hypochlorite. R. C. Menzies. (*J. Chem. Soc.*, 1922, **121**, 2787–2793.)—The method described, which is suitable for the purification of methyl alcohol containing up to 12 per cent. of acetone, depends upon the fact that whilst acetone is instantly attacked by sodium hypochlorite in the cold, methyl alcohol is only slowly attacked at temperatures below 50° C. Sodium hypochlorite solution is prepared and its available chlorine estimated, and a little more than the calculated volume required for the reaction, $(CH_3)_2CO+3NaOCl \longrightarrow CHCl_3+CH_3CO_2Na+2NaOH$, is added to the methyl alcohol which may be diluted with water. The chloroform is separated, and the alcohol treated with a little more hypochlorite, if necessary, to discharge the brown colour, and then fractionated and dried over quicklime. Acetone in the methyl alcohol can be estimated by Messenger's hypoiodite method, and the total chlorine by boiling for two hours, with sodium dissolved in ethyl alcohol solution and then titrating the sodium chloride as usual. The yield by the proposed method is good and the product very pure. H. E. C.

Malic, Maleic, and Fumaric Acids as Volumetric Standards. N. A. Lange and H. Kline. (*J. Amer. Chem. Soc.*, 1922, **44**, 2709–2712.)—These acids may be used for the standardisation of sodium hydroxide solution, with phenolphthalein as indicator. They are readily purified by recrystallisation, and may be dried over sulphuric acid. Malic and fumaric acids may also be dried by heating them at 90°–120° C., but maleic acid should not be dried above 100° C., on account of the formation of anhydride. Maleic and fumaric acids are not so convenient and accurate as sodium oxalate for the standardisation of permanganate solution. W. R. S.

Quantitative Estimation of the Grignard Reagent. H. Gilman, P. D. Wilkinson, W. P. Fishel, and C. H. Meyers. (*J. Amer. Chem. Soc.*, 1923, **45**, 150–158.)—Of various methods tried for estimating the Grignard reagent, two, based on the reaction, $MgRX+H_2O=RH+MgX.OH$, yield satisfactory results.

In the first the basic magnesium halide formed is titrated with acid. About 20 c.c. of the Grignard reagent, measured in a 25 c.c. tube, graduated to 0·1 c.c., are poured slowly into a 400 c.c. Erlenmeyer flask containing about 50 c.c. of water, the tube being rinsed out into the flask, first with a little of the standard acid, and then several times with water. The acid is added in about 20 c.c. excess, and the flask heated to about 60° C. on an electric hot plate until solution is complete and then cooled. The liquid is then titrated with standard sodium hydroxide solution in presence of methyl orange.

In the second method, the volume of the hydrocarbon liberated in the above reaction is measured. The apparatus consists of a reaction chamber connected through cocks with (1) a graduated tube to hold the Grignard reagent, (2) a funnel to contain the dilute sulphuric acid, and (3) a concentrated sulphuric acid washer, cooled in ice and water, this removing any ether vapour before the gas passes to the measuring burette. After the reaction is finished, any residual hydrocarbon in the reaction chamber is expelled by directing a jet of steam on to the chamber. This method is more accurate than the titration method, which gives somewhat higher results. T. H. P.

Note on the Congelation of Essential Oils. W. J. Sanderson and W. J. Jones. (*J. Soc. Chem. Ind.*, 1922, **42**T, 1923.)—Since several essential oils, on being cooled slightly below room temperature, deposit crystals of their chief constituents, a method has been devised, depending on the depression of the freezing point under certain conditions, for finding the percentage content of the main constituents in the case of unadulterated oils. After thorough purification of the oils the freezing points were determined in the following manner: About 20 grms. of the oil were placed in a test tube supported vertically in a beaker filled with water at a temperature about 3° C. below the freezing point of the oil. In the inner tube stood a stirrer and standardised thermometer graduated in tenths of a degree. The temperature fell and then rose suddenly as congelation began, and the highest point reached was taken as the freezing point. The oil was then re-melted and allowed to cool 0·5° C. below the approximate freezing point already determined, and a small crystal of the pure solvent dropped in. The highest temperature then recorded was registered as the exact freezing point, and this method was used for all freezing point determinations.

It was found, on examining the freezing point of certain binary mixtures consisting of solute and solvent in known proportions by weight, that there was a direct proportionality between percentage of solute and depression of freezing point; in some cases even when using a 10 per cent. solution, and tables are given with anethole, methyl-*n*-nonyl ketone, and safrole as solvents for a variety of substances. With ternary and more complex mixtures the depressions were additive. When an oil contains not less than 93 per cent. of its main constituent the proportion of this constituent can be determined with the help of tables. For example, suppose the freezing point of a commercial safrole has been found to be 9·5° C. The depression is 11·0−9·5=1·5° C. The chief impurity in such an oil would be camphor, and reference to the tables shows that 1 per cent. of camphor causes a depression of 0·38° C. Hence, the oil contained 4 per cent. of impurity. When less than 93 per cent. of the main constituent is present the oil can first be fortified by the addition of a known proportion of this constituent, and the freezing point of the mixture determined. If an adulterant of an oil has been identified, and its depressing action on the freezing point determined, a value indicating the degree of adulteration can be obtained. D. G. H.

Analytical Characteristics of Tanning Materials and Detection of Adulterants. M. Jamet. (*J. Soc. Leather Trades Chem.*, 1922, **10,** 336.)—The author gives a resumé of the various tests already known, some dividing tanning materials into the two groups (pyrogallols and catechols), others, mostly colorimetric, which are specific for individual materials and extracts. He also describes fully some tests sufficiently precise to serve as true criteria of tanning materials. For separation into groups he gives the following tests: Bromine water, ammonium sulphide, lead acetate and acetic acid, formaldehyde, tinting of Mulhouse bands. These are all well known, except the last. This consists in mordanting strips of cotton tape with solutions of various metallic salts (iron, chromium, aluminium, tin), and immersing them in a cold 0·4 per cent. solution of the tannin under examination, the temperature of which is gradually raised to the boiling point, and the boiling continued a definite time (15 minutes). Finally, the strips are removed, rinsed and dried, and the tints compared. The individual less known tests described include the following:—*Nitrous acid test.*—An excess of sodium nitrite and 3 to 4 drops of 0·1 *N* acid are added to a few c.c. of the cold 0·4 per cent. tannin solution. A coloration which varies with the particular tannin is indicative of ellagitannic acid. *Ammoniacal copper sulphate test.*—A 1 per cent. solution of copper sulphate is allowed to act on the tannin solution, and excess of ammonia added. The ammonia generally dissolves the copper tannate formed, but in certain cases (notably with protocatechuic acid and tans derived from gallotannic acid) an insoluble tannate is left. Copper tannates formed by gambier, as well as by hemlock and other pine barks, are particularly soluble in ammonia solution. *Stannous chloride test.*—Ten c.c. of a strong solution of stannous chloride in hydrochloric acid are added to 2 c.c. of the tannin solution in a porcelain dish, and the mixture left for ten minutes. A clear rose colour is obtained in the case of mimosas and pine barks, notably larch. *Pine shavings test.*—A shaving (5 cm. by 1 cm.) is soaked in the tannin solution containing 5 per cent. of liquid extract, allowed to dry, and then moistened with fuming hydrochloric acid. The shaving immediately turns an intense violet-red in the case of phloroglucinol tans, such as gambier. *Sodium sulphite test.*—A crystal of this salt is moistened with several drops of the tannin solution. Valonia produces a bright red coloration in the crystal. *Concentrated sulphuric acid test.*—One c.c. of the acid is put into a test-tube which has previously been rinsed with the tannin solution and allowed to drain. The colour developing at the junction of the two liquids is noted. The tube is then shaken, and its contents diluted with water, care being taken to avoid heating. A tint, varying from crimson red to purple red, is obtained. *Lead acetate test.*—Five c.c. of a neutral 10 per cent. solution of lead acetate are added to 5 c.c. of tannin solution, the mixture filtered, and a portion of the filtrate treated with a 10 per cent. solution of sodium hydroxide free from carbon dioxide. Mangrove, mimosa, oak bark, chestnut, myrobalans, valonia, divi-divi, algarobilla, and gallotannic acid all give no coloration. Quebracho gives a pale yellow colour; lentiscus and sumac a full yellow; and wood pulp extract a deep yellow coloration. *Lauffmann's test.*—Two grms. of dry extract are treated with 20 c.c. of strong potassium hydroxide solution in a large silver crucible, and the mixture evaporated over a small flame. The temperature is gradually raised until the mass becomes pasty, after which it is treated with dilute sulphuric acid until the mixture no longer boils, then allowed to cool and shaken with ether. This extract (or the direct ether extract of 2 grms. of the tanning material itself) is evaporated, the residue dissolved in about 5 c.c. of water, and the solution tested by the pine-shaving test, as described above. *Wool-tinting test.*—A weight of extract corresponding to 2 grms. of dry material is dissolved in 250 c.c. of water. Three grms. of white wool are added, and the whole warmed on the water-bath for 12 to 18 hours. The wool is squeezed and transferred for 15 minutes to a 1 per cent. solution of potassium dichromate at 70° C. It is then rinsed and dried. Sumac, nut galls and chestnut produce a clear green shade; mimosa, mangrove and quebracho give a more or less dark brown; and myrobalans a yellow shade.

QUANTITATIVE TESTS.—The well-known ethyl acetate test is chiefly used to estimate mangrove in the presence of quebracho. The solubility of the latter gives a value of 70 to 80, and that of the former, 0 to 5. *The molybdenum value* is also especially useful for the detection of mangrove in quebracho. The values range from 113 to 144 in the case of mangrove, and from 5 to 37 in that of quebracho. In the case of pyrogallol tans it is 80 to 120, and in that of catechol tans, 0 to 135.

Estimation of pentosans.—A quantity of the extract, corresponding with 5 grms. of the dry sample, is placed in a litre distillation flask provided with a side tube. One hundred c.c. of hydrochloric acid containing 12 per cent. HCl are added, together with some fragments of porcelain and a little paraffin oil to prevent bumping and frothing if the extract is sulphited. Any sulphur dioxide is oxidised by heating it with iodine solution beneath a reflux condenser. The mixture, which must contain 12 per cent. of HCl, is distilled at 145° C., either over a naked flame or on an oil bath, 12 per cent. hydrochloric acid being added from time to time through a stoppered funnel. The distillation is continued until a drop of the distillate gives no reaction with aniline acetate paper. Phloroglucinol, previously dissolved in 12 per cent. hydrochloric acid, is added to an aliquot portion of the distillate in such amount as to be double that corresponding to the furfural present. With quebracho the liquid becomes yellow and then green, and finally a greenish-black precipitate forms, the solution itself becoming colourless. With mangrove the liquid turns from yellow to red, and finally yields a red-brown precipitate. The precipitate is left for 15 to 24 hours, collected in a weighed Gooch crucible, washed with exactly 150 c.c. of water and dried for 4 hours at 98–100° C. This gives the total phloroglucides present, a correction of 0·0095 grm. being made for each 100 c.c. of the distillate taken.

Differentiation of Oakwood and Chestnut extracts (*Stiasny*).—The filtrate from the precipitate in the lead acetate test is treated with 10 drops of 1 per cent. ferric ammonium sulphate solution and about 0·5 grm. of sodium acetate crystals. Oak extract ought to give no definite colour, whilst chestnut extract gives a blue-violet colour. This test, however, is not conclusive. Again, the ash of oak-wood extract often exceeds 1·5 per cent., whilst the ash of chestnut extracts of the same density averages only 0·5 per cent.

Suggestions are also given for examining mixtures of tanning materials, the reactions described above being applied, and the results compared with those obtained with typical samples of different tannins. R. F. I.

Estimation of the Proportions of TNT and Tetryl from the Freezing Point Curve. C. A. Taylor and W. H. Rinkenback. (*J. Ind. Eng. Chem.*, 1923, **15**, 73–74.)—The method of determining the equilibrium curve of known mixtures of TNT and tetryl consisted in melting weighed quantities of the two substances in a tube 0·75 inches in diameter and 11 inches in length, a thermometer and wire stirrer being fitted in the tube. The latter was then inserted in a second tube, 1·75 inches in diameter and 12 inches in length, and this tube was immersed as far as possible in an oil bath maintained at a constant temperature somewhat below the crystallising point of the mixture. Temperature readings were taken every half minute. After falling for some time, there was a rise in the temperature coincident

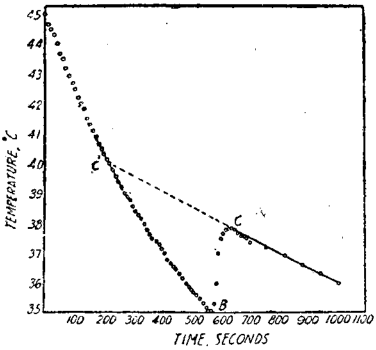


Fig. 1

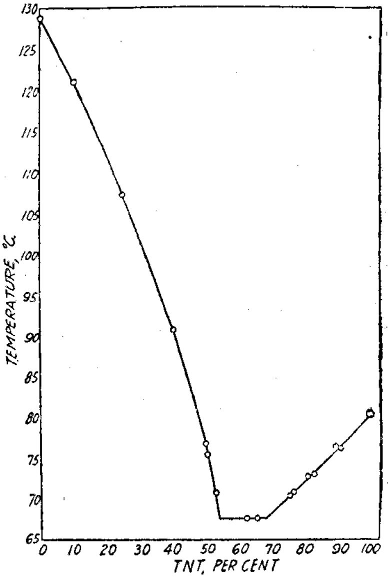


Fig. 2

with the appearance of a solid phase; the temperature then reached a maximum and afterwards fell at a slower rate than previously. Such a typical cooling curve is shown in figure 1. Although the point *C* is nearer the true value for the equilibrium temperature than is the point *B* (at which crystals first appear), the true value *C′* may be obtained by extrapolating the second and slower rate of cooling upon the initial rate of cooling. Results obtained by the authors are given in the equilibrium curve, figure 2. If a *C′* point obtained on an unknown mixture is between 67·5° and 80·3° C. there is no means of knowing whether the point is on the tetryl or TNT side of the curve. This can be ascertained by adding a known weight of either substance so as to make the TNT content less than 55 per cent. or greater than 65 per cent., determining another point on the curve, and observing whether the temperature is higher or lower than the original. It is usually more satisfactory to add tetryl for this purpose. It is seen from the equilibrium curve that there are two eutectic points connected by an almost straight line curve, indicating the existence of a complex consisting of 2 molecules of TNT and 1 molecule of tetryl. W. P. S.

Detection of Coal Tar Pitch in Natural Asphalt. O. Hackl. (*Chem. Zeit.*, 1922, **46**, 1156.)—It is found that natural asphalt which contains no coal tar pitch or artificial asphalt sometimes gives the reaction described by Claye, which is stated by him to be given only in the presence of coal tar pitch. The test referred to consists in extracting the powdered asphalt with benzene, and filtering and shaking the filtrate with alcohol, a golden brown colour imparted to the alcohol being stated to be evidence of the presence of coal tar pitch. H. E. C.

Inorganic Analysis.

Absorption of Carbon Monoxide by Cuprous Ammonium Carbonate and Cuprous Ammonium Formate. A. T. Larson and C. S. Teitsworth. (*J. Amer. Chem. Soc.*, 1922, **44**, 2878–2885.)—The relative efficiency of cuprous ammonium carbonate and cuprous ammonium formate solutions, as used in the synthetic ammonia process, for the absorption of carbon monoxide has been studied experimentally, and the following results obtained:—The weight of carbon monoxide absorbed is proportional to the concentration of cuprous copper in solution—a fact indicating the formation of an unstable compound containing 1 molecule of the gas for each grm.-atom of copper at 0° C., but with concentrations of copper exceeding 5·5 per cent. a considerable precipitate of metallic copper is formed. Both solutions show the same absorption capacity under the same conditions. Slight variations in the concentrations of total carbonate or formate present have no effect upon the absorption of the gas. On warming the solutions the combined gas is readily evolved, but with the carbonate solution metallic copper is rapidly deposited at 60° C. For this reason the copper ammonium formate is preferable, owing to its greater stability at higher temperatures.

T. J. W.

Electrometric Acidimetry and Alkalimetry without the Use of Hydrogen. P. A. van der Meulen and F. Wilcoxon. (*J. Ind. Eng. Chem.*, 1923, **15**, 62–63.)—A polished platinum wire immersed in an acid solution, with a calomel half-cell as the other electrode, gives a fairly stable potential, and the value changes as the acid is neutralised, the rate of change being a maximum when an equivalent quantity of alkali has been added. It is possible to eliminate the calomel half-cell and to substitute for it a beaker containing an alkali solution in which a second platinum wire is immersed. When it is desired merely to determine the end-point of a titration without following its entire course, the use of a potentiometer is unnecessary. A concentration cell is made up consisting of two beakers, one containing the solution to be titrated, and the other a solution whose hydrogen ion concentration corresponds with the desired end-point. The beakers are connected through a salt-bridge and a platinum wire is dipped into each; the wires are connected through a tapping key with the galvanometer. When the deflection of the galvanometer changes direction, the end-point has been reached. W. P. S.

Conductivity Titrations by means of Sodium Chromate. I. M. Kolthoff. (*Zeitsch. anal. Chem.*, 1923, **62**, 97–103.)—*Barium* can be titrated in neutral solution with considerable accuracy, even at great dilution; the conductivity becomes constant immediately after the addition of the precipitant. High results are obtained in presence of acetic acid, part of the barium being precipitated as dichromate. Strontium, if present, interferes, being partly precipitated. The conductometric estimation of *strontium* is unreliable unless an equal volume of alcohol is added. Even then, the break in the curve is not so decided as in the case of barium, but the estimation is accurate within about one per cent. *Lead* and *silver* are capable of exact estimation, like barium. *Manganese, zinc, copper,* and *cadmium* yield more or less basic chromates, and their estimation is not possible by this method. W. R. S.

Estimation of Copper in Alloys, etc. B. Winkler. (*Chem. Zeit.*, 1922, **46**, 1137.)—The use of hydrogen sulphide is avoided in the following method:—The weighed sample (0·7 grm.) of alloy or matte is dissolved in *aqua regia*; the solution is treated with 50 c.c. of a 34 per cent. solution of Rochelle salt and 25 c.c. of 16 per cent. sodium hydroxide solution, and heated to boiling. A slight excess of a 5 per cent. solution of hydroxylamine hydrochloride is cautiously added, and boiling is continued for one minute, with constant stirring. The precipitated cuprous hydroxide is left to settle, and the solution poured through a filter paper coated with precipitated aluminium hydroxide. The precipitate should be well washed by decantation and not disturbed after having been transferred to the filter. It is rinsed into a round flask, dissolved in hot, dilute aqua regia, and evaporated with a little potassium chlorate and 10 c.c. of sulphuric acid until fumes appear. The cold mass is diluted with a little water and once more evaporated to fumes after addition of nitric acid and bromine water. After dilution, the liquid is made ammoniacal, just acidified with sulphuric acid, and titrated with thiosulphate after addition of 3 grms. of potassium iodide. W. R. S.

Separation and Estimation of Zinc as Zinc Ammonium Phosphate. P. Artmann. (*Zeitsch. anal. Chem.*, 1923, **62**, 8–23.)—Pure precipitated zinc ammonium phosphate was boiled with water under reflux. After three hours' boiling, it was found to have been completely hydrolysed according to the equation $3ZnNH_4PO_4 \rightleftarrows Zn_3(PO_4)_2+(NH_4)_3PO_4$. On boiling with ammonium chloride, zinc ammonium phosphate is converted into zinc chloride; the solvent power of ammonium salts decreases in the order chloride-tartrate-nitrate-phosphate. Ammonium phosphate depresses the solubility of zinc ammonium phosphate in ammonium chloride. The following conditions are recommended for the quantitative precipitation of zinc:—The ammoniacal solution is neutralised at 60° to 70° C. with nitric acid; a slight excess is not harmful provided a sufficiency of ammonium phosphate is present; if more nitric acid is present, 1 to 2 grms. of sodium acetate may be added. The concentration of ammonium ion (other than phosphate) should not be higher than normality. The quantity of ammonium phosphate added should be such that the concentration of the salt after precipitation of the zinc is at least 0·2 *N*. If the solution contains ammonium tartrate (in the separation from nickel), the addition of ammonium phosphate must be increased at the rate of 0·5 grm. per 2 of tartrate. When the zinc is precipitated, the solution should be heated only to incipient boiling and left to stand on a water-bath for 20 minutes (*cf.* ANALYST, 1922, **47**, 91). *Separation from mercury.*—The solution (100 c.c.) containing 0·1 grm. of zinc and not more than 0·4 grm. of mercury, is treated with 6 grms. of ammonium nitrate, 10 to 20 c.c. of 5 *N* ammonia and 10 c.c. of 3 *N* ammonium phosphate solution, heated to about 60° C., and neutralised with 5 *N* nitric acid with constant stirring. It is heated just to boiling and left to settle for half an hour. The precipitate is collected in a Gooch crucible, washed first with hot one per cent. ammonium phosphate solution, then with water, and dried at 105° C. If more mercury than zinc is present the precipitation must be repeated. *Separation from nickel.*—The bulk of solution should be 120 to 150 c.c.; not more than 0·1 grm. each of zinc and nickel should be present; 30 c.c. of 2 *N* ammonium tartrate solution are added per 0·1 grm. of nickel. Before neutralisation with nitric acid, addition of 1 to 2 grms. of sodium acetate is recommended. The precipitation should always be repeated, otherwise the procedure is the same as in the preceding case.

W. R. S.

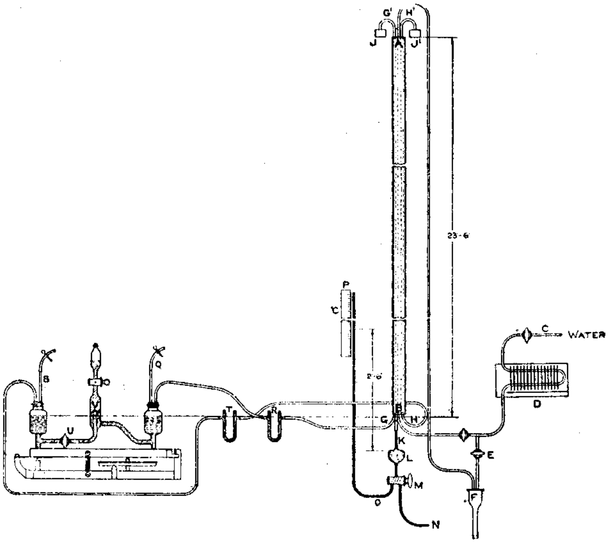
Electrometric Titration of Cobalt with Silver Nitrate. E. Müller and H. Lauterbach. (*Zeitsch. anal. Chem.*, 1923, **62**, 23–28.)—The method used for the electrometric estimation of nickel (ANALYST, 1923, 42) was successfully applied to cobalt. The neutral cobalt solution is treated with a measured excess of cyanide solution, which is titrated with standard silver solution. The strength of the cyanide solution has been determined by titration with the silver solution. The apparatus for the estimation of cobalt is the same as described for nickel, but the rheostat is adjusted to 0·290 volt. The galvanometer indicates zero when one atom of cobalt has combined with 5CN; this observation confirms the results obtained by other investigators, according to whom the compound $K_3Co(CN)_5.H_2O$ is formed. The formula for calculating the quantity of cobalt is

$$\frac{(m-n)\,a \times 2 \times 58{\cdot}97}{5 \times 107{\cdot}88},$$

in which m = c.c. of silver solution corresponding to the total volume of cyanide solution used, n = c.c. of silver solution corresponding to the excess of cyanide solution added to the cobalt solution, and a = grms. of silver in 1 c.c. of silver solution. W. R. S.

Physical Methods, Apparatus, etc.

Distribution Coefficients and the Estimation of Organic Acids by Extraction. J. Pinnow. (*Zeitsch. Untersuch. Nahr. Genussm.*, 1922, **44**, 204-209.)—Acetic acid and formic acid form double molecules in ether, and this explains the irregularities which have been observed in the estimation of the distribution coefficient of formic acid. As far as there is no formation of double molecules in water, the dissociation coefficient of the double molecule is 1·776 for acetic acid and 4·77 for formic acid, at 15° C.; the calculated distribution coefficient for the individual molecule ($c_W:c_E$) is 2·21 for acetic acid and 2·38 for formic acid at 15° C., and 2·79 for formic acid at 26·3° C. The presence of sugars does not influence the extraction of succinic acid from its aqueous solution. W. P. S.



Apparatus for the Measurement of the Specific Gravity of Gases in Small Quantities. A. Blackie. (*Fuel Research Bd. Tech. Paper No.* 5.)*—The apparatus figured is designed on lines similar to that of Threlfall (*J. Soc. Chem. Ind.*, 1907, **26**, 355) on the principle of the Chattock Tilting Gauge; a column of the gas is balanced against an equal column of air and the difference of pressure measured. The apparatus is suitable for measuring the specific gravity of gases with a limit of error of only ±0·5 per cent. when working on about 250 c.c. *AB* is a copper tube 24 in. long by $1\frac{3}{4}$ in. internal diameter through which water can be passed, and which acts as a jacket for the gas tubes. Water from the main *C* passes

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* H.M. Stationery Office, London, Manchester, Cardiff, and Edinburgh. Price 4d.

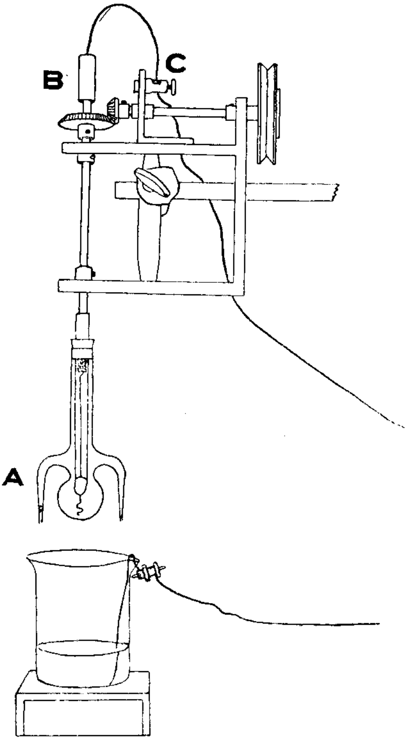
through a heater *D*, and enters the jacket at *B*. *E* is the cock for draining. The jacket contains four copper tubes of $\frac{1}{4}$ in. internal diameter, of which the tubes *GG′* and *HH′* contain the gas and air subject to experiment; the lower ends are connected to the tilting gauge, which contains salt solution of known density, and the upper ends dip into drums *JJ′* perforated for the purpose of bringing the top of the column to barometric pressure. The temperature of the jacket is measured by an air thermometer which has been standardised by an electrical resistance thermometer. The fourth tube forms the tube of the air thermometer; its lower end is connected with the capillary tube *K* of 1 mm. diameter sealed to the reservoir *L*, to the bottom of which connects another capillary tube to the stop cock *M*, one side of which forms a U-tube of 1·5 mm. capillary glass evacuated and sealed at *P*. *N* serves simply to adjust the level of the mercury. For use the tube *OP* and the reservoir *L* are filled with mercury until the latter is almost full, *K* being open to the air. The tube *K* and bulb filled with dry air are then connected by the rubber joint. When the temperature of the bulb increases the pressure of the air increases the height of the mercury in *OP*. The course of the air and gas is as follows: air enters one bulb of the gauge through a small tube *Q*, then through the calcium chloride tube *R* and thence to the copper tube *GG′*. On the other side air or gas can be fed through the tubes *S* and *T* to the copper tube *HH′*. The cock *U* must be closed when altering the air or gas in the apparatus. In making a measurement air is filled into both tubes through *S* and *Q*, which are then closed. The reading corresponding to the top of the meniscus is taken on the micrometer which tilts the gauge. Gas is then fed into *S* with the tap *U* closed, and the tubes *G* and *H* are full of air and gas respectively. *S* and *Q* are closed, *U* is opened, and the new reading is taken. The specific gravity of $\frac{\text{Dry air}}{\text{Dry gas}}$ is therefore

$$\frac{\text{weight of column of dry air} - \text{difference of weight by gauge}}{\text{weight of column of dry air.}}$$

The difference of weight by the gauge = difference in the micrometer reading + a constant which remains the same so long as the density of the salt solution is not altered.

H. E. C.

Simple Apparatus for Electrometric Titration. W. E. Garner and C. A. Waters. (*J. Soc. Chem. Ind.*, 1922, **41**, 337–338T.)—This apparatus (*cf.* Treadwell and Weiss, *Helv. Chim. Acta*, 1919, **2**, 680) consists of an electrode vessel attached to a rotating stirrer. The electrode vessel A carries a small bulb and two side tubes turned downwards and constricted at the ends. The appropriate metal used as electrode is either fused or waxed into a thin glass tube and attached by a small binding screw to a rotating spindle, electrical connection being made through a steel mercury cup B with a binding screw C. The constricted side tubes of the electrode vessel are packed with asbestos, as described by Treadwell, and the vessel is completely filled with electrolyte and supported from the glass tube by means of a waxed cork. To prevent the formation of bubbles in the constricted tubes, it is advisable to store these in a solution of the electrolyte of the same strength. It is essential also to avoid the presence of a bubble of air in the electrode vessel itself, as this increases the sensitiveness towards change of temperature and leads to leakage during the analysis. The downturned capillaries render it possible to start a titration with 5 c.c. of solution in the beaker, whereas Treadwell's apparatus of corresponding capacity requires nearly 50 c.c. before the ends of the capillaries are immersed. The electrode is best driven at the rate of 80–90 revolutions per minute. The outer electrode may be of any convenient form, such as that shown. In this particular instance the electromotive force generated between the electrodes was measured by means of a high-resistance millivoltmeter (1000 ohms) connected with one of the arms of a resistance box. The electrodes were connected across the whole resistance of the box (10,000 ohms), and the resistances in the two arms of the box adjusted so as to give the maximum deflection in the millivoltmeter. In the case of silver titrations results within 0·05 c.c. of $N/100$ sodium chloride solution were obtained, and zinc titrations with potassium ferrocyanide proved equally satisfactory. For titration of sulphates with barium salts the method is inapplicable, except in the case of sulphates of the alkali metals. T. H. P.



New Vessel for Electrometric Titration. W. T. Bovie. (*J. Amer. Chem. Soc.*, 1922, **44**, 2892–2893.)—The vessel is constructed of Pyrex glass and has a capacity of about 150 c.c. The lower conical end is prolonged into a solid rod, serving as support when dropped into a small metal stand. The upper part of the vessel is provided with four necks, into which are fitted, by means of rubber corks, a hydrogen electrode of the bubbling type, a calomel electrode and a burette. The fourth neck is convenient for the introduction of solutions, indicators, etc., and may be closed when necessary. The vessel is admirably adapted for use in classes and in research work. T. J. W.

New Colorimeter for Bio-colorimetric Work. V. C. Myers. (*J. Biol. Chem.*, 1922, **54**, 675–682.)—The apparatus consists of a vertical wooden box, to the front of which is fitted an eyepiece with divided field obtained by the use of a pair of prisms similar to those employed in the Duboscq form of instrument. Behind the left prism three vertical hollow glass wedges are arranged within the box, the vertical height of these being indicated by millimetre scales above the top of the box. A small glass cell for containing the liquid under examination is fitted to a door in the side of the box which, when closed, places the cell behind the right prism. Illumination is provided by an opal glass window at the back of the box for use with daylight, or by a reflecting surface of aluminium paint illuminated by a small nitrogen-filled half-watt electric lamp. When in use, one of the wedges is filled with a solution of the indicator containing sufficient acid to produce the maximum acid colour, whilst another contains a similar solution rendered alkaline. By varying the relative vertical positions of these wedges a colour equal to any P_H value within the range of the indicator may be obtained. For determining very small differences in P_H value the indicator solutions may be prepared with standard buffer solutions within a narrow range. The third wedge is employed to compensate for any colour or turbidity in the solution under examination, and it may be filled with this solution and adjusted to match the liquid contained in the cell before the addition of the indicator. The apparatus is of wide application and, under favourable conditions, will give readings with an accuracy of P_H 0·02.

T. J. W.

Reviews.

A DICTIONARY OF APPLIED CHEMISTRY. Vol. IV.; L—OXYDISILIN. By SIR EDWARD THORPE, C.B., F.R.S., assisted by Eminent Contributors. Revised and enlarged edition. Pp. 740. London: Longmans, Green & Co. 1922. Price 60s. net.

The four volumes of Thorpe's Dictionary which have appeared embrace the subject matter embodied in three volumes of the 1912 Dictionary; it is evident, therefore, that the work will probably be completed in seven volumes, plus (it is to be hoped) an Index.

This volume shows careful revision of the important articles, and is well up-to-date, but some few of the sub-headings would bear a little expansion. Under "Lead," for example, the new smelting processes are fully described, and there is a most interesting account of the atomic weight of lead in relation to its isotopes and transmutations; there is, however, no new work incorporated on the important subject of the action of water upon lead, but perhaps this may be included when the new article on "Water" appears. Some very valuable additions in the volume are upon Monazite and its analysis, Nephelometry, Nitron, and

Odour and Chemical Constitution; articles on the following are much enlarged:—Margarine, Metallography, Utilisation of Atmospheric Nitrogen, and Nickel. The subject of Micro-Balances has disappeared, having been already adequately dealt with in Volume I. under Balance.

An excellent presentation of Nephelometry is made; the important distinction between a turbidimeter and a nephelometer is noted, and much is made of the increasing usefulness of the latter instrument not only for purposes of research, but for technical methods.

Metallography occupies some twenty-two pages, thoroughly packed with the essentials, but rather suffering from limitation ot space. The recent improved methods of taking and recording thermal curves, of heating and cooling specimens at uniform rates, are now included, but some extension under this heading would probably enhance its value to readers who are not quite familiar with the subject; for example, a short resumé of etching reagents and their application, and some few practical instructions in polishing would certainly provide for the initial requirements of the reader wishing to acquire the rudiments of this applied science.

The article on Odour and Chemical Constitution makes interesting reading, and affords a useful synopsis for those who have not specially read this subject.

As a model of what such an article should be, possibly the reference to Lubricants stands out, being up-to-date, short and to the point. In the revised section of Nitrogen much more space is taken for Haber's process, and this, with the oxidation of ammonia, are described as warranted by their importance; it is indeed refreshing to notice the large number of English names quoted in reference to papers and patents, and although the industry is at present depressed, it is to be hoped that English work in this direction will not cease.

The Mond, Orford and electrolytic methods for Nickel refining are all mentioned—in fact, the industrial sections generally show the immense strides made by this country in recent years in chemical industry.

The reviewers would venture, however, to make one criticism, and that is that a few of the articles upon purely chemical subjects are far too long and too academic. Some are reminiscent of the abstracts of the Chemical Society or of "Beilstein"—*e.g.* the article on Naphthalene now extends to 106 pages, and briefly describes over a thousand compounds; a separate index should be given to this article alone. The industrial importance of Naphthalene certainly is very great, but it is doubtful whether it may be necessary to give such detailed information about its countless derivatives in a work of this kind. The articles on Methyl, Malonic acid and some of the dye-stuffs also read like a text book on a special branch of organic chemistry. One curious arithmetical error may be noted for future correction: On page 234, "8 million gross of boxes of sixty each" would contain **69,120** millions of matches, not **480** millions.

The very high standard of the preceeding volumes of this work is well maintained in its general excellence and accuracy throughout.

G. R. THOMPSON.
H. E. COX.

THE THEORY OF ALLOTROPY. By A. SMITS, Ph.D. Translated from the German by J. SNEATH THOMAS, D.Sc. Pp. xiii.+397. London: Longmans, Green & Co. 1922. Price 21s. net.

The book under review, which is a translation of the original recently published German edition, is not, as the title might suggest, a critical survey of the subject of allotropy, but is an elaborate treatment of the author's own theory.

The author takes as his starting point the known phase complexity of certain substances, as exemplified by tautomeric compounds, and then making use of the Planck potential, examines all the possible pseudo-binary systems in the light of the phase rule, deducing the ordinary phenomenon of allotropy as a special case of a more general theory. The existence of at least two different molecular species is thus postulated as the starting point, and the general theory is not dependent on their nature.

The book is divided into two sections, namely, Theoretical and Experimental. The theoretical section treats first the phase rule equilibrium relationships and the consequences which can be predicted from the complexity of phase; and secondly, with an extension of the theory to the problems of electrochemistry, in particular of passivity and over-voltage. This section, as well as the later experimental section, is profusely illustrated with diagrams, many of which are, unfortunately, badly reproduced, and far from clear. The treatment given to some of the systems is very brief, and symbols are constantly introduced without an explanation of their meaning, thus making this part of the book somewhat difficult for a reader not actively engaged in this particular field. In the extension to electro-chemistry it is doubtful whether some of the assumptions made are really justified; in particular the application of the mass law directly to the equilibrium between ions, electrons and neutral metallic atoms in the solid state, although it must be admitted that the author views are plausibly stated. Apart from these objections, the theory appears to provide a useful method of investigating the problem of allotropy and of phase complexity.

In the experimental section of the book a great many systems have been examined in the light of the author's theory, and whereas in the domain of the theory proper experiment is in good accord with theory, in the extension to electrochemistry the agreement is not always so convincing.

The book is not one for the casual reader, since the subject is presented in a manner which necessitates careful reading. Many of the conclusions reached by the author are unlikely to be accepted without considerable opposition, but the book is certain to stimulate interest in this important field, and will serve a useful purpose in indicating future lines of investigation.

C. S. SALMON.

THE THEORY OF EMULSIONS AND EMULSIFICATION. By WILLIAM CLAYTON, D.Sc. Pp. vii.+160. Text-books of Chemical Research and Engineering. London: J. and A. Churchill. 1923. Price 9s. 6d. net.

This book, as its author points out, is the first of its kind in the English language. In view of the theoretical and technical importance of emulsions, our indebtedness to Dr. Clayton for undertaking the task is very considerable. In a sense this treatment of emulsions rounds off the subject of margarine already treated by Dr. Clayton in an earlier work. Emulsions, however, are of peculiarly wide significance, not limited to any individual industry—so much so, indeed, that an adequate knowledge of such systems is now-a-days almost indispensable for any technical chemist. Dr. Clayton's intimate personal knowledge of the subject is a guarantee that the presentation is both well balanced and comprehensive.

The scope of the book is indicated by the chapter headings, which are as follows:—Emulsions and Emulsifying Agents, the Properties of Emulsions, Earlier Theories of Emulsions, Adsorption at liquid/liquid Interfaces, Dual Emulsions and the Inversion of Phases, the Modern Adsorption Film Theory, Physical Measurements in Emulsions, Emulsification, and De-emulsification. In addition to numerous references in the text, a valuable bibliography has been compiled which aims at giving the more important papers relating to the subject since the year 1865.

The book is written in an exceedingly readable style, and the whole exposition is remarkably clear. The treatment is essentially descriptive, as indeed must be the case when an attempt is made to present the whole subject within the limits of a monograph and also because of the fact that, as the author himself points out, a really comprehensive theory of emulsions and emulsification has yet to be worked out.

To read Loeb's book on the Proteins (which was reviewed in THE ANALYST a little time ago) and Clayton's book on Emusions, will give a clear idea of the two most important and distinct paths along which advances in colloid chemistry—using the term in its widest sense—have been, and are being made.

W. C. M. LEWIS.

THE NITROGEN INDUSTRY. By J. R. PARTINGTON, M.B.E., D.Sc., and L. H. PARKER, M.A., D.Sc., F.I.C. Pp. xi.+336. London: Constable & Co. Price 21s. net.

The importance of a self-contained nitrogen industry in every civilised country as an aid both to economic welfare and to effective warfare, has now become evident, even to those whose scientific knowledge is of the most sketchy type. Drs. Partington and Parker have contributed a useful volume in an endeavour to popularise this scientific axiom. Attention is paid to three aspects of the problem—the natural nitre deposits of Chile; the recovery of the nitrogen present in our national fuel, coal; and the fixation of atmospheric nitrogen in the form of ammonia, cyanamide and nitric acid. A chapter is likewise devoted to the problem of the oxidation of ammonia.

The book is of interest in that, as far as the reviewer is aware, it contains the first published account of some of the activities of the Nitrogen Products Committee's experimental staff and their contributions to the economic solution of the nitrogen problem.

Great attention is paid to the question of cost in the various methods discussed; and although at the present time the figures submitted are by no means valid, an approximation to the comparative values of different processes can be made; it has to be realised, however, that the recent fall in prices is by no means general.

Good but somewhat brief technical descriptions, illustrated by a few good photographs, add to the interest of the book, whilst the chemistry is sufficiently clear and concise not to make the contents unintelligible to the lay reader. It is questionable, however, whether the reactions discussed on p. 270 and 323 follow such a simple course as indicated by the authors; whilst the cyanide process mentioned on p. 231 is certainly worthy of more detailed mention, being, in all probability, the process of the future. Exception to this otherwise admirable volume might be taken in the fact that the authors thread their nitrogenous beads on a twisted double thread. One thread, clearly discernible throughout the book, is that the authors take it as axiomatic that neither government nor technical manufacturer regard the scientific or academic investigator with any pleasure or interest. In reality, it is probably the reverse of true; great interest is taken in pure science, but it is thought that the scientist flourishes most readily in adversity, if not in actual penury. The other thread, discernible at times between the beads, is that apparently the authors consider that the handing of the information collected by the Government during and after the war on the nitrogen problem "lock, stock and barrel" to Messrs. Brunner, Mond & Co. is a breach of faith with the English people in general, and with the Nitrogen Committee in particular. It is, of course, true that the experimental staff are still awaiting their reward in this world and may obtain it in the next, but the effect of Government enterprise in chemistry has in other directions been so inauspicious as to indicate that the policy of transfer was the wisest one to adopt. How far the lucky recipient will utilise or treasure his talent time alone will show, but from all accounts no mean progress has already been made.

ERIC K. RIDEAL.

FLAVOURING MATERIALS, NATURAL AND SYNTHETIC. By A. CLARKE. Oxford Technical Publications. Pp. vii.+166. London: Henry Frowde and Hodder & Stoughton. 1923. Price 8s. 6d. net.

The author of this little volume is to be congratulated on the extent and the accuracy of the information he has compressed into its pages. The introduction on the sense of taste is interesting, and the little bibliography, though not very full, is, at any rate, well up-to-date.

Much care has been given to the "Contents" of each chapter, and a perusal of these pages shows the variety of the materials dealt with; the micrographs in the Section devoted to Spices and Condiments are apparently original and quite good. In the text relating to analytical methods (p. 28) is the statement: "The amount of ash soluble in hydrochloric acid (sand) is estimated . . . ;" surely this might be better expressed.

In Section II., Essential Oils, the descriptions of processes for what the author calls "the recovery of essential oils" are so brief as to be almost useless, though some attempt at detailed information has been made in the paragraph on "Expression." In the consideration of the analytical methods for the examination of essential oils no reference is made to the determination of the solubilities of such oils in alcohol, yet the systematic survey of essential oils (Chapter VI.) contains numerous references to such solubilities. The information on the properties of various essential oils is well written and, though suffering a little from condensation of matter, is comprehensive, accurate and covers a very wide range of oils, whilst the frequent references to current literature add greatly to the utility of this portion of the book.

The recipes (compounded flavours, etc.) are of the type usual in books, but the author apparently realises this, and does not claim that they are anything other than indications of how flavourings and perfumes can be mixed. An abstract of recent articles on the compounding of floral perfumes published in the P.E.O.R. would have added materially to the value of this section.

The odorous chemical products are dealt with in Section IV., and this appears to be the weakest portion of the book, more especially when references are made to the preparation of the various substances, since the author has not introduced a first-hand knowledge of how many of the "Synthetics" are actually made. The information concerning the ionones might well be revised in a future edition and a little slip corrected, *viz.* "Pseudo-ionone, or homologous bodies, is first prepared by shaking with acetone, or homologues of acetone, in presence of baryta . . . for two or three days;" of course, the presence of citral is to be inferred. The method given for the formation of anthranilic acid (p. 144) *viz.* fusing indigo with caustic potash, is merely of scientific interest and never used for making this substance, as the anthranilic acid is manufactured as a stage in the production of synthetic indigotin (artificial indigo). The temperature at which the specific gravity of methyl anthranilate was determined might have been given, as this substance is crystalline, but melts at a low temperature and often remains liquid. The book would be much improved in a future edition by inserting the actual methods, if only in outline, and by the deletion of much useless information; for example, the information on the preparation of indol and skatol is quite useless. It is satisfactory to note that the term "artificial musk" is avoided, but the description "synthetic musk substitutes" might well have been introduced, and the descriptive matter could be amplified considerably.

The book is provided with a comprehensive index and, apart from the few shortcomings mentioned above, is a valuable addition to the library of every chemist interested in flavouring materials, and both the publishers and the author are to be congratulated on the production of such a well produced book at, in these times, such a moderate price.

L. GUY RADCLIFFE.

CAROTINOIDS AND RELATED PIGMENTS. THE CHROMOLIPOIDS. By LEROY S. PALMER, Ph.D. (American Chemical Society Monograph Series.) Pp. 316. New York: Chemical Catalog Co. Inc. 1922. Price $4.50.

It might at first sight be doubted whether the subject of the chromolipoids is sufficiently advanced either on the chemical or the physiological side to justify its selection for a monograph of this series. The book, however, discloses so many avenues for the investigator and brings together so much interesting information that one feels that the decision of the editors has been justified.

The author gives a history of the development of the subject, beginning with the work of Thudichum. Special attention is paid to the nomenclature adopted by each worker, the student being thereby saved much confusion in consulting the authorities quoted. The nomenclature adopted by the author is that of Tswett.

The distribution of the carotinoids in the organs of plants, and the attempts at their separation culminating in the achievements of Willstätter, are exhaustively dealt with. A vast literature is quoted in this connection, and forms an almost complete work of reference. The treatment of the subject fails somewhat in distinguishing pioneer workers who advanced the subject many stages—such as Stokes and Willstätter—from a countless host of lesser lights. This chapter opens up an immense number of problems, and presents the reader with a store of suggestive facts hitherto buried in the archives.

A particularly interesting section treats of the passage of the carotinoids from plants to animal tissues. In dealing with this subject the author is on familiar ground, since for much of the research he and his co-workers are responsible. The identification of the pigment associated with serum albumin of herbivores with the carotin of the green plant and the history of its subsequent concentration in the corpora lutea and in the milk fat, makes an interesting chemical story still lacking a physiological explanation. It is parallelled by the presence of xanthophyll (or xanthophylls) in the blood of fowls, and the subsequent concentration of this pigment in egg yolk, a subject on which the author's own researches have thrown much light.

The obscure question of the function of the carotinoids in plant tissues is dealt with in Chapter XI. In the same chapter their possible function in animals is also discussed, with especial reference to the question of their identity or association with the fat-soluble vitamin. The author—largely as a result of his own careful investigations—produces strong evidence against such an identity, and regards the association as probably fortuitous. He considers that no evidence is at present forthcoming which throws any light on the function of the carotinoids in the animal body.

The book, regarded as a whole, forms an invaluable work of reference; where so much detail is given it is perhaps a pity that more of the chemical manipulations by which the pigments are separated and identified are not described. The contribution of Willstätter to the chemistry of the subject, showing the necessity for, and methods of, extracting large quantities of plant or animal tissue in order to isolate the pigment in a pure condition and to establish its chemical constitution is hardly sufficiently stressed.

The book contains an excellent bibliography and is fully indexed.

M. STEPHENSON.

THE INLAND LAKES OF WISCONSIN. THE PLANKTON. I. ITS QUANTITY AND CHEMICAL COMPOSITION. EDWARD A. BIRGE AND CHANCEY JUDAY. Wisconsin Geological and Natural History Survey. Bulletin No. 64. Scientific Series No. 13. Pp. 222. Madison: Wisconsin, U.S.A. 1922.

This monograph records the results of a most exhaustive study of the fresh water plankton at the Wisconsin lakes. Most of the space is devoted to the question of the distribution of the various species and their seasonal variations, but large numbers of chemical analyses of the organisms are tabulated. The significance of the plankton as a source of food for larger animals is apparent from an estimate that the mean quantity of dry organic matter in the standing crop of total plankton of Lake Mendota amounted to an average of 214 lbs. per acre.

J. C. DRUMMOND.

New British Chemical Standard.

BASIC SLAG "A"

(ANALYTICALLY STANDARDISED SAMPLE).

THE organisers of the British Chemical Standards Movement are pleased to announce the issue of a Basic Slag Standard.

The special uses of the slag are :—(1) Primarily as an analytical standard for total phosphoric acid and phosphates. (2) In addition, as a standard mainly for basic steel makers, but also for acid steel makers, iron and steel founders and others, to enable them to check their methods for silica, iron, lime and magnesia, etc., in slag.

The analysis is as follows :—Phosphoric anhydride (P_2O_5), 12.93 (equal to phosphates ($Ca_3P_2O_8$), 28.24 ; iron, 8.97 ; and silica, 16.15 per cent.

During the standardisation of this slag the need for such a standard has been made abundantly evident to the organisers, for it has been found that even in the estimation of such elements as iron, silica, lime and magnesia, which, it may be thought, present little or no difficulty, improvements in methods have been essential in order to get agreement between experienced chemists.

The standard has been tested by a selection of 16 prominent chemists representing :—Independent Analysts (1) Metallurgical, (2) Agricultural ; U.S. Bureau of Standards ; English and French Iron and Steel Works Chemists (manufacturers) ; and English Basic Slag Grinders and Merchants.

The standard sample may be obtained in 100 or 50 grm. bottles either direct from Organising Headquarters, 3, Wilson Street, Middlesbrough, or through any of the leading laboratory furnishers at a price just sufficient to cover the cost. A certificate giving the names of the analysts co-operating, the types of methods used, and a detailed list of the results will be supplied with each bottle.

A special *new* feature of this certificate is the very full notes on the methods used by the different chemists (3 quarto pages in small type).

It is hoped that chemists will take full advantage of this standard, which has been prepared with the object of promoting unification of analysis.

Publications Received.

CHEMICAL REACTIONS AND THEIR EQUATIONS. By J. W. D. HACKH. Pp. 131. London: Chapman & Hall. Price 6s. net.

CEMENTS AND ARTIFICIAL STONE. By J. WATSON. Cambridge: W. Heffer & Sons Ltd. Price 6s. net.

FUNDAMENTALS OF BIO-CHEMISTRY. By T. R. PARSONS. Cambridge: W. Heffer & Sons Ltd. 1923. Price 10s. 6d. net.

OPTICAL METHODS. Vol. I. 2nd Ed. By J. N. GOLDSMITH, S. J. LEWIS, F. TWYMAN. London: Adam Hilger Ltd. 1923. Price 1s. 6d.

TECHNICAL PAPERS. DEPT. OF THE INTERIOR, BUREAU OF MINES, U.S.A.

No. 188. CORROSION UNDER OIL FILMS, with Special Reference to the Cause and Prevention of the After-Corrosion of Firearms. By W. J. HUFF. Pp. 26. 1922.

No. 290. INCLUSIONS IN ALUMINIUM-ALLOY SAND CASTINGS. By R. J. ANDERSON. Pp. 25. 1922.

No. 292. TESTS OF GAS MASKS AND RESPIRATORS FOR PROTECTION FROM LOCOMOTIVE SMOKE IN RAILROAD TUNNELS; WITH ANALYSES OF TUNNEL ATMOSPHERES. By A. C. FIELDNER, S. H. KATZ and S. P. KINNEY. Pp. 27. 1922.

No. 309. RECENT PROGRESS IN THE THAWING OF FROZEN GRAVEL IN PLACER MINING. By C. JANIN. Pp. 34. 1922.

Bull. No. 199. EXPERIMENTAL PRODUCTION OF ALLOY STEELS. By H. W. GILLETT and E. L. MACK. Pp. 81. 1922.

The Institute of Chemistry of Great Britain and Ireland.

PASS LIST.

JANUARY EXAMINATIONS: 1923.

The following Associates have passed the examination for the Fellowship:—*In Branch E, The Chemistry, including Microscopy, of Food and Drugs*: J. W. Hawley, B.Sc. (Lond.), and J. King.

The following candidates have passed the examination for the Associateship:—*Current Regulations in General Chemistry*: G. W. Bender, A. P. Cattle, J. Lomax, F. C. Madden, J. B. McKean, C. J. Powell, T. E. S. Reynolds. *Regulations prior to* 1920; *in Branch* (*a*), *Mineral Chemistry*: T. W. Dallimore and W. Smith. *Regulations prior to* 1920; *in Branch* (*d*), *Organic Chemistry*: M. H. Hansford, V. T. Tadman and G. Taylor.