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THE ANALYST.

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

ANNUAL GENERAL MEETING AND ORDINARY MEETING HELD FEBRUARY 5, 1919.

THE annual general meeting of the Society was held on Wednesday, February 5, in the Chemical Society's Rooms, Burlington House, W. The President, Dr. S. Rideal, occupied the chair.

The minutes of the previous annual general meeting were read and confirmed.

Messrs. G. J. Alderton and N. T. Foley were appointed scrutators of the ballot-papers for election of Officers and Council for 1919.

The Acting Honorary Treasurer presented the accounts of the Society for 1918, and votes of thanks were passed to the Acting Hon. Treasurer and Hon. Secretaries.

Messrs. Marreco, Houseman and Rixon, chartered accountants, were appointed auditors of the Society's accounts for 1919.

The President delivered his annual address.

Dr. J. A. Voelcker 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. John Hughes, and the motion was carried by acclamation.

The scrutators having reported the result of their examination of the ballot-papers, the President announced that the Officers and Council for 1919 had been elected in accordance with the Council's nominations, as follows:

President.—Samuel Rideal.

Past-Presidents Serving on the Council (limited by the Society's Articles of Association to eight in number).—Leonard Archbutt, Edward J. Bevan, A. Chaston Chapman, Bernard Dyer, George Embrey, Otto Hehner, E. W. Voelcker, J. Augustus Voelcker.

Vice-Presidents.—W. T. Burgess, G. N. Huntly, Alfred Smetham.

Hon. Treasurer.—Edward Hinks.

Acting Hon. Treasurer.—E. W. Voelcker.

Hon. Secretaries.—P. A. Ellis Richards, E. Richards Bolton.

Other Members of Council.—W. Bacon, W. J. A. Butterfield, H. G. Colman, G. D. Elsdon, R. Hellon, D. Lloyd Howard, H. Hurst, C. A. Keane, W. H. Simmons, W. Lincolne Sutton, G. Rudd Thompson, J. F. Tocher.

An ordinary meeting followed the annual general meeting, the President, Dr. S. Rideal being in the chair.

The minutes of the previous ordinary meeting were read and confirmed.

A certificate for election in favour of Mr. C. W. Wood was read for the second time, and certificates in favour of Mr. Robert Odell Bishop, c/o Messrs. Fullers, Ltd., Hammersmith, W. 6, Works Chemist at Messrs. Fullers, Ltd.; Dr. Hubert William Bywaters, Ph.D., F.I.C., The Laboratory, Messrs. J. S. Fry and Sons, Bristol, Chemist to Messrs. J. S. Fry and Sons, Ltd.; Lieut. Bernard Scott Evans, M.C., B.Sc. (Lond.), F.I.C., 18, Keymer Road, Streatham Hill, S.W. 2; Mr. Frank Scott Foweather, M.Sc., A.I.C., 62, Dale Street, Liverpool, analytical, consulting and technical research chemist; Mr. Robert Atkinson Oddy, The Laboratory, Abbey Street, Toad Lane, Rochdale; Mr. William Branch Pollard, Turf Club, Cairo, Chemist to the Government Analytical Laboratory, Cairo; and Dr. Charles Kenneth Tickler, F.I.C., King's College for Women, Campden Hill Road, W. 8, Head of the Chemistry Department, King's College for Women, were read for the first time.

Messrs. S. H. Blichfeldt, J. C. N. Eastick, A.I.C., R. H. Pickard, D.Sc., Ph.D., F.R.S., F.I.C., L. G. Radcliffe, M.Sc. Tech. (Manc.), F.I.C., J. Smith, and F. E. Weston, B.Sc., were elected members of the Society.

The following papers were read: "Technique of Iodine Determinations, with a Note on a New Machine for Subdividing Oleaginous Seeds," by John Allan; "Recovery of Nessler Reagent," by D. Pullman; and "The Use of *o*-Tolidine as a Colorimetric Test for Gold," by W. B. Pollard.

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ANNUAL ADDRESS OF THE PRESIDENT.

(Delivered at the Annual General Meeting, February 5, 1919.)

THIS Annual Address is written under happier conditions than four of its predecessors. I am sure you will allow me as your President to put on record our heartfelt hope that the Conference now assembled in Paris may lay the foundations for a lasting peace among the nations, and that this Society may resume its normal career of activity devoted to the advancement and betterment of the branch of Applied Chemistry which we are associated together to promote. The aftermath of war, however, leaves us with many unsolved problems and irreparable losses, which seem almost impossible to mitigate.

I wish to thank our members for the services which they have rendered during the war in the defence of their King and country, and to ask them to be prepared for still greater exertion and more efficiency in the reconstruction which lies ahead.

During these anxious times it is satisfactory to record the progress of the Society.

The total number of members at December 31, 1918, including twelve honorary members, was 439, which figure included seventeen new members and allowed for five deaths and nine resignations, thus giving us a net gain of three. This figure is practically identical with our pre-war strength (440 at the end of 1914). I hope that now we may have an accession of new members. I ask those who have recently joined us to help our Society by their attendance at our meetings and by contributions to our proceedings, so that we may be worthy successors of those who pioneered the Society in the days which have passed.

Our losses by death during the year were Harry Broadbent, James Nimmo, Alfred Gordon Salamon, Thomas Tyrer, and Reginald Cowdell Woodcock. They were well known to most of us, and we deplore their loss.

Thomas Tyrer was one of the few remaining chemists who received their training at the Royal College of Chemistry under Hoffmann; a notice of his life appeared in the ANALYST in May, 1918.

Alfred Gordon Salamon died on April 10, and his obituary is recorded in the June number; he was a member of this Society since 1887.

Harry Broadbent died on July 25. He was not a frequent attendant at our meetings, as he lived and worked at Leeds, where for many years he was in charge of the laboratory of Messrs. Goodall, Backhouse and Company, of that city.

James Nimmo joined our Society in 1879, and was very constant in his attendance at our meetings. He died on December 3, and his obituary will be found in the January ANALYST of this year.

Mr. Woodcock was associated with Mr. C. T. Kingzett, and collaborated with him in many of his investigations on disinfectants.

During the past year thirty papers were read at our meetings, and twenty-eight original communications and forty-eight "Notes" on Analytical practice and kindred matters have been published in the ANALYST. These "Notes" commenced in the January (1918) number of the ANALYST, and have been continued throughout the year. They have brought to the notice of our members many interesting suggestions, and I am sure have been welcome additions to the Journal, and it will be the wish of the Society to continue their publication.

Titles of papers read at the meetings of the Society, and published in the ANALYST during 1918, are as follows:

"The 'Valenta Number,' as a Discriminating Test for Oils and Fats." By Percival J. Fryer and Frank E. Weston.
"The Reductase Test for Milk." By P. S. Arup.
"The Composition of 'Sharps' and Bran, and the Effect thereon of the Food Controller's Orders." By H. E. Cox.
"A Modified Acetic Acid Reagent for Valenta Tests." By Albert E. Parkes.
"Estimation of Potash." By Bertram Blount.
"Graduation and Calibration of Gerber New Milk Butyrometers." By F. E. Day and Michael Grimes.
"Dog-Fish Liver Oil." By A. Chaston Chapman.
"Estimation of Moisture and Total Fatty Matter in Acid Oils and Soap Stocks." By E. R. Bolton and Cecil Revis.
"Deterioration of Lime on Keeping." By S. Allinson Woodhead.
"Analysis of 'Cocoa Teas.'" By Julian L. Baker and H. F. E. Hulton.
"Estimation of Shell in Cocoa and Cacao Products." By Julian L. Baker and H. F. E. Hulton.
"The Ministry of Food and the Cocoa Order."
"Effect of Codeine in hindering the Precipitation of Morphine by Ammonia from a Solution of its Lime Compound." By H. E. Annett and Hardayal Singh.
"Oiticica Oil: A New Drying Oil." By E. R. Bolton and Cecil Revis.
"Factors affecting the Composition of Plant Ashes, with Special Reference to Tobacco." By Oswald D. Roberts.
"Nucleic Acid and its Analytical Examination." By A. Chaston Chapman.
"Additive Factors for the Calculation of Fat in Milk from the Specific Gravity and Total Solids." By Leslie J. Harris.
"Volumetric Determination of Barium, and the Solubility of Barium Chromate in Various Aqueous Solutions." By John Waddell.
"Two Plant Products from Colombia." By A. L. Bacharach.
"Optical Dispersion of Oils from an Analytical Point of View." By Frank E. Weston.
"Method for the Colorimetric Estimation of Cobalt." By E. Gabriel Jones.
"Polarimetic Estimation of Morphine in Opium." By Jitendra Nath Rakshit.
"Opium Wax." By Jitendra Nath Rakshit.
"New Formula for the Calculation of Added Water in Milk." By Leslie J. Harris.
"Witgatboom: A Substitute for Chicory." By J. McCrae and A. Kloot.
"Table for Sorting Milk Samples." By Leslie J. Harris.
"Examination of Saccharin Tablets." By H. Droop Richmond, Septimus Royce, and C. A. Hill.
"Note on the Graduation of Gerber Butyrometers." By H. Droop Richmond.

In 1917 the ANALYST consisted of 406 pages; this year, notwithstanding increased costs, we have increased our pages by 22, making a total of 428. Thirty-four pages were devoted to thirty-one reviews of new books, and these have become a feature of the Journal, and are probably the best set of chemical reviews published in the country.

During the year we have worked in conjunction with the Institute of Chemistry in many matters of professional interest to our members. Those who hold appointments as Public Analysts or District Agriculture Analysts will have heard that, in conjunction with Sir Herbert Jackson, I sent out a circular letter to all Local Authorities which have appointed such officers, drawing attention to the inadequate remuneration arising out of the new war conditions. This has now in many cases become very serious. The analyst differs from most other professional men in using gas, fragile apparatus, chemical reagents, as well as other consumable material, for his work, all of which have considerably increased in cost, so that the fees fixed in pre-war time do not at all represent an adequate remuneration, apart altogether from the general increase in the cost of living and taxation which must be shared by all.

At present I have received only four replies from County Councils promising that the subject shall be considered. The clerk of one Council informs me that his Council have already suitably revised the terms of the County Analysts' appointment, and I hope that during the year all the Councils will recognise the justice of this revision in the scale of remuneration to their officers.

The Institute of Chemistry have also assisted us in laying before the Chairman of the Departmental Committee of the Local Government Board the views of our members on the question of superannuation of persons employed by Local Authorities in England and Wales. A meeting was convened for January 1 for consideration of the replies which were received from a circular letter addressed to all these officers who are members of our Society, and as a result I, as chairman of the meeting, was authorised to inform the Departmental Committee that it has been decided to support the claim for the inclusion of Public Analysts, whether occupying whole or part-time appointments, in any general scheme that may be adopted for superannuation of Local Government officers, whether on a contributory basis or otherwise.

We found that Public Analysts generally are in favour of the adoption of sixty-five years as the age for retirement, or earlier if incapable of discharging the duties of their office by reason of bodily or mental infirmities.

I think that the following are good grounds for the inclusion of Public Analysts in any superannuation scheme:

1. The Public Analyst, whatever the terms of the appointment, is a permanent official, whose appointment is obligatory on all Local Authorities by Clause 3 (1) of the Sale of Food and Drugs Act, 1899, whose work cannot be delegated to others, and who cannot be removed without the consent of the Local Government Board. As such he would be entitled to the same consideration as all the other officers on the permanent staff of a Local Authority, and should be included with them in any scheme of superannuation.

2. Owing to the fact that a fee of 10s. 6d. entitles a private purchaser in any district to have samples analysed by the Public Analyst of such district (Clause 12

of the Sale of Food and Drugs Act of 1875), this fee has for many years come to be regarded by most Local Authorities as a standard one. It was recognised at the time the Act was passed that such a fee was entirely incommensurate with the labour and skill involved, and during the discussion in the House of Commons which preceded the passing of the Act, Professor (later Lord) Playfair pointed out that the private purchaser, in obtaining an analysis at such a fee, should be regarded as being subsidised at the expense of the ratepayers, and this view was endorsed by the then President of the Local Government Board. The work has since then, owing to the recent advances in science, become far more difficult and arduous, and the necessary equipment in the way of apparatus much more elaborate and costly, so that at the present time this fee is more than ever inadequate. It follows that the present average rate of remuneration leaves little or no margin for provision for old age or infirmity, and this applies especially to Public Analysts whose working expenses have to be defrayed out of the fees they receive.

3. Few, if any, of the Public Analysts' appointments carry with them progressive increments of salary, as is the case with the other officers, so that in spite of the increased demands on their skill and experience their remuneration remains stationary, while their expenditure rises with the growing complexity of the work.

4. Many so-called part-time officers, acting for two or more Authorities, have but little leisure in which to supplement their income, all or most of which is derived from the Authorities they serve. The fact that, owing to their size, comparatively few Local Authorities utilise the whole time of their Public Analyst is no justification for depriving either the authority or the officer of the advantages which a superannuation scheme confers on both alike.

5. Superannuation schemes have already been adopted by a number of Authorities, and in several cases the Public Analyst, although acting for more than one Authority and engaging in private practice, has been included. If a general scheme of superannuation should be established, it is manifestly unfair that some Public Analysts should be included and others not.

The London Government Act of 1899, which set up the twenty-eight London Boroughs in the place of the old Vestries and Local Boards, provided for the compensation for loss of office, by superannuation or otherwise, of all officers, whether part time or whole time, and the principle that governed that provision appears to apply with equal force to any general scheme of superannuation.

As your President I have attended several meetings of the Federal Council for Pure and Applied Chemistry formed to advance, safeguard, and voice the interests of Chemical Science. Our Society has reaffirmed its adhesion to this new Federal Council, and is now one of its constituents, and I am sure that members will wish me to do all I can to support the scheme. Hitherto the neglect of science by our Government Departments has been proverbial; it is important that the war awakening should lead to permanent change of attitude, and that a return to somnolence should be prevented. The Federal Council can speak in the name of all, and supply the stimulant needed to foster and keep alive the present interest which lack of union might endanger. The Council have already made some progress towards housing the various chemical societies, and are considering steps to be taken to secure the production of special chemicals for use in research work, and the adequacy of the grants at the disposal of the Royal and other Societies for the purposes of chemical research. The necessity for further library facilities and co-ordination in the publication of abstracts and papers relating to chemical science are also matters which are of considerable interest to this Society, and from which a small Society like ours can reap advantages in greater economy and co-operation.

I have also represented the Society at the meetings of the Conjoint Board of Scientific Societies since we were added to the list of constituent societies in October last. This collective Board works through the representative executive committee on matters of common interest to all the scientific societies, and has initiated subjects for study which so far have been outside the scope of existing societies, the result of which cannot fail to be of real utility.

Among these directly interesting to this Society is an Adhesives Committee appointed to consider and investigate glue and other adhesives for industrial purposes, more especially in relation to their use on aircraft.

A bulletin of Scientific and Technical Societies has also been issued this month for the first time under the auspices of this Conjoint Board, which gives a diary of forthcoming meetings of scientific societies hitherto unavailable, and a committee on the prevention of overlapping is sitting which may help in increasing economy and future efficiency in many directions. It must not be forgotten that our Society is one specially constituted to deal with analytical subjects, and I hope that our members at any rate will try and induce readers of papers on this subject to offer them to us for publication in the ANALYST.

The Committee of the Privy Council for Scientific and Industrial Research, in their third Report, published in the autumn, announce that a Food Investigation Board has been established, and that this new Board has already initiated a series of investigations, which will undoubtedly be of considerable interest to our members. When this new Government Research Committee was started a deputation was received from this Society by Sir William MacCormack, when our own Analytical Investigation Scheme was explained, and it was then hoped that in due course it might form a channel for a larger and wider organisation. Now that the horizon is clear, it would seem possible that these two schemes might both advance. Under the the provisions of our own scheme some fifty original investigations have been already brought to completion, and the results published in the ANALYST. We have marked time during the last years, but we have applications now for subjects for research. We want further suggestions from members for subjects and investigations and offers of assistance from members with spare time to devote to the work.

The suggestion to establish a Ministry of Health and a Board of Health to exercise in this country powers with respect to health and local government has been considered by your Council during the year in its effects upon those of the members who hold appointments as Public Analysts. It has for a long time been felt that co-ordination of the Public Health services was urgently needed, and that in our own profession the duties placed upon Public Analysts by the various Acts and recent Orders in Council could be more effectively carried out if the measures conducive to the health of the people were revised.

The Bill, I understand, in some form or other, is to be dealt with by the present Parliament, and contains the suggestion that the new Ministry shall take over all those persons employed under the Local Government Board as may be determined, and this will include the transference of Public Analysts to the new Ministry.

One of the most helpful provisions in the proposed Bill is to the effect that it shall be lawful for His Majesty by Order in Council to establish Consultative Councils for giving, in accordance with the provisions of the Order, advice and assistance in connection with such matters affecting or incidental to the health of the people as may be referred to in such Order.

I take this to mean that it will be possible for our profession to be represented in this way, and that we shall have at last some machinery which will be an improvement on that of the past, and which will help us in our duties of safeguarding the purity of the food of the people.

So long as a Local Government Board or Ministry of Food can make regulations defining an article of food in any matter affecting its nature, substance, or quality, without due regard to analytical possibilities on the one hand or natural variations on the other, difficulties are likely to arise. We long urged the necessity of a Court of Reference to prescribe standards and limits of the quality and purity of food, and we have seen in the war period how the absence of such a court, which was originally suggested by the Select Committee of the House of Commons on Food Products Adulteration in 1894, has led not only to confusion, but to a manipulation of the food of the people, which has contributed to the increased cost of living and also been detrimental to health, as, for example, in the case of fatal illnesses arising from contaminated sausage skins.

Under the exigencies of war it seems to have been necessary to appoint a Ministry of Food, with power to modify distribution, amount and quality, without reference to the Local Government Board and the Public Analysts appointed under that Board.

The new Bill as drafted transfers all the powers and duties of the Local Government Board and of the Insurance Commissioners to the New Ministry, but leaves the Ministry of Food (so long as it is retained in peace-time) outside the scope of the measure; it also provides that the Medical Research Committee, which has done useful work for the Insurance Commissioners, shall not be transferred to the new Ministry, but remain under the direction of a Committee of the Privy Council, so that sums which were being applied for the purposes of medical research will not be transferred to the Health Board.

It is to be hoped that the new Ministry will not start without any Research Endowment, but that adequate provision for an extension of both medical and chemical research into problems connected with public health will be deemed essential for its success.

In Scotland the Board of Health is substituted for the Minister, and no Consultative Councils are provided.

The Board shall at all times comprise a member of the Faculty of Advocates and a registered medical practitioner holding a D.P.H. Diploma in State Medicine, and should in my opinion also comprise a member of our profession, as one of the six members constituting the new Board.

Among the problems which the new Ministry will have to deal with, one of the greatest is undoubtedly a revision of our methods of dealing with the milk-supply and of fixing suitable standards of purity. Hitherto the Public Analyst has protected the consummer against deficiency in fat and against adulteration, but no satisfactory methods for protection from infection have been devised. Administrative control of the health of the cow and of the persons engaged in the dairy industry can be and is attempted, but contamination of milk takes place, between the cow and the churn, by dust in the air, by flies, and dirt from the cow, on the strainer, the cooler, the pails, and the churn itself. No bacterial standards can be adopted in the present state of our knowledge, and the removal of fæcal and other dirt by filtration and centrifugalisation are not sufficient safeguards. Possibly a temperature standard at the moment of sale might be devised which would ensure refrigeration before transit, and thus prevent undue multiplication of bacteria. Tubercular milk cannot be abolished until the tubercular cow is eliminated.

Standards for boiled or sterilised milk could be devised which could be easily enforced.

Dried milk is condensed milk under the Sale of Food and Drugs Act, 1899. Dried separated milk must be sold as made from machine-skimmed milk, even if the milk is only partly skimmed. No preservative can be added to dried milk under the Milk and Cream Regulations; even sodium bicarbonate would be a preservative substance. Twenty-five per cent. of fat is suggested by Dr. Coutts as a standard for full-cream, and 15 per cent. for half-cream, milk-powder. The addition without declaration of Soya-bean oil or other foreign fat to a skim milk would be an offence under the Act.

In the last Report of the Government Chemist attention is drawn to the low percentage of fat in consignments of evaporated milk from America, which usually consists of whole milk evaporated to about half its bulk.

The law relating to milk and dairies was consolidated as to Scotland by the Milk and Dairies (Scotland) Act, 1914, and extended provision was made to secure the purity of milk-supplies, and as to England and Wales by the Act of 1915, but the operation of both these Acts has been suspended until a period after the termination of the war. By the Milk (Summer Prices) Order, 1918, of March 8 and its amendment on June 9, addition of colouring matter to milk or cream intended for sale was prohibited, as well as addition of water, and Food Committees, with the consent of the Food Controller, could give directions for securing the purity, cleanliness, and wholesomeness of milk in their area, and infringements of this Order became summary offences against the Defence of the Realm Regulations.

The signing of the armistice has brought about, let us hope, a cessation of the rate of production of new Orders relating to food. Since 1875 Public Analysts have endeavoured to fulfil the rôle of Food Controllers in relation to quality and adulteration, and I believe that all were willing to assist in the war period. As pointed out by my predecessor, the Ministry of Food had apparently to ignore the machinery which Government had set up in peace-time, and the correspondence which took place between this Society and the Food Controller in 1917 shows that no consultative council of chemical experts in analytical control similar to that suggested for the new Ministry of Health was provided for in appointment of this Ministry. During· the year, however, the Director of Oils and Fats has taken a lead by calling together a committee of analysts, who are preparing a schedule of standand methods for the examination of oils and fats, which will shortly be published; and is likely to form the basis for the control of future trading in oil seeds, nuts and kernels, and their products.

Early in the war period of Food Control our secretaries pointed out that there is no scientific method in existence whereby it can be ascertained whether any sample of flour or bread is of the composition prescribed by one of these regulations, and the matter remains to the present day in this unsatisfactory state.

The public have been more usefully served by the Cake and Pastry Orders, as in this case the Government Chemist, representatives of our Society and of the dealers, have been able to formulate a control which has to some extent met the case.

When bacon becomes pork, or when an ice-cream is not an ice-cream, might form subjects for future papers before this Society.

The shortage of fats owing to war conditions not only gave an absolute diminution in the available supply, but led to a substitution for lard and butter of fats derived from other sources. The control in this country rested with the Ministry. Palm-kernel, coconut, cotton-seed, sesame, pea-nut, rape, and other vegetable oils, have in recent years been mixed with beef fat or beef stearine or with hardened seed oil to resemble lard, and even whale oil and other fish oils can now be rendered free from taste and rendered available for a margarine of suitable melting-point.

This substitution of vegetable and marine oils for the harder fats from the pig and from beef and mutton must have some physiological influence upon the community, and it devolves upon the analyst to study the food values of these fats and their detection when used as substitutes.

I think that with the increase of knowledge, which is now available, Public Analysts should be put in possession of some legal definition based on the analytical properties of lard substitutes, salad oils, margarines, and other fat foods, which should ensure that these should be sold to the public at a fair price and of a standard quality representing a definite food value.

In other countries lard and its substitutes have been legally defined. Prepared lard is known here by its B.P. (1914) constants, but whether ordinary lard should be sold absolutely clean and free from rancidity, or whether a lard compound or compound lard should contain any lard at all, are matters upon which we should like further information. Tristearin does not occur in lard, and the American Association of Official Agricultural Chemists have, I understand, been investigating a method for detecting these hardened fats in lard.

In my opinion, for example, deodorised herring oil should be purchasable as such, and used as a cheap and valuable food, but I am not so certain that hardened whale oil should be sold as a butter substitute without declaration.

Recent work on the fat-soluble vitamines is an important contribution to our knowledge of food fats which cannot be ignored by the analyst. If these vitamines are present in beef fat and oleo oil, margarines containing them may be suitable for butter substitutes, whilst compounds which do not contain vitamines, like those made from the nut and seed oils after hydrogenisation, should not be sold as butter substitutes.

The increase in the use of these vegetable oils for food is well seen in the returns for the United States. In their fiscal year ending June 30 last they imported in million pounds:

	1918.	1914.
Copra	250	74
Coconut oil	487	45
Pea-nut oil	80	10
Pea-nuts	76	18
Soya-bean oil	337	16

Under the Home Melt Tallow and Grease (Maximum Prices) Order, 1918, edible bone fat or dripping must only contain beef or mutton, and be manufactured in the United Kingdom by a process other than the acid process, and shall not contain more than 1 per cent. of water and impurities together, and not more than 2 per cent. of free fatty acids; whilst other bone, fat, or dripping must be sold as technical tallow and priced on the titre basis.

Dripping containing cotton-seed oil was one of the reference cases under the Acts during the year, also another sample which had not the character of dripping, and three samples of "nut lard."

There is always a difficulty in fixing standards for compound and novel foods, and even in the simple cases of the milk standards or of limits of water in butter legislative action in fixing limits has not in every case benefited the consumer.

All the samples of butter tested on importation during the last war year from eleven different countries contained less than the legal limit of 16 per cent. of water. All the countries except Denmark, however, indulged in the use of boron preservative, and most of the samples contained added colouring matter. On the other hand, of 617 samples of imported margarine 10 were found to contain water in excess of the limit.

The conflict of authority even when definite standards of purity have been legalised was well illustrated at Luton last summer, when the Town Clerk had to withdraw a summons against the Chairman of the Grocers' Association who was a member of the Local Food Committee for selling butter containing 3·8 per cent. of added water in excess of the Board of Agriculture standard. The Butter and Cheese Committee of the Food Ministry in this case were acting both as retailer and wholesaler, and as Government agents sold the butter exactly as they received it, the Government were the real offenders.

Another war Order of interest to analysts, and at the same time difficult of interpretation by them, was the Order forbidding the sale of new bread. In one case in which I was present the evidence turned on the temperature of the bread, although it is a well-known practice to re-heat stale loaves. The Order has not yet been rescinded. It is difficult to support it in the interest of public health. Bread is difficult to store at all times, and in the summer the fly nuisance can and does contaminate the surface, and it would seem that the Order may have lead to waste, if not to disease.

To distinguish between fourpenny and fivepenny ale would seem strange to be part of the official duty of a Public Analyst, but a certificate of an analyst appointed under the terms of the Sale of the Food and Drugs Act is now required under the Beer (Prices and Description) Order, 1917.

The new Original Gravity Statutory Tables published with the Excise legislation (ANALYST, 1915, **40**, 122), rendered this determination a practicable analytical operation, and we are thus carrying out the duties of the ale-conners of old, under conditions in which their physical tests would no longer apply.

A certificate of an analyst appointed under the Acts is also now required by the Spirits Order, 1918.

The same provisions as to warranties as in the Sale of Food and Drugs Act applied to proceedings under the Cake and Pastry Order, 1917, the Jam (Prices) Order, 1917, and the Tea (Net Weight) Order, 1917.

I have already referred to the first of these Orders, and the net weight of tea in packets presents no difficulty. The Jam (Prices) Order of 1917, however, requires careful analytical consideration, as the jams and jellies scheduled in that Order are to be made in accordance with the following provisions:

(*a*) Not more than 10 per cent. shall consist of added fruit juice.
(*b*) Mixed jam must contain at least 25 per cent. of each ingredient fruit by weight.
(*c*) The dried weight shall not be less than 65 per cent. of the total weight of such jam or jelly.

Cocoa is included in the definition of articles of food and foodstuffs for the purpose of the various Orders of the Ministry of Food, and your Council has had these Orders under consideration during the year. The subject has also been discussed at our meetings, and papers have been published thereon, and our hon. secretaries and editor at interviews with the officials of the Ministry of Food have laid before them the views of this Society.

I need not go into the matter further in this address beyond quoting from Messrs. Baker and Hulton's paper on the "Estimation of Shell in Cocoa and Cacao Products" (ANALYST, 1918, **44**, 201): "In estimating considerable proportions of shell, the analyst is on fairly safe ground, but when it comes to such small differences as separate grades A and B, the available methods are quite inadequate." Messrs. Knapp and McLellan—who represent Messrs. Cadbury and Rowntree—in a paper on the "Estimation of Cacao Shell" (ANALYST, 1919, 21) state: "In the Cocoa Powder Order, 1918, the amount of shell in cocoa powder was defined—Grade A to contain not more than 2 per cent. of shell, and Grade B not more than 5 per cent. of shell. It will be clear from the above that in our opinion no analytical method by itself, or in conjunction with others, will enable the analyst to distinguish between cocoa containing 2 per cent. and cocoa containing 5 per cent. of shell."

I had hoped that the war legislation in connection with food supply and production would have helped us in fixing standards for new foods and for controlling others which might be of permanent advantage.

It looks as if few, if any, of these emergency standards of food will survive the war, and as there has been a special branch of the Ministry dealing with the enforcement of the Food Controller's Orders, we must await the report of the Department to see if they are in a position to recommend the retention of some of these new controls as a permanent part of the work which our official members will have to perform.

Although drugs have been outside the scope of the Food Controller, many changes have taken place during the war in the composition of pharmaceutical preparations. These have been of quite a startling nature when one considers the conditions which governed these compositions in pre-war days. The question of standards has been opened up in a way that interests and puzzles analysts. It will be necessary to sketch briefly the position. The British Pharmacopœia, which is the recognised standard for chemicals, drugs, and preparations used in medicine, is produced by the General Medical Council by virtue of the powers conferred upon the Council under Section 54 of the Medical Act, 1858. The section is as follows:

> "The General Council shall cause to be published under their direction a book containing a list of medicines and compounds and the manner of preparing them, together with the true weights and measures by which they are to be prepared and mixed, and containing such other matter and things relating thereto as the General Council shall think fit, to be called 'The British Pharmacopœia'; and the General Council shall cause to be altered, amended, and republished such Pharmacopœia as often as they shall deem it necessary."

Before the passing of the Medical Act, 1858, there were three Pharmacopœias in the United Kingdom, but, as will be noticed, these were to be replaced by one work, the "British Pharmacopœia." This was first brought out in 1864, subsequent amended editions having been published in 1867, 1885, 1898, and 1914. The section of the Medical Act does not, it will be observed, make the work official in the sense that the formularies given are those which pharmacists must use in dispensing. It is the Pharmacy Act, 1868, which completes the story. By Section 15 a pharmacist is liable to a penalty of five pounds "who shall compound any medicines of the British Pharmacopœia except according to the formularies of the said Pharmacopœia."

The General Medical Council obtain a handsome return from the publication of the Pharmacopœia, and spend the greater part of it in employing experts in revising the work. The facts just mentioned are well known to most of you, but they are repeated because of the bearing they have upon war-time alterations. The power to alter and amend the Pharmacopœia has been exercised on two occasions since the war. This is brought about by notices in the *London Gazette*. The first was on July 27, 1917, when owing to the scarcity of glycerol and sugar, preparations containing glycerol and most of those containing sugar were "withdrawn." The substances glycerol, sugar, and syrupus were, however, retained. In 1918, when the necessity arose for conserving the supply of edible fats and oils, a further notice appeared in the *Gazette* of March 29, 1918, the effect of which was to give permission to employ substitutes for lard and olive oil in ointments, plasters, and liniments containing these substances. It should be noted, however, that by the Oils and Fats (Restriction) Order made under the powers of the Defence of the Realm Act, it was illegal to use edible fats and oils for other than food purposes, so that the *Gazette* notice and the Order conflicted in that the former stated that lard, suet, ground-nut oil, and sesame oil *may* be used in medicines. Permission was also given for using neutralised seconds castor oil instead of castor oil, but it was suggested that the substitution should be acknowledged by a label or otherwise. The position is, however, complicated by the fact that the Food Controller, acting through a special committee, provided certain quantities of vegetable oils for use in the manufacture of camphor liniment. Similarly in regard to syrups, the Royal Commission on Sugar Supplies allowed wholesale druggists and pharmacists to obtain 50 per cent. of the amount of sugar used in 1915.

The full list of preparations withdrawn and modified is as follows:

Preparations Withdrawn.

Caffeinæ citras effervescens.
Confectio sennæ.
Confectio sulphuris.
Decoctum aloes compositum.
Extractum gossypii radicis corticis liquidum.
Glycerinum acidi borici.
Glycerinum acidi carbolici.
Glycerinum acidi tannici.
Glycerinum aluminis.
Glycerinum amyli.
Glycerinum boracis.
Glycerinum pepsini.
Glycerinum plumbi subacetatis.
Glycerinum tragacanthæ.
Linimentum camphoræ
Linimentum chloroformi.
Linimentum hydrargyri.
Linimentum potassii iodidi cum sapone.
Linimentum terebinthinæ aceticum.
Liquor calcis saccharatus.
Liquor cresol saponatus.
Magnesii sulphas effervescens.
Mel boracis.
Mistura ammoniaci.
Mistura amygdalæ.
Mistura guaiaci.
Mistura sennæ composita.
Pulvis amygdalæ compositus.
Pulvis glycyrrhizæ compositus.
Pulvis tragacanthæ compositus.
Sodii citro-tartras effervescens.
Suppositoria glycerini.
Syrupus acidi hydriodici.
Syrupus aromaticus.
Syrupus aurantii.
Syrupus aurantii floris.
Syrupus calcii lactophosphatis.
Syrupus cascaræ aromaticus.
Syrupus ferri phosphatis.
Syrupus limonis.
Syrupus pruni virginianæ.
Syrupus rhei.
Syrupus rhœados.
Syrupus rosæ.
Syrupus scillæ.
Syrupus sennæ.
Syrupus tolutanus.
Syrupus urgineæ.
Syrupus zingiberis.
Tinctura cardamomi composita.
Tinctura kino.
Tinctura pruni virginianæ.
Tinctura rhei composita.
Tinctura sennæ composita.
Trochiscus acidi benzoici.
Trochiscus acidi carbolici.
Trochiscus acidi tannici.
Trochiscus bismuthi compositus.
Trochiscus catechu.
Trochiscus ferri redacti.
Trochiscus guaiaci resinæ.
Trochiscus ipecacuanhæ.
Trochiscus kino eucalypti.
Trochiscus krameriæ.
Trochiscus potassii chloratis.
Trochiscus santonini.
Trochiscus sulphuris.
Unguentum iodi.

Preparations which may be Modified.

Adeps benzoatus.
Collopium flexile.
Emplastrum belladonnæ.
Emplastrum calefaciens.
Emplastrum hydrargyri.
Emplastrum plumbi.
Emplastrum resinæ.
Emplastrum saponis.
Linimentum ammoniæ.
Linimentum calcis.
Linimentum sinapis.
Liquor epispasticus.
Mistura olei ricini.
Sapo durus.
Sapo mollis.
Unguentum aconitinæ.
Unguentum atropinæ.
Unguentum belladonnæ.
Unguentum cantharidini.
Unguentum cocainæ.
Unguentum gallæ.
Unguentum gallæ cum opio.
Unguentum hydrargyri.
Unguentum hydrargyri ammoniati.
Unguentum hydrargyri compositum.
Unguentum hydrargyri iodidi rubri.
Unguentum hydrargyri nitratis.
Unguentum hydrargyri oleati.
Unguentum hydrargyri subchloridi.
Unguentum iodoformi.
Unguentum myrobalani.
Unguentum myrobalani cum opio.
Unguentum picis liquidæ.
Unguentum plumbi iodidi.
Unguentum potassii iodidi.
Unguentum resinæ.
Unguentum staphisagriæ.
Unguentum sulphuris.
Unguentum zinci.

The General Medical Council, notwithstanding the profit obtained from the sale of the British Pharmacopœia, did not apparently feel called upon to devise and publish alternative formulæ for those which had been withdrawn. However, the Pharmaceutical Society of Great Britain produced, in 1917, an Addendum ("War

Emergency Formulary ") to the British Pharmaceutical Codex which supplied substitutes for the Pharmacopœial preparations (glycerols and sugar-containing preparations) withdrawn by the first *Gazette* notice (July 27, 1917). On August 31, 1918, a leaflet was issued by the Pharmaceutical Society giving alternative formulæ for the plasters and ointments affected by the second *Gazette* notice (March 29, 1918). These formulæ are supposed to embody the best traditions of pharmacy, but they can hardly be said to reflect credit on those responsible for the compilation. Judged by the standard of the analyst, I may be allowed to express a doubt as to the wisdom of designating as *glycerinum boracis* a composition consisting of boric acid solution thickened with tragacanth and preserved with chloroform. Observe that although called *glycerinum boracis*, it contains neither glycerol nor borax. Again, what is called *syrupus factitius*, or " artificial syrup," consisted of a mucilage of tragacanth, 0·7 per cent., preserved with 5 per cent. chloroform water. This sugar substitute replaces the genuine carbohydrate in thirty-seven syrups, while in nine liquors and fifteen *misturæ* the glycerol or sugar is replaced by plain water. In five tincturæ the glycerol is removed and replaced by the use of a stronger (60 per cent.) spirit than is ordinarily used (40 per cent.). In regard also to *adeps factitius* which, although translated in the formulary " lard substitute," means artificial lard, it is hardly good policy to use the word lard in connection with a mixture of hard and soft paraffin containing 5 per cent. of wool fat. It is doubtful whether such a mixture can claim to be even a useful substitute for lard, the distinctive pharmacological effect of which is that it promotes the adsorption of the medicament mixed with it. It hardly carries out the intention of the *Gazette* notice, which is " wool fat, or hydrous wool fat, simply or together with such additions (if any) of hard paraffin, liquid paraffin, soft paraffin, paraffin ointment, white beeswax, yellow beeswax, or any combination of these, etc." From this it would appear that a composition consisting entirely or mainly of wool fat should be used, instead of which the semi-official suggestions of the Pharmaceutical Society make provision for an ointment basis containing only 5 per cent. of wool fat.

Suggestions were made by the National Health Insurance Commissioners to medical men who are on the panel of practitioners under the medical benefit provisions of the National Insurance Act in regard to the use of these substitute formulæ, and it is understood that the Local Government Board desired Public Analysts during the war to turn a blind eye to pharmaceutical preparations which are not in conformity with the British Pharmacopœia.

It is possible that the Defence of the Realm Act could have provided power for the repeal, during the war, of parts of the Sale of Food and Drugs Acts—some extraordinary things have been done in the name of the defence of the realm—but nothing has been done.

The position of the Public Analyst who has samples of the pharmaceutical preparations given in the list brought to him by an Inspector under the Sale of Food and Drugs Acts is thus one of considerable difficulty. Camphorated oil, for example, may be made with olive oil, sesame oil, arachis oil, or yellow liquid paraffin. The use of a mineral oil in this preparation can hardly be justified. It would seem, however, that the analyst has only to concern himself about the proportion of camphor present, and yet there is the question unsettled as to how far a " withdrawn " formula of the British Pharmacopœia can be taken as presumptive standard.

The scarcity of glycerol, sugar, fats, oils, etc., has caused considerable ingenuity in devising substitutes for non-official preparations such as are employed for the toilet or domestic purposes. The use of saccharin has been much extended as a sweetening agent in beverages, but when sugar at a reasonable price is again obtainable it is likely that the use of saccharin will be dropped in many cases. The manufacture of "white oils" and similar embrocations containing eggs has had to be abandoned, except in those cases where Chinese eggs—not of suitable quality for use in human food—could be used. The difficulty in obtaining turpentine, the usual accompaniment of an egg-emulsion liniment, has also contributed to change the type of household liniment, one containing capsicum and essential oil of camphor having replaced the older liniments. Carrageen and quince mucilages have been resuscitated on account of the scarcity and high price of tragacanth and the best quality of acacia. There cannot, however, be recorded any step taken during the emergency that is likely to be permanent. Perhaps the greatest inconvenience that has been caused has been the absence of glycerol, which has become apparently indispensable as a solvent, or as a sweetening, thickening, or moistening agent. To find a substitute to supply the hygroscopic quality of glycerol called for the most ingenuity, the agents employed being magnesium chloride, calcium chloride, and calcium lactate, but these could only be used in such things as printers' rollers and copying-graphs, and only then with indifferent success.

The high price of saccharin has been somewhat of a temptation for some makers of saccharin tablets to "economise" in the use of this chemical, but as a rule these people are careful to avoid definite statements as to the quantity of saccharin in each tablet.

The absence of Austrian and German natural aperient waters has caused the exploitation of artificial aperient waters, the formulæ being based on analyses of the original waters. Some of these will probably survive the war.

I must not forget that since 1907 our Society has been incorporated as the Society of Public Analysts and Other Analytical Chemists, and that consequently I must address myself to other analytical chemists than those interested in official duties connected with the Sale of Food and Drugs Acts.

Our papers during the year, to which I have already referred, bear testimony to the many-sidedness of the Society, and, as you are aware, I am myself interested in other matters than those which I have felt it necessary to review on this occasion. I am not certain whether we might not consider shortening the long name of our Society to that of the Society of Analysts, and thus bring our title in accord with that of our journal.

Although matters of health and food supply are at all times important, I must excuse myself for dealing at length with the duties which were thrust upon some of us during the war on the ground that we have been living in these exceptional times. I trust that we may soon be at greater liberty to devote our science to problems of reconstruction in the industries which must now be developed.

My address, however, has now been quite long enough, and I must conclude in thanking you for the honour you have conferred upon me in asking me to preside at these meetings, and to add that my work has been light compared with that of your two excellent secretaries, who have so ably assisted me in this year of office.

AN INSTRUMENT FOR THE DETERMINATION OF SMALL QUANTITIES OF CARBON MONOXIDE IN HYDROGEN.

BY CAPTAIN E. K. RIDEAL, R.E., AND HUGH S. TAYLOR, D.Sc.

(*Read at the Meeting, December* 4, 1918.)

FOR purposes of ammonia synthesis hydrogen of a high degree of purity, more especially free from traces of carbon monoxide, is essential.

In the investigations which have been carried out by the Munitions Inventions Department relative to this problem, the necessity arose for the rapid and accurate analysis of hydrogen samples with a view to the determination of their carbon monoxide content. As a consequence, a method of estimation of carbon monoxide was evolved, based upon the principle of preferential catalytic combustion of the carbon monoxide with a small amount of added oxygen, the carbon dioxide formed being suitably absorbed and estimated. This method of estimation has been adapted for use in an instrument for continuous analysis of hydrogen supplies and for automatic registration of the carbon monoxide content.

The principle of analysis by preferential combustion is not new, since it dates back to the earliest work on catalysis at the beginning of the nineteenth century. The discovery of Sir Humphry Davy that the combustion of illuminating gases could be caused by platinum wire introduced into them at a temperature below ignition, and the succeeding observations of Döbereiner that spongy platinum immediately glows and causes the combustion of hydrogen and oxygen even when introduced into the gases without previous heating, were rapidly followed by the very important and fundamental investigations of Henry (*Phil. Mag.*, 1825, **65**, 269) on the preferential combustion of gases in contact with platinum. It was shown that in the presence of platinum in mixtures of hydrogen, carbon monoxide, methane, and ethylene with oxygen, "hydrogen and carbonic oxide are most easily acted upon, then olefiant gas, and carburetted hydrogen with the greatest difficulty. . . . By due regulation of the proportion of hydrogen it is possible to change the whole of the carbonic oxide into carbonic acid without acting on the olefiant gas or carburetted hydrogen. . . . With respect to olefiant gas this exclusion is attended with some difficulty . . . but it is easy when olefiant gas is absent so to regulate the proportion of hydrogen that the carbonic oxide may be entirely acidified and the whole of the carburetted hydrogen be left unaltered." Henry's method of selective combustion was afterwards elaborated in detail by Hempel (*Ber.*, 1871, **12**, 1006), and by substituting palladium for platinum the process was adapted to the requirements of gas analysis. By observation of volume contraction occurring both before and after absorption in potash of any carbon dioxide formed, the proportions of hydrogen and carbon monoxide present in mixtures which also contain methane can readily be ascertained.

The preferential combustion of hydrogen and carbon monoxide in presence of methane by passage over copper oxide maintained at 250° C. is also noted, although in this particular case the reaction is a simple chemical reaction, and not catalytic.

It is claimed as superior to the catalytic combustion in contact with palladium, since no air or oxygen need be added to the combustible gases. For purposes of continuous analysis and record, however, it is obvious that this constitutes a disadvantage, since occasional oxidation of the reduced copper becomes necessary.

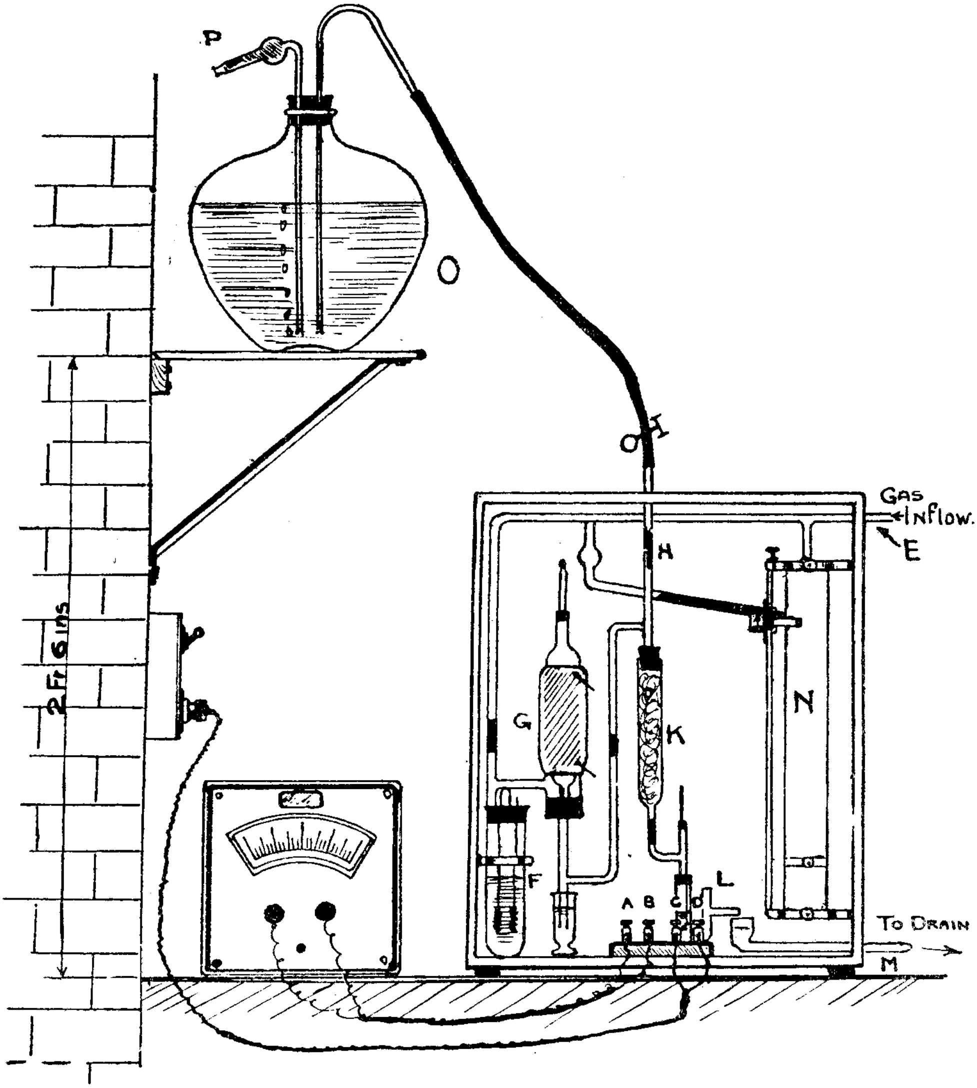
The experiments of Bone and his co-workers (*J. Chem. Soc.*, 1902, **81**, 535 *et seq.*) on the combustion of hydrocarbons in inadequate supplies of oxygen reveal, however, that the reactivity of the several gases is governed in marked degree by the nature of the surface at which combustion is conducted. In striking divergence from the results outlined above is Bone's observation that, at moderate temperatures in borosilicate glass bulbs, methane, ethane, ethylene, and acetylene are oxidised more rapidly than hydrogen. Indeed, it has been emphasised by Bancroft (*J. Phys. Chem.*, 1917, **21**, 666) that methane appears to burn in preference to hydrogen under all conditions which approximate to combustion away from a surface, and the general conclusion may be drawn that the reactivity of oxygen for the constituents of a mixture of combustible gases is largely a function of the contact agent in presence of which the oxidation process is conducted.

The instrument under consideration supplies a further illustration of the application of the principle of selectivity in catalytic combustion to a mixture of hydrogen and carbon monoxide. Wright and Luff (*J. Chem. Soc.*, 1878, **33**, 1) and Fay, Seeker, Lane and Furgusson (*Polytech. Eng.*, 1910, **10**, 72), have shown that the initial temperature at which reduction of metallic oxides by carbon monoxide occurred was consistently inferior, in the cases investigated, to the initial temperature at which hydrogen causes reduction. This factor naturally suggested that the catalytic combustion of carbon monoxide with oxygen in the presence of hydrogen would occur preferentially in contact with metallic oxides, and experimental investigation showed this to be true. On the other hand, with certain metallic contact agents, as, for example, reduced nickel, complete interaction of the oxygen with hydrogen may be secured. Indeed, by suitable selection of the catalytic agent all the stages between the two extremes of combustion of hydrogen and combustion of carbon monoxide may be secured. It was found also that the preferential nature of the reaction between the monoxide and oxygen could be enhanced by using a mixture of several metallic oxides, and that with such mixtures at regulated temperatures carbon monoxide could be completely converted to carbon dioxide without the hydrogen being in any way attacked. Thus, with copper oxide suitably activated by alternate reduction and oxidation at low temperatures, preferential combustion occurs at temperatures as low as 110° C. With iron oxide, reaction proceeds less satisfactorily and at 300° C. Mixtures of iron and chromium oxides act as preferential catalysts between 250° and 350° C., whilst the further admixture of small quantities of ceria and thoria gives a catalyst working excellently between 200° and 300° C. Such a catalyst has proved very satisfactory, and has shown high efficiency and long life.

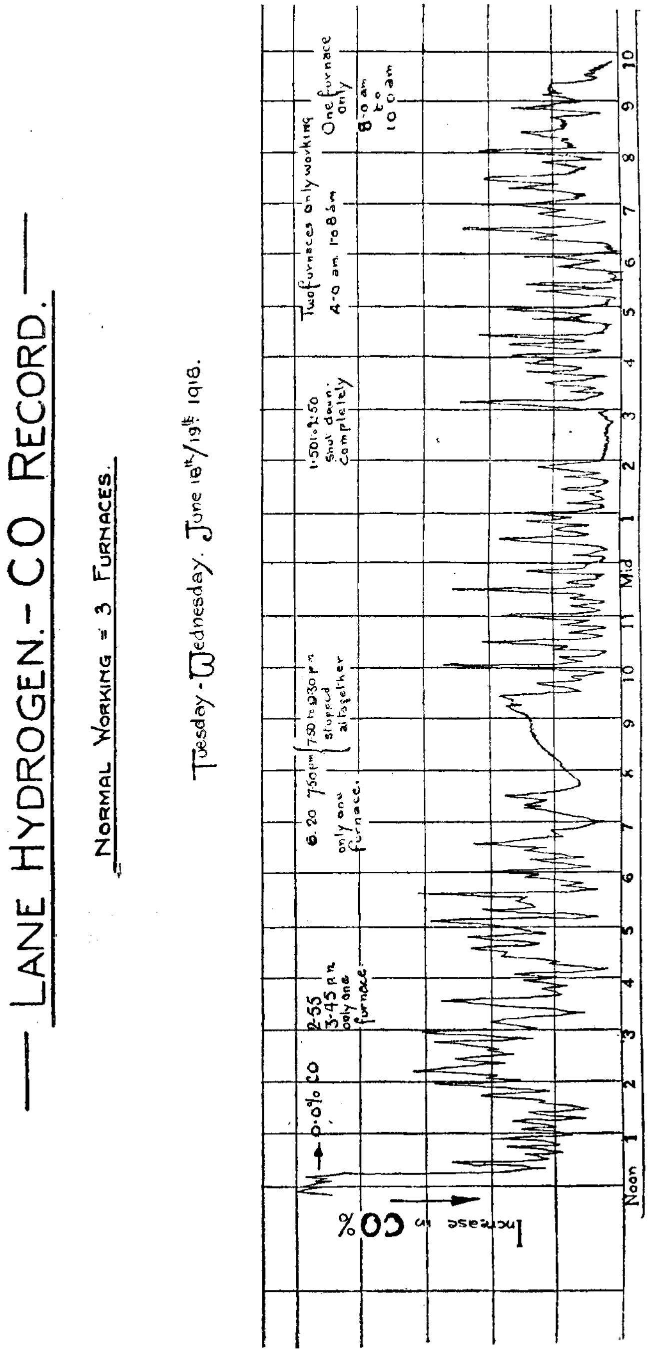
THE APPARATUS.

The salient features of the apparatus may now be enumerated.

Gas enters at an inlet tube, and is measured by means of a Venturi-type gauge, *E*. It thereupon meets a supply of oxygen, obtained (in admixture with hydrogen, which, however, is immaterial to the process of estimation) by electrolysis of caustic soda solution between nickel electrodes, *F*. The mixture of gases then passes to a catalyst chamber, *G*, containing the suitably prepared catalyst maintained at a temperature of about 230° C., in which the carbon monoxide is converted to carbon dioxide. With the catalyst material employed, this reaction occurs in preference to the oxidation of the hydrogen to form water.



The exit gases from the catalyst pass to an absorption column packed with glass wool *K*, through which is flowing through the glass jet *H*, at regulated speed, a standard (about N/200) solution of lime water. In this way the gases are freed from


LANE HYDROGEN. - CO RECORD.
NORMAL WORKING = 3 FURNACES.
Tuesday - Wednesday. June 18th/19th 1918.
→ 0·0% CO
2-55
3-45 p.m.
only one
furnace.
6.20 7.50pm
only one
furnace.
7.50 to 9.30 p.m
stopped
altogether
1.50 to 2.50
shut down
completely
Two furnaces only working
4-0 am to 8 am
One furnace
only
8-0 am
to
10-0 am
Increase in CO%
Noon
1
2
3
4
5
6
7
8
9
10
11
Mid
1
2
3
4
5
6
7
8
9
10

all the carbon dioxide generated by combustion of the carbon monoxide in the catalyst unit, and then pass away into the air.

The lime water passes from the reservoir *O* through the jet *H* and the absorber *K* to a small electrolytic cell, *L*, in which the conductivity of the solution may be measured. The cell is so designed that with the solution of lime water used a high adjustable resistance is obtained, thus permitting the conductivity to be measured by application of a direct current at 200 volts, without the disturbing influences brought about by polarisation effects at the electrodes. In practice it has been found suitable to have a current of 20 milliampères passing when the lime water is flowing through the absorber to the waste *M*, in the absence of carbon dioxide. The conductivity of the lime water varies with the quantity of carbon dioxide absorbed in the column, and may be measured by placing in series with the cell a milliameter or recording instrument of suitable type.

A knowledge of the speed of gas and liquid flow, the strength of lime water used, and observation of the reading on the electrical measuring instrument, enables the percentage of carbon monoxide in the original gas to be obtained. By suitable graduation of a chart in a recording type of instrument the actual percentages of carbon monoxide may be read off from the chart. By varying the speeds of gas and liquid flow the sensitivity and range of the apparatus may be varied at will.

In the instrument so constructed the operation is conducted with the aid of the ordinary direct-current lighting circuit, which is made to generate the oxygen supply, heat the catalyst unit, and supply the current necessary for the measurement of the conductivity of the lime water. The instrument is so designed that it will operate within the voltage limits of 100 to 240 volts.

In actual and continuous use it has shown itself a convenient and reliable apparatus for the purposes of hydrogen analysis. The illustrations show the general set-up of the recorder and a chart which has been obtained upon a hydrogen of industry showing the variability in carbon monoxide content of the gas at different periods of the day. Examination of the chart shows that the recorder follows accurately the conditions of plant operation, showing periods in which respectively six, four, two, and no periods of hydrogen production per hour occurred in the day's interval.

The variation in carbon monoxide percentage in the hydrogen produced during a single " make " is clearly demonstrated, and enabled the authors to examine in detail the theoretical aspects of the problem of hydrogen production. It was shown thereby that the relative concentrations of carbon dioxide and carbon monoxide in the gases issuing from the retort system were governed by the water-gas equilibrium—$K = \frac{P_{H_2O} \times P_{CO}}{P_{H_2} \times P_{CO_2}}$—at the operating temperature. At the commencement of the steaming phase, where the yield of hydrogen from the interaction of steam and reduced iron was high, and therefore where the ratio P_{H_2O}/H_2 was at its lowest, the proportion of carbon monoxide to carbon dioxide formed was at its maximum. Towards the end of the period of steaming, where a considerable proportion of the steam passes through the retort system unchanged, the bulk of the carbon-containing gases issues in the form of carbon dioxide, as would be expected from theory.

As an instrument for facilitating chemical research the apparatus has proved excellent. It has been found possible with its aid rapidly to differentiate between various catalytic agents, and also support materials, both for preferential catalytic combustion processes and for the elimination of carbon monoxide by processes of methanation. Employing the apparatus the long and laborious analytical determinations of traces of carbon monoxide in hydrogen have been replaced by a method of analysis and record which could be secured in the space of a few minutes.

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THE USE OF ORTHO-TOLIDINE AS A COLORIMETRIC TEST FOR GOLD.

By W. B. POLLARD.

(*Read at the Meeting, February* 5, 1919.)

Ortho-tolidine dissolved in dilute acetic acid was suggested by E. B. Phelps (Bulletin No. 1, Ohio State Board of Health, January, 1913) as a delicate colour test for free chlorine in water. This test was modified by J. W. Ellms and S. J. Hauser (Analyst, 1914, **39**, 454), who showed that a hydrochloric acid solution of ortho-tolidine was better adapted for the purpose. Their reagent was prepared by dissolving 1 grm. of ortho-tolidine in a litre of 10 per cent. hydrochloric acid.

This reagent in its modified form has now been found to be a delicate test for aurichloric acid. A solution of 1 part of gold in a million parts of water gave a bright yellow colour on addition 1 c.c. of the reagent. With a solution containing 1 part of gold in 20 million parts of water the yellow colour can just be detected in a depth of 10 cms. of liquid.

Ellms and Hauser found that in the case of dilute solutions containing free chlorine the colour took about three minutes to fully develop, and was then permanent for about half an hour, after which it slowly faded. This was also found to be the case with aurichloric acid.

In making the test large amounts of strong mineral acid should not be present as the reaction becomes less delicate.

The following metals, when present as chlorides in a dilute hydrochloric acid solution, were found to give no reaction with ortho-tolidine: Al, Sb(ic), Ba, Bi, Cd, Ca, Cr, Co, Cu, Ir, Pb, Mg, Hg, Mn(ous), Ni, Pt, K, Rh, Na, Sr, Sn(ic), U, and Zn.

In a second paper Ellms and Hauser point out that iron in the ferric condition also reacts with ortho-tolidine. The author found that in the case of ruthenium a yellow colour was also formed. Osmic acid gives a yellow colour, but this changes to green on standing. Vanadates acidified with dilute hydrochloric acid give a reaction. Molybdates acidified with hydrochloric acid do not react.

Sodium tungstate acidified with dilute hydrochloric acid gives a precipitate on addition of ortho-tolidine, but no yellow colour develops.

In preparing standard chlorine solutions, Ellms and Hauser found that it was necessary to employ specially purified distilled water. This was not found to be so necessary in the case of gold solutions. The more dilute gold solutions should, however, only be prepared when required, and should contain a small amount of free hydrochloric acid.

In testing solutions which have been obtained by the use of *aqua regia*, special care should be taken to guard against the possible presence of free chlorine or of nitrous acid. The latter not only reduces gold solutions, but gives a yellow colour with ortho-tolidine. Any reagents used should always be tested for reducing impurities; thus, on one occasion a sample of "pure" ammonium chloride completely reduced a weak gold solution.

In presence of much copper a green colour is obtained instead of a pure yellow; colorimetric comparison can, however, still be made if the standard gold solution is tinted with copper to a similar extent.

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Cairo.

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NOTES.

The Editor desires 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.

DETERMINATION OF THE CALORIFIC VALUE AND SULPHUR CONTENTS OF PETROL BY MEANS OF A BOMB.

Various devices for measuring the calorific value or sulphur contents of petrol by means of the calorimetric bomb have been proposed, such as the use of weighed envelopes of collodion or celluloid or other combustible material, the calorific value of which can be separately determined.

The use of thin glass envelopes which are broken by the pressure of the oxygen in the bomb has also been advocated.

The writer has tried these devices, but has found the following to be a more convenient procedure:

The petrol is weighed out in a small sealed glass bulb or stoppered bottle. This is placed on the platinum tray of the bomb, together with a weighed amount of pure naphthalene. The naphthalene is ignited in the ordinary manner, and the heat thus liberated breaks the bulb or blows the stopper out of the bottle and ignites the petrol. If glass bulbs are used, they should not have long or narrow sealing-off tubes, for it has been found that such narrow tubes sometimes contain traces of uncombusted petrol after the explosion has taken place.

A small, thin, glass-stoppered bottle, such as is sometimes used for vapour density determinations, has been found to be most convenient. The bottle should have a capacity of about 1 to 1½ c.c.

A bomb for determining the calorific value of petrol should be made more strongly than one which is satisfactory for determinations of the calorific value of coal or ordinary fuel oils.

The high calorific value of petrol and its high rate of combustion, due to its volatility, cause high temperatures, and the correspondingly high pressures which are consquently set up render the use of the bomb dangerous if it is not made amply strong. Moreover, the wear and tear on a bomb used for petrol is great, and if the bomb is internally enamelled this rapidly becomes chipped off and damaged.

A distinct and marked clicking sound can generally be heard when combusting petrol in a calorimetric bomb, and this appears to be due to strain in the steel; repeated use must therefore produce danger of breakdown due to fatigue, and it is considered that the combustion of petrol by means of a bomb should only be carried out in a suitable enclosure which will protect the observer from the results of an explosion.

Arnold Philip.

H.M. Dockyard,
Portsmouth.

NOTE ON THE ASSAY OF RED CINCHONA BARK.

In the official process of the 1898 British Pharmacopœia for the assay of *Cinchonæ rubræ cortex*, the alkaloids were extracted from the bark by mixing 20 grms. of the powdered sample with 6 grms. of calcium hydroxide and 20 c.c. of water. After standing for an hour or two, the resulting moist powder was boiled with benzolated amylic alcohol under a reflux condenser, submitted to two further similar extractions, and then percolated with still more benzolated amylic alcohol.

Benzolated amylic alcohol quickly extracts cinchona alkaloids from a simple aqueous suspension, but from a mixture of bark, calcium hydroxide, and water, their extraction is an extremely tiresome process.

In the 1914 edition of the British Pharmacopœia, the same amount (6 grms.) of calcium hydroxide is mixed with half the quantity (10 grms.) of powdered bark and slightly more (22 millilitres) water. The result is a paste. When to this 130 millilitres of benzolated amylic alcohol are added, the coherency of the paste is enhanced, and it appears to be almost undisturbed by the boiling of the solvent. If the boiling be stopped and the plastic mass be separated into particles with a glass rod, it only requires a gentle rotation of the flask to bring the wet powder to an almost immobile mud again. Subsequent extractions with fresh quantities of the boiling solvent do little to granulate the mud, and after as many as twelve or fourteen percolations the mass is not completely exhausted of alkaloids.

It is better to reduce the amount of water; approximately 12 c.c. of this gives, with 10 grms. of powdered bark and 6 grms. of calcium hydroxide, a powder of the right consistency. Using this proportion of water, higher contents of total alkaloids were obtained on three occasions, the increases being respectively 2·02, 1·16, and 1·46 per cent., above the amounts found when the Pharmacopœial instructions were followed. All the same, the process remains very tedious.

That the Pharmacopœial Revision Committees have retained Squibb's process (with different modifications) through the 1885, 1898, and 1914 editions, seems to imply a special confidence in it; but as at present described I, at any rate, have not been able to obtain satisfactory results with it.

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ABSTRACTS OF PAPERS PUBLISHED IN OTHER JOURNALS.

FOOD AND DRUGS ANALYSIS.

Constituents of Oil of Cassia—II. F. D. Dodge. (*J. Ind. and Eng. Chem.*, 1918, **10**, 1005-1006.)—The author has identified benzaldehyde and methyl salicylaldehyde in oil of cassia. Neither of these substances has previously been shown to be present. In collaboration with Sterndale, the author has previously shown (*J. Ind. and Eng. Chem.*, 1915, **7**, 155) that oil of cassia contains salicylic aldehyde (0·1 to 0·2 per cent.), coumarin, benzoic acid, salicylic acid, and a liquid acid of fruity odour, not further identified. In addition to the above-named substances, it has long been known that oil of cassia consisted mainly (75 to 90 per cent.) of cinnamic aldehyde, and that cinnamyl acetate and methyl ortho-coumaric aldehyde were present, whilst it has been stated, but scarcely proved beyond doubt, that phenylpropyl acetate is or may be present. G. C. J.

Cultivation of Edible Beans in Burma. (*Bull. Imp. Inst.*, 1918, **16**, 275-287.)—Experiments have been continued in order to ascertain whether it is possible to cultivate profitably in Burma better varieties of beans than those commonly produced there for export to Europe for human consumption (ANALYST, 1915, **40**, 234). The varieties dealt with include forms of *Phaseolus lunatus* (Madagascar beans, Rangoon beans, etc.), *P. vulgaris* (haricot beans), and *P. acutifolius* (Tepary beans). There has been a largely increased cultivation of white beans in Burma during the war, due to the great demand from the United Kingdom. *Phaseolus lunatus*.—(1) Madagascar beans. Very satisfactory results were obtained during the three-year period of experimental trials of this variety, the results showing that beans comparing favourably in colour with those grown in Madagascar can be produced in Burma, and that after five years' cultivation in Burma the yield of prussic acid is not materially higher than any samples from Madagascar. These latter, however, have the advantage in size. The prussic acid yield varies from 0·002 to 0·003 per cent. (2) A variety of *P. lunatus* with small white seeds, which was introduced from the United States, has been cultivated experimentally for the last three years under the name of *pè-ngè*; the results so far obtained with this bean in Burma seem satisfactory, the yield and colour having been good, and the quantity of prussic acid has not exceeded 0·005 per cent. (3) White Rangoon beans. The prussic acid yield for this class is somewhat high, but would not, in view of past experience, be considered dangerous; the percentage varies from 0·016 to 0·03 per cent. *P. vulgaris*.—The haricot or kidney bean is chiefly cultivated in Burma as a market-garden crop, and not for export. In no case were they ever found to yield prussic acid. They are of good appearance, and a better colour than Tepary beans. *P. acutifolius*.—The yield of these beans has been somewhat poor, and, compared with other varieties, has so far proved unprofitable in Burma. No prussic acid was obtained from any sample examined. The following table shows the comparative analytical values obtained from the samples above described:

	P. vulgaris.		*P. lunatus* (Madagascar Beans).	*P. acutifolius* (Tepary Beans).	*P. vulgaris* (Haricot Beans). (Figures recorded by Church.)
	(1.)	(2.)			
Moisture	9·5	9·5	12·5	12·0	14·0
Crude proteins... ...	23·6	28·7	25·7	23·6	23·0
Consisting of—					
True proteins ...	21·2	24·0	22·8	20·6	—
Other nitrogenous substances	2·4	4·7	2·9	3·0	—
Fat	1·8	2·0	0·9	1·3	2·3
Starch, etc., by difference	57·2	51·1	53·9	57·2	52·3
Fibre...	4·3	4·3	3·4	2·7	5·5
Ash	3·6	4·4	3·6	3·2	2·9
Nutrient ratio (1) ...	1 : 2·6	1 : 1·9	1 : 2·2	1 : 2·5	1 : 2·5
Food units (2)	121	128	120	119	116

(1) The ratio between the percentage of crude proteins and the sum of the percentages of starch and fat, the latter being first converted into its starch equivalent.

(2) The total obtained by adding the percentage of starch to 2·5 times the sum of the percentages of fat and crude proteins.

H. F. E. H.

Determination of Hexabromide and Iodine Numbers of Salmon Oil as a Means of Identifying the Species of Canned Salmon. H. S. Bailey and J. M. Johnson. (*J. Ind. and Eng. Chem.*, 1918, **10**, 999-1001.)—Five species of salmon (*Oncorhynchus*) are found in the North Pacific—(1) *O. tschawytscha*, quinnat, tyee, chinook, spring, or King salmon; (2) *O. nerka*, blueback, red, sukkegh, or sockeye salmon; (3) *O. kisutch*, silver, coho, white, or medium red salmon; (4) *O. keta*, dog, keta, or chum salmon; and (5) *O. gorbuscha*, humpback or pink salmon. Only a single specimen of pink salmon passed through the authors' hands, but for the other species, they set up limits for the iodine and hexabromide values of the expressed oil which should serve for their identification, except for certain specimens of chinook or chum, which may be mistaken for one another. The limits set up are as follows:

	Iodine Number.	Hexabromide Value.
Chinook	127-134	23-31
Chum	133-136	28-30
Red	141-148	33-37
Coho	153-156	43-46
Pink	154	40
Medium Red	161-166	48-59

To carry out the tests, sufficient of the salmon is chopped and pressed in a screw press, the oil and water mixture is centrifuged and the oily layer dried with anhydrous sodium sulphate and filtered through paper. The iodine number is determined by the Hanùs method and the hexabromide value by a combination of earlier methods, as follows :

About 1 grm. of oil is weighed into a tared tube, 6 inches by 1 inch, 25 c.c. absolute ether are added, and the mixture cooled to 0° C. Next there is added, drop by drop, a mixture of 1 volume of bromine with 5 volumes of glacial acetic acid. Enough of this mixture (usually 2 to 3 c.c.) is added to impart a deep red colour. The tube with its contents is kept overnight in a cool place (not over 20 c.c.), cooled next morning to 0° C., centrifuged for three minutes, the solvent decanted off, 10 c.c. ice-cold absolute ether added to the precipitate, which is stirred up, and the mixture cooled to 0°.C. and centrifuged again. The ether is decanted off and the precipitate washed twice more in the same way, after which the tube and its contents are dried at 100° C. to constant weight, thirty minutes being usually sufficient. As a very bulky precipitate cannot readily be centrifuged and washed rapidly enough to prevent the solution warming up and dissolving hexabromide, salmon oils with high hexabromide values are best diluted with an equal weight of cotton-seed oil, shown by test to yield no hexabromide precipitate, and 1 grm. of this mixture is taken for the test.

G. C. J.

Analysis of Commercial Saccharin. Detection and Estimation of Impurities. H. D. Richmond and C. A. Hill. (*J. Soc. Chem. Ind.*, 1919, **38**, 8-10T.)—*Moisture.*—This is taken as being the loss when the sample is dried in the water-oven. *Mineral Matter.*—In estimating the ash, the substance should be heated gently at first, until most of the saccharin has volatilised; the remaining organic matter then burns readily. *p-Sulphonaminobenzoic Acid.*—Extraction with ethyl acetate is recommended for the separation of this acid. The sample is hydrolysed as usual, the ammonia distilled off, the solution rendered just acid, diluted to 25 c.c., and extracted with about six successive portions of ethyl acetate, using 50 c.c. each time ; the extracts are evaporated, the residue redissolved, and again extracted, and the para-acid thus obtained is titrated. *o-Sulphonaminobenzoic Acid.*—A weighed quantity of 2·5 grms. of the sample is shaken for one hour with 25 c.c. of water, and the acidity of the solution is then determined ; if this acidity exceeds that of pure saccharin under these conditions (at 15° C., 100 grms. of water dissolve 0·26 grm. of saccharin), the ammonia produced by boiling 20 c.c. of the solution for one hour with 10 c.c. of hydrochloric acid (sp. gr. 1·16) is titrated and the result calculated into saccharin ; if this exceeds the quantity mentioned (0·26 grm. per 100 c.c.), the excess is calculated into ortho-acid (100 c.c. of water at 15° C. dissolves 1·77 grm. of ortho-acid). *o-Toluene Sulphonamide.*—Good commercial saccharin contains but small traces of this impurity, which may be detected by mixing 1 grm. of the sample with 0·5 grm. of sodium hydrogen carbonate, and then adding three successive quantities of 1 c.c. of water ; the water must be added slowly while the mixture is shaken. The whole mixture is next shaken violently, when the saccharin dissolves, leaving the amide undissolved as flocculi. *Melting-Point.*—Pure saccharin melts at 229° C. ; moisture and impurities lower the melting-point, and the authors attach but little importance to this test. *Ammonia.*—This may be detected by means of Nessler's reagent; it is rarely present except in traces. *Lead and Arsenic.*—Lead is detected and estimated as sulphide after the sample has been boiled with dilute hydrochloric acid; arsenic is estimated by Harvey and Hibbert's modification of the Gutzeit test, after the sample has been ignited with magnesium and sodium hydrogen carbonate, and the ash heated with sulphuric acid and potassium pyrosulphate. *Easily Carbonisable Organic Matter.*—This may be detected by the brown coloration obtained when the sample is boiled for half a minute with 70·5 per cent. sulphuric acid.

W. P. S.

Composition of the Seed of the Silver Maple *(Acer Saccharinum)*. J. Anderson. (*J. Biol. Chem.*, 1918, **34**, No. 3, 509-513; through *Inter. Rev. Sci. and Prac. of Agric.*, 1918, **10**, 1178.)—The Samaras (fruits with winged appendages) dried to constant weight in a current of air at a temperature of 40 to 50° C. lost 55·34 per cent. of their weight; 70 per cent. of the dried samara composed the seed properly speaking, the other 30 per cent. composed the wings (pericarp). The powdered dried seeds, separated from the wings and outer seed coat by rubbing and sifting, gave on analysis the following percentages on a water-free basis: *Cotyledons.*—Starch 41·94, protein (N × 6·25) 27·50, cane sugar 15·78, pentosans 4·07, galactan 1·08, crude fibre 2·36, crude fat 3·55, ash 5·01 containing phosphorus 0.72, sulphur 0·16, chlorine 0·07 calcium 0·09, manganese 0·01, magnesium 0·18, potassium 0·70, sodium 0·07. *Pericarp.*—Dextrose (reducing sugar) 6·11, cane sugar 0·99, galactan 3·45, pentosans 15·24, starch 14·73, crude fibre 34·50, crude fat 2·40, protein (N × 6·25) 8·15, moisture 6·29, ash 3·98 containing manganese 0·018, sulphur 0·10, phosphorus 0·19, potassium 0·46, sodium 0·08, calcium 0·40, magnesium 0·10. Of the total phosphorus of the ash of the cotyledons (0·72 per cent.), 0·65 per cent. is soluble in 2 per cent. hydrochloric acid (time of extraction = 3 hours), 50 per cent. is organic, and 15 per cent. inorganic. The total nitrogen content of the cotyledons is 4·40 per cent., 0·39 per cent. of which is soluble in 70 per cent. alcohol, and 2·06 per cent. in 5 per cent. sodium chloride; 1.93 per cent. of the total nitrogen remains in residue. The principal constituents of silver maple seeds are, therefore, starch, protein, and sucrose. The principal protein is a globulin. It was found possible to isolate an organic compound of phosphorus very similar to, if not identical with, phytin.

H. F. E. H.

Coffee Substitutes made with Lupin. H. Eckenroth. (*Zeitsch. f. Untersuch. Nahr. Genussm.*, 1918, **6**, 240; through *Inter. Rev. Sci. Prac. Agric.*, 1918, **10**, 1151.)—Coffee substitutes, containing up to 50 per cent. of lupins, are being used in Germany, and have an extremely bitter flavour, which is not eliminated by roasting. Such material may cause illness, and must be considered as unfit for human consumption. Measures have already been taken in Austria to prohibit their use as food.

H. F. E. H.

BACTERIOLOGICAL, PHYSIOLOGICAL, ETC.

Method for the Selective Coloration of Woody Tissue in Vegetable Membranes. P. Bugnon. (*Comptes rend.*, 1919, **168**, 62-64.)—The section is treated with sodium hypochlorite solution, washed, and then immersed for ten minutes in a saturated solution of Light Green (the sodium salt of diethyldibenzyldiaminotriphenylcarbinol trisulphonic acid) and Soudan III. The section is finally washed with water. Under this treatment the woody tissue is coloured green, whilst the cork tissue is dyed red-orange. W. P. S.

Antiseptic Value of Some Essential Oils. L. Cavel. (*Comptes. rend.*, 1918, **166,** 827-829; through *Inter. Rev. Sci. Prac. Agric.*, 1918, **10,** 1151.)—For each essential oil the minimum quantity was determined which was found necessary to prevent all bacterial growth in ordinary neutralised meat broth plentifully sprinkled with water from a septic source. The inhibiting quantity of phenol under the same experimental conditions being 5·6 parts per 1,000, the author obtained the following classification for the essential oils: Thyme 0·7 part per 1,000, marjoram 1·0, orange-peel oil 1·2, verbena 1·6, cassia 1·7, rose 1·8, clove 2·0, eucalyptus 2·25, mint 2·5, geranium (rose de France) 2·5, vetiver 2·7, bitter almond 2·8, gaultheria 3·0, geranium (Indian) 3·1, winter-green 3·2, meadow-sweet 3·3, spike lavender 3·5, aniseed-tree, 3·7, iris 3·8, common cinnamon 4·0, wild thyme 4·0, birch 4·8, anise 4·2, mustard 4·2, rosemary 4·3, cumin 4·5, neroli 4·75, lavender 5, balm 5·2, ylang-ylang 5·6, juniper 6·0, sweet fennel 6·5, reseda 6·5, garlic 6·5, lemon 7·0, cajeput 7·2, sassafras 7·5, heliotrope 8·0, cedrate 8·4, turpentine 8·6, parsley 8·8, violet 9·0, camphor 10·0, angelica 10·0, patchouly 15·0. Seven months after innoculation the culture plates were still sterile when the above quantities were used. (Cf. ANALYST, 1918, **43,** 171.) H. F. E. H.

Analysis of a Rhinolith. Karabedian and Ciarlan. (*Ann. Chim. anal.*, 1919 [ii.], **1,** 12-13.)—A rhinolith (a concretion sometimes found in the nasal cavities) examined by the authors had the following composition: Water, 14·05; organic matter (loss on ignition), 16·34; substances soluble in boiling water, 1·17; tricalcium phosphate, 48·14; calcium carbonate, 12·58; losses and not estimated, 7·72 per cent. W. P. S.

Comparative Estimation of the Richness of Soils in Humus. L. Lapicque and E. Barbé. (*Comptes rend.*, 1919, **168,** 118-121.)—Soils absorb different proportions of chlorine from a solution of sodium hypochlorite, which can therefore be used as a reagent for measuring the oxidisability of a particular soil and, indirectly, its relative richness in humus. In making an estimation it is better to take a definite volume rather than weight of the soil, in order to eliminate the influence of moisture within wide limits. Ten c.c. of a representative sample of the soil are vigorously shaken for one minute in a stoppered 150 c.c. flask with 50 c.c. of sodium hypochlorite solution (5 to 10 volumes of chlorine), and then shaken at intervals for half an hour. After settling, 2 c.c. of the practically clear supernatant liquid are drawn off and mixed with 50 c.c. of water and 5 c.c. of a 20 per cent. solution of potassium iodide, 2 c.c. of hydrochloric acid added, and the liberated iodine titrated with thiosulphate solution. A blank estimation is made with 2 c.c. of the hypochlorite solution, and the difference between the results, multiplied by 2·5, gives the amount of active chlorine absorbed by 1 c.c. of the soil. If more than half the chlorine has disappeared, the estimation should be repeated with twice the amount of hypochlorite solution, and the result multiplied by 5. It was found that worked soils examined by this method gave fairly constant values, the ratio in volumes between the chlorine and the soil usually ranging from 15 to 20. Subsoils taken at a depth of 20 to 40 cms. contained much less oxidisable matter, the ratio usually varying from 4 to 11, and approaching towards zero with the increase in the depth at which the sample was taken. Leaf mould from woods gave results double or treble those of ordinary soils and approximating those given by vegetable mould from a vineyard, whilst turf gave values about ten times as high as the average values of worked soils. The soil from sloping ground gave much lower results than that from plains, whilst very low figures (5 to 7) were obtained with the soil from artillery grounds and with soil from a devastated area near Verdun. C. A. M.

Absorbent Power of Dry or Moist Earth for Gaseous Chlorine. D. Berthelot and R. Trannoy. (*Comptes rend.*, 1919, **168**, 121-123.)—Samples of sand and earth dried at 110° to 120° C., and also containing 10 and 20 per cent. of moisture, were exposed in uniform layers for two hours at 20° C. in an atmosphere of chlorine gas. Ten grms. of quick-lime were then added to the contents of each basin, and the absorbed chlorine estimated by means of silver nitrate and thiocyanate, after ignition of the mass. It was found that white sand absorbed very little chlorine, and was of little use as a protective agent in gas-masks. Yellow ferruginous sand absorbed considerably more chlorine (0·019 grm. per 10 grms.), but much less than earth moulds (0·05 to 0·056 grm. per 10 grms.). The presence of moisture increased the absorbent capacity of all the samples. Thus, samples of mould containing 10 per cent. of moisture absorbed 0·118 to 0·154 grm., and those with 20 per cent., 0·12 to 0·169 grm. per 10 grms. Beyond a certain initial increase in the absorptive capacity, the addition of water to a dry earth only increases the absorption to the extent of the solvent action of the added water. C. A. M.

Determination of the Absolute Salt Contents of Soils by the Freezing-Point Method. E. J. Bouyoucos and M. M. McCool. (*J. Agric. Research*, 1918, **15**, 331.)—When different classes of soil are washed until their soluble salt content is greatly reduced, their lowering of the freezing-point is practically identical; thus, sandy loams, loams, clay loams, and clays give a depression of about 0·007° C., and sands and light sandy loams about 0·005° C. It has in consequence been established that at a high moisture content or in excess of water the method could be used to determine the absolute salt content of all normal soils with a high degree of accuracy, and thus afford a comparison of their relative absolute salt content. Since it was experimentally found that air-drying the soils did not increase the freezing-point depression, the samples for examination are allowed to air-dry if freshly taken from the field, and a 15-grm. sample is then taken and poured into the freezing tube containing 10 c.c. of distilled water, and after stirring the depression of the freezing-point is determined. The salt content of soils can be expressed both in degrees of depression and in parts per million of solution, a depression of 0·004° C. being equivalent to 100 parts per million of solution. Numerous records of soils at different seasons and cultural conditions are appended, showing the variations to extend from 225 to 1,700 parts per million according to season, rainfall, soil character, and other factors. H. F. E. H.

ORGANIC ANALYSIS.

Estimation of Acetone in Smokeless Powders. A. Pieroni. (*Gazz. Chim. Ital.*, 1918, **48**, 183-186.)—In estimating acetone by conversion into iodoform the velocity of the formation of that compound is much smaller than the velocity of the decomposition of the hypoiodite, whilst nascent iodoform in presence of a large excess of alkali reacts to form potassium iodide and formate. Hence, to convert acetone quantitatively into iodoform it is necessary to have large excess of hypoiodite, or to effect the reaction with the smallest possible quantities of reagents in a given time. Under these conditions accurate results are obtained, and the method is applicable to the estimation of acetone in smokeless powders. For this purpose from 35 to 50 grms. of the powder are ground up in a special apparatus, being meanwhile immersed in a current of cold water to prevent evaporation of the acetone. The mass and the water are then introduced into a distillation flask, treated with 100 c.c. of dilute sulphuric acid (1 : 1), to prevent emulsification, and distilled in a current of steam, the distillate passing through a condenser into an Erlenmeyer flask, which is connected with a washing bottle to catch any trace of acetone escaping from the receiving flask. After the whole of the acetone has distilled, the distillate (about 250 to 300 c.c.) is made up to 500 c.c., and the acetone estimated in an aliquot portion (100 c.c.). This is placed in a stoppered cylinder, into which are then introduced simultaneously from two burettes a solution of potassium hydroxide (112 grms. per litre) and an iodine solution containing 257 grms. of iodine and 330 grms. of potassium iodide per litre. The solutions are added at the rate of about 20 drops per minute, the cylinder being meanwhile constantly shaken, until, after standing for a short time, no further turbidity (due to iodoform) is produced. After a few minutes standing, the liquid is saturated with sodium chloride, and shaken with 50 c.c. of ether, and the cylinder allowed to stand until the layers separate, when 25 c.c. of the ethereal solution of iodoform are withdrawn by means of a pipette, and added to 25 c.c. of a saturated alcoholic solution of potassium hydroxide. The liquid is diluted with alcohol until a clear solution is obtained, the ether evaporated on the water-bath, the alcohol distilled, and the residue diluted with water, cooled, and acidified with dilute nitric acid. The potassium iodide is then estimated by Volhard's method, and from the number of c.c. silver nitrate solution required the amount of acetone in the smokeless powder is calculated by means of the formula—Acetone, per cent. $= \frac{2a}{b}$, where a represents the number of c.c. of $\frac{N}{10}$ silver nitrate, and b the weight of the sample of powder. C. A. M.

Identification of Acids. IV. Phenacyl Esters. J. B. Rather and E. E. Reid. (*J. Amer. Chem. Soc.*, 1919, **41**, 75-83.)—Phenacyl bromide is a convenient reagent for the identification of acids. It is readily prepared, and it forms esters of acids when boiled in dilute alcohol solution with the alkali salts of the acids. Many of the esters are solids, easily purified by recrystallisation from dilute alcohol, and have convenient melting-points.

Phenacyl bromide is prepared by adding 28 grms. bromine slowly, with constant shaking, to 20 grms. acetophenone dissolved in 30 grms. glacial acetic acid. If towards the end of the reaction hydrobromic acid is not given off readily, the mixture is warmed by immersing the flask in hot water for a few minutes. After all the bromine has been added and the whole has begun to cool, the mixture is poured into ice water. After an hour, the crude phenacyl bromide is filtered off with suction and recrystallised from hot alcohol. When pure it melts at 50° C., but a high degree of purity is not necessary.

In the preparation of phenacyl esters, 1 grm. of the reagent, slightly more than the equivalent amount of acid, slightly less than the amount of sodium carbonate necessary to neutralise the acid, and 15 c.c. of 63 per cent. alcohol, are boiled under a reflux condenser. To prepare this mixture, the acid and the carbonate are heated with 5 c.c. water until solution takes place, when the reagent and 10 c.c. of 95 per cent. alcohol are added. Heating under a reflux condenser is continued for one hour with monobasic acids, two hours with dibasic, and three hours with tribasic acids, adding alcohol from time to time if necessary to prevent the precipitation of ester. With polybasic acids it is best to have the reagent present in excess. After boiling, the mixture is cooled under the tap, the crystals filtered off by suction, washed twice with 5 c.c. of 63 per cent. alcohol, twice with water, and recrystallised until constant melting-points are obtained. The following esters of phenacyl alcohol have been prepared, the figure following each being the m.-p. (uncorrected) in degrees C.

Acetate (40).
Aconitate (90).
o-Aminobenzoate (182).
Benzoate (119).
p-Bromobenzoate (87).
Cinnamate (141).
Citraconate (109).
Citrate (104).
m-Cresotate (117).
o-Cresotate (139).
p-Cresotate (146).
Fumarate (198).
Glutarate (105).
Itaconate (80).
Lactate (96).
Malate (106).
Maleate (119).
Mandelate (85).
p-Nitrobenzoate (128).
Palmitate (53).
Pyrotartrate (102).
Saccharate (120).
Salicylate (110).
Stearate (64).
Succinate (148).
Tartrate (130).

G. C. J.

Analysis of Commercial "Pure" Benzols. F. B. Jones. (*J. Soc. Chem. Ind.*, 1918, **37**, 324-327.)—The impurities to be looked for in commercial pure benzols are carbon bisulphide, thiophen, toluene, and paraffin. These are present only in small quantities, and the author proposes physical methods for their estimation, based on constants plotted in the form of graphs determined with known mixtures of the pure constituents. The carbon bisulphide and the thiophen are estimated by the differences in the freezing-points of the mixture before and after their respective removal. The remaining liquid is a mixture of benzene, toluene, and paraffin. The difference between its freezing-point and that of pure benzene (5·48° C.) is a measure of the toluene and paraffin, and these are determined from the difference between the specific gravity of the mixture and that of pure benzene (0·8842 at 15·5°/15·5° C.). The results are obtained by solving four equations :

(1) $\Delta_1\theta = c_1 \times$ carbon bisulphide per cent.
(2) $\Delta_2\theta = c_2 \times$ thiophen per cent.
(3) $\delta\theta = k_1 \times$ toluene per cent. $+ k_2 \times$ paraffin per cent.
(4) $\delta(s.g.) = g_1 \times$ toluene per cent. $+ g_2 \times$ paraffin per cent.,

where k_1 and k_2 are the freezing-point depressions produced by 1 per cent. of toluene and paraffin respectively in pure benzene, and g_1 and g_2 the corresponding specific gravity depressions. The first three impurities may be present to the extent of a few tenths per cent., but the "paraffin" may range up to 3 per cent. in rare cases. Its constants may vary according to the origin of the benzene. A typical specimen from gas-tar benzene had sp. gr. at 15·5°/15·5° C. 0·7231, and boiled at from 4° up to 93° to 97° C. The following constants have been used in preparing the graphs: Depression in the freezing-point of pure benzene caused by 1 per cent. by volume of solute : carbon bisulphide, 0·94° C. (c_1); thiophen, 0·465° C. (c_2); toluene, 0·52° C. (k_1); paraffin, 0·425° C. (k_2). Depression in the sp. gr. : toluene, 0·0001 (g_1); paraffin, 0·0018 (g_2). The determinations necessary for the analysis comprise three freezing-points and one specific gravity. The thermometer should afford readings accurate to 0·01° C., corresponding to about 0·02 per cent. of impurity, or 0·01 per cent. in the case of carbon bisulphide. The thermometer having been calibrated, the freezing-point of the sample is determined; the carbon bisulphide is then completely removed by treatment for not more than one hour with alcoholic potash, avoiding a large excess of alcohol, followed by three washings with water. The freezing-point is then taken again, and the thiophen removed by shaking the benzene continuously for two to three hours with twice its volume of a cold solution of basic mercuric sulphate (Denigès reagent), prepared by dissolving 5 grms. of mercuric oxide in a solution of 20 c.c. of strong sulphuric acid in 100 c.c. of water and filtering the solution. The residual benzene is washed twice with water and filtered, and its freezing-point and specific gravity at 15·5°/15·5° C. are determined. The specific gravity must be determined accurately to within 5 in the fifth decimal place. The presence of moisture does not appear to affect the freezing-point determinations, but the benzene should be dried by calcium chloride before measuring its specific gravity. Other impurities must be substantially absent, and if the sample shows more than a lemon-yellow colour with 90 per cent. sulphuric acid, it must be purified by washing with sulphuric acid.

J. F. B.

Analysis of Benzols and Light Oil. J. M. Weiss. (*J. Ind. and Eng. Chem.*, 1918, **10**, 1006-1012)—Another of the author's series of communications on the methods of analysis used in the coal-tar industry (*cf.* ANALYST, 1918, **43**, 419; 1919, 58). Methods are described for the determination of the specific gravity of benzols, the distillation of pure products and of commercial benzols, the estimation of carbon bisulphide, paraffins, hydrogen sulphide, and sulphur dioxide, and for determining the solidifying-point of "pure" benzol. A quantitative test of the amount of colour imparted to concentrated sulphuric acid on shaking commercial benzols with the acid under standard conditions is described at length, and standards suggested for the various grades of benzol, for commercial toluol, and solvent naphtha.

For the examination of light oil, methods for straight distillation and distillation with a dephlegmator (Hempel) column are described, also methods for the estimation of crude naphthalene and for the estimation of benzol and toluol. G. C. J.

Volumetric Estimation of Mercury Oxycyanide. A. Tagliavini. (*Ann. Chim. anal.*, 1919, [ii], **1**, 26.)—A weighed quantity of the salt is dissolved in 50 c.c. of water, 1 grm. of sodium chloride and a drop of methyl-orange solution are added, and the mixture is titrated with $\frac{N}{10}$ hydrochloric acid. $HgOHg\,(CN)_2 + 2HCl = HgCl_2 + Hg\,(CN)_2 + H_2O$. Two grms. of potassium iodide solution are then added to the mixture, and the yellow solution obtained is again titrated with $\frac{N}{10}$ acid. $Hg(CN)_2 + 4KI + 2HCl = HgK_2I_4 + 2KCl + 2HCN$. The quantities of mercury oxycyanide and mercury cyanide present may be calculated from the volumes of hydrochloric acid used in the two titrations. W. P. S.

Estimation of Nitroso-β-naphthol. P. Nicolardot and L. Valli-Donau. (*Bull. Soc. Chim.*, 1918, **23**, 455-459.)—On adding to an acetone solution of nitroso-β-naphthol a solution of a ferric salt the compound $(C_{10}H_6ONO)_3Fe$ is obtained, and the excess of iron may then be indicated by a spotting test with ammonium thiocyanate. For this purpose a solution of ferric ammonium sulphate (15 grms. per litre) is standardised against a solution of 1 grm. of pure nitroso-β-naphthol in 50 c.c. of acetone, diluted with 30 c.c. of water. In analysing a commercial product, 2 grms. of the sample, which has been dried at 35° C., are placed in a stoppered flask with about 120 c.c. of acetone and left for at least an hour with frequent agitation. The liquid is then diluted to 200 c.c. with water, the impurities allowed to subside, and 100 c.c. of the solution titrated with the standard ferric ammonium sulphate solution. For a gravimetric estimation an excess of about 10 c.c. of the ferric solution and about 50 c.c. of water are added to the acetone solution, and the mixture stirred for two minutes and allowed to stand overnight. The precipitate is collected on a double tared filter, washed with cold water until free from iron sulphate, and dried at 70° C. until constant in weight. C. A. M.

Quantitative Estimation of Soluble Starch in the Presence of Starch and its Hydrolytic Cleavage Products. J. C. Small. (*J. Amer. Chem. Soc.*, 1919, **41**, 107-112.)—Alcohol, barium hydroxide, ammoniacal lead acetate, and ammonium sulphate, have been employed by previous workers in the attempt to fractionate dextrins and to separate soluble starch from dextrins. These reagents precipitate not only soluble starch, but starch hydrolysis products in addition dependent upon the concentration of the precipitant in the mixture. The author finds that the iodide of soluble starch can be precipitated readily from its solution in presence of "dextrins" and "lower carbohydrates" by ammonium sulphate, the precipitate being washed free from the other carbohydrates by means of solutions of ammonium sulphate. On heating the iodine precipitate in aqueous suspension with a little free hydrochloric acid, the iodine is driven off, and the residual starch is then hydrolysed by further boiling with more acid and estimated polarimetrically as dextrose. (Dextrose × 0·9 = starch.) Test samples were analysed, made of mixtures of "preparations containing soluble starch" and "commercial erythrodextrin," high results being obtained, due to the disturbing presence of "amylodextrin or the erythrodextrin No. 1 of some authors," which was precipitated along with the soluble starch by excess of iodine. This was obviated by adding no iodine during the successive sulphate washings of the soluble starch-iodide precipitate, the result being that the amylodextrin-iodide compound is washed out by the ammonium sulphate.

Note by Abstractor.—The substances described as amylodextrin, soluble starch, or erythrodextrin in this paper are not defined, nor is any physical or chemical constant included by which they may be characterised. No alternative or control method was used for the estimation of soluble starch, which was not prepared in a pure state, but was only employed in the form of an unanalysed preparation alleged to contain it. H. F. E. H.

Method for the Preparation of Soluble Starch. J. C. Small. (*J. Amer. Chem. Soc.*, 1919, **41**, 113-120.)—Numerous attempts to prepare soluble starch containing a minimum of allied carbohydrates by the use of hydrochloric acid are described, the factors of time, temperature, volume, acid concentration, starch concentration, and medium, being among those varied. Since the use of elevated temperatures causes much soluble starch to pass into solution as soon as formed, 95 per cent. alcohol was employed, in which soluble starch in insoluble. It is found that the greatest yield of soluble starch unaccompanied by "unchanged starch," "erythrodextrin," or "Benedict-Fehling reduction," is obtained when 3 grms. of pure raw potato starch (moisture content not specified) are heated to boiling for ten minutes under a reflux condenser in 100 c.c. of 95 per cent. alcohol containing 0·75 c.c. of strong hydrochloric acid (sp. gr. 1·19). At the end of the period of heating, the acid is at once neutralised to methyl orange with sodium bicarbonate, and the starch is then filtered and washed with fresh alcohol. Under these conditions a 100 per cent. yield is obtained before any further hydrolysis, resulting in the production of reducing substances, supervenes, while no unchanged starch survives conversion into soluble starch. The author states that in soluble starch as usually prepared by the standard Lintner method (seven days at room temperature in 7·5 per cent. acid), amylodextrin, erythrodextrin, and copper-reducing substances may be readily identified.

H. F. E. H.

Volumetric Estimation of Zinc Sulphophenate. Adanti. (*Ann. Chim. anal.*, 1919, [ii.], **1**, 25.)—Fifty c.c. of aqueous solution containing 0·05 grm. of the salt are treated in a stoppered flask with 50 c.c. of 0·6 per cent. potassium bromide solution, 50 c.c. of 0·1671 per cent. potassium bromate solution, and 5 c.c. of concentrated sulphuric acid; the mixture is kept at 25° C. for three hours in a dark place, 10 c.c. of potassium iodide solution are then added, and, after an hour, the free iodine is titrated with $\frac{N}{10}$ thiosulphate solution. A control test is carried out at the same time, using the above-mentioned quantities of reagents, but no zinc sulphophenate. The difference between the quantities of $\frac{N}{10}$ thiosulphate solution used in the two titrations is multiplied by 0·00447 to obtain the quantity of crystallised zinc sulphophenate in the 50 c.c. of solution taken for the estimation.

W. P. S.

INORGANIC ANALYSIS.

Physico-Chemical Method for the Estimation of Alkali Carbonates in the Presence of Free Alkalies. R. Dubrissay, Tripier, and Toquet. (*Comptes rend.*, 1919, **168**, 56-59.)—The method is based on the fact that alkalis increase the miscibility coefficient of water and phenol, whilst alkali carbonates have the opposite action. Solutions are prepared containing molecular equivalents per litre of sodium hydroxide and sodium carbonate respectively; varying mixtures of these are made, and 50 c.c. of the mixtures are each mixed with 50 grms. of phenol. These phenolic mixtures are heated until the phenol has dissolved, and then cooled slowly, the temperature being noted, in each case, at which the mixture first becomes turbid. The turbidity-points observed are tabulated or plotted graphically. In dealing with a mixture of unknown composition, the total alkali is estimated, the solution then brought to a definite strength (*e.g.*, 40 grms. of total alkali per litre), and the turpidity temperature is determined as described. Reference to the tables or curves will then give the proportion of carbonate present. It will be found convenient to prepare curves for $2N$, $\frac{N}{1}$, $\frac{N}{2}$, and $\frac{N}{4}$, solutions. For the estimation of carbon dioxide in flue gases, 1 litre of the gases is bubbled through 71·5 c.c. of solution containing 0·25 grm. of sodium hydroxide; the turbidity-point of the solution is then taken, and the proportion of carbonate ascertained by reference to the $\frac{N}{4}$ curve.

W. P. S.

Analysis of Aluminium Alloys and Metallic Aluminium. J. J. Fox, E. W. Skelton, and F. R. Ennos. (*J. Soc. Chem. Ind.*, 1918, **37**, 328-333 T.)—The methods used for the analysis of aluminium and its alloys must be adapted according to the particular type of the sample. In the classification proposed three types are recognised: (1) Metallic aluminium unalloyed, in which the quantity of any single impurity rarely exceeds 1 per cent. (2) Alloys containing up to 13 per cent. of copper and up to 3 per cent. of zinc; tin, if present, is usually below 3 per cent., and manganese, nickel, and magnesium may be present. (3) Alloys containing up to 20 per cent. of zinc., up to 5 per cent. of copper, and all other constituents not exceeding 1 per cent. The type to which the alloy belongs is determined by a rapid qualitative test. Nickel must be looked for carefully, as its presence necessitates certain precautions in the subsequent analysis. The reagents employed for attacking the metal are a 10 per cent. solution of sodium hydroxide and a mixture of 300 c.c. of strong sulphuric acid, 300 c.c. of water, and 200 c.c. of nitric acid (sp. gr. 1·42). The first method proposed is applicable to metallic aluminium and alloys poor in zinc (Type 2). The lead and the manganese are estimated in a separate portion of the sample. For the estimation of lead the metal is dissolved in caustic soda, the insoluble portion is filtered off, dissolved in nitric acid, and the solution is evaporated to fuming-point with sulphuric acid. The lead sulphate is separated from silica by dissolving in ammonium acetate, precipitating as sulphide, and reconverting into sulphate. The filtrate from the first precipitation of lead sulphate is oxidised in presence of nitric acid with sodium bismuthate in the cold. If the manganese is less than 0·1 per cent., it may be titrated at once with ferrous salt; but if it be more, a fresh portion of the sample should be dissolved in soda, then taken up with nitric acid, and oxidised with bismuthate. For the main analysis, 1 grm. of the sample is dissolved in the mixture of nitric and sulphuric acids and the solution evaporated, with certain precautions to avoid bumping, to the fuming-point. The mass is dissolved in water, the mixture of silicon, silica, and lead sulphate filtered off, and gently ignited. The silica is volatilised by ignition with hydrofluoric and sulphuric acids, and the silicon by ignition with hydrofluoric, nitric, and sulphuric acids, the total being calculated as silicon. The filtrate is treated with nitric acid, and the copper deposited electrolytically on a rotating platinum gauze cathode. The solution after electrolysis is saturated with hydrogen sulphide. If tin is absent, the precipitate is ignited, taken up with nitric acid, and residual traces of copper estimated colorimetrically with ammonia. If tin is present, the sulphide is extracted with warm dilute sodium sulphide solution. The solution of sodium-thiostannate is carefully acidified and resaturated with hydrogen sulphide. The tin sulphide is oxidised in a crucible with strong nitric acid, ignited, and weighed as tin dioxide; any traces of copper in it should be estimated colorimetrically. The filtrate from Group 2 is treated with tartaric acid, ammonia, and ammonium sulphide. If nickel is absent, the sulphides of zinc, iron, and manganese are filtered off, washed, dissolved in hot hydrochloric acid, the solution is oxidised by bromine, and the iron and manganese are precipitated by bromine and ammonia, a double precipitation being necessary. The iron is separated from the manganese as basic acetate, then dissolved, and precipitated as sulphide in presence of ammonium tartrate. The filtrate containing the zinc is slightly acidified, and the zinc precipitated as zinc ammonium phosphate by microcosmic salt and ammonium chloride; but if the zinc is less than 1 per cent., it is preferably precipitated as sulphide. The magnesium is precipitated from the filtrate from the mixed sulphides as magnesium ammonium phosphate, which is redissolved and reprecipitated in the presence of a little tartrate. If manganese is present in quantity, it is liable to contaminate the magnesium and the zinc, and the ignited precipitates containing these should be tested colorimetrically by the bismuthate method. If nickel be present, it is partly present in the mixed sulphides, which then have to be dissolved, with the addition of a little nitric acid to the hydrochloric acid. The nickel accompanies the zinc after separation of the iron and manganese, and must be precipitated by means of dimethylglyoxime before the zinc can be estimated. Part of the nickel as sulphide passes into the filtrate with the magnesium, and must be separated by acidifying with acetic acid, boiling off the hydrogen sulphide, adding dimethylglyoxime, and making slightly alkaline with ammonia. The nickel itself is best estimated in a separate sample by dissolving out the bulk of the aluminium and zinc with caustic soda, dissolving the residue in nitric acid, separating the metals of Group 2, boiling off the hydrogen sulphide, adding tartaric acid, excess of dimethylglyoxime, and sufficient ammonia, and collecting the glyoxime precipitate.

For alloys of Type 3, containing much zinc, the above method is somewhat tedious as regards the manipulation of the iron and zinc sulphides. An alternative method has been worked out as follows: The lead is estimated as before. The nickel is precipitated after eliminating the bulk of the aluminium and zinc, as described above, from an ammoniacal tartrate solution with dimethylglyoxime; the filtrate is examined for magnesium after separating iron and zinc as sulphides. As a rule nickel is absent from alloys of this type, and magnesium is not present except as traces. In the main analysis the alloy is dissolved in nitric and sulphuric acids, as in Method 1, and the silicon and silica separated. To the filtrate occupying about 100 c.c., 7 c.c. of "20 volume" hydrogen peroxide is added, and the copper deposited by electrolysis in the presence of excess of the peroxide instead of nitric acid to keep the metal bright. The sulphides of Group 2 are then precipitated and washed with warm water only. The filtrate is boiled and oxidised with bromine, and then treated with 1 grm. of tartaric acid and sufficient 50 per cent. sodium hydroxide solution to just redissolve the precipitate formed; a further 20 c.c. of the soda is then added, and the solution is diluted to about 300 c.c. At this stage magnesium hydroxide will be precipitated, if present. The solution is then electrolysed, using a rotating gilded platinum cathode, for thirty minutes with a current of 1·7 ampères (3 to 4 volts), and subsequently for thirty minutes with 2 ampères. The deposit contains the total iron and zinc, together with traces of nickel and manganese, if present. It is weighed and dissolved in dilute sulphuric acid. If it contains no manganese, the iron is estimated by permanganate; if manganese is present, the solution is divided into two parts, in one of which the iron is titrated, and in the other the manganese is oxidised by sodium bismuthate and nitric acid and titrated. If nickel is present, the solution, after titrating the iron, is treated with dimethyglyoxime and ammoniacal tartrate. The zinc is calculated by difference. The alkaline liquid, after electrolysis, is examined for small quantities of zinc and iron by treatment with sodium sulphide, and if appreciable quantities are found these must be separated in the usual way.

J. F. B.

Commercial "Concentrated Ammonia Liquor" and its Impurities. H. G. Colman and E. W. Yeoman. (*J. Soc. Chem. Ind.*, 1918, **37**, 319-324T.)—Commercial concentrated ammonia liquor has a strength of about 25 per cent.; it still contains appreciable quantities of hydrogen sulphide, the amount of which should not exceed 0·5 per cent. This may be estimated by adding 10 c.c. of the sample to 50 c.c. $\frac{N}{10}$ iodine containing sufficient hydrochloric acid to neutralise the ammonia. A similar test is made after treatment with cadmium chloride, the second value indicating the thiosulphate and the difference the hydrogen sulphide. The results are influenced by the presence of phenols and thiocyanate, and the value for thiosulphate is slightly too high. The carbonate is determined by running 10 to 25 c.c. into a hot solution of calcium chloride, avoiding as far as possible exposure to the air. The calcium carbonate is filtered off, washed, and dissolved in standard hydrochloric acid. Phenols are determined by the iodine method described by Skirrow (ANALYST, 1908, **33**, 134), and pyridine bases by the method of Pennock and Morton (*J. Amer. Chem. Soc.* 1902, **24**, 377). The accurate estimation of the free ammonium cyanide is a matter of great difficulty, and the cyanogen is one of the most objectionable impurities for the manufacture of ammonium nitrate. The difficulty is due to the conversion of the cyanide into thiosulphate on exposure to the air during the manipulation of the samples. For many purposes the estimation of the total cyanogen in the samples is sufficient, in which case a few drops of ammonium polysulphide should be added to complete the conversion, and the thiocyanate is estimated as a whole. For the free cyanide, 100 c.c. of liquor are taken in a pipette, avoiding exposure to the air, and run into 150 to 200 c.c. of boiling water containing 10 c.c. of $\frac{N}{1}$ caustic soda. When the bulk of the ammonia has been driven off, a solution of 5 grms. of lead nitrate is added and the mixture distilled for twenty to twenty-five minutes. The distillate is collected in water containing 25 c.c. of $\frac{N}{1}$ caustic soda, and the cyanide is titrated with silver nitrate. For the estimation of total cyanogen, as thiocyanate and ferrocyanide, a few drops of ammonium polysulphide are added to 100 c.c. of the sample till the solution shows a permanent yellow colour. After about fifteen minutes lead carbonate is added to remove hydrogen sulphide, and the filtrate boiled with 10 c.c. of $\frac{N}{1}$ caustic soda until most of the ammonia is driven of. The solution is made faintly acid with sulphuric acid, and ferric alum solution added drop by drop till it shows the distinct colour of ferric thiocyanate. The liquid is then filtered through a paper-pulp filter in a Gooch crucible, so as to remove the Prussian blue, which is washed with water containing a salt, such as sodium sulphate. This filtration is important, even though no Prussian blue is visible in the red liquid, otherwise the end reaction of the subsequent titration may be uncertain. The blue precipitate is decomposed on the filter with 10 c.c. of $\frac{N}{1}$ caustic soda, washed, and the filtrate strongly acidified. The liquid is distilled with cuprous chloride, and the hydrogen cyanide collected in the manner described above for the cyanide. The filtrate from the ferrocyanide is treated with a further quantity of ferric alum, heated to 95° C., cooled, acidified with dilute pure nitric acid, and titrated with silver nitrate by Volhard's method. A pink colour due to phenols, however, interferes and some little practice is required to recognise the end-point. To obviate this difficulty, and in any case if chlorides are present, an alternative method is used. The filtrate from the ferrocyanide is only slightly acidified and heated to boiling with the addition of an excess of sodium sulphite to reduce all the ferric salt. Copper sulphate is added, the precipitated cuprous thiocyanate is filtered off through a pulp filter, washed, and decomposed with hot caustic soda solutions. The mixture is again filtered, and the thiocyanate in the filtrate titrated by Volhard's method. For the manufacture of ammonium nitrate the total cyanogen, calculated as ammonium thiocyanate, should not exceed 0·01 grm. per 100 c.c. J. F. B.

Estimation of Carbon Monoxide in Gas Mixtures. J. I. Graham. (*J. Soc. Chem. Ind.*, 1919, **38**, 10-14T.)—The iodine pentoxide method is recommended (see Graham and Winmill, ANALYST, 1914, **39**, 445). Instead of heating the iodine pentoxide tube in a water-bath, use is made of a small steam-bath. This obviates the necessity for cooling the iodine pentoxide tube before the final reading is taken, since all burette readings are taken with the tube at the constant temperature of the steam-bath. The latter also contains a small U-tube containing palladinised asbestos connected, through a three-way tap, with the burette, and on the other side to the ordinary form of Haldane combustion pipette. In a form of apparatus described for use in pits where naked lights are not permitted the iodine pentoxide tube is placed in a thermos or other vacuum flask filled with oil; the oil is heated previously by means of a coil of resistance wire placed in the flask and connected with the ordinary lighting circuit when required for use. In other pits the iodine pentoxide may be heated by an air-bath, the required temperature of which is maintained by a heating coil attached to an accumulator. Methane does not react with iodine pentoxide at 110° C.; normal pentane in quantities of less than 0·2 per cent. is only slightly attacked, but with larger quantities a considerable amount of iodine is liberated.

W. P. S.

Effect of Dilution in Electro-titrimetric Analyses. G. A. Freak. (*J. Chem. Soc.*, 1919, **115**, 55-61 T.)—Small quantities of sulphates, chlorides, calcium, and magnesium, may be estimated by the electro-titrimetric method, the error not exceeding 1 per cent. In each case, however, a limit of dilution is reached at which the results cease to be accurate, smooth conductivity curves being obtained. The lowest concentrations at which the method can be used are as follows: SO_4, 100; Cl_2, 10; Ca and Mg, 200 mgrms. per litre. Saturation of the solution with the substance to be precipitated does not lead to an improvement except in the case of sulphuric acid, where, with the addition of finely divided barium sulphate, good results were obtained down to a concentration of 50 mgrms. of SO_4 per litre.

W. P. S.

Estimation of Gold, especially in Animal Tissue. S. M. Cadwell and G. Leavell. (*J. Amer. Chem. Soc.*, 1919, **41**, 1-12.)—With a maximum error of 0·05 mgrm., 3 mgrms. or less of gold, present as fulminating gold, can be deposited electrolytically in forty minutes from a phosphoric acid solution at 60° C., using a rotating cathode and an electrode P.D. of from 0·9 volt to 1·2 volts. By the addition of 6 grms. ammonium chloride to prevent precipitation, 30 to 40 mgrms. of gold can be electrolysed with a voltage of less than 0·6 for the first thirty minutes and below 1·3 volts for the remainder of the time, complete deposition requiring about 1·5 hours. Under the above conditions, gold can be separated completely from equivalent amounts of copper and iron. The concentration of acid may be varied within wide limits without influence on the results. For obtaining suitable solutions for electrolysis, animal tissue is treated as follows: 10 grms. is digested with 10 c.c. sulphuric and 10 c.c. nitric acid until colourless, adding nitric acid from time to time if necessary. The solution is concentrated to about 2 c.c., 1 c.c. of nitric and 1 c.c. hydrochloric acid are added, the mixture is boiled, a further 1 c.c. hydrochloric acid added, and boiling repeated. To the cooled solution 5 c.c. water and a slight excess of ammonia are added, and the mixture is boiled for a minute. It should still smell of ammonia, and if it does not, more must be added and boiling repeated. To the cooled mixture 5 c.c. hydrochloric acid are added, followed by three minutes boiling—not more, although a white precipitate thrown down by ammonia may not be wholly dissolved. The solution is filtered through an alundum plate packed with asbestos into the beaker in which the electrolysis is to be carried out. Ammonia is added to the filtrate until the odour of ammonia is distinct. Gold usually does not precipitate at this time, but hydroxides of other metals may. The solution is made faintly acid, and warmed if necessary to dissolve all the precipitate. The solution is then diluted to 40 c.c., 1·1 c.c. of 85 per cent. phosphoric acid and 0·75 grm. of disodium hydrogen phosphate are added, and electrolysis is proceeded with. G. C. J.

Rapid Estimation of Lead in Brass and Alloys. G. H. Hodgson. (*Chem. News*, 1919, **118**, 37-38.)—The following gravimetric and volumetric methods are based on the precipitation of the lead as chromate; in the gravimetric method the chromate is converted into the sulphate, then into the molybdate, and weighed as such; the volumetric method consists in titrating the lead chromate with ferrous sulphate, or the chromate is estimated iodimetrically. Five grms. of the drillings (containing about 1 per cent. of lead) are dissolved in 25 c.c. of nitric acid (sp. gr. 1·4), the solution is diluted with 200 c.c. of water, ammonia is added in quantity sufficient to precipitate the copper as hydroxide, which is dissolved in a slight excess of acetic acid, and the mixture is then treated with 10 c.c. of 3 per cent. potassium bichromate solution. After one hour the precipitate is collected on a paper-pulp filter, washed with water, and hot 30 per cent. sulphuric acid is then poured on the precipitate (about 30 c.c. of the acid is required) until the yellow chromate is converted into sulphate. The latter is washed with cold water, dissolved in hot ammonium acetate solution, the solution diluted to 300 c.c., boiled, and ammonium molybdate solution is added gradually. The lead molybdate is collected, washed with very dilute ammonium acetate solution, ignited, and weighed. The same procedure is adopted in the volumetric method up to the precipitation of the lead chromate; this is washed with warm 5 per cent. acetic acid, then treated with cold dilute hydrochloric acid, and the filter washed with water. The filtrate contains all the chromic acid and practically all the lead. The chromic acid may be titrated in the usual way with ferrous ammonium sulphate solution, or potassium iodide may be added and the liberated iodine titrated with thiosulphate solution. W. P. S.

Estimation of Value of Agricultural Lime. S. D. Connor. (*J. Ind. and Eng. Chem.*, 1918, **10**, 996-999.)—Samples of agricultural "limes" were examined as to their content of carbon dioxide, of acid-soluble calcium and magnesium, and as to their acid-neutralising power. Pot cultures of wheat and clover were also made on two very acid soils, using calcite, woolastonite, raw rock phosphate, gypsum, dolomite, magnesite, enstatite, and serpentine as correctors of soil acidity. The two soils were of widely different types, one very rich in humus, the other very low in organic matter. Soil acidity was determined after cropping. Crop increases due to various treatments were in the following order, the higher being placed first: calcite, dolomite, magnesite, woolastonite, rock phosphate, serpentine, enstatite, and gypsum. The treatments decreased the soil acidity in the following order: magnesite, dolomite, calcite, woolastonite, serpentine, rock phosphate, gypsum, and enstatite. The results indicate that the titration method is the most accurate method for determining the value of agricultural lime. The method consists in treating a weighed portion of the sample with a measured and more than sufficient volume of standard acid, the excess of which is subsequently titrated with standard alkali. G. C. J.

Estimation of Nitrites. F. Dienert. (*Ann. Chim. Anal.*, 1919, [ii], **1**, 4-5.)—The reaction between nitrites and hydriodic acid proceeds according to the equation $NaNO_2 + 2HI = NaI + I + NO + H_2O$, and may be used for the estimation of nitrites, provided that ferric salts, hydrogen peroxide, free chlorine, etc., are absent. The reaction must, however, be carried out in an atmosphere free from oxygen, since the nitric oxide reacts with oxygen, giving nitrogen peroxide, which liberates a further quantity of iodine from hydriodic acid. The details of the method are as follows: The nitrite solution is placed in a flask, and a current of carbon dioxide, washed previously by passing it through sodium hydrogen carbonate solution and potassium iodide solution, is conducted through the solution for fifteen minutes; 10 c.c. of $\frac{N}{1}$ sulphuric acid are then introduced into the flask by means of a tapped funnel, and the delivery tube of the potassium iodide wash-bottle is lowered until its end dips into the solution. The potassium iodide solution is thus forced, by the pressure of the carbon dioxide, into the reaction flask. Iodine is liberated immediately, and after the addition of 10 c.c. of 20 per cent. ammonium carbonate solution, the iodine is titrated with $\frac{N}{70}$ arsenious acid solution. Each cubic centimetre of the latter is equivalent to 0·0002 grm. of nitrous nitrogen. W. P. S.

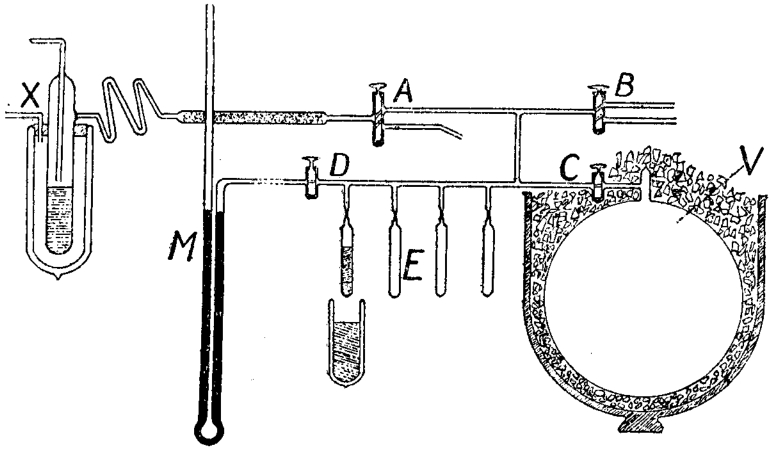
Sources of Error incident to the Lindo-Gladding Method for Determining Potash. T. E. Keitt and H. E. Shiver. (*J. Ind. and Eng. Chem.*, 1918, **10**, 994-996.)—It is shown that there are two sources of error which are partially compensating. The volume of the solution is decreased by the bulk of the precipitate formed on addition of ammonia and ammonium oxalate, which tends to make the results too high. On the other hand, the potash in solution is decreased by occlusion of potash by the heavy gelatinous precipitate formed. It is impossible to wash out with hot water the potash occluded within the precipitate. The occluded potash may be separated to a certain extent by repeatedly dissolving the precipitate in hydrochloric acid, diluting to a large volume, precipitating with ammonia and ammonium oxalate, filtering and determining potash in the filtrates and washings. It is shown that both iron and calcium phosphate, when precipitated with ammonia, occlude potash, and that a combination of the two is even more effective in producing occlusion. G. C. J.

Estimation of Sulphur in Spent Oxide. W. Diamond. (*J. Soc. Chem. Ind.*, 1918, **37**, 336-337 T.)—The usual method of estimating sulphur in spent oxide by extraction with carbon bisulphide gives results which are too high, owing to the extraction of other matters soluble in that liquid, including cyanogen compounds, ammonia, tar, and oil. The author proposes to remove the tar and oil by a preliminary extraction with cold benzene. About 10 grms. of the spent oxide are placed in an extraction thimble, and nine successive portions of 20 c.c. of cold benzene are poured over it and allowed to percolate through, each portion being allowed to drain off before adding the next. The whole extract is divided into two portions: the first is evaporated to dryness and the residue weighed; the second is evaporated to dryness and the sulphur estimated in the residue after oxidation with boiling nitric acid. The first estimation gives the tar, oil, and soluble sulphur compounds, and the second the sulphur only. The sulphur remaining in the sample is then extracted by carbon bisulphide, so that from the three estimations are obtained—(1) Tar, oil, and organic matter soluble in benzene; (2) sulphur compounds soluble in benzene; (3) sulphur extracted by carbon bisulphide. The sulphur soluble in benzene may be added to that extracted by carbon dioxide to give the total sulphur. J. F. B.

Emanation Method of Estimating Thorium. G. H. Cartledge. (*J. Amer. Chem. Soc.*, 1919, **41**, 42-50.)—Apparatus is described and illustrated for circulating an air current through a solution and ionisation chamber for thorium emanation measurements. The sources of error in such determinations, and the factors in the emanation activity of a solution have been studied by the author, who has worked out a method for preparing radiochemically complete solutions of monazite sand, so as to give an accuracy of within 1·5 per cent. total thorium. G. C. J.

APPARATUS, ETC.

Method for Measuring Density of Gases. O. Maas and J. Russell. (*J. Amer. Chem. Soc.*, 1918, **40**, 1847-1852.)—The method described is applicable to gases which can be condensed by liquid air or other freezing agent. A known volume of the gas at known pressure and temperature is liquefied in a small bulb attached to the containing vessel; the bulb is sealed off, and the liquefied gas weighed at room temperature. This procedure is advantageous in enabling one to weigh a large quantity of gas on a small sensitive balance, and to weigh it in a vessel whose weight is of the same order as that of the gas itself. The accompanying diagram is drawn to scale, with the exception of the manometer. V is a large flask, the volume of which is determined by drying it for some time under a vacuum of 0·001 mm.,



weighing it full of air and then full of water. Correcting for the weight of the air and the density of the water at the temperature of measurement, the volume is readily calculated. The manometer scale, etched on a mirror, is calibrated by means of a comparometer, and can be read to 0·1 mm. without the use of a cathetometer. At E are four tubes, about 6 cms. in length, of such a size that the condensed liquid will just about fill them, and capable of withstanding 100 atmospheres. All cocks are mercury-sealed. The substance whose vapour density is to be determined is distilled into X, and the delivery tube sealed off. The air in the tubing from it to the tap is eliminated by opening the two-way cock A to the atmosphere, and boiling the liquid in X for some time. The large flask V, with all tubing and bulbs at E, is evacuated to 0·0001 mm. pressure by means of a pump connected to the two-way cock B. B is then closed, and A opened to connect the flask to the tube X, in which the liquid is boiled until V is filled to about atmospheric pressure, when A is closed. The system is now allowed to stand some time until the gas in V, surrounded by cracked ice, has attained a uniform temperature, the manometer being read at five-minute intervals until there is no measurable change in fifteen minutes. C is closed, and the tubing and bulbs thoroughly exhausted. There is then in V a known volume of gas under a known pressure and temperature. C is next opened, and the gas condensed in one of the bulbs at E by means of liquid air or solid carbon dioxide. The bulb is sealed off, and the pressure of the gas remaining in the system read after equilibrium is again established. The bulb with its contents is allowed to warm up to room temperature and is weighed; it is then immersed in liquid air, the tip cut off, the contents allowed to evaporate, and the dried bulb with its tip reweighed, correction being made for the weight of the air. Thus the weight of the gas condensed is determined accurately. The temperature of the room at the time of experiment is noted in order to correct for mercury expansion in the manometer and for the temperature of the gas remaining in the tubing. The weight of 1 litre of the gas is given by the formula:

$$D = \frac{76 \, . \, W \, . \, 1{,}000}{(P - p)\,V - 273\,pv/273 + t},$$

where W = weight of condensed gas; P = initial pressure of gas in large flask, the height of the mercury column being corrected to 0° C.; p = pressure remaining in system after condensation of the gas; V = volume of the large flask; v = volume of the system from the cocks at B and C to the cock at A, and the level of the mercury in the manometer; and t = the temperature of the tubing, etc., outside the ice-bath. The accuracy attainable by the method will be apparent when it is stated that, when experimental values are substituted, $(P-p)V$ is 10,000 times as large as $273\,pv/273+t$, since V is about 2,000 c.c., v about 20 c.c., and the ratio of P to p about 100 : 1. Therefore, as large an error as 10 per cent. in the quantity $273\,pv/273+t$ will cause an error in D of only 1 part in 100,000; and on this fact depends the ease of manipulation, for the volume v need be known only approximately, and the changes in this volume, due to sealing on of fresh bulbs for further determinations, may be neglected. Furthermore, the temperature of the apparatus outside V and M need not be kept constant. The method of measuring

P $-p$ described above does not permit this measurement to be made more closely than corresponds to an error of 1 in 2,000, and this is the limit of accuracy of the method as described; but since W and V can readily be measured to better than 1 part in 10,000, the use of a cathetometer, which would insure equal accuracy in the pressure measurements, would reduce the probable error to about 1 in 10,000.

G. C. J.

Stopcock for Dropping Liquids arranged for Equalising the Pressure Above and Below the Outlet in the Stopcock. H. L. Fisher. (*J. Ind. and Eng. Chem.*, 1918, **10**, 1014-1015.)—The stopcock illustrated was designed in connection with a generator for carbon dioxide which was to be used alternatively with pressures below and above atmospheric. Ordinarily an outside tube connecting the top of the

Fig 1a

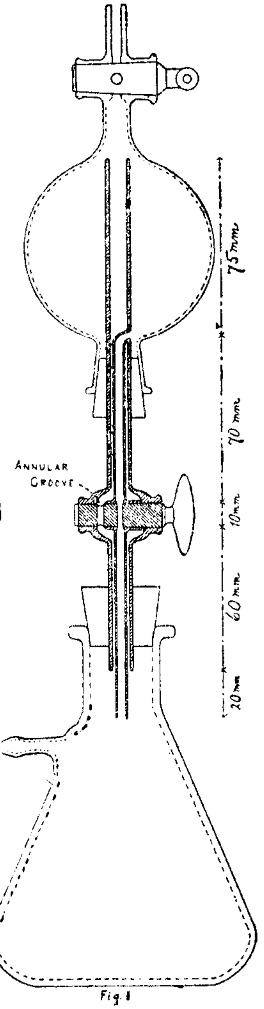


Fig 1

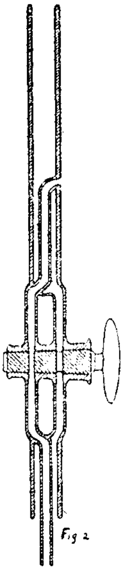


Fig 2

reservoir of acid with the upper part of the container of carbonate is used. In this new apparatus the connection is made by means of an annular groove in the key of the stopcock, so that no matter which position the key occupies there is always communication between the atmosphere in the lower flask and the atmosphere in the upper flask. One arm of the stopcock is extended until it opens above the liquid in the upper container. The liquid enters at an aperture in the lower part of this extended arm, and is delivered through a small glass tube sealed in at this opening. The entire arrangement is more clearly understood by a glance at the accompanying diagram. Two different styles are made, using the same principles in each. The makers are Messrs. Eimer and Amend of New York. G. C. J.

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GOVERNMENT REPORT.

Report on the Work of Inspectors of Foods for the Year 1917-18.

A. W. J. Macfadden. (3d. net. H.M. Stationery Office.)—The report deals with work carried out by the Food Inspection Branch of the Medical Department of the Local Government Board. The Branch has continued the supervision of food materials for the Army undertaken on behalf of the War Department, the work being much increased by the decision of the Army Council to provide home-killed meat for the troops in this country, thus necessitating extensive abattoir construction at short notice. In all, thirty-three slaughtering centres were established, with a killing capacity of 1,500 cattle a day. Careful records were kept by the inspectors of the incidence of disease in the cattle slaughtered, tuberculosis being found, as a rule, present in about 3 per cent. of the animals slaughtered, while cystic and other morbid conditions of the liver were found in about 16 per cent.

In connection with the normal work of the Branch several outbreaks of bacterial food-poisoning were investigated, and in one of these at the Sussex County Hospital, Brighton, Dr. W. G. Savage isolated an organism not hitherto encountered in such cases. Groups of cases which were reported to the Boards as cases of botulism proved on investigation not to be this very rare form of food-poisoning, but to be polioencephalitis. During the latter part of last year liquid egg began to appear on the market in large quantities, packed for domestic use in small tins and jars. This material, which is mainly of Chinese origin, always contains boric acid, and often in excessive amounts rising to over 100 grains to the pound. In some districts the Public Health Authorities have made it a condition of the use of imported liquid eggs that this material be only supplied to wholesale confectioners, etc., and not sold in less quantities than 7-pound packages. It is pointed out that dried eggs are in every way preferable both as regards economy in shipping space and the health of the consumer. Dried-egg imports have proved very successful, and when prepared and packed properly are a wholesome and useful foodstuff.

The series of investigations containing the results of Dr. Coutts's exhaustive inquiries into the preparation of dried milk and its use for infant feeding have been already noticed (Food Reports No. 24, ANALYST, 1918, **43**, 239).

H. F. E. H.

REVIEWS.

MONOGRAPHS ON INDUSTRIAL CHEMISTRY. THE NATURAL ORGANIC COLOURING MATTERS. By A. G. PERKIN and A. E. EVEREST. Pp. 655. London: Longmans, Green and Co., 1918. Price 28s. net.

The authorship of this book is a guarantee that the subject will be treated in a clear and comprehensive manner, and prospective readers will not find their confidence misplaced. Ample justification for the appearance of such a work at the present moment lies in the fact that natural dyes have recently enjoyed an Indian summer of prosperity, owing to the scramble for artificial colouring-matters occasioned by the war, and although, if regarded solely from a technical standpoint, it is impossible to dissociate the treatise from the character of an obituary notice, the subject itself is by no means moribund, because a great variety of chemical and biochemical problems are suggested by it, and demand solution. Consequently, the volume may be recommended as an exhaustive and authoritative compendium of accumulated knowledge, having the added virtue of a stimulus to fresh investigations.

Arrangement of the contents has been made according to the chemical constitution, when this is known, of the principal tinctorial components obtainable from the dyestuffs, and pursues the following order: Anthraquinone, naphthaquinone, benzophenone, xanthone, flavone, chalkone and flavanone, flavonol, γ-pyran, dihydropyran, α-pyrone or coumarin, dicinnamoylmethane, diphenyldimethylolid, tannins, coumarane, indole, lichens, and *iso*quinoline, succeeded by chapters on colouring-matters of unknown constitution, and lakes from vegetable colouring-matters. Plants containing members of two distinct groups, such as those derived from flavone and anthraquinone, are discussed under whichever heading appears the more appropriate.

Although a very large proportion of the material collected is necessarily historical, the recent work of Willstaetter and his collaborators on blossom-pigments receives well-merited attention, more than one hundred pages being devoted to this highly attractive subject; the contributions made by Dr. Everest in this province have doubtless assisted the authors in rendering the division a very valuable one. Similar excellence may be noted in connection with the treatment of brazilin, hæmatoxylin, the tannins, and indigo, although, in reference to the last named, there has been omitted from the list of syntheses that one which, very probably, has a technical importance at least equal to that of the phenylglycine process—namely, the fusion of hydroxyethylaniline with potash; this omission is the more remarkable as the method was patented as long ago as 1906, and is to be found in a textbook appearing in 1913.

It is to be regretted that the value of an admirable treatise is diminished by an inadequate index, of which the threadbare simplicity can scarcely be justified, even as a war economy. No doubt indexing, to most authors, resembles washing in Jordan to Naaman the Syrian; but whilst the present work is crowded with interesting material, much of it must remain unappreciated for the reason indicated. The authors appear to have adopted the principle of excluding the names of common organic substances, although these arise on every hand from the degradation of natural colouring-matters. For instance, twenty references to phloroglucinol may be found in the text without elaborate research, and yet phloroglucinol does not occur in the index, which is equally innocent of acetophenone, aniline, benzaldehyde, phthalic acid, protocatechuic acid, pyrogallol, resorcinol, salicylic acid, and others involved in syntheses or analyses of the materials described. Again, pp. 529 to 542 comprise hundreds of lichens associated with the acids and other compounds obtainable from them, but the names of the lichens and the associated substances do not appear in the index. Whilst it cannot be denied that the labour involved would be both considerable and uninteresting, it is equally certain that the value of the treatise would be very much enhanced thereby. These remarks are not offered in a spirit of captious criticism, but solely in the hope that a second edition may rectify the only obvious fault in a work of sterling merit. M. O. FORSTER.

PETROLEUM REFINING. By ANDREW CAMPBELL. Pp. xv + 297. London: Charles Griffin and Co., Ltd., 1918. Price 25s. net.

This book has been published at a most suitable time. The enormous importance of the petroleum industry has been forced home to us by the tragedy of the war—in fact, without fuel oils and motor spirit we could not have won the war. This book deals with petroleum refining, and is, we believe, the first book devoted solely to the subject. One very important feature of the book is the inclusion of laboratory methods of analysis, and this feature of the book makes it of very great value to the oil chemist. Mr. Campbell's particular knowledge of refining enables him to write with authority, and his style is lucid and clear.

The book commences with a description of the methods employed for examining the crude oil. The usual physical and chemical processes are described, and there is nothing particularly novel here, except a detailed description of the modified method of Dunstan and Thole for estimating sulphur by the lamp method. Mr. Campbell rightly recommends the employment of the bomb calorimeter for testing heavy oils, but the lamp for distillates such as motor spirit, benzol, and kerosine.

In order to obtain data for a complete refining process, the author distills the crude oil in a 5-gallon still fitted with superheater and arrangement for connecting with a vacuum pump in case the oil is inclined to crack when subjected to high temperature. We wish that the author would not use the term "benzine" for the lowest fraction obtained when fractionating. The names benzene and benzine are so frequently used by those who do not understand the difference between the two classes of hydrocarbon. It would probably be better to call the lowest fraction gasoline or spirit, as this would prevent any misunderstanding.

The description of the chemical and physical properties of oils, paraffin wax, asphalt, etc., is clear and lucid, and consequently this book will be a necessary reference to all laboratories in which these substances are tested. Apart, however, from the analytical side, the book has great technical interest, owing to the interesting manner in which the refining plant for oils is dealt with.

Chapter VI., dealing with candle manufacture, will be of interest even to the non-technical reader. To chemical readers, after the chapter on analytical processes. Chapter VII., dealing with chemical treatments, is of particular interest.

The book is lavishly illustrated, there being no fewer than 138 drawings. It gives us pleasure to heartily recommend it as being one by an author who is thoroughly conversant with his subject and who writes with the knowledge of practical experience.

F. M. PERKIN.

SURFACE TENSION AND SURFACE ENERGY AND THEIR INFLUENCE ON CHEMICAL PHENOMENA. By R. S. WILLOWS and E. HATSCHEK. Second Edition. Pp. viii + 115. London: J. and A. Churchill, 1919. Price 4s. 6d. net.

We are glad to see that the demand for this little book has been sufficient to call for a second edition, for it gives a clear and conscientious account of the subject treated. The most important of the fresh matter introduced is a new chapter dealing mainly with certain commercial processes in which surface phenomena play an important part. In this chapter attention is first called to the way in which the formation of emulsions is governed by the tendency to form systems which involve a minimum of surface energy, and then to the consequent explanation of the possibility of the reversal of an oil-water emulsion into a water-oil emulsion by the suitable selection of the solids which, added in small quantities, form a film round the droplets. The electrical double layers at the surface of small particles in liquid are next described, with the application to the dying of fibres, which have their own electric charges, by acid and basic dyes, and to tanning. Finally, reference is made to the separation of finely divided sulphide ores from the gangue by means of the flotation process, which involves many complex factors. It will be seen that this new chapter is of great interest, and sufficient references are given to enable the reader who so desires to follow up the subject.

Various additions in the way of descriptions of work carried out in 1916—*i.e.*, since the first edition—have been made in the body of the book. We may perhaps suggest that a mention of Quincke's interesting theory of the "foam structure" of metals deserves reference where Thompson's work is mentioned. We strongly recommend this book to all who require a brief, well-ordered account of the vast body of work that has been done in recent years on surface phenomena.

E. N. DA C. ANDRADE.

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NOTICE.

ARRANGEMENTS have recently been made whereby members of the Society of Public Analysts and other Analytical Chemists may use the Library of the Chemical Society and borrow books under the existing rules. The Library is open on Monday, Wednesday, and Thursday from 10 a.m. to 6 p.m., on Tuesday and Friday from 10 a.m. to 9 p.m., and on Saturday from 10 a.m. to 5 p.m.

THE INSTITUTE OF CHEMISTRY.

At the forty-first annual general meeting of the Institute of Chemistry, held at 30, Russell Square, on Monday, 3rd instant, Sir Herbert Jackson, the President, referred to the work of the Institute during the war. The record afforded an example of the value to the country of organised professional bodies in times of crisis. The Report contained a concise statement indicating the various directions in which chemists had rendered good service both with the forces and in industries connected with the war.

The Institute is now co-operating with the Appointment Department of the Ministry of Labour in the resettlement in civil life of those who have been so engaged, and it is hoped that with the return of more normal conditions chemists will be utilised to the fullest benefit in the application of their science to the industries of the country. The President, in referring to the losses sustained by the profession, mentioned especially Lieut.-Colonel E. F. Harrison, who will always b remembered for his exceptional work in the provision of means of defence against poisoncus gas attacks, to which work he undoubtedly sacrificed his life.

The Institute has before it a period of reconstruction, and will endeavour to bring together in one body the trained and competent chemists, both for their own benefit and for that of the community. The Regulations had been modified on such a broad basis that it was hoped all qualified chemists would be able to take part in promoting the welfare of their profession. The Council hoped in the near future to arrange a conference to review the subject of the training for a chemist. Local sections are being formed in various parts of the country, and the method of the election of the Council will be amended to insure that its constitution is properly representative of all districts and all branches of professional work. Events of the war have done much to establish the claim of chemists to greater recognition than has been accorded them in the past. The Council have recently prepared a scheme of Government chemical service, which they hoped will secure better conditions for chemists holding appointments under various Departments. The vital importance of chemical service to the State had been clearly demonstrated in recent years, and a good example set by the Government would go far to bring home to the public the importance of chemistry to industry and commerce.

The officers and members of Council for the ensuing year was then elected.