THE ANALYST

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

AN Ordinary Meeting of the Society was held in the Chemical Society's Rooms, Burlington House, on Wednesday, February 6th, the President, Mr. Edward Hinks, being in the chair.

Certificates were read for the first time in favour of:—Frank Atkins, Edmund Baron Bennion, M.Sc., A.I.C., John Haslam, M.Sc., A.I.C., Stanley Gordon Kendrick, B.Sc., A.I.C., Bryn Jones, B.Sc., A.I.C., John Upton Lewin, B.Sc., A.I.C., Leslie John Walker.

Certificates were read for the second time in favour of:—William Bennett Adam, M.A., A.I.C., Alfred Louis Bacharach, B.A., F.I.C., Andrew Dargie, B.Sc., A.I.C., and Wadie J. Itayim.

The following were elected Members of the Society:—Edwin Herbert Bunce, A.I.C., Frederick O'Brien, M.Sc., F.I.C., William Macro Seaber, B.Sc., F.I.C., John Graham Sherratt, B.Sc., F.I.C.

The following papers were read and discussed:—"The Fatty Acids and Component Glycerides of some New Zealand Butters," by T. P. Hilditch, D.Sc., F.I.C., and Eveline E. Jones, M.Sc.; "A New Test for Boric Acid and Borates," by A. Scott Dodd, B.Sc., F.I.C., F.R.S.E.; and "The Determination of Beryllium in Rocks," by B. E. Dixon, M.Sc., A.I.C.

Obituary.

THOMAS PORTER BLUNT, M.A., F.I.C.

THE Society of Public Analysts has lost one of its oldest members by the death of Thomas Porter Blunt, who died quite suddenly in his sleep on February the 8th, in his 87th year.

He was born in Shrewsbury and educated at Friar's School, Bangor, and Magdalen College, Oxford, where he studied chemistry under the late Professor Harcourt, taking first class honours in Natural Science in 1864. From Oxford he returned to his native town, joining his father in his business as pharmacist.

With the passing of the Food and Drugs Act he was appointed Public Analyst for Shropshire, which post he retained for over fifty years, and on his retirement, three years ago, his services were retained as Consulting Analyst to the County. He also acted as Official Agricultural Analyst for Shropshire, and Public Analyst for the Counties of Montgomery and Merioneth, and for the Borough of Wenlock.

Up to within two years of his death he was actively engaged in his laboratory, but a serious accident when on holiday in North Wales prevented him carrying on with the work he loved so well, and I know that at the last "he was very tired after months of inactivity and discomfort." Apart from his Public Analyst's work, he was also Gas Examiner to the town of Shrewsbury until 1917, and he was on the Board of Examiners to the Pharmaceutical Society from 1886 to 1893.

Blunt joined the Society of Public Analysts in the year the Society was founded, 1874, and served on the Council in 1891–1892. He published the following papers in THE ANALYST:—"Permanganate Process for Water" (**4**, 94); "Effect of Light on some Reagents and Chemical Compounds" (**5**, 79); "Williams' Nitrogen Process" (**6**, 202); "Use of Platinic Chloride as an Indicator in Determination of Free Iodine" (**7**, 135); "Ferrocyanide Test for Zinc" (**9**, 232); "Determining the Fixed Acids in Butter and Margarine" (**13**, 110); "Notes on Tabarie's Process for the Indirect Determination of Alcohol" (**16**, 221); "Note on Ginger" (**21**, 309); "Note on the Separation of Arsenic" (**48**, 596); "The Analysis of Commercial Lime" (**51**, 625).

All Public Analysts have reason to be grateful for his elegant simplification of Tabarie's formula, for his neat method for determining nitrates in water, and for his very convincing article on the detection of "exhausted" ginger.

In 1865 he contributed an original paper on phosphide of magnesium to the Transactions of the Chemical Society, and other chemical contributions will be found in the *Chemical News* and the *Pharmaceutical Journal* during years 1880 to 1893.

His outstanding contribution to science was his work, in association with Sir Arthur Downes, on the action of light upon bacteria. As early as 1877 he proved definitely the bactericidal effect of sunlight, and this pioneer work, which was published in the Proceedings of the Royal Society, London (1877, XXVI, 488), laid the foundations for modern work on actinotherapy; and it is only with the

revived interest in "light" treatment that Blunt's work has received due recognition.

It was my good fortune to join Blunt in his analytical work in 1912; this was the beginning of an association which was marked by Blunt's unfailing willingness to share his knowledge and experience with a man many years his junior, and by a staunch friendship lasting until his death.

He had many interests apart from his work; a keen and able field botanist, he was a vice-president of the Caradoc and Severn Valley Field Club, acted as honorary curator of the botanical section of the Shrewsbury Museum, and as a judge of wild flowers at the Shrewsbury Show for half a century. An enthusiastic educationist, he served on the board of management for several schools.

A love of the Classics, formed in his Oxford days, was retained throughout his life, and his ability as a Latin and Greek scholar was of no mean order. In his younger days he was a rowing man, being in his College crew, and he also served as a volunteer.

Blunt combined exceptional charm of manner with a generous and kindly disposition; a scholar and a gentleman, he did much to establish the traditions and dignity of his profession, and his example is one which a younger generation of Public Analysts may well strive to emulate.

HAROLD LOWE.

JAMES WEST KNIGHTS.

WE have recently had to mourn the loss of several of the oldest members of our Society, and the death of James West Knights, at the age of 75, has now added another to the list.

James West Knights was the second son of Mr. James Knights, of St. Ives, Hunts. He was educated at St. Ives Grammar School and at Barton School, Wisbech. After leaving school he served an apprenticeship with a local druggist, and then came to London to undergo a course of training in analytical chemistry.

His professional career began by his becoming chief analyst to a firm of chemical manufacturers in Flint, and shortly afterwards, at the early age of 25, he was appointed Public Analyst for the Borough and County of Cambridge, the Isle of Ely, the County of Hunts., and the Boroughs of Wisbech and King's Lynn. These appointments he held until last year, when he retired, after 50 years' service. For many years he also acted as gas examiner to the Cambridge Corporation.

West Knights joined our Society in 1878, and he contributed several papers to the early volumes of THE ANALYST, including a method for the estimation of nitrates in water (1882, **6**, 56) and a description of the familiar form of extraction apparatus which bears his name (1886, **8**, 65).

For many years past he took no part in the work of the Society, and was therefore personally known to only a few of our members.

EDITOR.

The Determination of Small Amounts of Alcohol in the Human Subject.

By JOHN EVANS, F.I.C., and A. O. JONES, M.A., F.I.C.

(*Read at the Meeting, December* 5, 1928.)

When a person drinks alcohol some of it is absorbed as such into the blood, and as this blood passes through the kidneys a certain amount is excreted in the urine.

As early as 1915 Widmark published results of the examination of the urine of persons arrested for drunkenness, and since then the subject has been investigated by others. The object of this paper is to draw attention to an extensive series of investigations made at Sheffield University by Professor Mellanby and Dr. Southgate in 1924–1925, in order to obtain information as to the rate of absorption of alcohol into the blood and the rate of its excretion in the urine, and more particularly to draw attention to the ingenious apparatus employed by Dr. Southgate to determine small amounts of alcohol in blood and urine. The apparatus is so designed that only 2 c.c. of the sample are required for a single determination.

We have had considerable experience in the use of the apparatus, and find it easy to manipulate, and, judging by the agreement obtained between duplicate determinations, highly accurate. As it may be necessary at any time in forensic practice, or even in the Public Analyst's ordinary work, to determine alcohol in low concentrations, we think that this method ought to be more widely known.

Summary of the Process.—Two c.c. of urine are evaporated slowly at 80° C. in a current of air which has previously been washed by passing it through concentrated sulphuric acid.

The mixture of air and alcohol vapour is led through a mixture of 15 c.c. of $N/5$ potassium dichromate solution and 20 c.c. of concentrated sulphuric acid in an apparatus specially designed to promote efficient interaction. The alcohol is oxidised to acetic acid at the expense of some of the dichromate, in accordance with the equation—$CH_3.CH_2OH + 2O = CH_3.COOH + H_2O$.

The unreduced dichromate is determined by causing it to liberate iodine from potassium iodide and titrating the liberated iodine with $N/10$ sodium thiosulphate solution. The reduced dichromate is thus known by difference, and is calculated to its equivalent of alcohol.

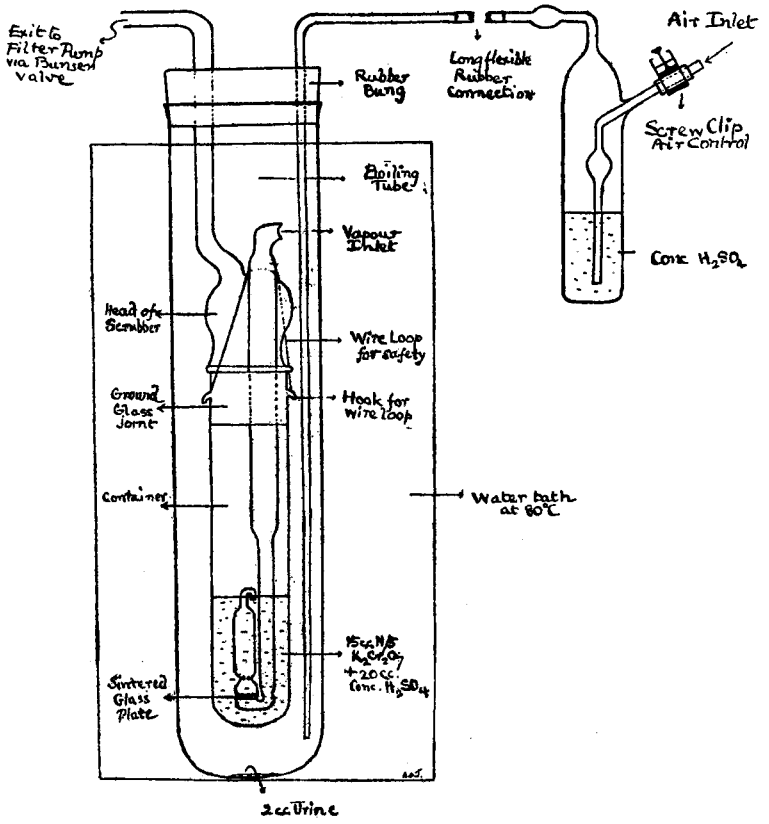
Description of the Apparatus.—The apparatus is a modification, devised by Dr. Southgate, of an apparatus used by Canan and Sulzer, and consists of three parts: a boiling tube, a container, and a scrubber.

The large outer boiling tube is closed by a rubber bung pierced by two holes. Through one hole passes a narrow glass tube reaching nearly to the bottom of the

boiling tube. The inlet of this tube is connected with the sulphuric acid air-washer. Through the other hole passes the exit tube of the scrubber, which is connected with an ordinary filter pump.

Inside the boiling tube is the container, in which the acid dichromate solution is placed. By means of a ground-glass joint this container is fitted to a glass bulb-shaped head, which is in communication with the exit tube to the pump.

Fused into this glass head is a wide tube, the inlet of which is open to the interior of the boiling tube. At the other end of this tube, which reaches nearly



to the bottom of the container, is an ingenious scrubber, containing a sintered glass plate. The scrubber is immersed in the acid dichromate solution, and 2 c.c. of the urine to be examined are placed in the outer boiling tube. Fifteen c.c. of the $N/5$ dichromate solution are placed in the container, and 20 c.c. of concentrated sulphuric acid added, the container being kept cool in water. The container is then fitted to the scrubber head, wired on for safety, and by means of the rubber bung the boiling tube is attached. The narrow inlet tube is connected with the sulphuric acid air-washer, and the exit tube with the pump. When a steady aspiration is established the apparatus is weighted with a heavy weight and almost

completely immersed in a water-bath maintained at 80° C. The current of air draws the volatile products of evaporation of the urine through the dichromate solution, the sintered glass plate of the scrubber reducing the vapour to a stream of minute bubbles and thereby ensuring rapid and complete oxidation. When evaporation is complete (in 20–30 minutes) the apparatus is removed from the bath, the boiling tube disconnected, and the dichromate solution transferred to a litre flask.

The container and scrubber are washed several times with water by suction at the pump, and the combined liquids are diluted to about 500 c.c. About 1 grm. of solid potassium iodide is now added to the solution, and the liberated iodine is titrated with $N/10$ sodium thiosulphate solution, starch being used as an indicator. Factor: 1 c.c. of $N/10$ thiosulphate = 0·00115 grm. of alcohol.

Manipulation of the apparatus is easy, and with ordinary care accurate results are obtained. The following details and precautions readily suggest themselves to the operator.

A steady uni-directional flow of air is essential, and its rate of flow can be controlled by means of a screw-clip on a piece of pressure-tubing on the inlet to the air-washer. The mercury column of the pump should stand at 4–6 inches, and the evaporation of the 2 c.c. of urine should be complete in 20 to 30 minutes.

An obvious danger is a sudden reduction in the aspiration, which may cause alcohol vapour to be blown back into the air-washer and retained there. It is therefore advisable to interpose a Bunsen valve between the exit from the apparatus and the pump. A reversal of the air-current, due to failure of the pump, is thus avoided.

For the same reason a vigorous and steady aspiration should be established before the apparatus is placed in the water-bath; otherwise expansion of the air in the boiling-tube may drive alcohol vapour into the air-washer.

Full dilution of the dichromate solution is, of course, essential, and care must be taken that no undiluted liquid remains on the sides of the litre flask, as it is sufficiently acid to liberate iodine independently of the dichromate.

The urine should be tested for freedom from glucose, as the presence of a fermentable carbohydrate makes the interpretation of the results impossible, as some of the alcohol might be derived from the sugar.

It is our practice also to test for albumin.

PHYSIOLOGICAL RELATIONS.—The following information is extracted from a paper by Drs. H. W. Southgate and G. Carter, in the *British Medical Journal* (March 13th, 1926, pp. 463–469):—"The alcohol in the blood is related to the amount of alcohol consumed when this is imbibed under constant conditions, and the ratio between the alcohol in the blood and the alcohol in the urine is surprisingly constant and is of the order of 1·35.

The presence of alcohol in the blood is recognisable, even 12 hours after the time of drinking.

The concentration of alcohol in the blood attains a maximum value about 1½ hours after consumption, and falls at the rate of about 12 mgrms. per hour per 100 grms. of blood.

If the same person consumes equal amounts of alcohol in widely different concentrations, it is found that the alcoholic concentration rises more rapidly, and to a higher point, in the case of the stronger solution. Also, the slower the rate of drinking, the lower will be the maximum concentration attained.

All foods tend to depress the absorption of alcohol from the stomach and intestines and thereby lower the alcoholic concentration of the blood, but some have such a potent action in depressing blood alcohol as to be almost specific. Among these foods bread and milk stand out pre-eminent. Food however makes little difference to the ratio between blood alcohol and urine alcohol.

It has been shown by Schwersheimer that if abstainers, moderate drinkers and heavy drinkers take the same quantity of alcohol when other conditions are equal, then the concentration of alcohol in the blood is highest in the case of the abstainer and lowest in the heavy drinkers. In other words, a kind of tolerance has been established in the case of the heavy drinker.

FACTORS.—If a sample of urine has been excreted when its alcohol content is at its maximum point (*i.e.* 1½ hours after consumption), the following relations can be used to determine the amount of alcoholic liquor consumed:—

Whisky.—Ninety-six c.c. of absolute alcohol (=235 c.c. of whisky) correspond to 200 mgrms. of alcohol per 100 c.c. of urine.

Beer.—Ninety-six c.c. of absolute alcohol (=1920 c.c. of beer) correspond to 178 mgrms. of alcohol per 100 c.c. of urine.

i.e. for whisky:

Mgrms. of alcohol per 100 c.c. × 0·04137 = fluid ounces consumed.

for beer:

Mgrms. of alcohol per 100 c.c. × 0·0190 = pints consumed.

EXPERIMENTAL WORK.—In order to satisfy ourselves as to the working of the analytical process described, and to assure ourselves of the possibilities of the method as a chemical determination of the amount of alcoholic liquor consumed, we made the following experiments.

(1) *With a solution of pure alcohol.* A sample of *Spiritus Vini Rectificatus*, B.P., was taken, and its alcoholic content determined by specific gravity. An accurate 1 per cent. v/v solution was then made, and the alcohol in it determined by Dr. Southgate's method. The amount of alcohol found per 100 c.c. was 0·68 grm.

By calculation from the specific gravity 0·69 grm. of alcohol was present in 100 c.c.

(2) Two samples of urine were supplied by a person who stated that he had taken a quantity of beer at about 7 p.m.

The first sample of urine, excreted at 7.20 p.m., showed 27·3 mgrms. per 100 c.c.

The second sample of urine, excreted at 8.30 p.m., showed 55·5 mgrms. per 100 c.c.

Taking the figure found with the second sample, the consumption of beer works out to 1·05 pint. After the analysis the consumer stated that the quantity taken was one pint.

(3) Sixty c.c. (2·1 fl. ozs.) of whisky, diluted with 60 c.c. of water, were drunk rapidly on an empty stomach. The alcohol in the urine was then determined.

(i) 50 minutes after consumption, 23 mgrms. per 100 c.c.

(ii) $1\frac{1}{3}$ hours after consumption, 57 mgrms. per 100 c.c.

(iii) $2\frac{3}{4}$ hours after consumption, 17·5 mgrms. per 100 c.c.

The maximum figure obtained (57 mgrms. per 100 c.c.) corresponds to 2·3 fl. ozs. of whisky. The quantity drunk was 2·1 fl. ozs.

(4) Two samples of urine were provided by a person who had taken two pints of beer, followed by two small whiskies.

The first sample, excreted 45 minutes after consumption, showed 92·5 mgrms. per 100 c.c.

The second sample, $1\frac{1}{4}$ hours after consumption, showed 129 mgrms. per 100 c.c.

By calculation from the amount consumed, the maximum concentration of alcohol attained should be 150 mgrms. per 100 c.c.

The necessity for determining alcohol in the human subject, either during life or *post-mortem*, is one which can easily arise in forensic chemistry. The method described is admirably suited for this purpose, provided that no other volatile oxidisable matter is present.

In the present congested state of traffic in our cities the intoxicated motorist is a danger both to himself and to the public. How little alcohol is required to upset the higher mental faculties (which by a well-known physiological law are affected first) we are not in a position to state—the question is pre-eminently one for the physiologist, but our own experiments show that when a quantity of alcoholic liquor, insufficient to produce intoxication in the ordinary sense of the term, is consumed, the alcohol excreted in the urine can be determined.

We have had the opportunity of determining the alcohol content in numerous samples of urine taken from persons arrested for being drunk in charge of motor cars.

For comparison, therefore, we append a few of these results to indicate the degree of concentration of alcohol in the urine in cases where large amounts of alcoholic liquors have been consumed.

	1st Sample.		2nd Sample.		3rd Sample.	
	Time.	Alcohol per 100 c.c. Mgrms.	Time.	Alcohol per 100 c.c. Mgrms.	Time.	Alcohol per 100 c.c. Mgrms.
1.	9.15 p.m.	269	10 p.m.	261	11.15 p.m.	202
2.	1.0 a.m.	292	2 a.m.	264	—	—
3.	11.45 p.m.	336	1.10 a.m.	302	—	—
4.	8.50 p.m.	395	10.15 p.m.	373	—	—
5.	12.50 a.m.	412	—	—	—	—
6.	5.10 p.m.	268	5.55 p.m.	285	7.30 p.m.	211
7.	1.8 a.m.	342	2.48 a.m.	287	—	—
8.	4.40 p.m.	349	5.5 p.m.	355	—	—
9.	11.15 p.m.	286	12.20 a.m.	243	—	—
10.	4.15 p.m.	293	—	208	—	—
11.	9.0 p.m.	378	9.45 p.m.	338	—	—

In conclusion, we may quote a statement from a paper read by Dr. Godfrey Carter before the Society for the Study of Inebriety: "Two hundred mgrms. of alcohol per 100 c.c. of urine suggests moderate intoxication, 360 mgrms. per 100 c.c. of urine suggests definite drunkenness.

The apparatus (excluding the sulphuric acid air-washer) is supplied by: Messrs. The Scientific Glass Blowing Co., 12–14, Wright Street, Oxford Road, Manchester.

REFERENCES.

Southgate, H. W. *Biochem. J.*, **19**, 737.
Canan and Sulzer. *Heart*, 1924.
Southgate and Carter. *Brit. Med. J.*, March 13th, 1926.
Carter. *British Journal of Inebriety*, October, 1927.

DISCUSSION.

Sir WILLIAM WILLCOX congratulated the authors on their paper, and said that he thought the chemical tests outlined would ultimately come into general medico-legal use. At present the whole position was unsatisfactory, for in general legal practice it had not been decided what constituted drunkenness.

He then proceeded to read from the considered report of a committee appointed by the British Medical Association, which purported to give a definition of drunkenness, and which described the various physical and psychological tests to be applied to a suspected person.

The present state of the law, Sir William proceeded, was almost ludicrous. The definition evolved by the committee (of which he himself was a member) was worthless from the legal point of view, because the popular legal idea of drunkenness was a condition of disorderliness and complete helplessness due to the consumption of alcohol There was nothing in the legal acts suggesting that a man was drunk when he had lost such higher faculties as an ability to play billiards or drive a motor car. The result was that there was a tendency not to regard a person as drunk unless he was "dead drunk."

He had been giving evidence, he said, a few days previously in an important case. The accused person had responded to all the tests outlined, but no single one of them could be said to be proof that he was drunk; drunkenness could only be diagnosed by a combination of all the tests, and even then, from a legal point of view, the diagnosis appeared to be insufficient.

The law was unsatisfactory in that, unlike arsenic or strychnine, drink could not usually be proved to be in the system in sufficient amount to cause drunkenness; and there was a tendency nowadays to give the benefit of the doubt to the accused person. The milder degrees of drunkenness were not recognised by the law, and for that reason the definition evolved by the B.M.A. committee was of no legal value.

Hence, Sir William continued, the present paper was of very great value in that it pointed the way to placing the diagnosis of drunkenness on a scientific basis. A good deal of work, however, had still to be done: the chemical data were so far insufficient. It was not yet possible to say what percentage of alcohol meant drunkenness and what sobriety. He would like to know, again, how the various psychological tests were affected by the presence of different quantities of alcohol in the blood and urine.

Another difficulty that occurred to him was the case of the "old toper." Did he get an excessive amount of alcohol in the blood, or had the body developed the power of oxidising and preventing absorption? There was also the legal difficulty that a man could not be forced to give evidence against himself by the provision of specimens of blood or urine from himself.

The one great advantage of the test at the moment was that it would prevent the conviction of innocent persons, for the absence of alcohol would disprove drunkenness. In this connection Sir William related the story of an unfortunate person suffering from a nervous disease who had walked some distance to the park, only to discover that he had no money in his pocket for his 'bus fare home. He walked rather unsteadily up to a policeman and asked him to lend him twopence—whereupon he was promptly arrested for being drunk.

Mr. E. R. BOLTON suggested that the paper should have been entitled "Chemical Tests for Drink," the object being to determine how much alcohol a man had taken. The acute question of the definition of drunkenness had become of importance in reference to motor drivers, though some men were more dangerous, even when sober, than a skilled driver who might have taken a little drink. The test, he contended, should be used for sorting-out purposes, to decide whether an accused person had, or had not, taken drink. Other points should, of course, be considered, and due regard should be paid to the fact that a man who had been shaken by an accident was not in a condition to be judged as to his competency to drive a car.

Dr. B. S. EVANS said that he had often tried to determine traces of chronic acid by the amount of iodine liberated from potassium iodide, but never with satisfactory results, and he had had to fall back on colorimetric determination.

Mr. J. R. NICHOLLS remarked that the apparatus was neat and efficient for the determination of volatile oxidisable matter. But the acidity of the oxidising mixture was so great, and the conditions of oxidation so drastic, that many other substances besides ethyl alcohol would be attacked, *e.g.* acetone. A comparatively small proportion of oxygen was necessary to oxidise ethyl alcohol to acetic acid, whereas most other substances being oxidised to carbon dioxide and water required much larger proportions. On the assumption that all the oxygen so used had produced acetic acid from ethyl alcohol, a very small quantity of impurity would show as a much larger quantity of alcohol. The test, therefore, could

only be of value as a negative test to indicate that a man had not taken alcohol ; a positive result would be liable to a highly dangerous interpretation.

Dr. ROCHE LYNCH said that the test had been proved to be sound some two years previously. The apparatus had been found to give accurate results when known quantities of alcohol were taken, and when acetone alone was present negative results had been obtained. In attempting to co-ordinate the amount of alcohol found, however, they were confronted with individual variation, time relations between the taking of the alcohol, the accident and the test, and the rate at which the alcohol was consumed. These, in his opinion, made the test difficult of interpretation, so far as court cases were concerned. Finally, samples of blood or urine could only be taken from a prisoner with his full consent.

Mr. J. EVANS replied that their idea was simply to bring the apparatus (which was made by the Scientific Glass-blowing Company, Manchester) before the Society. They were not responsible for the taking of the police samples, but had carried out the analyses on those handed to them. With regard to the legal aspect, he understood that it was not a legal offence to be drunk; a man had to be drunk and disorderly, or drunk in charge, or drunk and incapable. He did not wish to infer that the man who had taken a pint of beer was drunk. As regards interfering substances, there was always the case of the diabetic patient, and he intended to examine diabetic urine; but his business was not to interpret results: he tested for alcohol, albumin, and sugar and sent in his report. Tests made on non-alcoholic urines had given a blank every time. Not all the experiments had been referred to: the remainder would be published.

The Determination of Aluminium in Steel.*

BY A. T. ETHERIDGE, B.Sc., F.I.C., M.B.E.

ALUMINIUM is used as a deoxidiser for molten steel in the ladle, but usually only a trace remains in the metal. The effect of aluminium, below 0·2 per cent., is practically negligible (except in the form of inclusions of alumina which are very detrimental; this, if present, is not estimated here, as it is insoluble in acid, due to the high temperature to which it has been exposed). Steels with 0·5 per cent. and upwards have been investigated by Hadfield (*J. Iron and Steel Inst.*, 1890, **2**, 161), and later by Guillet (*Revue de Métallurgie*, 1905, 312), but have not achieved commercial importance. Recently, however, a chromium steel with 1·2 per cent. of aluminium has come into prominence for the nitrogen process of surface-hardening (Guillet, *Compt. rend.*, 1928, **186**, 1177).

The method of determining aluminium in steel, as given in technical books dealing with steel analysis, consists in precipitating it as phosphate from acetic acid solution, the iron being kept in the ferrous state by sodium thiosulphate. This has been tested by adding 0·01 and 0·02 per cent. of aluminium to electrolytic

* Communication from the Research Department, Woolwich.

iron. In the case of a 0·01 per cent. addition no precipitate was obtained, and with 0·02 per cent. addition the amount recovered was less than 0·01 per cent.

The method is therefore unreliable for small amounts of aluminium. As regards larger amounts, it has been shown by Clennell (*Mining Magazine*, May, 1922) that aluminium phosphate is of variable composition according to the amount of excess of reagent and conditions of precipitation.

Experiments were therefore made with a view to discovering a method which could be relied upon for all amounts of aluminium. Briefly stated, the iron is removed from a chloride solution by extraction with ether, and other interfering metals are removed by electrolysis over a mercury cathode from a sulphuric acid solution. The apparatus and the operations are the same as given by the author in a previous communication. (The Determination of Vanadium in Steel, ANALYST, **1928, 53**, 423.)

The liquid, after electrolysis, contains the aluminium, together with manganese (and vanadium and titanium if present). The aluminium is precipitated with ammonia and, after weighing, is analysed to obtain the correction for other substances present, in order to arrive at the actual weight of aluminium oxide. The details are as follows: In the case of most steels the weight taken is 10 grms. But, if aluminium is known to be present as a constituent, and the amount is also approximately known, a weight is taken which will give about 0·1 grm. of oxide; on account of the gelatinous nature of the precipitate it is not advisable to handle much more than this. A weight of 10 grms. of steel is dissolved in 100 c.c. of concentrated hydrochloric acid (less for smaller weights), oxidised with the minimum amount of concentrated nitric acid, evaporated to a low volume, transferred to a separating funnel, and extracted with ether, as described in the paper referred to previously (*loc. cit.*).

The liquid is treated with sulphuric acid and electrolysed, the electrolyte removed and evaporated, traces of mercury precipitated with hydrogen sulphide, and the filtrate from the precipitate boiled down, as therein described. After the addition of 5 grms. of ammonium chloride the aluminium is precipitated with ammonia (sp. gr. 0·940), methyl red being used as indicator according to the instructions given by Blum (*Scientific Paper* 286, *Dept. of Commerce, U.S.A.*). The precipitate is filtered off on a filter paper of low ash, washed with weak ammonium chloride solution (Blum, *loc. cit.*), burnt in a low temperature muffle till the paper has been completely ashed, and ignited at 1200° C. for half an hour (Blum, *loc. cit.*). It is not necessary to make a double precipitation, unless the precipitate is considerable and the manganese is high in amount. A blank test must be made on the reagents by carrying through the process from beginning to end, omitting the steel, or, if preferred, using electrolytic iron. This usually gives a weight of about 1 mgrm. (This includes the alumina in the reagents, the filter paper ash, and traces of iron and silica from the reagents and glassware used after sulphating.)

The precipitate contains phosphorus pentoxide, ferric oxide, manganese oxide (very small), and chromic oxide (from a chrome steel). The phosphorus

pentoxide is derived from the steel, ferric oxide from reagents used after electrolysis, and manganese oxide (MnO) is usually negligible. The chromic oxide may be present in traces, as chromium is more difficult to remove by electrolysis than iron or nickel. If the weight of precipitate is not greater than 5 mgrms., it has been found that it is not worth while to analyse it, since, after the corrections have been made, the aluminium can be said to be not greater than 0·01 per cent. In such cases the aluminium should be estimated colorimetrically (see later). The precipitate is brought into solution by fusion with 1 grm. of potassium bisulphate (free from iron or containing only a known small amount) and extraction with water. If vanadium (or titanium) is known to be present, the vanadium pentoxide or titanium dioxide TiO_2 can be determined at once colorimetrically with hydrogen peroxide.

After the hydrogen peroxide has been boiled off the following oxides are determined on the same solution in the order given.

Ferric oxide is determined by nearly neutralising with ammonia, and adding sulphur dioxide solution, expelling the sulphur dioxide by boiling, cooling, and titrating with $N/100$ permanganate solution.

Manganese oxide is determined colorimetrically by the persulphate and silver nitrate method, allowance being made for the manganese already present from the previous operation.

Chromic oxide (if a chrome steel is being tested) is determined colorimetrically by oxidation with permanganate.

Phosphorus pentoxide. A weight of 0·1 grm. of electrolytic iron is dissolved in dilute nitric acid (sp. gr. 1·2), added to the liquid, and the iron (carrying all the phosphorus pentoxide) precipitated with ammonia (sp. gr. 0·940).

After filtering and washing, the precipitate is dissolved in 45 c.c. of dilute nitric acid (sp. gr. 1·2), poured while hot on to the paper. After the washing of the paper, the liquid is boiled down to 45 c.c., and 1·9 grms. of electrolytic iron dissolved in it. This process brings about the same conditions as are used for determination of phosphorus in steel, and the phosphorus is now determined alkalimetrically as usual.

This analysis gives all the information required to obtain the net weight of alumina in the precipitate. It will be seen from the table given below, that the phosphorus pentoxide forms the largest part of the correction to be made. If the result shows that the amount of aluminium is of the order of 0·01 per cent. or less, it will probably be sufficient to report the analysis in this way. If, however, more precise information is required, it is necessary to carry out a colorimetric analysis. The analysis is started again and carried out in the same way as far as the electrolysis stage. The washing liquid is hot water slightly acidified with sulphuric acid, instead of ammonium sulphate solution, as this has been found to interfere somewhat with the development of the correct shade of colour. The liquid is evaporated and traces of mercury removed as described. The filt- is boiled down, cooled, and made up to 500 c.c.

An aliquot volume of 50 c.c. is first tested colorimetrically in order to decide on the best volume to take. The reagent used is aurin-tricarboxylic acid, and the process is used as described by Lundell and Knowles (*J. Ind. Eng. Chem.*, 1926, 60). The optimum amount of aluminium is 0·1 mgrm. and the range for suitable comparison with the standard solution is 0·05 mgrm. to 0·5 mgrm. A blank test must, of course, be carried out on all the reagents used.

TABLE OF RESULTS.

		Gravimetric Analysis.									
		Corrections Mgrms.						Aluminium.			
									Found,		
Steel. (10 grms.).	Weight of precipitate. Mgrms.	Fe_2O_3. Mgrms.	MnO. Mgrms.	P_2O_5. Mgrms.	Cr_2O_3. Mgrms.	Blank. Mgrms.	Net weight of precipitate. Mgrms.	Total Per Cent.	corrected for Al in steel used. Per Cent.	Added Per Cent.
Plain steel	4·8	0·8	<0·1	1·0	—	1·0	2·0	0·01	—	—
Same steel ..	11·0	0·8	0·1	3·0	—	1·0	6·1	0·03	0·02	0·02
Same steel ..	48·4	1·4	0·1	3·5	—	1·0	42·4	0·22	0·21	0·20
Nickel chrome steel with high phosphorus	9·6	1·4	0·1	3·5	1·2	1·0	2·4	0·01	—	—
Same steel ..	12·5	0·5	<0·1	5·2	0·5	1·0	5·3	0·03	0·02	0·02

COLORIMETRIC ANALYSIS.—The following example may be cited as typical of several:

Electrolytic iron 10 grms.

1/5 liquid=0·8 c.c. of standard solution (1 c.c.=0·1 mgrm. Al.)=4·0 c.c. for the whole liquid.

The same with 0·005 per cent. of aluminium added.

1/10 liquid=0·9 c.c. of standard solution=9·0 c.c. for the whole liquid.

Difference=5·0 c.c.=0·005 per cent.

The reagents alone, with 1/5 of the liquid required 0·5 c.c. of standard solution (which apparently indicates a trace of aluminium in the electrolytic iron used).

In testing a steel with these reagents, a correction of 0·0025 per cent. would be made.

The Determination of Small Quantities of Mercury in the Presence of Organic and Inorganic Compounds.

By R. ROBINSON.

The determination of small quantities of mercury has been the subject of research by chemists during the past 20 years. The vast majority of these methods are applicable where mercury only is present, in which case no great difficulty arises except in the case of less than 0·002 grm.

The high volatility of mercury and its salts is the cause of low results due to losses in the various operations necessary in obtaining the mercury free from metals of the hydrogen sulphide, ammonium sulphide and ammonia groups.

The method described in this paper, although not universally applicable, may, with slight modification, be used in most cases, and requires no elaborate apparatus.

For various researches it was necessary to determine between 0·002 and 0·040 grm. of mercury in the presence of organic matter; the material having approximately the following composition:

Mercury	0·002–0·040 grm.
Copper	0·010–0·200 ,,
Iron	0·100–0·250 ,,
Zinc	0·050–0·060 ,,
Calcium	0·060–0·100 ,,
Sodium chloride	0·100 ,,
Organic matter	0·300 ,,

The organic matter consisted of resinous bodies, and the mercury was present as a mixture of metallic mercury, mercuric oxide and an organic compound of mercury.

The method of removing the mercury with copper and determining it by volatilisation was found to be unsatisfactory; this can be understood from the paper by Gordon (Analyst, 1920, **45**, 41), who shows that, above 0·0100 grm., the mercury is not precipitated quantitatively, and does not adhere well unless very large copper coils are used.

The later method of Evans and Clarke (Analyst, 1926, **51**, 224) by filtration through copper filings was not tried, this method not having been published before a satisfactory method had been found.

Colorimetric methods necessitated the separation of the copper, iron and zinc, with consequent losses of mercury, and with regard to these it might be mentioned that the diphenylcarbazide method of Menière (*Compt. rend.*, 1908, 754) was very unsatisfactory, the colour being considerably altered by a slight change in acidity.

The iodimetric method of Rupp is good for small quantities, but cannot be used in the presence of copper and iron. This also applies to a similar method proposed by Adanti which was, however, tried with pure mercury, standard solutions of one-tenth the strength suggested by him being used. The end-point is not sharp unless excess of sodium thiosulphate is added and the solution back titrated with $N/100$ iodine. This gives excellent results with quantities of 0·005 to 0·010 grm. of mercury, but only if the filtration of the mercury is carried out with the aid of the suction pump and a paper pulp pad, since it was found impossible totally to retain 0·005 grm. of mercury on an ordinary filter, owing to the fine state of division of the precipitate.

By precipitating the mercury with hypophosphorous acid, filtering on a pulp filter, and titrating with $N/100$ iodine and $N/100$ sodium thiosulphate satisfactory results are obtained with large and small quantities of mercury.

Some experimental results are shown, together with factors which influence the determination.

Howard (*J. Soc. Chem. Ind.*, 1904, **23**, 151) has determined mercury by precipitation with hypophosphorous acid and weighing. The results were fairly satisfactory, although always slightly low, due to loss by volatilisation. To minimise the error, Howard used only large quantities.

Moser and Neissner (*Z. anal. Chem.*, 1928, 200), using a modification of Howard's method, obtained very satisfactory results by filtering on a counterpoised filter paper.

They also investigated the effect of impurities, and found that iron, lead, cadmium and zinc do not interfere, whilst copper rendered the method useless. As will be shown later, mercury can be determined in the presence of copper by means of hypophosphorous acid, if sodium chloride is added to the solution before precipitation.

The solutions required are:—(1) Hypophosphorous acid of sp. gr. 1·137; (2) $N/100$ iodine solution; (3) $N/100$ sodium thiosulphate solution.

A. Pure Mercury.—The determination is carried out in a 350 c.c. conical flask provided with a glass cover. The solution containing the mercury is diluted to 200 c.c. with distilled water, and the acidity adjusted with hydrochloric acid, so that the solution contains 5 c.c. of $2N$ hydrochloric acid in excess; 2 grms. of sodium chloride and 0·010 grm. of paper pulp are added. Thirty c.c. of hypophosphorous acid (sp. gr. 1·137) are added, and the solution allowed to stand overnight.

The flask and contents are next heated on a water bath for 15 minutes and allowed to stand for 20 minutes, after which the liquid is filtered by suction through a well-packed paper pulp filter, and the flask and filter washed with cold distilled water. Thorough washing of both the flask and filter is essential to ensure the complete removal of all the hypophosphorous acid. The pulp and mercury are transferred to the original flask, the sides of the funnel being wiped with a piece of wet filter paper to remove adhering particles of mercury. This is also transferred

to the original flask, and 100 c.c. of distilled water and 2 c.c. of 30 per cent. acetic acid are added, followed by excess of $N/100$ iodine (at least twice as much as is required to combine with the mercury) and 2 grms. of potassium iodide. The flask is allowed to stand for at least 30 minutes, with occasional shaking, then treated with $N/100$ sodium thiosulphate solution in excess (1 c.c. excess is sufficient) and titrated to faint blue with $N/100$ iodine, starch being used as indicator (1 c.c. of $N/100$ iodine = 0·0010 grm. of mercury). A blank determination should be made, and the amount deducted from the result. This is due to the excess of iodine used, and to a small amount reacting with the pulp; it generally amounts to 0·0002 grm.

The paper pulp is prepared by digesting filter paper with 17 per cent. hydrochloric acid, filtering, and washing free from acid on a Buchner funnel.

The addition of a small quantity of paper pulp has the effect of causing the mercury to precipitate on its surface, thereby keeping it in a fine state of division and rendering the reaction of the iodine more rapid. This is a great advantage when using $N/100$ solutions.

RESULTS WITH MERCURIC CHLORIDE SOLUTION.—(1 c.c.=0·002 grm. of mercury) no other metal being present. Above method used.

Solution. c.c.	Mercury present. Grm.	Mercury found. Grm.	Error. Mgrm.
1.	0·002	0·0018	0·2
3.	0·006	0·0058	0·2
5.	0·010	0·00975	0·25
5.	0·010	0·00964	0·36
5.	0·010	0·00964	0·36
5.	0·010	0·00994	0·06
5.	0·010	0·00975	0·25
5.	0·010	0·00970	0·30
10.	0·020	0·0197	0·30
15.	0·030	0·0295	0·50
15.	0·030	0·0295	0·50

The results are slightly low, averaging about 0·3 mgrm. This, no doubt, is due to the volatility of the mercury, as is shown later.

Effect of Acid.—The method described above was used, with excess of hydrochloric acid. The following results were obtained:

Excess of hydrochloric acid. c.c.	Mercury found. Grm.	Mercury present. Grm.	Error. Mgrm.
1 (2N)	0·00975	0·010	0·25
5 ,,	0·00970		0·30
10 ,,	0·00955		0·45
5 (conc.)	0·0079		2·10

Excess of hydrochloric acid thus causes low results, and 5 c.c. of 2 N hydrochloric acid should be the maximum present. In this respect the figures disagree with

those obtained by Moser and Neissner (*loc. cit.*), who do not get low results when using 8–10 c.c. of concentrated hydrochloric acid in a volume of 150 c.c.

Effect of Volume of Liquid.—In these experiments 5 c.c. excess of 2 *N* acid were added in each case.

Volume. c.c.	Mercury found. Grm.	Mercury present. Grm.	Error. Mgrm.
25	0·00945	0·010	0·55
100	0·00965	0·010	0·35
200	0·00975	0·010	0·25

The mercury is not totally precipitated in a small volume with the usual excess of acid; this, no doubt, is mainly due to the increased concentration of hydrochloric acid.

Effect of Heating on Water Bath for Varying Times.—This is important on account of the volatility of mercury. It is essential that the liquid should be warmed to 80° C., otherwise there is a danger of the mercurous chloride not being totally reduced to mercury; on the other hand, there is a danger of losses due to volatilisation. With the type of water bath used throughout these experiments the liquid rose to its maximum temperature of 85° C. after 10 minutes.

Time of Heating on Water Bath.—The following results were obtained:

Minutes.	Mercury present. Grm.	Mercury found. Grm.	Error. Mgrm.
15	0·010	0·00975	0·25
30	0·010	0·00960	0·40
45	0·010	0·00935	0·65
80	0·010	0·00890	1·10

It is obvious from these analyses that the low results are due to the volatility of the mercury; consequently, every care should be taken to minimise them as far as possible.

The fact that, in general, the results are about 0·3 mgrm. low is probably due to the air space in the flask becoming saturated with mercury vapour, which is lost when filtering. The air space in the flask would generally be 100–150 c.c. The table below, calculated from the vapour pressure, shows the weight of mercury which would be present in 100 c.c. of air at various temperatures and a pressure of 760 mm.

Temperature. ° C.	Mercury per 100 c.c. Grm.
100	0·00032
90	0·00019
80	0·00011
70	0·00006
60	0·00003

With prolonged heating on a water bath a considerable volume of gases would escape, taking with it mercury in the form of vapour.

Effect of standing after Heating on Water Bath before Filtering.—The results obtained were as follows:—

Time of standing. Minutes.	Mercury present. Grm.	Mercury found. Grm.	Error. Mgrm.
0	0·010	0·0097	0·3
30	0·010	0·0098	0·2
60	0·010	0·0098	0·2

It has been suggested that very finely divided mercury oxidises on exposure to air. If this were the case, a low result should have been found. Since oxidation did not take place, it is not essential to titrate at once.

Effect of Quantity of Hypophosphorous Acid.—With only pure mercury salts present in the solution it makes no difference whether 5 c.c. or 40 c.c. of hypophosphorous acid are used. In the presence of copper, iron and other reducible compounds it is essential to use a large excess, partly on account of the loss of hypophosphorous acid due to oxidation, but mainly because mercury is not completely precipitated in the presence of these impurities unless a large excess of precipitant is used.

In the presence of impurities previously mentioned the results are usually 0·5 mgrm. too low, unless at least 30 c.c. of hypophosphorous acid are used.

B. Determination of Mercury in the Presence of Impurities.—The effect of various impurities is shown in the following table:—

Mercury present. Grm.	Impurity. Grm.	Mercury found. Grm.	Error. Mgrm.
0·010	1 of KNO_3	0·0098	0·2
0·010	1·3 of $Al_2(SO_4)_3$	0·0097	0·3
0·010	1·0 of NaCl	0·00985	0·15
0·010	0·5 of Zn	0·00975	0·25

In the case of aluminium compounds it is essential to have sufficient excess of hydrochloric acid to prevent the precipitation of aluminium hydroxide or phosphate on heating. In one case a high result was obtained. This was due to the precipitation of aluminium hydroxide or phosphate which could be seen, and it rendered the solution extremely difficult to filter.

Iron.—Iron causes low results unless sodium chloride is present. Probably the iron prevents the complete precipitation of mercury, since if ferrous hydroxide or ferrous phosphates were present in the precipitate, a high result could be expected.

Mercury. Grm.	Iron. Grm.	Sodium chloride. Grm.	Mercury found. Grm.	Error. Mgrm.
0·010	0·50	—	0·0091	0·9
0·010	0·50	—	0·0089	1·1
0·020	0·50	—	0·0164	3·6
0·010	0·50	1	0·00975	0·25
0·010	0·50	1	0·00980	0·20
0·020	0·50	1	0·01960	0·40

Copper.—Copper in neutral or very faintly acid solutions gives a precipitate of copper hydride on the addition of hypophosphorous acid. Copper hydride decomposes slowly at ordinary temperatures and rapidly above 40° C., giving metallic copper and hydrogen.

Moser and Neissner endeavoured to determine copper by precipitation with hypophosphorous acid, but were unsuccessful. With hypophosphorous acid in the presence of excess of free hydrochloric acid no copper hydride or metallic copper is formed, but cuprous chloride is formed. This is filtered off with the mercury, and, reacting with the iodine and potassium iodide, gives erroneous results.

The addition of sodium chloride not only keeps the cuprous salts in solution, but also assists in the complete precipitation of mercury.

Mercury. Grm.	Copper. Grm.	Sodium chloride. Grms.	Mercury found. Grm.	Error. Mgrms.
0·010	0·5	—	0·0079	2·1
0·010	0·5	—	0·0143	4·3*
0·010	0·5	1	0·0097	0·3
0·010	0·5	2	0·0098	0·2
0·020	0·5	1	0·0195	0·4

* Brownish precipitate with hypophosphorous acid.

By keeping the solution sufficiently acid and adding sodium chloride, copper does not affect the result unless too small an excess of hypophosphorous acid has been added, in which case the whole of the mercury is not precipitated, and the mercury found is approximately 1·0 mgrm. less than that present.

DETERMINATION OF MERCURY IN THE PRESENCE OF COPPER, IRON AND ZINC.

	Copper. Grm.	Iron. Grm.	Excess 2*N* HCl. c.c.	Zinc. Grm.	Sodium chloride. Grm.	Hypophosphorous acid used. c.c.	Mercury present. Grm.	Mercury found. Grm.	Error. Mgrm.
1.	0·1	0·05	5	0·03	—	5	0·01	0·0092	0·8
2.	0·1	0·05	15	0·03	—	5	0·01	0·0086	1·4
3.	0·1	0·05	5	0·03	1	5	0·01	0·00875	1·25
4.	0·1	0·05	5	0·03	—	5	0·01	0·0079	2·10
5.	0·1	0·05	3	0·03	0·1	5	0·01	0·0091	0·90
6.	0·1	0·05	3	0·03	—	10	0·01	0·0089	1·10
7.	0·1	0·05	3	0·03	0·1	15	0·01	0·0096	0·40
8.	0·1	0·05	3	0·03	0·1	5	0·03	0·0269	3·10
9.	0·1	0·05	2	0·03	2	30	0·01	0·0098	0·20
10.	Impurities and treatment as No. 9 (average of 10 determinations)						0·01	0·00981	0·19
11.	0·1	0·05	2	0·03	1	30	0·02	0·0195	0·50
12.	0·1	0·05	2	0·03	1	30	0·02	0·0198	0·20
13.	0·04	0·05	3	—	2	30	0·01	0·0098	0·20
14.	0·08	0·11	3	—	2	30	0·01	0·0097	0·30
15.	0·12	0·17	3	—	2	30	0·01	0·0097	0·30

In the presence of sodium chloride and by using 30 c.c. of hypophosphorous acid the results show excellent agreement. With smaller quantities of precipitant and in the absence of sodium chloride, mercury is not completely precipitated if copper and iron are present. Once again the necessity for keeping the concentration of hydrochloric acid as low as possible will be noticed.

An attempt was made to separate the mercury and copper from the zinc, iron, etc., by precipitation with hydrogen sulphide, and subsequent solution in acid, followed by neutralisation with hydrochloric acid, before precipitating the mercury with hypophosphorous acid in the presence of copper only. This method always gave low results, which were due to the volatilisation of the mercury when dissolving in *aqua regia* or hydrochloric acid and bromine. At the same time, owing to the sulphur deposited by the interaction of the ferric iron and hydrogen sulphide, extreme difficulty was found in completely dissolving the copper and mercury sulphides, which were occluded by the sulphur.

C. Determination of Mercury in the Presence of Organic Compounds.—The destruction of the organic matter presents no great difficulty, since sodium and potassium nitrates do not affect the result. Consequently, heating in a sealed tube at 180° C. with fuming nitric acid is quite satisfactory in the majority of cases.

For the purpose for which this method was to be used it would have been fatal if the tube had burst, as, owing to the small quantities available, one burst tube would have spoilt the whole series. Consequently, it was decided to try other methods in which this danger was not present. Heating with sulphuric acid until the organic matter was destroyed in an ordinary Kjeldahl flask gave results which were 1 to 2 mgrms. low, and in the presence of small quantities of chlorides no satisfactory figures could be obtained, owing to the mercury volatilising.

It was found that by connecting the top of the Kjeldahl flask with two washing bottles and occasionally adding a crystal of potassium nitrate, the organic matter could be destroyed in a few hours at 150° C. With these precautions no mercury was lost, even in the presence of chlorides.

In this series the percentage composition of the impurities was always the same, but the amounts of the total impurities and the total mercury were varied.

The impurities present had the following composition:—Copper oxide, 27·7; iron oxide, 22·2; zinc oxide, 3·5; aluminium oxide, 2·1; silica, 2·8; and organic matter, 41·7 per cent.

Method.—The following was the method used:—From 0·2 to 0·5 grm. was placed in a Kjeldahl flask connected with two washing bottles, and heated in a liquid paraffin bath at 130°–150° C. with 10 c.c. of concentrated sulphuric acid, with the occasional addition of a crystal of potassium nitrate.*

When the organic matter has been completely destroyed and the solution no longer smells of sulphur dioxide, the contents of the washing bottles are added to the main bulk, the insoluble matter filtered off, and the filtrate neutralised with

* From 1 to 5 c.c. of nitric acid have also been used, with satisfactory results and shortening of time for the destruction of the organic matter.

sodium hydroxide, the temperature being kept below 50° C. The liquid is then rendered just acid with hydrochloric acid and 3 c.c. of 2*N* acid in excess are added, after which 2 grms. of sodium chloride and a trace of paper pulp (approx. 0·01 grm.) are added, the liquid diluted to 200 c.c., cooled, treated with 30 c.c. of hypophosphorous acid, and allowed to stand overnight. The method as previously outlined is then continued.

A blank determination should be made; this generally amounts to 0·0002 grm., being due to the excess of iodine necessary to give the blue coloration in the presence of the paper pulp.

The following table gives results thus obtained:

Impurity. Grm.	Mercury present. Grm.	Mercury found. Grm.	Error. Mgrm.
0·2	0·0100	0·0098 (average of 7 determinations)	0·2
0·5	0·0095	0·0094 ,, ,, 3 ,,	0·1
0·5	0·0024	0·0019 ,, ,, 2 ,,	0·5
0·5	0·0047	0·0044 ,, ,, 2 ,,	0·3
0·5	0·0142	0·0141	0·1
0·5	0·0190	0·0191	0·1
0·5	0·0250	0·0253	0·3

SUMMARY.—(1) Mercury can be determined in the presence of various impurities, notably copper, iron, zinc, sodium, and potassium, by precipitation with hypophosphorous acid and determination of the mercury by means of standard iodine.

(2) The results are generally 0·3 mgrm. too low, this being due to volatilisation of mercury. By adhering closely to the details of the method this loss will be constant.

(3) The effects of various factors influencing the estimation are shown.

(4) The volatility of mercury is proved to be a cause of low results.

(5) A method for the determination of mercury in the presence of organic matter is given.

In conclusion, the author wishes to thank Dr. P. E. Bowles, F.I.C., and Mr. R. Gill, M.Sc., for their assistance and advice.

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Erratum: The Fatty Acids and Component Glycerides of Some New Zealand Butters:—In the table on p. 80, line 26 (Feb. issue), *for* "Iodine value of solid fatty acids, **101·5**" *read* "**10·15**."

Notes.

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

POISONING BY BITTERSWEET (*SOLANUM DULCAMARA*).

THE recorded cases of poisoning by bittersweet are few (*Vet. Record*, 1906, and *Farmer and Stockbreeder*, 1911), so that quite often doubt is expressed as to whether this plant is poisonous or not. The toxic principle is solanine, the berries containing some 0·5 per cent. of the alkaloid. Solanine is readily hydrolysed by mineral acids into solanidine, so that both alkaloids are found after the usual alkaloidal extraction methods have been used.

In cases of suspected poisoning I have found the usual Stas-Otto method of extracting alkaloids from viscera to be satisfactory, but as solanine is practically insoluble in ether and chloroform, a final extraction with warm amyl alcohol from ammoniacal solution is necessary, this being the most satisfactory solvent.

Solanidine is stated to be extracted from acid solution by ether, but I have not been able to verify this, my experience being that a mixture of solanine and solanidine is left after evaporation of the amyl alcohol extract.

The most useful tests on the mixed alkaloids were found to be:

(1) A concentrated solution of the alkaloids in amyl alcohol sets to a jelly-like consistence. (2) Phosphomolybdic acid gives a cream-coloured precipitate. (3) Fröhde's reagent gives a violet colour. (4) Nitric acid gives a purple colour on warming. (5) Vanadic sulphuric acid gives a red colour. (6) Ethyl sulphuric acid gives a red colour. (7) Concentrated sulphuric acid with bromine water gives red colours, forming in streaks. (8) Selenic sulphuric acid gives a red colour. (9) The haemolytic action on blood.

During the last few years I have had two definite cases of poisoning by bittersweet.

The first case occurred in the month of October, when a valuable foal was allowed into a field in which was a pond surrounded by masses of bittersweet. It was noticed that the foal ate the plant, but it was believed by those in charge of the animal to be harmless. When the foal became ill a veterinary surgeon was called in; he suspected poisoning, and when the foal died believed it might be due to deadly nightshade.

An examination of the stomach contents was made; the contents, on washing with water, were found to be in a very finely divided state, and no leaves or other characteristic parts of plants could be identified. Two hundred and fifty grms. of stomach contents were extracted for alkaloids, and 0·085 grm. of a mixture of solanine and solanidine was found.

In the second case, which occurred in the month of September, several cows died, and others were ill but subsequently recovered.

In this case the stomach contents consisted mainly of portions of leaves and fibrous stems which closely resembled those of bittersweet; no berries or seeds were found.

One hundred grms. of stomach contents yielded 0·06 grm. of mixed solanine and solanidine. The dung from other cows suffering, apparently, from the same

form of poisoning, was extracted for alkaloids, but nothing was found, so that it appears that solanine is not excreted as such in the dung.

A subsequent inspection of the field in which the cows had grazed revealed the fact that bittersweet was growing abundantly on the sides of a ditch.

In this case a veterinary examination and the *post-mortem* appearances suggested the possibility of solanine poisoning.

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THE EXTRACTIVES OF BRANDY.

IN *Aids to the Analysis of Food and Drugs*, Fourth Edition, (1918), p. 185, there occurs the statement that the total solids of brandy are "about 1 per cent." This statement had been carried on from the second edition (1899), at any rate, and through the third (1909). Whether it occurred in the first edition (1895), I do not know.

This figure of 1 per cent. was certainly a fair average up to 1910; from then until 1925 I have no adequate data for criticism, but since 1925 it certainly seems to be too high.

In twenty-six brandies I have analysed during the past three years the maximum figure has been 0·71 per cent. (weight/volume). For the purposes of this "Note" I have ventured on a rough classification into three groups:

No. 1 Group: The best-known brands, Three Star in each case, examined for the purposes of comparison. These consisted of Martell (two bottles), Hennessy, Otard, and Courvoisier.

No. 2 Group: Brandies supplied loose to Inspectors under the Sale of Food and Drugs Acts, which contained over 0·25 per cent. of total solids.

No. 3 Group: Brandies supplied loose to Inspectors under the Sale of Food and Drugs Acts, which contained up to 0·25 per cent. of total solids.

Actual figures (w/v) were as follows:

No. 1 Group: 0·61, 0·64, 0·56, 0·71, and 0·55 per cent.
No. 2 Group: 0·36, 0·38, 0·39, 0·55, 0·56, 0·62, and 0·62 per cent.
No. 3 Group: 0·07, 0·13, 0·14, 0·14, 0·15, 0·15, 0·15, 0·16, 0·17, 0·20, 0·20, 0·21, 0·21, and 0·25 per cent.

Excluding, for the time being, No. 1 Group, the principal cause of a drop in the total solids appears to be the change in public taste from a dark brandy to a pale brandy.

Apparently in the old days the demand for brown brandy arose from the knowledge that the article was colourless to commence with and steadily gained colour from the years it spent in the cask. Then came the period when the brown colour ceased to be any criterion of age, because burnt sugar was admittedly used to deepen the tint. This addition seems to have been taken as a matter of course. Thus Alexander and Meredith Wynter Blyth, in *Foods: Their Composition and Analysis* (Sixth Edition, 1909), p. 386, gave, as constituents of a typical brandy made from wine, 0·82 per cent. of sucrose and 0·37 per cent. of inverted sugar.

Brandy did not find a place in the *British Pharmacopoeia*, 1864, but appeared in the 1867 edition, with the description of having "a light sherry colour derived from the cask in which it has been kept" under the well-known title of *Spiritus*

Vini Gallici. Brandy continued to be an "official" substance in the 1885 and 1898 editions, with no recognition of caramel as a legitimate addition; but it disappeared in the avalanche of alterations that characterised the appearance of the 1914 edition. No figure was ever suggested for total solids. While the text of this "Note" is based on the falling-off in residue, it is of passing interest to observe that the Pharmacopoeia of the United States, where they have decennial revision, did not allow more than 0·5 grm. of residue from 100 c.c., in the 1905 edition. But the *U.S.P.*, 1926, includes the following test:—When 20 c.c. are evaporated and dried "the weight of the residue does not exceed 0·30 grm." This is 1·5 per cent. for a maximum. Perhaps the former 0·5 per cent. was a misprint for 1·5 per cent.; the former would certainly, at any period in the analysis of brandy have condemned every reliable brand. In digression, it does not seem likely that the new name for brandy in the *U.S.P.*, which is *Spiritus Vini Vitis* (*Sp. Vin. Vit.* being the prescribed short title), has anything to do with the matter, although in old days some high figures for total solids were found in brandies from sources other than French.

Squire's Companion, 19th Ed., 1916, appears to have got closest to the truth with the line: "The extractive matter varies from 0·6 to 1·5 p.c., and averages 0·75 p.c. w/v.," but to be on the high side then.

A most pleasant feature of the matter is the discovery that two of the most famous brands have never changed in their total solid content. *Lancet* analyses of one in 1899 and 1908 showed 0·69 and 0·67 per cent., my 1928 figures being 0·61 and 0·64. A 1905 analysis of another showed 0·69, the 1928 one being 0·56 per cent. It would appear that the best-known brands are to be relied on even in such an unimportant constituent as the total solids, which presumably means using the same type of oak cask for storage.

WILLIAM PARTRIDGE.

Notes from the Reports of Public Analysts.

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

CITY OF BIRMINGHAM.

REPORT OF THE CITY ANALYST FOR THE FOURTH QUARTER, 1928.

DURING the quarter 1333 samples were examined, of which 1177 were taken under the Sale of Food and Drugs Acts. Of these, 1085 were bought informally (27 adulterated), and 92 were formal samples (14 adulterated).

PRESERVED SAUSAGE.—Six samples were bought from shops in which notices were exhibited, such as, "All sausages exposed or offered for sale in this shop contain preservative," or "These sausages contain preservative," but in two cases the preserved sausage contained neither boric acid nor sulphur dioxide. Probably the shopkeeper had put up the notice believing he was selling preserved sausage, but the manufacturer, on that occasion, at any rate, had supplied sausage free from preservative.

It would appear to be much better if the Regulations had not allowed notices to be exhibited, but had required a declaratory label with each sample of sausage sold. The manufacturer who packs the sausage is in a position to know whether the article contains preservative, though the shopkeeper may not, and it would be quite easy to supply a preservative label with each retail sale.

OXYMEL OF SQUILL.—Twelve samples were of satisfactory composition, but one had been prepared with glucose syrup instead of honey. It was labelled "Oxymel Scillae," with the name of the vendors underneath, but no indication was given on the label that it was not of B.P. strength.

TALC IN DRUG TABLETS.—Seven samples each of potassium chlorate and phenacetin, and one each of calcium lactate, aspirin, and salol were examined. In each case the amount of drug present approximated to that stated, but there was considerable variations in the amounts of talc used in making the tablets. Of the 17 tablets, nine contained 0 to 0·4 per cent., three 1·4 to 1·7 per cent, three 2·8 to 2·9 per cent., and two, 5·7 and 5·9 per cent. Some manufacturers used much more talc than others for similar tablets. In some cases the excess of talc made the tablets slow in disintegration, and they were unsatisfactory, though they could hardly be described as adulterated.

J. F. LIVERSEEGE.

Legal Notes.

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

VALIDITY OF A SUMMONS UNDER THE NEW FOOD AND DRUGS ACT.

ON January 30th a summons was heard at Wimbledon against the licensee of a Wimbledon hotel, for the sale of whiskey to which 9 per cent. of water had been added.

The solicitor for the defence said that the alleged offence in this case had taken place on December 29, 1928, and he submitted that proceedings ought to have been taken under the old Act, since the new Food and Drugs Act was a consolidating or unifying Act, repealing all previous Food and Drugs Acts and part of the Licensing Act, 1921. The complainants were in the position of a person who lost the last bus; they could not apply to have the summons amended, as the stipulated period for bringing a case had elapsed.

Colonel J. Ubsdell, who appeared for the Surrey County Council, contended that the point was settled under Sec. 37 of the new Act, which said: "Every regulation, registration and sample shall have effect as if taken or given under this Act" (meaning the new Act).

The magistrates upheld the objection and dismissed the summons, but agreed to state a case for appeal.

SAND IN CINNAMON.

On January 23rd, a firm of spice manufacturers was charged at Liverpool with giving a false warranty in respect of ground cinnamon, which had been found, on analysis, to contain 7·3 per cent. of sand and siliceous matter.

Professor Roberts, giving evidence in support of his certificate, said that genuine cinnamon should not contain any sand or siliceous matter; if any were inadvertently present, its amount should not exceed 0·5 per cent.

In cross-examination the witness admitted that in the examination of some cinnamon he had found as much as 15 per cent. of sand. A method was in use by which the sand could be removed from cinnamon, but its exact details were known only to the firm which had perfected the process. He suggested that analysts could render assistance in the matter.

The solicitor for the defence said that the defendants had done their best, and had approached people who could help, but had been unable to obtain the information. There had been previous cases in 1907 and 1924, in which the summonses had been dismissed. In face of these cases he asked whether the defendants had acted unreasonably.

A witness for the defendant firm said that he had applied to eminent Liverpool chemists, and to the Ministry of Health, and had searched the municipal libraries for information on the elimination of sand from cinnamon, but had been unsuccessful.

The Stipendiary, in discharging the defendants with a caution, said that no moral reflection on the firm was involved, but it was indisputable that the cinnamon did contain 7·3 per cent. of sand. The defendants must pay £10 10s. costs.

EXCESS OF SOLUBLE CHLORINE IN RAG FLOCK FROM COCONUT FIBRE.

On January 15th proceedings were taken against an upholsterer, at the High Wycombe Police Court, for having in his possession flock manufactured from rags, and intended to be used for the purpose of making articles of upholstery, which did not conform to the standard of cleanliness demanded by the Rag Flock Regulations, 1912.

The sample was made from bagging and coconut fibre, and contained 243 parts of soluble chlorine per 100,000.

The case was taken under the Rag Flock Act (1911) Amendment Act, 1928, which defines "flock manufactured from rags" as being "flock which has been produced wholly or partly by tearing up woven or knitted or felted materials, whether old or new, but does not include flock obtained wholly in the process of the scouring and finishing of newly woven or newly knitted or newly felted fabrics."

There was no defence that the sample did not come within the Rag Flock Acts, 1911 and 1928, and the defendant had not protected himself by obtaining a warranty. A fine of £5 was imposed and costs.

About 5 years ago an exactly similar case came before the same Bench; a conviction was obtained, and this was upheld at Quarter Sessions, but was reversed by the High Court. (*Cf.* ANALYST, 1924, **49**, 430.)

The effect of the Amendment Act is therefore satisfactory, as it brings this class of material within the meaning of the Act.

Ministry of Agriculture and Fisheries.

REPORT ON MUSSEL PURIFICATION.*

By R. W. Dodgson.

A more explanatory title of the Report would be "Purification of Shellfish as the solution of certain fishery and public health problems arising from sewage pollution; with special reference to mussels," and the book, dealing throughout with utilitarian problems, is written partly from the popular and partly from the technical point of view.

Part I.—*Section I* deals with the pollution of shellfish and its significance, with a general review of the position. Purification methods for the oyster and mussel do not depend on sterilisation, but take advantage of the capacity for self-cleansing, for mussels are diligent and successful, under favourable conditions, in getting rid of sewage and bacteria, together with particles of solid matter.

Section II describes the pathological conditions which may follow the consumption of mussels, together with the evidence supporting the view that mussels may be the cause of these conditions. Typhoid fever and other specific infections are traced to oyster and mussel infection, and experimental, epidemiological evidence is given in detail. "Mussel Poisoning" may be classified as:

(*a*) *Erythematous*, the familiar "musselling" of short duration, of entirely favourable prognosis, due to mussel protein, and showing a characteristic urticaria and itching.

(*b*) *Paralytic*, much more severe in character and derived from mussels in stagnant or foul water. Death from asphyxia may occur in a few hours, or recovery in from 2–3 to 24 hours.

(*c*) *Bacterial Food-poisoning Type.* Mussels, in common with almost any food, may become the vehicle of the bacteria or their toxins, or both, which are responsible for the various forms of bacterial food poisoning.

(*a*) and (*b*), although of rapid onset, with vomiting and diarrhoea as a possible common feature, are entirely distinct pathologically and chemically. The physiological action of the poison in (*b*) has a marked similarity to that of curare, and Brieger isolated a poisonous alkaloidal substance from poisonous mussels which he called mytilotoxine. Thesen found that, on placing normal aquaria mussels in solutions of curare and strychnine, although the mussels themselves remained healthy, their extracts soon caused symptoms of curare or strychnine poisoning or infection in rats, and such extracts added to the aquarium water of other normal mussels soon caused the latter to become poisonous. Such toxicity was fleeting. He suggests that the mussels may take in the poison from the water and destroy it, acting as scavengers. Chapman (Analyst, **1926**, **51**, 548), after investigating the arsenic content of mussels, which in some samples was extraordinarily high, suggested that these cases might be connected with mytilotoxine poisoning. But his statement, that mytilism frequently follows the eating of mussels, suggests confusion between the (*a*) and (*c*) types of poisoning, on the one hand, and (*b*) on the other; and, while mytilotoxine may be responsible in some cases of (*b*), there appears to be strong evidence that arsenic is not. It may be mentioned that the

* Fishery Investigations. Series II. Vol. X, No. 1, 1928. H.M. Stationery Office. Price £1 1s. net.

popular view that poisonous properties reside in the "beard," foot and other particular parts of the mussel is erroneous.

Section III deals with the extent and significance of the pollution of shellfish beds by sewage; methods of ascertaining the existence and extent of such pollution; and measures which have been adopted or suggested for removing or mitigating the danger to the public health consequent upon such pollution.

Section IV recommends that, since the great majority, if not all, of the mussel beds in England and Wales from which mussels are taken for human consumption are polluted constantly or intermittently with sewage, and since mussels taken from any beds run serious risk of being subsequently gravely polluted by washing or storage, or both, in inshore polluted water; and, further, since it has been proved impracticable to safeguard either by relaying in unpolluted areas, by sterilising, by cooking, by any system of inspection, or by application of bacteriological standards, or by closing all polluted beds, the conclusion is that a process of purification should be applied, at once satisfactory, simple and economical, which has been in practice for 12 years at Conway, and that all home-grown and imported mussels should be thus purified.

PART II.—This deals with the work carried on at Conway, and describes the process there in use, which consists of a preliminary cleansing of the mussels by hosing, subsequent exposure overnight to a bath of sterile sea-water, draining, a second hosing, flushing, and immersing in a bath of sterile sea-water, the process being repeated a third time with a bath of 3 parts of chlorine per 1,000,000 parts of water, in which the mussels remain 1 hour, followed by draining and packing in sterilised bags. The mussels cleanse themselves inside the shell, and the chlorine is intended for sterilisation of the outside of the shell. A detailed description is given of the physiology of the mussel and of the technique employed. Mussels purified by this process should not contain more than 5 lactose-fermenting bacteria per 1 c.c., or, say, 100 per large mussel. Results of the practical operation of the plant are given, which show it as a sound economic proposition.

PART III.—*Section I* deals with certain bacteriological principles involved in the examination of shellfish, including a discussion of the question of the differentiation of "excretal" from "non-excretal" lactose-fermenting bacteria. Mussels may be regarded as polluted, either from inferential evidence, *e.g.* topographical, often sufficient in itself, or direct, *i.e.* bacteriological. The information required is usually whether the shellfish or water, or both, contain bacteria of sewage origin, and for this purpose a very large number of tests have been proposed. No bacteria definitely prove pollution to be derived from a human source, but the presence of certain ones, notably *Bacillus coli*, taken in confirmation with other circumstances, may make probability almost into certainty. Intestinal bacteria are, generally speaking, the only lactose-fermenting micro-organisms, and the differentiation of lactose fractors found in shellfish may be carried out broadly by dividing them into two main groups:—(1) The low-ratio type, giving a low gas ratio ($CO_2/H_2=1$); a positive methyl red reaction, a negative Vosges and Proskauer reaction, and (but not always) a negative Koser reaction, and (2) The high-ratio type, giving a high gas ratio ($CO_2/H_2=1{\cdot}5$ or 2); methyl red negative, Vosges and Proskauer negative, and (again not always) Koser positive. Dr. W. G. Savage concludes that the presence of high-ratio organisms only is a strong indication of contamination. The name *B. coli communis* should be confined to the original bacillus so named by Escherich in 1885, and should conform to the tests given by him. Although much importance has been attached in the past to the presence or absence of *Bacillus enteritidis sporogenes* (*B. Welchii*) and streptococci as indicators of faecal pollution, their significance appears to be merely traditional,

and their presence or absence does not modify the author's views, formed as a result of the quantitatively ascertained presence (or absence) of lactose-fermentative bacilli, and one report on polluted shellfish which condemned them simply owing to the presence of these two organisms and made no mention of lactose fractors (*B. coli*), is regarded as remarkable. It may be noted that *B. Welchii* is bracketed after *B. enteritidis sporogenes*. Klein's bacillus is now considered in many quarters as hypothetical, and his culture to have consisted of *B. Welchii* and some putrefactive organism such as *B. sporogenes*, so that beyond the traditional significance there is little to justify retention of the name *B. enteritidis sporogenes*.

Section II comprises a discussion of the bacteriological methods employed by the Fishmongers' Company and certain other authorities for the examination of shellfish, and on the validity or otherwise of the interpretations placed by them on the results of the tests, and concludes by submitting:

(1) That the element of chance is of such significance that successive tests of the same shellfish, under exactly similar conditions, and with the lapse of the minimum possible amount of time between the setting up of the tests, may show widely divergent results, even to the extent of unequivocal condemnation of the shellfish, on the one hand, and unequivocal approval on the other.

(2) That the presence of glucose in the shellfish themselves or developed (or both) during the course of the test, in the shellfish substance used, may lead to entirely erroneous results, even to the extent of bringing about the condemnation of the shellfish on the apparent evidence afforded of the presence in them of bacteria of the *B. coli* group, although there may, in fact, be no such bacteria present.

(3) That, in the diagnosis of the presence or absence of bacteria of the *B. coli* group, it is unsafe to introduce, as a factor in such diagnosis, discrimination as regards the amount of gas collected during the test, except that in certain cases, where a very minute bubble of gas is in question, the shellfish may be given the benefit of the doubt.

Section III deals with the bacteriological standards of purity or impurity of shellfish.

PART IV. This gives descriptions of certain mussel-bearing areas serving as examples.

Appendix I is a note on the formation of glucose in minced mussels and oysters on incubation, by H. M. Webb.

Appendix II gives other methods of purification of shellfish.

Appendix III treats of the isolation of *Bacillus typhosus* from sewage, sewage-polluted water, and shellfish by means of glucose, sulphite, iron and bismuth, and brilliant green medium.

The text is illustrated by 15 plates, 9 figures and three maps.

D. G. H.

Connecticut Agricultural Experiment Station.

REPORT ON FOOD PRODUCTS AND DRUG PRODUCTS FOR THE YEAR 1927.

THIS is the 51st Report of the Station, and it includes the 32nd Report on Food Products and the 20th Report on Drug Products. It comprises analyses of cacao products, cereal products, fats and oils, fruit and fruit products, ice-cream, drugs,

etc., and special investigations on similar lines to those described in the previous Report (ANALYST, 1928, **52**, 160).

CARBONATED BEVERAGES.—None of the 152 samples examined contained saccharin, and all exceeded the 5 per cent. of sugar required by the law. In general, the products were correctly labelled as to statements of artificial colouring matters and flavour.

UNLEAVENED BREAD.—Two samples, submitted by the dietetic department of a hospital, gave the following percentage results on analysis:

	Moisture.	Ash.	Proteins.	Fibre.	Carbohydrate.	Fat.
I.	8·02	2·13	12·13	0·17	76·95	0·60
II.	8·13	1·58	10·69	0·12	78·92	0·56

AMERICAN CHEESE.—American cheese, also known as Cheddar cheese and American Cheddar cheese, is cheese made by the Cheddar process, from heated and pressed curd obtained by the action of rennet on whole milk. It should not contain more than 39 per cent. of water, and, in the water-free substance, not less than 50 per cent. of milk fat.

Cream cheese is the unripened cheese made by the Neufchatel process from whole milk enriched with cream. It contains, in the water-free substance, not less than 65 per cent. of milk fat.

Under the laws of some states it is permissible to call cheese made from whole milk "full cream cheese." This is confusing, since cream cheese is a separate and distinct product.

Twelve samples of American cheese were examined for the Dairy and Food Commissioner. Three of these were sold as cream, or full cream, cheese, but they were evidently cheese of the Cheddar type, and the fat content, on the dry basis, corresponded to the requirements for Cheddar cheese.

The moisture in the samples examined ranged from 31 to 37·4 per cent. and the fat content, on the dry basis, ranged from 48·6 to 52·2 per cent. The average moisture was 33·4 per cent. and the average percentage of fat in the dry substance was 50·7 per cent.

LABELLING OF EGGS.—Under the State law, eggs held for more than 15 days in any place where the temperature is reduced by means of artificial refrigeration are cold storage eggs and must be designated as such when sold or offered for sale. Eggs preserved by any other artificial process must be labelled "preserved eggs."

When the price of locally gathered eggs is high and the best grades of cold storage eggs are available there is commercial advantage in offering the storage product as and for fresh eggs. Later, as prices for the two types of products become more nearly equalised the abuses cease, because there is little, if any, commercial gain to be made.

It has been estimated that only about 10 per cent. of the eggs produced are placed in cold storage. Withdrawals begin during July, and by the end of the year three-fourths or more of the total holdings may have been removed. The balance is used up by the 1st of March. The greatest abuses in the marketing of eggs occur during the autumn and early winter months.

It is evident that laboratory examinations alone cannot determine whether or not eggs are offered or sold in violation of the statute relating to cold storage eggs, but the evidence procured by such examinations, supplemented with inspection evidence, will generally lead to reasonably definite conclusions. Laboratory tests aim chiefly at determining whether or not eggs are fresh, judged by the usually accepted characteristics of fresh eggs as determined by candling, the condition of

the eggs as broken out of the shell and the ammonia content. If not classified as fresh, the evidence may give further suggestion as to probable history which will be of service in supplementing inspection evidence. Large air spaces accompanied by low ammonia content indicate eggs held at low temperatures or at cold storage temperatures. Large air spaces with high ammonia content indicate eggs held under less favourable conditions, such as eggs held too long by the retailer or held by the producer in anticipation of higher prices.

Of 62 samples examined, 60 of which were submitted by the Dairy and Food Commissioner, all were edible, with one exception, but 46 were not sold under proper descriptions.

STANDARD FOR BUTTER.—The Federal law required not less than 80 per cent. of milk fat, but has no specification for moisture. By regulation in the State of Connecticut butter must contain not less than 80 per cent. of fat and not more than 15·99 per cent. of water.

OYSTERS.—A sample of oysters shipped out of the State was returned as unfit for food. Another sample of the same lot, intended for shipment, was also examined (No. 2). Sample No. 3 was from the same dealer earlier in the year.

	1.	2.	3.
Weight of sample, grms.	124·8	167·7	—
Weight of liquor, grms.	19·7	17·7	—
Weight of drained oyster meat, grms. ..	105·1	150·0	—
Loss on boiling meat, per cent.	58·99	45·00	49·90
Solids in oyster meat, per cent. ..	18·21	21·96	21·50
Ash ,, ,, ,, ,, ,, ...	1·23	1·74	1·59
Salt ,, ,, ,, ,, ,, ...	0·03	0·16	0·40
Ash in liquor ,, ,, ...	0·92	1·39	—
Salt in ,, ,, ,, ...	0·19	0·66	—

The oysters had been treated with saline solution according to approved methods. The figures indicate more water in the oyster as returned than in those before shipment. No evidence of unwholesomeness could be detected by the odour or general appearance. Bacteriological examinations were made elsewhere.

ANALYSIS OF HONEY.—The numerical limits, as given in the definition and standard for honey, are not over 25 per cent. of water, not over 0·25 per cent. of ash, and not over 8 per cent. of sugar (sucrose).

No evidence of adulteration was found in 13 samples examined. The water content was not excessive in any sample. The ash varied from 0·06 to 0·27 per cent., and the sucrose ranged from 0·11 to 8·06 per cent. The invert sugar content was within the usual limits, ranging from about 72·5 to 78·0 per cent. For the detection of added invert sugar recourse is had to the fact that commercial processes for the manufacture of invert sugar result in the formation of furfural, which may be detected by suitable tests. The resorcinol and the aniline chloride tests gave no indication of commercial invert sugar in any of the samples examined. The procedure proposed by Auerbach and Bodlander (*Z. Nahr. Genussm.*, **1924**, **47**, 233) may be of value for the purpose of detecting added invert sugar and the possibilities of this method are being investigated by the referee on honey.

Extensive analyses of authentic samples of honey from various sources have shown that the differences between invert polarisations of honey at 20° C. and 87° C. are fairly constant, ranging between the rather narrow limits of 23 and 30 in a large proportion of cases. Differences substantially less than 23 are indications of added glucose. Several methods of estimating glucose from polarisation values

have been proposed. One of these is Browne's formula (*A.O.A.C. Methods of Analysis*, p. 201), which is generally used in control work. The Beckman test is a qualitative test of some value, but negative results do not necessarily mean absence of commercial glucose, because some of such glucose gives no iodine reaction.

In the samples examined the differences between invert polarisations at 20° C. and at 87° C. were all between 23·2 and 26·4, with one exception, where the difference was 20·5, but in which case one of the polarisation values is questionable. The Beckmann tests were negative in all cases, but the reservation noted above must be made. Determination of glucose by means of Browne's formula indicated no considerable additions of commercial glucose. On the whole, there was no acceptable evidence of adulteration in any of the samples.

TOMATO CATSUP.—The composition now, as compared with that found in earlier examinations, may be seen from the following summary:

	1927. Per Cent.	1910. Per Cent.
Total solids (as purchased basis) ..	20·2 to 36·0	7·3 to 32·5
Salt (as purchased basis)	1·9 to 3·6	0·7 to 5·2
Salt-free ash (as purchased basis) ..	0·7 to 1·1	0·6 to 1·8
Salt-free ash (water and salt-free basis)	2·2 to 4·9	3·2 to 20·8
Insoluble solids (as purchased basis) ..	1·2 to 1·6	1·2 to 6·1
Insoluble solids (water and salt-free basis)	3·6 to 8·1	7·0 to 45·0
Protein (as purchased basis)	1·7 to 2·4	0·8 to 3·1
Protein (water and salt-free basis) ..	4·6 to 12·5	5·4 to 24·6
Fibre (as purchased basis)	0·4 to 0·6	0·3 to 0·8
Fibre (water and salt-free basis)	1·2 to 2·8	1·4 to 10·9

It appears that in the products recently examined the total solids exceed 20 per cent. in the material as sold, whereas in the earlier inspection many samples contained less than 20 per cent., the minimum being less than 10 per cent. Salt-free ash in the dry, salt-free material is 5 per cent. or less, whereas this was about the minimum found in earlier samples, the maximum being over 20 per cent. The percentages of protein and fibre are also distinctly lower in the recently examined products.

No standards have been adopted for tomato catsup, but on the basis of earlier analyses it appeared that reasonable limits of composition for a standard catsup might be, in the water and salt-free material, not more than 15 per cent. of insoluble solids, not more than 7 per cent. of ash, not over 4 per cent. of fibre, and not more than 12 per cent. of protein. All of the samples in the recent inspection came well within these limits.

COD-LIVER OIL VITAMIN TESTS.—*Colour Tests for Vitamin A.*—Twenty samples of cod-liver oils, mainly Norwegian medicinal oils, were submitted to the antimony trichloride test of Carr and Price, and the colour values were compared with the results of feeding tests expressed in terms of U.S.P. units. The following table shows some of the corresponding values:

Colour value of oil (approx.) ..	5	5	10	15	20	30	70
Vitamin *A* value (U.S.P. units) ..	250	500	250	250	500	500	1000

Two samples, each with colour values about 5, but having vitamin *A* values of 250 and 500 respectively, destroy the otherwise reasonably consistent correlation between the two sets of tests. The oil giving the highest value in both tests was

a sample of American oil intended only for stock-feeding purposes. A sample of "Gaduol," a so-called extract of cod-liver oil, gave a very low result in the feeding tests, and a negative result with antimony chloride.

Colour Tests for Vitamin D.—Shear's test (*Proc. Soc. Exp. Biol. and Med.*, **23**, 546) was tried on a number of samples. It was found that cottonseed oil may give a colour not readily distinguishable from that produced by cod-liver oil, and the green shade stated to be characteristic of cod-liver oil was not observed. Rosenheim and Webster (*Biochem. J.*, **20**, 544) have found that the Shear test is given by substances which are inactive as regards vitamin *D*, and also by certain organic peroxides.

"DENICOTINISED" TOBACCO.—Enquiries from physicians and others regarding the merits of so-called "denicotinised" tobaccos, or tobacco products for which reduced nicotine content is claimed or inferred by the label, have led to the examination of as many of these products as could be obtained.

The usual method by which denicotinised tobaccos are prepared is essentially a re-sweating process accomplished by treatment with superheated steam or by heating in vacuum chambers. Dixon (*Brit. Med. J.*, Oct. 1927) cites the use of solvents for removing nicotine and other objectionable constituents. It is conceivable also that diluents consisting of non-nicotine-containing leaves foreign to tobacco might be used, but no attempt was made in this investigation to detect the presence of such foreign material.

The terms "processed" and "unprocessed," frequently used in this discussion, refer to the special re-sweating treatment employed to reduce nicotine content. It is understood, of course, that all tobacco undergoes various processes in the course of its preparation for commercial purposes.

None of the brands examined were claimed to be nicotine-free. However, such terms as "denicotinised" and "denicotined" were generally construed to mean "practically free from nicotine," particularly if the further assurance is given, or implied, that the consumer may smoke as much as he likes of these processed tobaccos. To such declarations as "bulk of nicotine removed" or "reduced nicotine content" less objection can be raised; from the first statement we should expect that over one-half of the original nicotine had been removed, while any reduction at all in nicotine would suffice to make the second declaration one of fact. The obvious difficulty in judging whether or not these statements are true lies in the lack of information as to the amount of nicotine in the various tobaccos before they were processed. No average figure for the nicotine content of tobacco in general can be given, because wide differences occur due to varieties of leaf and varied conditions of culture and growth. There may be substantial differences also among the leaves of the same plant, dark (upper) leaves showing higher nicotine content than leaves lower down on the stalk (lights and seconds).

From an examination of data from analyses of ordinary tobacco (given in a series of tables) and "denicotinised" products the following comparative summary has been drawn up:

	Nicotine in ordinary tobaccos. moisture-free. (58 analyses.) Per Cent.	Nicotine in "Denicotinised" tobaccos. moisture-free (17 analyses.) Per Cent.
Maximum	3·63	2·73
Minimum	0·47	0·74
Average	1·96	1·41

From this summary it is clear that, on the basis of averages, these "denicotinised" products, as a group, contain about 30 per cent. less nicotine than is likely to be found in ordinary unprocessed tobaccos. If we may assume 2 per cent. as a fair approximation of the average nicotine content (dry basis), which may be expected in the various forms of ordinary smoking tobaccos, a reference to the analyses showed that four "denicotinised" samples contained more than this average, and that four contained less than one-half as much. For the remainder, it seems fair to conclude that approximately one third to one half of the original nicotine had been removed.

It is of interest to compare these processed tobaccos, so far as possible, with ordinary tobaccos of corresponding types on the basis of nicotine content, assuming, as fairly representative nicotine values, 2·5 to 3·5 per cent. for Virginia tobacco, 2·0 to 3·0 per cent. for various other domestic leaf, 1·1 to 2·4 per cent. for Havana, and 1·0 to 1·5 per cent. for Turkish.

Another comparison may be made on the basis of the classes of products examined. The unprocessed cigarettes, as shown by analyses, have a range of nicotine content from 1·1 to 3·2 per cent., whereas "denicotinised" cigarettes range from 1·2 to 2·7 per cent. Pipe tobacco, unprocessed, ranges from 1·6 to 2·3 per cent., as compared with 1·1 to 2·5 per cent. for the denicotinised article. The data on cigars are rather limited, but the range is 1·3 to 2·1 for ordinary cigars and 0·7 to 1·4 per cent. for processed cigars.

From these data it is quite obvious that, in general, the denicotinised products here represented contained but little less nicotine than do ordinary tobaccos of corresponding leaf types. Notwithstanding considerable reductions which may be indicated in certain instances, it is not difficult to find among ordinary tobaccos brands in which nicotine is not greatly in excess of that present in the most thoroughly "processed" of these denicotinised products.

Parliamentary Notes.

CHLORINE TREATMENT OF FLOUR.

On January 28th the Minister of Health was asked by Lt.-Col. Heneage if his attention had been called to the use of chlorine for improving certain inferior grades of foreign flour, and if so, whether he proposed to take any action in the matter.

Sir Kingsley Wood, replying, said that the Minister was aware that chlorine was sometimes used for treating foreign flours, but that he understood that its use was diminishing. In these circumstances, and in view of the danger of increasing the cost of bread, and of driving the milling trade abroad, he did not propose at present to take any action.

POISONING BY NITROGLYCERIN.

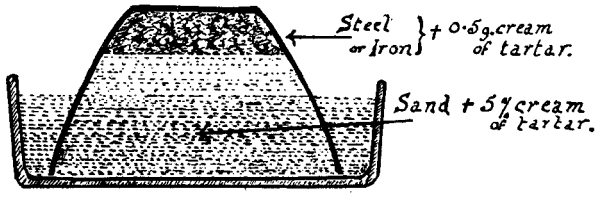
On January 24, the Minister of War was asked in the House of Commons, if his attention had been called to the death of a research worker at Woolwich Arsenal; whether it had been established that the death was due to the fumes of nitroglycerin; and what action he proposed to take to prevent the future occurrence of such fatalities.

Mr. Cooper replied that he had seen a report of the inquest at which the Coroner, in his verdict, stated that death was accelerated by the deceased having come into contact with the fumes of some chemical poison allied to nitroglycerin. The Minister of War was advised that poisoning by nitroglycerin was an extremely rare occurrence, and might imply an individual predisposition which could not be foreseen. Instructions had been issued directing any worker who felt indisposed as a possible result of contact with the materials he was using, to report the fact at once to his superior.

The Determination of Sulphur by the Evolution Process in Steels and Cast Iron.

THE organisers of the British Chemical Standards Movement have for some time pointed out that all carbon steels and cast iron in the form of millings, drillings, etc., after being in contact with air for a considerable period—usually at least two years—cease to yield the full quantity of sulphur as sulphide when dissolved in hydrochloric acid, even when they have been stored in a sealed container, and still remain bright. The result in such a case is that the standard value for sulphur, as determined by the evolution process, is low; and this can only be remedied by annealing the drillings, etc., in an oxygen-free atmosphere, such as carbon dioxide or nitrogen, before making the determination. This is not ordinarily carried out with ease in a works laboratory, and the following simple annealing process has therefore been devised:

Five grms. of the drillings are mixed with 0·5 grm. of dry powdered cream-of-tartar, placed in a porcelain crucible ($1\frac{5}{8}$ in. diameter at the top, and $\frac{7}{8}$ in. high),



which is then filled to the brim with a mixture of 95 per cent. of acid-washed, 40-mesh, calcined sea-sand, and 5 per cent. of powdered cream-of-tartar. On it is placed a silica capsule, $1\frac{3}{4}$ in. internal diameter and $\frac{1}{2}$ in. deep. The crucible is inverted, and the space on the outside, between the crucible and the capsule, is filled with the mixture of sand and tartar, as shown in the diagram.

The crucible is inserted gradually into a muffle at 750 to 850° C. (not hotter or the glaze may be badly attacked), and when pushed completely in, it is heated for 20 minutes, after which it is taken out and cooled on an iron plate, and the entire contents transferred to a sulphur flask, and sulphur is evolved as usual, by means of hot strong hydrochloric acid (sp. gr. 1·26).

A blank test should be made with the reagents, to insure that they do not yield any sulphur as sulphide when treated according to the test. Cream-of-tartar is usually free from sulphur, but sand, even after washing, has been found to contain a little, which will be reduced to sulphide and for which an allowance must be made.

The accuracy of the process has been established after carefully making a number of tests on different standards. White irons and certain alloy steels which do not yield all their sulphur as sulphide by direct evolution may also be treated successfully by this method.

As further confirmation of the application of the method for white irons, it has been submitted to two different chemists experienced in the analysis of these irons—namely, Mr. R. D. Dick of Messrs. Pease & Partners, Ltd., Normanby Iron Works, Middlesbrough, and Mr. A. E. Peace of Messrs. Leys Malleable Castings, Ltd., Derby, and in each case several tests on white iron have given results in close agreement with those obtained by the gravimetric method, whilst the ordinary evolution process, without annealing, has given low results.

Annealing with cream-of-tartar, etc., has, of course, been recommended for years, but the methods of carrying it out have not been satisfactory on account of the uncertainty of ensuring complete freedom from oxidation. The only new feature about this method is the simple and sure means employed to avoid oxidation.

N. D. RIDSDALE.

LABORATORY, 3, WILSON STREET,
MIDDLESBROUGH.

Statutory Rules and Orders.

1928, No. 571.

MERCHANDISE MARKS.

THE MERCHANDISE MARKS (IMPORTED GOODS) No. 3 ORDER, 1928.*

At the Court at Buckingham Palace, the 13th day of July, 1928.

Present: The King's Most Excellent Majesty in Council.

Whereas by sub-section (1) of Section 2 of the Merchandise Marks Act, 1926 (16 & 17 Geo. 5, c. 53), it is provided that after an enquiry in relation to goods of any class or description has on a reference from the appropriate department been held by a committee appointed for the purposes of the said Act, and the report of the committee on the matter has been taken into consideration by the department, that department may, unless it appears to them that the trade of the United Kingdom or the trade generally of other parts of His Majesty's Dominions with the United Kingdom would be prejudiced if imported goods of that class or description for use or consumption in the United Kingdom were prohibited to be sold unless they bear an indication of origin, make a representation to His Majesty that it is desirable that an Order should be made under the said Section 2, and His Majesty in Council may thereupon, subject to the provisions of the said Act, make an Order prohibiting the sale or exposure for sale in the United Kingdom of imported goods of that class or description unless they bear an indication of origin:

And whereas in accordance with the provisions of the said section enquiries in relation to (*a*) Honey, and (*b*) Fresh apples, have on references from the appropriate department, namely the Minister of Agriculture and Fisheries, the Secretary of State for the Home Department, and the Secretary of State for Scotland acting jointly (hereinafter called "the Department") been held by a committee appointed for the purposes of the said Act and the reports of that committee have been taken into consideration by the Department:

And whereas by sub-section (5) of Section 2 of the said Act it is provided that if on an enquiry under sub-section (1) of the said section it appears to a committee to be desirable that any imported goods should bear an indication of origin at the time of importation, and the committee so reports to the appropriate department, that department unless, having regard to all the circumstances of the case including the re-export trade of the United Kingdom in that class or description of goods, it considers such action undesirable, may make a representation to His

* H.M. Stationery Office. Price 1d. net.

Majesty that the goods should bear an indication of origin at the time of importation, and His Majesty may by Order in Council under the said section (without prejudice to His powers under sub-section (1) of the said section) make provision accordingly:

And whereas it does not appear to the Department that the trade of the United Kingdom or the trade generally of other parts of His Majesty's Dominions with the United Kingdom would be prejudiced if the goods which were the subject of the said enquiries and are described in Parts I and II of this Order imported for use or consumption in the United Kingdom were prohibited to be sold unless they bear an indication of origin, and the Department has accordingly made representations to His Majesty that it is desirable that an Order should be made under the said Section 2:

And whereas the committee has reported to the Department that it appears to them to be desirable that such of the said goods as are described in Part II of this Order should bear an indication of origin at the time of importation:

And whereas the Department having had regard to all the circumstances of the case, including the re-export trade in those goods, has made representations to His Majesty that it is desirable that such of the said goods as are described in Part II of this Order should bear an indication of origin at the time of importation:

And whereas by sub-section (2) of Section 10 of the said Act, it is provided that an Order in Council made under the foregoing provisions of the Act with respect to goods of any class or description shall not extend to blends or mixtures consisting of or containing those goods unless the Order expressly so provides and, where any Order in Council so provides, the indication of origin to be given in respect of the blends or mixtures shall, notwithstanding anything in the said Act, be an indication in such form as the Order prescribes;

Now, therefore, His Majesty, by and with the advice of His Privy Council, in pursuance of the powers vested in Him by the said Act, and of all other powers enabling Him in that behalf, is pleased to order, and it is hereby ordered, as follows:—

PART I.—(*Honey*).

1. It shall not be lawful to sell or expose for sale in the United Kingdom any imported honey, or any blend or mixture of honeys of which imported honey forms part, unless it bears an indication of origin.

2. The indication of origin shall be printed, stencilled, stamped or branded on the container, or on a label securely attached thereto, indelibly and in a conspicuous manner, in plain block letters not less than one-twelfth of an inch in height when the greatest dimension of the package does not exceed six inches, and not less than one-eighth of an inch in height when the greatest dimension of the package exceeds six inches. For the purpose of this Part of this Order the expression " greatest dimension " shall mean the height, length or breadth, whichever is the greatest, of a rectangular or approximately rectangular package, and the height or maximum diameter, whichever is the greater, of a cylindrical, oval or conical package.

3. The form of the indication of origin in the case of blends or mixtures containing imported honey shall be, at the option of the person applying the indication, either:—(*a*) in the case of honey derived entirely from countries within the Empire, the word "Empire"; and, in the case of honey derived entirely from foreign countries, the word "Foreign"; or (*b*) a definite indication of all the countries of origin of the honeys forming the blend or mixture; or (*c*) the words "Blended imported"; provided that the indication "Blended imported" shall be applicable to any blend or mixture of honey, even though it contain honey produced in the United Kingdom.

4. This Part of this Order shall not apply to exposure for sale wholesale if the person exposing the goods is a wholesale dealer.

5. The provisions of this Part of this Order shall come into force at the expiration of six months from the date hereof.

PART II.—(*Fresh Apples*).

6. Subject as hereinafter provided, it shall not be lawful to import any fresh apples into the United Kingdom, nor to sell or expose for sale in the United Kingdom, any imported fresh apples unless they bear an indication of origin.

7. The indication of origin shall be marked indelibly and in a conspicuous manner as follows: —(*a*) On importation, on exposure for sale wholesale and on sale, by means of printing, stencilling, stamping or branding on each outer container, or on a label securely attached thereto, in letters not less than half an inch in height. (*b*) On exposure for sale by retail, by means of a show-ticket, clearly visible to intending purchasers, bearing the indication of origin in letters not less than half an inch in height.

8. This Part of this Order shall apply on exposure for sale wholesale whether the person exposing the goods is or is not a wholesale dealer.

9. Nothing in this Part of this Order shall apply to sales of fresh apples in quantities of fourteen pounds or less.

10. The provisions of this Part of this Order shall come into force at the expiration of four months from the date hereof.

PART III.—(*General*).

11.—(*a*) This Order may be cited as The Merchandise Marks (Imported Goods) No. 3 Order, 1928;

(*b*) The Interpretation Act, 1889,* shall apply to the interpretation of this Order as if it were an Act of Parliament.

M. P. A. HANKEY.

1928, No. 1052.

MERCHANDISE MARKS.

THE MERCHANDISE MARKS (IMPORTED GOODS) No. 5 ORDER, 1928.†

At the Court at Buckingham Palace, the 21st day of December, 1928.

Present: Her Majesty the Queen, His Royal Highness the Prince of Wales, His Royal Highness the Duke of York, Archbishop of Canterbury, Lord Chancellor, Prime Minister, Lord Chamberlain, Secretary Sir W. Joynson Hicks, Hon. Walter Guinness.

Whereas His Majesty was pleased by His Commission dated the 4th day of December, 1928, to nominate and appoint Her Majesty the Queen, His Royal Highness the Prince of Wales, K.G., K.T., K.P., G.C.S.I., G.C.M.G., G.C.I.E., G.C.V.O., G.B.E., His Royal Highness the Duke of York, K.G., K.T., G.C.V.O., the Most Reverend Father in God Cosmo Gordon, Archbishop of Canterbury, the Right Honourable Douglas McGarel, Baron Hailsham, Lord High Chancellor of Great Britain, and the Right Honourable Stanley Baldwin, Prime Minister and First Lord of the Treasury, or any three of them, during His Majesty's illness, to summon and hold on His Majesty's behalf His Privy Council, and to signify thereat His Majesty's approval of any matter or thing to which His Majesty's approval in Council is required:

And whereas by sub-section (1) of Section 2 of the Merchandise Marks Act, 1926 (16 & 17 Geo. 5, c. 53), it is provided that after an enquiry in relation to goods of any class or description has on a reference from the appropriate department been held by a committee appointed for the purposes of the said Act, and the report of the committee on the matter has been taken into consideration by the department, that department may, unless it appears to them that the trade of the United Kingdom or the trade generally of other parts of His Majesty's Dominions with the United Kingdom would be prejudiced if imported goods of that class or description for use or consumption in the United Kingdom were prohibited to be sold unless they bear an indication of origin, make a representation to His Majesty that it is desirable that an Order should be made under the said Section 2, and His Majesty in Council may thereupon, subject to the provisions of the said Act, make an Order prohibiting the sale or exposure for sale in the United Kingdom of imported goods of that class or description unless they bear an indication of origin:

And whereas in accordance with the provisions of the said section enquiries in relation to (*a*) Currants, Sultanas and Raisins; (*b*) Eggs in shell and Dried Eggs; and (*c*) Oat Products have on references from the appropriate department, namely the Minister of Agriculture and Fisheries, the Secretary of State for the Home Department, and the Secretary of State for Scotland acting jointly (hereinafter called "the Department") been held by a committee appointed for the purposes of the said Act and the reports of that committee have been taken into consideration by the Department:

And whereas by sub-section (5) of Section 2 of the said Act it is provided that if on an enquiry under sub-section (1) of the said section it appears to a committee to be desirable that any imported goods should bear an indication of origin at the time of importation, and the committee so reports

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* 52–3 V. c. 63.

† H.M. Stationery Office. Price 2d. net.

to the appropriate department, that department unless, having regard to all the circumstances of the case including the re-export trade of the United Kingdom in that class or description of goods, it considers such action undesirable, may make a representation to His Majesty that the goods should bear an indication of origin at the time of importation, and His Majesty may by Order in Council under the said section (without prejudice to His powers under sub-section (1) of the said section) make provision accordingly:

And whereas it does not appear to the Department that the trade of the United Kingdom or the trade generally of other parts of His Majesty's Dominions with the United Kingdom would be prejudiced if the goods which were the subject of the said enquiries and are described in Parts I to IV of this Order imported for use or consumption in the United Kingdom were prohibited to be sold unless they bear an indication of origin, and the Department has accordingly made representations to His Majesty that it is desirable that an Order should be made under the said Section 2:

And whereas the Committee has reported to the Department that it appears to them to be desirable that the said goods should bear an indication of origin at the time of importation:

And whereas the Department having had regard to all the circumstances of the case, including the re-export trade in those goods, has made representations to His Majesty that it is desirable that the said goods should bear an indication of origin at the time of importation:

And whereas by sub-section (2) of Section 10 of the said Act, it is provided that an Order in Council made under the foregoing provisions of the Act with respect to goods of any class or description shall not extend to blends or mixtures consisting of or containing those goods unless the Order expressly so provides and, where any Order in Council so provides, the indication of origin to be given in respect of the blends or mixtures shall, notwithstanding anything in the said Act, be an indication in such form as the Order prescribes:

Now, therefore, Her Majesty the Queen, His Royal Highness the Prince of Wales, His Royal Highness the Duke of York, His Grace the Archbishop of Canterbury, the Lord High Chancellor of Great Britain, and the Prime Minister and First Lord of the Treasury, being authorised thereto by His Majesty's said Commission, in pursuance of the powers vested in them by the said Act, and of all other powers enabling them in that behalf, by and with the advice of His Majesty's Privy Council, on His Majesty's behalf are pleased to order, and it is hereby ordered, as follows:—

PART I.—(*Currants, Sultanas and Raisins*).

1. Subject as hereinafter provided, it shall not be lawful to import any currants, sultanas or raisins into the United Kingdom, nor to sell or expose for sale in the United Kingdom any imported currants, sultanas or raisins, unless they bear an indication of origin.

2. The indication of origin shall be marked indelibly and in a conspicuous manner as follows:—(*a*) On importation, on exposure for sale wholesale and on sale, by means of printing, stencilling, stamping or branding on each outer container, or on a label securely attached thereto, in letters not less than half an inch in height.

(*b*) On exposure for sale by retail—(i) in the case of currants, sultanas or raisins not prepacked for sale by retail either on the premises where they are exposed for sale or otherwise, by means of a show ticket, clearly visible to intending purchasers, bearing the indication of origin in letters not less than half an inch in height; (ii) in the case of currants, sultanas or raisins prepacked for sale by retail, save as provided in paragraph 3 (*b*) of this Order, by means of printing on or printed labels affixed to each package bearing the indication of origin in plain block letters not less than one-twelfth of an inch in height when the greatest dimension of the package does not exceed six inches, and not less than one-eighth of an inch in height when the greatest dimension of the package exceeds six inches.

3. Nothing in this Part of this Order shall require imported currants, sultanas or raisins to bear an indication of origin:—(*a*) On importation as samples not exceeding one pound in weight; (*b*) On exposure for sale by retail in packages made up for sale on the premises of a retailer; or (*c*) On sale when sold in quantities not exceeding fourteen pounds in weight.

4. The provisions of this Part of this Order so far as they relate to marking on importation shall come into force at the expiration of four months from the date hereof, and so far as they relate to marking on exposure for sale and sale at the expiration of six months from the date hereof.

PART II.—(*Eggs in Shell*).

5. It shall not be lawful to import any hen or duck eggs in shell into the United Kingdom, nor to sell or expose for sale in the United Kingdom any imported hen or duck eggs in shell, unless they bear an indication of origin.

6. The indication of origin shall be conspicuously and durably marked in ink on the shell of each imported egg in letters not less than two milimetres in height.

7. The provisions of this Part of this Order shall come into force at the expiration of four months from the date hereof.

PART III.—(*Dried Eggs*).

8. Subject as hereinafter provided, it shall not be lawful to import any dried eggs into the United Kingdom, nor to sell or expose for sale in the United Kingdom any imported dried eggs, unless they bear an indication of origin.

9. The indication of origin shall be marked indelibly and in a conspicuous manner as follows: —(*a*) On importation, by means of printing, stencilling, stamping or branding on each outer container, or on a label securely attached thereto, in letters not less than half an inch in height. (*b*) On exposure for sale, wholesale or by retail, and on sale, save as provided in paragraph 10 of this Order, by means of printing, stencilling, stamping or branding on each container, or on a label securely attached thereto, in plain block letters not less than one-twelfth of an inch in height when the greatest dimension of the package does not exceed six inches, and not less than one-eighth of an inch in height when the greatest dimension exceeds six inches.

10. Nothing in this Part of this Order shall require imported dried eggs to bear an indication of origin when sold or exposed for sale by retail otherwise than in packages which are made up before reaching the retailer.

11. The provisions of this Part of this Order shall come into force at the expiration of three months from the date hereof.

PART IV.—(*Oat Products*).

12. For the purpose of this Part of this Order, the expression "oat products" shall mean oatmeal, rolled oats (but not crushed or bruised natural oats), oat flour and groats.

13. Subject as hereinafter provided, it shall not be lawful to import into the United Kingdom any oat products, nor to sell or expose for sale in the United Kingdom any imported oat products, unless they bear an indication of origin.

14. The provisions of this Part of this Order shall extend to all blends or mixtures of oat products which consist of or contain imported oat products.

15. The indication of origin shall be marked indelibly and in a conspicuous manner as follows:—

(*a*) On importation, on exposure for sale wholesale and on sale, by means of printing, stencilling, stamping or branding on each outer container, or on a label securely attached thereto, in letters not less than half an inch in height.

(*b*) On exposure for sale by retail—(i) in the case of oat products not prepacked for sale by retail, by means of a show ticket, clearly visible to intending purchasers, bearing the indication of origin in letters not less than half an inch in height; (ii) in the case of oat products, prepacked, before importation, for sale by retail, by means of printing or stamping on each package, or on a label securely attached thereto, in plain block letters not less than one-twelfth of an inch in height when the greatest dimension of the package does not exceed six inches and not less than one-eighth of an inch in height when the greatest dimension of the package exceeds six inches; and (iii) in the case of oat products prepacked, after importation, for sale by retail, either by means of a show ticket, as in (i) above, or by means of marking on each package, as in (ii) above, at the option of the person applying the indication.

16. The form of the indication of origin in the case of blends or mixtures of oat products which consist of or contain imported oat products shall be, at the option of the person applying the indication, either:—(*a*) in the case of oat products derived entirely from within the Empire the word "Empire"; and, in the case of oat products derived entirely from foreign countries, the word "Foreign"; or (*b*) a definite indication of all the countries of origin of the oat products forming the blend or mixture; or (*c*) the words "Blended imported." Provided that the indication "Blended imported" shall be applicable to any blend or mixture of oat products containing imported oat products even though it also contain oat products produced in the United Kingdom.

17. Nothing in this Part of this Order shall require imported oat products to bear an indication of origin on sale when sold in quantities of fourteen pounds or less.

18. The provisions of this part of this Order so far as they relate to marking on importation shall come into force four months from the date hereof and, so far as they relate to marking on exposure for sale and sale at the expiration of six months from the date hereof.

PART V.—(*General*).

19. Parts I, II, III, and IV of this Order shall apply on exposure for sale wholesale whether the person exposing the goods is or is not a wholesale dealer.

20. For the purpose of paragraphs 2, 9 and 15 of this Order, the expression "greatest dimension" shall mean the height, length or breadth, whichever is the greatest, of a rectangular or approximately rectangular package, and the height or maximum diameter, whichever is the greater, of a cylindrical, oval or conical package.

21. (*a*) This Order may be cited as "The Merchandise Marks (Imported Goods) No. 5 Order, 1928."

(*b*) The Interpretation Act, 1889,* shall apply to the interpretation of this Order as if it were an Act of Parliament.

M. P. A. HANKEY.

1928, No. 984.

AGRICULTURAL PRODUCE (GRADING AND MARKING).†

THE AGRICULTURAL PRODUCE (GRADING AND MARKING) (EGGS) REGULATIONS, 1928, DATED DECEMBER 15, 1928, MADE BY THE MINISTER OF AGRICULTURE AND FISHERIES AS TO GRADE DESIGNATIONS AND GRADE DESIGNATION MARKS FOR EGGS PRODUCED IN ENGLAND AND WALES AND AS TO THE MARKING OF EGGS WHICH HAVE BEEN SUBJECTED TO ANY PROCESS OF PRESERVATION.

In exercise of the powers conferred on him by the Agricultural Produce (Grading and Marking) Act, 1928, the Minister of Agriculture and Fisheries hereby makes the following regulations:—

1. Grade designations to indicate the quality of hen eggs produced in England and Wales shall be as follows:—Special, Standard, Pullet Standard; and the quality indicated by such grade designations shall be deemed to be as defined in columns (2) and (3) of the First Schedule hereto.

2. Grade designations to indicate the quality of duck eggs produced in England and Wales shall be as follows:—Special (Duck), Standard (Duck), Ducklet Standard; and the quality indicated by such grade designations shall be deemed to be as defined in columns (2) and (3) of the Second Schedule hereto.

3. A grade designation mark shall be any one of the grade designations specified in regulations (1) and (2) above associated with the words "Empire Buying Begins at Home" and with the following mark, namely, a map of England and Wales in silhouette with the words "Produce of England and Wales" inscribed in a circle placed centrally in the map within which circle is a design representing the Union Jack and which is more particularly described in the Third Schedule hereto.

4. After the twenty-eighth day of February, nineteen hundred and twenty-nine, any egg to which Section 3 of the aforesaid Act applies shall be marked conspicuously and legibly on the shell with the word "PRESERVED" in letters of not less than $\frac{1}{16}$ inch in height, the word being enclosed in a circle of not less than $\frac{1}{2}$ inch diameter.

5. If and so long as any Order in Council made under Section 2 of the Merchandise Marks Act, 1926, is in force prohibiting the sale or the exposure for sale in the United Kingdom of imported eggs unless they bear an indication of origin, any British egg which has been kept in cold storage or chemical storage shall, in the former case, be marked conspicuously and legibly on the shell with the word "CHILLED" or with the words "COLD STORED" and, in the latter case, with the word "STERILISED," the letters being in each case not less than $\frac{1}{16}$ inch in height and the word or words being enclosed in a circle of not less than $\frac{1}{2}$ inch diameter.

6. When any person applies for the registration of premises to be used by way of trade or for purposes of gain for the cold storage or chemical storage of eggs, the Council of the County or County Borough, or, as respects the administrative County of London, the Common Council of the City of London and the Council of every Metropolitan Borough, in which the premises are

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* 52–3 V. c. 63.

† H.M. Stationery Office. Price 1d. net.

situated shall enter in a register the name and address of the person and the address of the premises and shall forward a copy of each such entry to the Ministry of Agriculture and Fisheries and shall issue a certificate of registration to the person making the application.

7. These regulations may be cited as the Agricultural Produce (Grading and Marking) (Eggs) Regulations, 1928.

In Witness whereof the Official Seal of the Minister of Agriculture and Fisheries is hereunto affixed this fifteenth day of December, 1928.

(L.S.) CHARLES J. H. THOMAS.

SCHEDULE I.

HEN EGGS PRODUCED IN ENGLAND AND WALES: GRADE DESIGNATIONS AND DEFINITIONS OF QUALITY.

Grade designation. (1)	Definitions of quality.	
	Minimum weight. (2)	State or condition. (3)
	oz.	First Quality, *i.e.* the egg must not have been preserved by any process, the shell must be clean and sound, the yolk translucent or faintly but not clearly visible, the white translucent and firm, and the air-space must not exceed $\frac{1}{4}$ inch in depth.
SPECIAL	$2\frac{1}{4}$	
STANDARD	2	
PULLET STANDARD ..	$1\frac{3}{4}$	

SCHEDULE II.

DUCK EGGS PRODUCED IN ENGLAND AND WALES: GRADE DESIGNATIONS AND DEFINITIONS OF QUALITY.

Grade designation. (1)	Definitions of quality.	
	Minimum weight. (2)	State or condition. (3)
	oz.	First Quality, *i.e.* the egg must not have been preserved by any process, the shell must be clean and sound, the yolk visible but not dense and moving slowly when the egg is rotated, and the white must be translucent and firm.
SPECIAL (DUCK) ..	$2\frac{3}{4}$	
STANDARD (DUCK) ..	$2\frac{1}{2}$	
DUCKLET STANDARD ..	$2\frac{1}{4}$	

SCHEDULE III.

GRADE DESIGNATION MARK.

The mark hereunder shown shall be a grade designation mark when used in association with a grade designation and with the words "Empire Buying Begins at Home."

MARKING OF PRESERVED EGGS; EGG GRADING REGULATIONS, etc.

The Minister of Agriculture and Fisheries has made an Order under Section 3 of the Agricultural Produce (Grading and Marking) Act, 1928, exempting from the operation of that Section eggs preserved by cold storage and chemical storage. The reason for this Order is that it is not possible to ascertain by analysis whether eggs have, in fact, been kept in cold storage or chemical

storage. The effect of the Order, therefore, is to limit the operation of Section 3 to eggs preserved by methods such as immersion in lime-water, water-glass or oil; all eggs so preserved, whether home-produced or imported, must, after February 28th, 1929 (the date fixed by the Act), be marked in the prescribed manner on sale or exposure for sale.

Section 4 of the Act requires that British eggs which have been cold-stored or chemically stored should be marked before they leave the storage premises, but this Section only becomes operative if and so long as an Order in Council is enforced under the Merchandise Marks Act, 1926, prohibiting the sale or exposure for sale of imported eggs unless they bear an indication of origin.

The Minister has prepared draft regulations under Sections 1, 2, 3, and 4 of the Act prescribing (*a*) grade designations and grade designation marks for hen and duck eggs, (*b*) the way in which eggs preserved by any process, including cold storage and chemical storage, shall be marked, and (*c*) the method by which premises used for the cold storage or chemical storage of eggs shall be registered by Local Authorities responsible for the enforcement of the Statute. Copies of these draft regulations, known as the Agricultural Produce (Grading and Marking) Draft (Egg) Regulations, 1928, can be obtained from His Majesty's Stationery Office, Adastral House, Kingsway, London, W.C.1, price 1d.

MINISTRY OF AGRICULTURE AND FISHERIES,
10, WHITEHALL PLACE, LONDON, S.W.1.
16*th October*, 1928.

Reconstituted Cream Bill.

A BILL TO REGULATE THE SALE AND MANUFACTURE OF RECONSTITUTED CREAM.*

Be it enacted by the King's most Excellent Majesty, by and with the advice and consent of the Lords Spiritual and Temporal, and Commons, in this present Parliament assembled, and by the authority of the same, as follows:—1.—(1) Reconstituted cream shall not be sold or offered or exposed for sale for human consumption under any description or designation including the word "cream" unless that work is immediately preceded by the word "reconstituted." (2) Every receptacle used for the conveyance of reconstituted cream for sale for human consumption, or containing reconstituted cream at any time when it is exposed for such sale, shall have the words "reconstituted cream" printed in large and legible type either on the receptacle itself or on a label securely attached thereto. (3) If any person contravenes any of the provisions of this section he shall be guilty of an offence against this Act.

2.—(1) Reconstituted cream shall not be manufactured, sold or exposed or kept for sale for human consumption except at premises registered with the Food and Drugs Authority:

Provided that this requirement shall not apply—(*a*) to the manufacture of reconstituted cream solely for consumption on the premises on which it is manufactured or for use in the preparation on those premises of some other article of good; or (*b*) to the sale, exposure or keeping for sale of reconstituted cream on any premises where it is sold or exposed or kept for sale for consumption on those premises only or is not supplied otherwise than in the properly closed and unopened receptacles in which it was delivered to those premises.

(2) The Food and Drugs Authority shall keep a register of premises under this section, and shall on application being made by the owner or occupier of any premises enter the premises in the register and shall from time to time revise the register as occasion may require.

(3) Any officer of the Food and Drugs Authority duly authorised in that behalf by the authority may at all reasonable times enter and inspect any premises registered with the authority under this section.

(4) If a justice of the peace is satisfied by information on oath that there is reasonable ground for supposing that any unregistered premises are being used for the manufacture of reconstituted cream contrary to the provisions of this section, he may grant a search warrant authorising any

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* [Bill 34; 19 Geo. 5.] Ordered by the House of Commons to be printed, January 24, 1929. To be purchased from H.M. Stationery Office. Price 2d. net.

such officer as aforesaid to enter and inspect the premises and to search for and seize any machine suitable for use in the manufacture of reconstituted cream.

(5) If any person uses any unregistered premises for the manufacture or sale of reconstituted cream in contravention of this section, or obstructs any such officer as aforesaid in the execution of his powers under this section, or fails to give any such officer all reasonable assistance in his power, or to furnish him with any information he may reasonably require, he shall be guilty of an offence against this Act.

3. Such of the provisions of the Public Health Acts, 1875 to 1926 (or, in London, the Public Health (London) Acts, 1891 to 1926), and the Milk and Dairies (Consolidation) Act, 1915, and of any order or regulation made under any of those Acts, as relate to cream (other than those relating to registration) shall apply to reconstituted cream.

4. It shall be the duty of every Food and Drugs Authority to enforce the provisions of this Act, and any expenses incurred by the authority for that purpose shall be defrayed as expenses under the Food and Drugs (Adulteration) Act, 1928:

Provided that this section shall not apply to such of the provisions of any Act, order or regulation applied by this Act as are enforceable by any other authority.

5.—(1) If any person commits an offence against this Act he shall be liable on summary conviction to a fine not exceeding, in the case of a first offence, five pounds, in the case of a second or subsequent offence, fifty pounds, and in any case where the offence is a continuing offence, to a further fine not exceeding forty shillings for each day during which the offence continues.

(2) For the purposes of proceedings under this Act—(*a*) where reconstituted cream is sold or offered exposed or kept for sale, it shall be presumed to be sold or offered exposed or kept for sale for human consumption unless the contrary is proved; (*b*) where any article having the composition of cream or reconstituted cream is sold or exposed or kept for sale on premises registered under this Act, it shall be presumed to be reconstituted cream unless the contrary is proved.

(3) The provisions of subsection (6) of section twenty-seven and of sections twenty-nine and thirty of the Food and Drugs (Adulteration) Act, 1928, relating to offences and warranties under that Act, as set out with the appropriate modifications in the schedule to this Act, are hereby incorporated with this Act and shall apply to proceedings under this Act.

6. In this Act—"Food and Drugs Authority" has the same meaning as in the Food and Drugs (Adulteration) Act, 1928; "Cream" means that portion of milk rich in milk fat which has been separated by skimming or otherwise; "Reconstituted cream" means an article of food resembling cream and containing no ingredient which is not derived from milk except water or any ingredient or material which may lawfully be contained in an article sold as cream.

7. This Act shall apply to Scotland subject to the following modifications—(*a*) The following section shall be substituted for section three—Such of the provisions of the Milk and Dairies (Scotland) Act, 1914, and of any order, regulation or bye-law made under that Act as relate to cream (other than those relating to registration) shall apply to reconstituted cream: (*b*) The expression "defendant" shall mean respondent, and the expression "information" shall mean "complaint."

8.—(1) This Act may be cited as the Reconstituted Cream Act, 1929. (2) This Act shall come into operation on the first day of June, nineteen hundred and twenty-nine. (3) This Act shall not extend to Northern Ireland.

SCHEDULE.

PROVISIONS OF FOOD AND DRUGS (ADULTERATION) ACT, 1928, APPLIED.

1. Where an employer is charged with an offence against this Act, he shall be entitled, upon information duly laid by him, to have any other person whom he charges as the actual offender brought before the court at the time appointed for hearing the charge, and if, after the commission of the offence has been proved, the employer proves to the satisfaction of the court that he had used due diligence to enforce the execution of this Act, and that the said other person had committed the offence in question without his knowledge, consent or connivance, the said other person shall be summarily convicted of the offence, and the employer shall be exempt from any penalty.

2. Subject to the provisions of this schedule a defendant shall be discharged from any prosecution under this Act for selling, or offering or exposing for sale reconstituted cream if he proved to the satisfaction of the court that he had purchased the article in question as cream, and with a written warranty or invoice to that effect, and that he had no reason to believe at the time of the commission of the alleged offence that the article was not cream and that at that time the article was in the same state as when he purchased it.

3. A warranty or invoice shall only be a defence to proceedings under this Act if—(*a*) the defendant has within seven days of the service of the summons sent to the prosecutor a copy of the warranty or invoice with a written notice stating that he intends to rely on it and specifying the name and address of the person from whom he received it and has also sent a like notice of his intention to that person; and (*b*) in the case of a warranty or invoice given by a person resident outside the United Kingdom the defendant proves that he had taken reasonable steps to ascertain and did in fact believe in the accuracy of the statement contained therein.

4. The person by whom the warranty or invoice is alleged to have been given shall be entitled to appear at the hearing and to give evidence, and the court may, if it thinks fit, adjourn the hearing to enable him to do so.

5. Where the defendant is a servant of the person who purchased the article under a warranty or invoice he shall be entitled to rely on the provisions of this schedule in the same way as his employer would have been entitled to do if he had been the defendant, provided that the servant further proves that he had no reason to believe that the article was not cream.

6. Every person who wilfully applies to an article in any proceedings under this Act, a warranty of invoice given in relation to any other article, shall be guilty of an offence against this Act.

7. Every person who, in respect of reconstituted cream sold by him as principal or agent, gives to the purchaser a false warranty in writing, shall be guilty of an offence against this Act, unless he proves to the satisfaction of the court that when he gave the warranty he had reason to believe that the statements or descriptions contained therein were true.

8. Where the defendant in a prosecution under this Act has been discharged under the provisions of this schedule relating to warranties, any proceedings under this schedule for giving the warranty relied on by the defendant in the prosecution, may be taken as well before a court having jurisdiction in the place where the contravention of this Act took place as before a court having jurisdiction in the place where the warranty was given.

ABSTRACTS OF PAPERS PUBLISHED IN OTHER JOURNALS.

Food and Drugs Analysis.

Use of 2.6-Dichlorphenol Indophenol as a Reduction Indicator in the Examination of Foodstuffs. J. Tillmans, P. Hirsch and E. Reinshagen. (*Z. Unters. Lebensm.*, 1928, **56**, 272–292.)—The indicator, which may be obtained by coupling a solution of 5 grms. of 2.6-dichlorquinonechlorimide (the preparation of which from *p*-nitrophenol is fully described) with 8 to 12 c.c. of an alkaline 20 per cent. solution of phenol, is very stable if stored in the dark in the form of a filtered 0·01 *N* (0·29 per cent.) solution in a phosphate buffer solution of P_H 7. It changes in colour from pale red to blue with a change in P_H from 4 to 5, and appears deep blue and colourless in the presence of oxidising and reducing reagents, respectively. The potential corresponding with the second type of change was determined by titration till colourless of the 20-fold diluted, oxygen-free stock solution with 0·01 *N* ferrous sulphate solution in the presence of sodium oxalate, in an atmosphere of oxygen-free nitrogen. The amounts of iron solution added, and the corresponding colorimeter values (*f*) and potentials against a saturated calomel electrode or a platinum electrode (standardised in a 0·1 *N* solution of ferrous and ferric sulphates in 0·02 *N* sulphuric acid) were determined. The potentials at 20° C. were obtained from the formula 0·02905 log $f/(1-f)$, and

values compared with the hydrogen electrode of 255 and 233 millivolts were found at P_H 6·85 and 7·01, respectively. There is a fall in potential of 1 to 2 millivolts for a rise in temperature of 1° C. (*cf.* Hirsch and Ruter, *Z. anal. Chem.*, 1926, **69**, 217). The method was used to determine the effects of formaldehyde and varying degrees of heat on the Schardinger reaction of milk, but no definite results were obtained. The oxidation-reduction potentials of milk in the presence of 5 per cent. of mercuric chloride, however, gave an indication of these effects. Indefinite results were also obtained when the method was applied to the determination of the nature and degree of putrefaction of meat extracts (Tillmans, Hirsch and Kuhn, ANALYST, 1927, **52**, 289). Artificial lemon juice was distinguished from the natural product by the fact that it produced no decolorisation of the indicator. The nature of the constituents responsible for these phenomena is discussed. J. G.

Thiocyanogen Value of Parsley Seed Oil. A. Steger and J. van Loon. (*Z. Unters. Lebensm.*, 1928, **56**, 365–367.)—The authors have applied Kaufmann's method of determining the thiocyanogen value (ANALYST, 1926, **51**, 157, 264) to the determination of the linolic and saturated acids in parsley seed oil. The following is the revised composition of the oil:—Unsaponifiable matter, 30; total fatty acids, 65·2 (comprising: saturated acids, 3·0; petroselinic acid, 45·0; 9, 10-oleic acid, 8·0; linolic acid, 9·1 per cent.); glycerol residue, 2·8; and volatile matter, 2·0 per cent. Petroselinic acid is an octodecene (6)-acid isomeric with oleic acid previously obtained by the authors (*Rec. trav. Chim.*, 1927, **46**, 492) from an extract of parsley seeds in petroleum spirit. Twitchell's lead salt and alcohol method cannot be used for separating the fatty acids of this oil, owing to the fact that the lead salt of petroselinic acid is fairly insoluble in cold alcohol. Bertram's oxidation method (*Z. deutsch. Oel. u. Fett. Ind.*, 1925, **45**, 733) is also not applicable. J. G.

Castanha de Arara Nuts. A New Oil Seed from Brazil. (*Bull. Imp. Inst.*, 1928, **26**, 416–418.)—A sample of Brazilian "Castanha de arara" nuts, stated to be from *Joannesia heveoides* Ducke (Nat. O. *Euphorbiaceae*) was examined and found to agree closely both in size, proportion of shell and kernel, constants for the oil, and analysis of the residual meal with a sample of arara nuts examined in 1924. The nuts (2–2½ inches in length by 1⅝ to 1⅞ inches diam.) consisted of 55·2 per cent. of shell and 44·8 per cent. of kernel and were of an average weight of 53·8 grms. The kernels contained 4·6 per cent. of moisture, and on extraction with petroleum spirit gave 61·4 per cent. of a pale yellow liquid oil of sp. gr. at 15° C./15° C., 0·9239; n_D 20° C., 1·467; saponification value, 188·5; iodine value (Hübl, 17 hours), 129·8; unsaponifiable matter, 0·48 per cent., and acid value, 2·1. A thin film of oil took 11 days to dry (*cf.* 8 days for linseed). The residual meal contained: Water, 8·0; crude proteins, 47·4; fat, 0·7; starch (by difference), 25·1; crude fibre, 6·5; and ash, 12·3 per cent. The oil could be readily used for soap making and possibly, after "boiling," for paint when in admixture

with linseed oil. Its edible use is doubtful, and since an alkaloidal substance appears to be present in the meal, physiological experiments would be necessary before the meal could be used as a cattle food. D. G. H.

Examination of Lard in Ultra-Violet Light. F. Weiss. (*Z. Unters. Lebensm.*, 1928, **56**, 341–355.)—The behaviour of a large number of samples of lard of widely different origin in ultra-violet light has been examined, and the nature of any fluorescence or opalescence produced in each case is recorded, together with the taste, odour, and behaviour on setting of the sample. The effects of the action on the lard of activated charcoal, heat, light, air or carbon dioxide, were also studied under varying conditions. In general, the lards could be classed in 6 divisions :—(1) Lards obtained in the laboratory, and certain good commercial lards which showed either no fluorescence or yellow, white or pale blue fluorescence. (2) The same samples after exposure to air and light, when the fluorescence might be modified, *e.g.* the blue colour confined to the upper layers. (3) The same samples which, after treatment with activated charcoal, gave the same results as in (2). (4) Laboratory samples, heated to 150 to 170° C. or in superheated steam, and heated commercial lards which showed a white fluorescence with sharply defined rings. (5) Lards refined by Dutch methods which showed a characteristic clear blue fluorescence. (6) The same samples after heat or charcoal treatment, and " unrefined white grease," which showed white, blue or violet fluorescence with ring-formation decreasing in the lower layers. This classification is not rigid, since not only is the fluorescence dependent on the type of lard, but also it may be modified considerably by the drastic processes involved in refining. The conclusion of Feder and Rath (*cf.* Van Raalte, ANALYST, 1929, 110) that the substance causing fluorescence is present in the unsaponifiable matter, and is related to the presence of paraffin hydrocarbons, is criticised and modified, since the unsaponifiable matter of a fluorescent lard fails to produce the same degree of fluorescence when added to a non-fluorescent lard. Changes in fluorescent properties due to heat may result from oxidation of cholesterol, and ultra-violet rays themselves may play a similar part. J. G.

Mineral Constituents of Cranberries. F. W. Morse. (*J. Biol. Chem.*, 1929, **81**, 77–79.)—Recently Morse (*J. Biol. Chem.*, 1928, **79**, 409 ; ANALYST, 1928, **53**, 659) recorded the iodine content of Cape Cod cranberries, and results are now given of determinations which were made of the mineral constituents of cranberries from the crop of 1925. Samples of the berries were weighed out, cut in halves, dried in a steam oven, cooled, weighed, ground in an iron mortar to pass through a 1 mm. mesh sieve, and bottled for analysis. Methods of the Association of Official Agricultural Chemists, Washington, 1920, were used in the determinations of the constituents, except potassium and iron. Potassium was precipitated and weighed as the perchlorate, and iron was determined in specially prepared charges of the cranberries (which had been dried without cutting, and ground in a porcelain mortar) by the colorimetric thiocyanate method after incineration and solution of the material. Analyses gave the following percentages,

calculated to the basis of fresh fruit—the figures in brackets are earlier data :— Water, 88·44 ; ash, 0·158 (0·18) ; potassium oxide, 0·068 (0·086) ; sodium oxide, 0·003 (0·012) ; calcium oxide, 0·018 (0·033) ; magnesium oxide, 0·009 (0·012) ; phosphorus pentoxide, 0·019 (0·026) ; sulphur, 0·005 ; chlorine, 0·004 ; iron, 0·00022 ; manganese, 0·00057. Lindow and Peterson (*J. Biol. Chem.*, 1927, **75**, 173, 174 ; ANALYST, 1928, **53**, 43–44) published data for manganese in a long list of foods, and their results on fruits show these cranberries to be comparatively high in the element. The results show that fresh cranberries generally contain less than 0·2 per cent. of total ash. The individual mineral constituents of the cranberry form very small percentages of the whole fruit. P. H. P.

Identification of Yohimbine by Microcrystallography. G. Denigès. (*Bull. Soc. Pharm. Bordeaux*, 1928, **3**, 152 ; *J. Pharm. Chim.*, 1929, **121**, 27–28.)—A small portion of the free base is treated on a slide with hydrochloric acid (1:10) and warmed until a fine ring of crystallised hydrochloride appears ; after spontaneous evaporation of the solution the crystals have a flat rhomboidal appearance under the microscope, and are isolated or in groups resembling cholesterol crystals. To liberate the alkaloid the hydrochloride is dissolved in a trace of water and very dilute ammonia added until the precipitate which forms at first is dissolved, after which heat is applied till crystallisation begins. After evaporation the yohimbine crystals appear either as long prismatic needles grouped round a centre, or more or less in the prismatic form shown by magnesium ammonium phosphate. D. G. H.

Biochemical.

Studies in Milk Secretion based on the Variations and Yields of Milk and Butter Fat produced at Morning and Evening Milkings. S. Bartlett. (*J. Agric. Sci.*, 1929, **19**, 36–47.)—Tables and curves are given which show month by month the lactation yields of cows in respect of milk and fat, morning and evening yields being treated separately and differences in relative proportions indicated. Smaller proportions of milk and of fat at the morning milkings are yielded in early lactation by all cows, but particularly by heifers and heavy-yielding cows with relatively small udders, and it is suggested that, with such animals, re-absorption of milk occurs during a long night interval.

As regards seasonal variations, November and December are the months of lowest production of milk, whilst May and June give the highest production. The morning milking does not respond as much as the evening milking to the stimulus to secretion which operates during May and June. The trouble experienced during these two months on many farms with milk of poor quality is due to : young grass ; increased secretion of milk ; the calving of a large proportion of cows during the late winter, many of these cows reaching the lactation stage when the rate of milk secretion is at its maximum and the percentage of fat at its minimum during May and June ; excessive udder pressure at the morning milking,

with resultant depression in the percentage of fat; the occurrence of occasional samples of poor quality, although the average quality may be the same as in other months. T. H. P.

Metabolism of Laevulose, with a Colorimetric Method for its Determination in Blood and Urine. R. C. Corley. (*J. Biol. Chem.*, 1929, **81**, 81–98.)—The method of van Creveld (*Klin. Woch.*, 1927, **6**, 697) for the determination of laevulose, which had several disadvantages, including difficulty of measurement in a colorimeter, has been modified, and the new procedure has been found satisfactory in the analysis of aqueous solutions, urine and tungstic acid blood filtrates. One volume of the solution to be analysed, 0·5 volume of concentrated hydrochloric acid, and 0·1 volume of a 20 per cent. alcoholic solution of diphenylamine in a large test-tube are heated in a boiling water-bath for 15 minutes and then cooled. The tube is closed with a rubber stopper with a hole stuffed with glass wool, and the mixture may be kept indefinitely before the remainder of the determination is completed. The solution is shaken with a third of its volume of liquid (melted) phenol, which causes the immediate absorption of the diphenylamine together with the colour. The addition of 0·5 volume of 95 per cent. alcohol renders the mixture homogeneous and suitable for colorimetric comparison, which need not be made immediately. The colour slightly darkens on standing. Standards of solutions of laevulose which range downwards from 1 mgrm. of laevulose per c.c. of solution are prepared similarly and simultaneously. Recoveries of added laevulose in aqueous solution are from 97 to 103 per cent., and in blood from 95 to 105 per cent. Glucose yields about 3 per cent. of the colour of laevulose. The method is theoretically applicable to the determination of the laevulose in any substance yielding it on acid hydrolysis. Experiments on the metabolism of laevulose in the rabbit gave the following results. Laevulose appeared in the blood in small amounts after intestinal administration to rabbits. Mild poisoning with what are considered hepatotoxic agents had little influence on the laevulose present in the blood after intestinal administration. Under more rigorous conditions a certain effect has been observed in a few cases. Laevulose practically disappeared from the blood of rabbits in 90 minutes after the intravenous injection of 2 grms. per kilo of body weight. The rate of disposal of intravenously injected laevulose was little influenced by liver poisons, except with heavy doses. Laevulose injected intravenously simultaneously with insulin has been found to protect the rabbit against the latter, without there being any striking influence on the rate of removal of the circulating laevulose. If insulin has been given subcutaneously or intravenously an hour or more previous to the intravenous injection of laevulose, insulin shock has been observed on numerous occasions, and laevulose has disappeared more rapidly from the blood. P. H. P.

Quantitative Determination of the Amide Nitrogen of Blood. S. Bliss. (*J. Biol. Chem.*, 1929, **81**, 129–135.)—On the assumption that ammonia is transported in the blood in the form of a complex that might yield ammonia again under physiological conditions, a search was made to see whether an

enzyme could be found in kidney tissue capable of liberating ammonia from a compound in blood that did not yield the ammonia by ordinary direct aeration of the blood made alkaline with sodium carbonate. Such an enzyme was found and will be described in a separate communication. Its action showed certain facts: (1) The absolute value for the " ammonia complex " of blood is many times that of the old low ammonia values. (2) The values so obtained show excellent correspondence with the physiological state (the expected variations with double nephrectomy, alkaline tide, bicarbonate feeding, etc.). (3) The " ammonia complex " of blood is completely precipitated with the proteins by the common protein precipitants. (4) The enzyme resembles a deamidase, probably a protein deamidase. (5) The absolute values obtained by acid hydrolysis of the protein fraction of blood are of the same order of magnitude as those obtained by enzymatic hydrolysis. Due to the more rapid, complete, and satisfactory hydrolysis of amides by acids, as compared with enzymes, together with the labour involved in the purification of the new protein deamidase, a method has been developed for the quantitative determination of the amide nitrogen of blood. After the tungstic acid precipitation of the proteins of blood, the precipitate is washed with tungstic acid to remove traces of urea, dissolved, and a portion of it subjected to hydrolysis with sulphuric acid at the temperature of the boiling water bath. After the neutralisation of the sulphuric acid, the mixture is aerated with an excess of sodium hydroxide, and the ammonia Nesslerised as in the standard micro-aeration method of Folin and Macallum (*J. Biol. Chem.*, 1912, **11**, 523). The unavoidable error of the method is less than 1 per cent. Results by this method show that the normal level of amide nitrogen for blood drawn from the cubital vein in the human varies from 134 to 144 mgrms. of amide nitrogen per 100 c.c. of blood.

P. H. P.

Colorimetric Determination of Blood Calcium. J. H. Roe and B. S. Kahn. (*J. Biol. Chem.*, 1929, **81**, 1–8.)—The colorimetric method of Roe and Kahn (*J. Biol. Chem.*, 1926, **67**, 585) for the determination of blood calcium, in which the calcium is precipitated from an alkalinised trichloroacetic acid filtrate as calcium phosphate, and determined as phosphate by the method of Benedict and Theis (*J. Biol. Chem.*, 1924, **61**, 63 ; ANALYST, 1924, **49**, 537–8) has now been simplified and shortened, and the modification described is believed to be more accurate than any other method for the determination of blood calcium. In the new procedure the calcium phosphate is precipitated, washed, dissolved in molybdic acid, and treated for colour production in the same tube, and thus all transfers which would require time and offer chances for error are eliminated ; the method of Fiske and Subbarow (*J. Biol. Chem.*, 1925, **66**, 375 ; ANALYST, 1926, **51**, 205–6) for the determination of inorganic phosphorus is used instead of that of Benedict and Theis, but the latter procedure is retained as an optional method where a reducing agent of greater keeping qualities is desired (according to Fiske and Subbarow their amino-naphtholsulphonic acid reagent will keep for 2 weeks, but the authors find it quite satisfactory if freshly prepared every 2 or 3 months) ; a more successful washing mixture, namely, 55 parts of ethyl alcohol, 10 parts of

amyl alcohol, and 35 parts of water, made just alkaline to phenolphthalein, has been developed for the calcium phosphate precipitates, which eliminates the second washing ; the calcium is precipitated at a higher alkalinity to remove any possibility of interference by unusual amounts of magnesium ; and a number of minor changes in technique are also introduced. This method is not dependent upon a balancing of compensating errors, and by it very small amounts of calcium (0·02 mgrm.) can be determined. It is stated that colorimetry is the logical procedure for the determination of blood calcium, since calcium is present in the blood in relatively small amounts. The micro method for blood calcium of Kuttner and Cohen (*J. Biol. Chem.*, 1927, **75**, 517), adapted from the original method of the authors, is criticised on the grounds that it does not provide for the possibility of interference by unusual amounts of magnesium, that the stannous chloride reagent recommended is not specific for phosphomolybdic acid, and that with this reagent the non-changing zone of colour production is so exceedingly small (between 0·02 and 0·022 per cent.). The authors are engaged in the application of their method to the development of a micro method. P. H. P.

Action of Cholesterol from Cod-Liver Oil on a Photographic Plate. L. Hugounenq and E. Couture. (*Compt. rend.*, 1929, **188**, No. 4, 349–350.)—In the course of a comparative study of cholesterol of different origins, it has been found possible to distinguish the cholesterol from cod-liver oil from cholesterol from other sources. Cholesterol from sources such as gallstones, or ox brain, spread on a photographic plate and left for several days, has no effect on the plate, whereas, on development of a plate which has had crystals of cholesterol from cod-liver oil on it under similar conditions, very definite black stains appear wherever the crystals have been in contact. An experiment showed that cholesterol from cod-liver oil placed on a thin quartz plate and left for six days in absolute darkness affected a photographic plate on which the quartz plate was lying, whilst the use of a similar glass plate (in the place of the quartz) gave negative results. Therefore the action appears to be a physical one, and further study of this subject is being carried out. P. H. P.

Antirachitic Properties of Cod-liver Meals. R. M. Bethke, G. Zinzalian, D. C. Kennard, and H. L. Sassaman. (*J. Agric. Res.*, 1928, **36**, 747–753.)—In recent years, the residue left after the production of cod-liver oil from the livers of the codfish (*Gadus callarias*) has been dried and sold in the open market under the name " cod-liver meal." It has been claimed that this liver residue, apart from the quality of its proteins, has certain vitamin properties, principally those of an antirachitic nature ; thus its nutritional value is of great interest. Cod-liver oils may vary greatly in their vitamin *A* and *D* content, and, likewise, the residue which remains after the partial extraction of the fats would be expected to vary in vitamin properties, depending upon the original vitamin content of the livers, the amount of oil remaining in the residue, the method employed for the oil extraction, and the procedure used in drying the liver residue. Experiments

on their antirachitic properties have been carried out on three cod-liver meals obtained from three different manufacturers after the removal of the oil by the steam process. Experiments with chicks and rats have shown conclusively that these dried residues which remain after the extraction of oil from fresh cod livers vary markedly in their antirachitic properties. The antirachitic variation was not proportional to the residual fat content of the livers, and the ether-extractable fraction did not prove nearly as potent as ordinary cod-liver oil. The cod-liver oil used was at least 6 times as potent antirachitically as the extract from the most efficient of the three liver meals. Therefore, it would seem unwise to use the liver meal as an antirachitic substitute for a good grade of cod-liver oil in either poultry or livestock production. It remains to be determined whether cod-liver meals may possess other merits apart from their questionable fat-soluble vitamin content. P. H. P.

Comparison of the Antirachitic Potency of Ergosterol irradiated by Ultra-Violet Light and by Exposure to Cathode Rays. A. Knudson and C. N. Moore. (*J. Biol. Chem.*, **1929**, **81**, 49–64.)—It has previously been shown that antirachitic properties can be induced in various substances, such as cholesterol, yeast, etc., by exposure to high voltage cathode rays. Experiments by Rosenheim and Webster (*Lancet*, 1927, **1**, 306 ; *Biochem. J.*, 1927, **21**, 389 ; ANALYST, 1927, **52**, 424) and Hess and Windaus (*Proc. Soc. Exp. Biol. and Med.*, 1927, **24**, 461) have indicated that ergosterol, when irradiated by ultra-violet light, is converted into a powerfully antirachitic substance, so that as small a dose as 0·0001 mgrm. of irradiated ergosterol per day cures or prevents rickets in rats kept on a rachitogenic diet. Experiments have therefore been carried out on the antirachitic activity of ergosterol produced by exposure to cathode rays, in order to determine the best procedure for obtaining the most potent product, and to compare this potency with that obtained by ultra-violet irradiation. Rats were used for the tests. Results show that ergosterol exposed to cathode rays with the tube operating at 180,000 to 200,000 volts is not rendered as potent as when irradiated with ultra-violet light from a mercury vapour quartz lamp. The highest potency obtained by cathode ray exposure (*i.e.* the lowest dose obtained which brings about a healing effect of rickets) was 0·0005 mgrm. per day, and by ultra-violet irradiation the highest potency was 0·00002 mgrm. per day. Ergosterol exposed to ultra-violet light for 15 seconds was more potent than that exposed for 30 minutes, although 30 minutes has been the time more or less generally used by a number of investigators. Ergosterol exposed to cathode rays undergoes a similar change in the absorption spectrum as when exposed to ultra-violet light. A plate which shows the absorption spectra is reproduced. The manner in which cathode rays produce their antirachitic action does not seem to be due to the production of ultra-violet light, for yeast, cholesterol and ergosterol were not activated when exposed to cathode rays behind a quartz plate. P. H. P.

Bacteriological.

Isolation of *B. paratyphosus B* from Sewage. J. D. A. Gray. (*Brit. Med. J.*, 1929, 142).—*B. paratyphosus B* (Schotmüller) was found in one of four main sewers of Edinburgh and traced to three of its seven tributary sewers. The methods tried for isolating and identifying the organism were: (1) Wilson and Blair's method—medium containing glucose, with bismuth, sulphite, iron and brilliant green (termed medium B); (2) Browning, Gilmour and Mackie's method, 1913—brilliant green enrichment method; (3) Rakieten and Rettker's modification of No. 2; (4) MacConkey's medium; (5) Wilson and Blair's medium, containing lactose, bile, salt, and brilliant green.

Any one of these methods may fail to detect paratyphoid bacilli isolated by the others. Method No. 1 has the advantage that it is a direct plating method and inhibits the growth of a very large number of coli-form organisms. The enrichment methods have the disadvantage that they tend to permit overgrowth of *B. fluorescens* and *B. proteus* types. Laboratory strains of various types were plated out on medium B. in order to obtain typical colonies, *viz. B. typhosus*, *B. paratyphosus A*, *B. paratyphosus B*, a typical *B. coli*, *B. proteus*, and *B. fluorescens*. *B. paratyphosus B* produced colonies with the following characteristics:—After 24 hours they were each 1 mm. in diameter; after 48 hours they became bright green, one of the strains producing black colonies with a metallic lustre; after four day's incubation the colonies were 6 mm. in diameter and had a raised greyish centre. None of the other varieties of organisms behaved in this way; for instance, *B. typhosus* and *B. paratyphosus A* produced only minute colonies. For confirmation of *B. paratyphosus B* sub-inoculations were carried out on Wilson's modification of the Endo medium, in which sucrose is used instead of lactose. Samples from those sewers giving positive results by method No. 1 on arrival at the laboratory were again tested after one, two, and four days, with negative results, thus indicating that *B. paratyphosus B* has a very short period of survival. Loss of motility in laboratory strains of *B. paratyphosus B* was observed when plated on medium B, but this property returned after the organism was sub-inoculated into ordinary nutrient media. It is pointed out that the district from which the sewers came, in which *B. paratyphosus B* was found, was the locus of an outbreak of paratyphoid B fever in 1927, probably caused by the flooding of byres due to the main sewer being unable to cope with flood water. Milk obtained in these byres probably became infected. The Medical Officer considered that the infection originated in resident "carriers" rather than in the numerous piggeries in that district. R. F. I.

Agricultural.

Rapid Electrometric Method for Measuring "Lime Requirements" of Soils. F. Hardy and A. H. Lewis. (*J. Agric. Sci.*, 1929, **19**, 17–25.)—The Hutchinson and MacLennan method for determining the lime requirement of a soil, depending on the interaction between calcium bicarbonate in aqueous solution

and the components of acid soils, is tedious and slow, and gives reproducible results only when the experimental conditions are strictly standardised. Moreover, the concentration of calcium bicarbonate recommended, namely, 0·02 *N*, is such that the solution is initially acidic (P_H 6·2), and may become more acidic (*e.g.* P_H 5·5) when finally in equilibrium with an acid soil. Again, although the concentration of calcium ion in the solution is relatively high, it is certainly not high enough to effect complete replacement of hydrogen ion from the soil adsorption complex, so that this method does not fully reproduce the various effects caused by liming a soil in the field.

In the method devised by the authors, 10 grms. of the air-dry soil, previously passed through a 1 mm. sieve, are mixed with 40 c.c. of neutral 0·2 *M* calcium chloride solution by shaking in a 150 c.c. wide-mouthed, hard glass bottle. Except with soils containing traces of free lime, no lengthy period of contact of soil and solution is necessary. A sufficient quantity of quinhydrone is then added to the mixture and the P_H value determined by the quinhydrone electrode. The mixture is next titrated with 0·03 *N* lime water in successive portions of 5 c.c., the liquid being shaken for three minutes, and the P_H determined, after each addition. This procedure is continued until the reaction has passed P_H 7·0, the results being plotted and the exact volume of the lime water needed to give the final reaction P_H 7·0 determined from the graph. This method gives results which are reproducible with any given salt-treated soil, and are much more regular than, and, in accordance with expectation, usually greater than those furnished by the Hutchinson and MacLennan method. Thus, it brings out clearly the proportionate increase in lime requirements (*a*) of soils of approximately the same initial exchange reaction but of increasing fineness of texture, and (*b*) of soils of approximately the same texture, but of increasing exchange P_H value. The results given by this electrometric method are compared with those yielded by a base-exchange method, the latter being appreciably the higher. T. H. P.

Organic Analysis.

Determination of Iodine (Halogen) in Organic Matter. J. Schwaibold. (*Chem. Ztg.*, 1929, **53**, 22–23.)—In the determination of iodine in organic materials, the inconveniences involved in the incineration in an open vessel in presence of a large amount of alkali, particularly the difficulty of preventing of loss of halogen during complete combustion of carbon, may be obviated by a procedure similar to the combustion method of determining carbon and hydrogen. Use is made of a hard (Supremax) glass combustion tube, 90 cm. long and 20 to 30 mm. wide, in which is placed a porcelain or nickel boat containing the dry substance, liquids being previously dried, preferably in the boat itself, after being rendered slightly alkaline. Platinum contact material is placed between the boat and the drawn-out end of the combustion tube, which is connected, by glass-to-glass joints, with two efficient wash-bottles, preferably of the Greiner and Friedrichs type, charged with 20 and 10 drops

respectively of saturated potassium carbonate solution. After the tube has been filled with oxygen purified by passage through concentrated potassium hydroxide solution and soda-lime, the platinum contact material is heated to redness and the substance itself then gradually heated, the heating and the oxygen current being continued until the organic matter is completely burned and no vapours or fumes are visible at the end of the tube. The wash bottles and the tube are washed out and the boat boiled in water, the residual material being tested, in the case of an unknown substance, to ensure its freedom from iodine. The total liquid is evaporated and, when most of the water has been expelled, filtered. If the amount of iodine is large, an aliquot part of the solution is titrated by Winkler's method, but with small amounts of iodine, the still aqueous residue left on evaporation is extracted with alcohol and the determination by Winkler's method carried out after expulsion of the alcohol by distillation. Sometimes, when large amounts of substance are used, white fumes reach the receiver, especially during the early stages of the combustion, owing to incomplete combustion. In such a case, the resulting liquids are evaporated in a platinum dish and the residue heated over a small flame until quite white ; the subsequent treatment is then as usual. With thyroid gland, milk, urine, and moorland soil, the method gives satisfactory results.

T. H. P.

Qualitative Colour Test for Reactive Organo-Metallic Compounds. H. Gilman and L. L. Heck. (*Rec. Trav. Chim. Pays-Bas*, 1929, **48**, 193–197.)—Modifications of this test (ANALYST, 1925, **50**, 523), in which test papers, a spot plate, or one drop of solution in a test-tube are used, prove unsatisfactory as regards sensitiveness, and the original method, in which 1 c.c. of solution is employed, is preferred. The results obtained with a number of typical Grignard reagents show that the sensitiveness of the test is increased by using a hot, saturated solution of the Michler's ketone in benzene, the coloration then appearing immediately. If cold solutions are used, positive results are obtained if the liquid is allowed to stand for 3 to 4 minutes prior to hydrolysis. For various Grignard reagents the minimal quantities necessary for the test are given. T. H. P.

Specific Gravity of Glycerol. L. W. Bosart and A. O. Snoddy. (*Ind. Eng. Chem.*, 1928, **20**, 1377–1379.)—Since the publication of the authors' tables for the specific gravity of glycerol (ANALYST, 1927, **52**, 434), the third volume of the International Critical Tables has been published, and it contains tables showing the absolute density of glycerol at various temperatures. The figures in the two tables are in fair agreement, except those given for the specific gravities at 20° C. While disclaiming any desire to criticise the work of the compilers of the International Critical Tables, the authors consider that these tables are unsatisfactory as a working basis where accuracy in the fourth decimal place is necessary.

W. P. S.

Film Characteristics of the Esters of the Component Fatty Acids of Linseed Oil. B. H. Thurman and W. R. Crandall. (*Ind. Eng. Chem.*, 1928, **20**, 1390–1392.)—Experiments with mixtures of ethyl esters of linseed oil fatty

acids with a nitrocellulose lacquer showed that the esters of the less unsaturated fatty acids (oleic acid type) are very stable in films, whilst those of the more unsaturated fatty acids are not so stable, as is shown by their rapid tendency to become sticky, odorous, and dark coloured. The difference in the darkening in colour of certain of the films, as compared with others, indicates that the yellowing of drying-oil films is the result, and a necessary result, of oxidation of the highly unsaturated fatty acid groups, and that it and the drying of linseed oil films are not interdependent; it is also independent of the presence of glycerol. In the case of films containing ethyl oleate and ethyl stearate, the latter tended to crystallise on the surface when the film was cooled below 35° C. W. P. S.

Composition of German Rape Oil. K. Täufel and C. Bauschinger. (*Z. Unters. Lebensm.*, 1928, **56**, 253–264.)—The oil was obtained by extraction under pressure (yield 21 per cent.), and was filtered at 40° C., purified by treatment with sulphuric acid, washed acid-free and dried. A list of its properties and constants is given. The total fatty acids were then separated from the oil, dissolved in 95 per cent. alcohol, and precipitated with suitable quantities of lead acetate solution (Twitchell, ANALYST, 1921, **46**, 466), and the precipitate filtered off after 12 hours at 15° C., washed with alcohol and recrystallised from ether. The operation was repeated three times, and the fatty acids obtained then dissolved in alcohol and fractionally precipitated six times with a 1 per cent. solution of lithium acetate in 95 per cent. alcohol. The purity of the product was controlled by iodine value, m.pt. and molecular weight determinations, and the original precipitate was shown to contain 18.85 per cent. of saturated fatty acids and 81·15 per cent. of erucic acid. The filtrate from the Twitchell separation was treated with an alcoholic solution of magnesium acetate, and erucic acid (23·45 per cent. of the total fatty acids) liberated from the magnesium salt obtained and recrystallised from alcohol. The mother-liquor, which contained a little erucic acid, all the oleic acid and the higher unsaturated fatty acids, was brominated at −14° C. for 3 hours, the bromide filtered off, washed with cold ether and weighed. The amount of α-hexabromstearic acid (m.pt. 179° C.) was found to correspond with 2·45 per cent. of linolenic acid. The residue left on evaporation of the mother liquor was warmed at 35° C. with petroleum spirit for 20 minutes, and an amount of α-tetrabromstearic acid (m.pt. 114° C.) corresponding with 5·42 per cent. of α-linolic acid was obtained. This separation depends on the fact that the hexabromide is sparingly soluble in ether or petroleum spirit, whilst the tetrabromide is readily soluble only in ether. The oleic acid was determined by precipitation of an alcoholic solution of the fatty acids with zinc acetate solution (Grabner, *Monatsh.*, 1921, **42**, 287). The percentage composition of the oil was therefore :— Saturated fatty acids, 0·8 ; erucic acid, 43·5 ; oleic acid, 37·8 ; linolic acid, 10·6 ; linolenic acid, 3·5 ; unsaponifiable matter, 1·0 ; and glycerol residue (as C_3H_2) 3·8 (*cf.* following abstract). J. G.

Glycerides of Rape Oil. K. Täufel and C. Bauschinger. (*Z. Unters. Lebensm.*, 1928, **56**, 265–272.)—The presence of oleo-linoleno-erucin, oleo-dierucin,

and trierucin in rape oil has been established (*cf.* Amberger, *id.*, 1920, **40**, 192). The amounts of oleo-dierucin and trierucin are uncertain, and cannot be obtained from the erucic acid content, on account of the presence of other mixed glycerides containing this acid. Molecular weight and bromine determinations on the products resulting from fractional crystallisation of the brominated glycerides indicated 1·7 per cent. of oleo-linoleno-erucin, corresponding with 0·5 per cent. of linolenic acid, and it is concluded that the remainder of the acid is combined in a different form (*cf.* preceding abstract). Fractional crystallisation from acetone at 20° C. and 0° C. of the elaidin produced by the method of Tomow (*viz.* by the action of gaseous nitrous acid on a mixture of equal parts of oil and acetone at ordinary temperatures; see also Heiduschka and Felser, *Z. Unters. Lebensm.*, 1919, **38**, 241), gave elaido-dibrassidin ($C_3H_5(C_{22}H_{41}O_2)_2(C_{18}H_{33}O_2)$) and tribrassidin ($C_3H_5(C_{22}H_{41}O_2)_3$). J. G.

Determination of Fat in Leather. D. Woodroffe. (*J. Inter. Soc. Leather Trades' Chem.*, 1928, **12**, 569).—In a previous paper (*id.*, 1926, 219) the author found that leathers which had been dried gave a lower figure for fat content, as found by a Soxhlet extraction, than if they had not been dried, but that if the dried leather were allowed to remain in a moist atmosphere for some days, the fat content became higher, approximating to the original figure. The explanation given in the present paper is that petroleum spirit extracts of air-dry leathers (containing 17 to 20 per cent. of moisture) persistently retain small amounts of moisture when dried in a water-oven for periods up to 16 hours. If heated for 3 hours at 105° C., the water appears to be driven off and a more accurate result is obtained, but there is danger of decomposing triglycerides. The author recommends the use of the vacuum oven for the purpose. R. F. I.

Determination of Thio-semi-carbazide by means of Iodine. A. Gaffre. (*J. Pharm. Chim.*, 1929, **121**, 19–23.)—In an iodimetric determination thio-semi-carbazide reacts like its two associated components—thiocyanic acid and hydrazine. In the presence of sodium carbonate, and with at least 8 hours of contact with the iodine, cyanogen iodide is formed, and then is decomposed on the addition of acid, with liberation of 2 atoms of iodine. The acid is added before titrating the excess of iodine; 10 atoms of iodine are taken by 1 molecule of thio-semi-carbazide.

$$SC\begin{matrix}NH_2\\NH\text{–}NH_2\end{matrix} + 5I_2 + 6H_2O \longrightarrow 10HI + HCN + N_2 + H_2SO_4 + 2H_2O.$$

In the presence of sodium hydroxide, with at least 30 minutes' contact, and on titration of the excess of iodine after acidification, 12 atoms of iodine are consumed by 1 molecule of thio-semi-carbazide.

$$SC\begin{matrix}NH_2\\NH\text{–}NH_2\end{matrix} + 6I_2 + 5H_2O \longrightarrow 12HI + HCNO + N_2 + H_2SO_4.$$

D. G. H.

Decomposition of Phenolsulphonic Acids and Purification of Phenols by the Sulphonic Acid Separation Method. H. Bruckner. (*Z. anal. Chem.*, 1928, **75**, 289–292.)—The sulphonic acids corresponding with various phenols are decomposed by steam at the following temperatures, which are independent of the concentration either of the sulphonic acid or of the sulphuric acid: 1-hydroxybenzene-4-sulphonic acid, 123–125° C.; 1-methyl-2-hydroxybenzene-5-sulphonic acid, 133–135° C.; 1-methyl-3-hydroxybenzene-6-sulphonic acid, 116–119° C.; 1-methyl-4-hydroxybenzene-3-sulphonic acid, 133–136° C.; 1:2-dimethyl-3-hydroxybenzene-6-sulphonic acid, 115–118° C.; 1:2-dimethyl-4-hydroxybenzene-5-sulphonic acid, 107–111° C.; 1:3-dimethyl-2-hydroxybenzene-5-sulphonic acid, 124–128° C.; 1:3-dimethyl-4-hydroxybenzene-5-sulphonic acid, 121–125° C.; 1:3-dimethyl-5-hydroxybenzene forms no sulphonic acid with concentrated sulphuric acid and can be distilled over by steam at 100° C.; 1:4-dimethyl-2-hydroxybenzene-5-sulphonic acid, 115–118° C.

These varying temperatures may be utilised for the purification of phenols. The sulphonation is best effected by heating the phenol gently with an equal weight of concentrated sulphuric acid and stirring with a glass rod until no stream lines remain visible, and then heating the mixture for 3 hours in an oven at 103–105° C. The mass is diluted with 200–300 c.c. of water and steam is passed through the boiling solution until all non-sulphonated phenol is expelled. The cold liquid is shaken with ether, which extracts resinous products, the pure sulphonic acid being obtained by evaporating the residual liquor at a rather higher temperature and, finally, by drying over sulphuric acid or phosphorus pentoxide. To prepare pure *m*-cresol from the commercial product, this is sulphonated and freed from non-sulphonated ingredients as above. The solution is then evaporated on an air-bath or in an oil-bath and with a gentle current of steam passing through it until the boiling point reaches the decomposition temperature (117–118° C.), which is maintained for some time by gentle heating and a vigorous current of steam. The *m*-cresol is thus distilled and separates in the condensate as an oil, which is purified by extraction with ether and distillation. A yield of about 80 per cent. of pure *m*-cresol is thus obtained from a 97–98 per cent. pure product.

T. H. P.

Inorganic Analysis.

New Method for the Quantitative Determination of Ozone in Air. M. S. Egorow. (*Z. Unters. Lebensm.*, 1928, **56**, 355–364.)—The method for the determination of small quantities of ozone in which the iodine liberated from potassium iodide is titrated with sodium thiosulphate solution is not sufficiently sensitive. The fluorescein method of Benoist (ANALYST, 1919, **44**, 183) has the disadvantage that the reaction is slow, and the ozone is destroyed, and the author suggests instead the formation of fluorescein from its non-fluorescent leuco-compound (fluorescin), by the action of ozone. Fluorescein (1 mgrm.) is dissolved in a few drops of 10 per cent. sodium hydroxide solution, 10 c.c. of a saturated solution of sodium hydroxide added, and the mixture shaken

with zinc dust, and filtered when the disappearance of fluorescence indicates that reduction is complete. One drop of freshly made solution is placed in a test-tube with 10 c.c. of 0·5 per cent. sodium hydroxide solution, and the ozonised air drawn through the liquid at a maximum rate of about 12 to 15 litres per hour by means of a graduated water-aspirator. If the tube is placed in an illuminated comparator, the flow may be stopped, and the volume of air measured when the fluorescence matches that of a standard solution containing 1 part of fluorescein in 100,000,000. The fluorescence is stable in alkaline solutions and is unaffected by hydrogen peroxide or oxides of nitrogen, and the method is sensitive, rapid and specific. One part by weight of fluorescein is produced by 0·96 part of ozone. J. G.

Determination of Cadmium in Organic and Inorganic Compounds. H. ter Meulen and (Mlle) H. J. Ravenswaay. (*Rec. Trav. Chim. Pays-Bas*, **1929**, **48**, 198–200.)—Cadmium may be determined in the same way as arsenic (ANALYST, 1926, **51**, 421), except that no spiral of platinum foil is required. If the substance contains sulphur or a halogen, it is mixed in the boat with calcium carbonate. To prevent traces of unreduced cadmium halide from reaching the incandescent zone of the tube, the hydrogen is passed through a wash-bottle containing concentrated ammonia solution, and then dried by means of quicklime before passing into the tube. This procedure is of advantage even in absence of halogen or sulphur. Any small quantity of ammonium halide deposited in the receiver may be removed by washing with water and then with alcohol, the deposit being dried in a current of dry air before being weighed. The cadmium in inorganic compounds and in cadmium alloys containing no other volatile metal may be determined similarly.

Attempts to determine zinc by the same method have failed, slightly high results being always obtained, owing to the formation of a film of the oxide.

T. H. P.

Ceric Sulphate as a Volumetric Oxidising Agent. VIII. Determination of Chromium. H. H. Willard and P. Young. (*J. Amer. Chem. Soc.*, **1929**, **51**, 139–149.)—A method is described in which the chromic salt is oxidised with ceric sulphate, the excess of which is measured potentiometrically with sodium nitrite or oxalate ; or the excess of ceric salt is destroyed with sodium nitrite, the latter in turn by urea, and the chromic acid titrated with ferrous salt. Reference should be made to the original paper. (*Cf.* ANALYST, 1928, 404, 674.) W. R. S.

Fineness and Available Lime Content of Quicklimes. J. S. Rogers. (*Ind. Eng. Chem.*, 1928, **20**, 1355–1356.)—Many industries prefer to use quicklime in place of slaked lime for neutralisation and other purposes, in order to utilise the heat of hydration. A properly burned lime will usually yield a slaked lime in such a fine state of division that it will pass a 200-mesh sieve ; particles coarser than this consist of unburned stone, over-burned lime, impurities, etc., and are of little, if any, use. To determine fineness, 100 grms. of the sample of quicklime are added to 500 grms. of water, the mixture is agitated for five minutes and

occasionally (about six times) during the succeeding twenty-four hours, care being taken to avoid mechanical disintegration. The mixture is poured into the top sieve of a series nested in the following order :—30-mesh, 50-mesh, 100-mesh, and 200-mesh. The sieves are washed with a stream of water, dried at 110° C., and their contents weighed. Available lime is determined by mixing 1·4 grm. of the sample with 200 c.c. of hot water, boiling the mixture for three minutes and titrating it with *N* hydrochloric acid, phenolphthalein being used as indicator; the titration is continued until the mixture remains colourless for one or two seconds. Another portion of 1·4 grms. of the sample is then placed in a litre flask, 200 c.c. of hot water are added, the flask is closed with a cork carrying a capillary vent, the mixture boiled for three minutes, cooled, *N* hydrochloric acid added in quantity 5 c.c. less than was required for the preliminary titration, and the whole is diluted to 1 litre, shaken for five minutes, and allowed to settle. Two hundred c.c. of the clear liquid are then drawn off and titrated with 0·5 *N* hydrochloric acid. The percentage of calcium oxide is calculated from the quantity of acid used for the neutralisation. The difference between the available lime, as thus determined, and the total calcium oxide in the sample may be taken as an index of the degree to which the lime has been burned, assuming that the hydrochloric acid neutralised only the calcium hydroxide and not the magnesium hydroxide, magnesium oxide and calcium oxide. W. P. S.

Erratum.

Rapid Method for the Determination of Selenium.—In line 5 of the abstract on p. 63 of the January issue, *for* " sodium sulphate " *read* " sodium sulphide."

Physical Methods, Apparatus, etc.

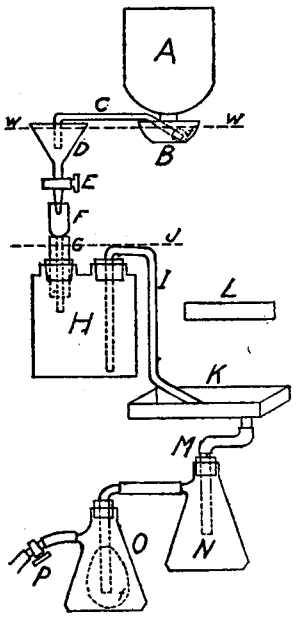
Transmission of Ultra-Violet Light through Tracing Cloth. C. H. Young. (*Nature*, 1929, **123**, 47.)—Ultra-violet light passes through ordinary commercial tracing cloth (or linen) to a surprisingly large extent.

No.	Type of screen.	Approximate thickness. mm.	Mesh count per cm.	U.-V. limit in Ångström units.
	None	—	—	2225
A	Excelsior	0·070	44×44	2535 (faint)
B	Imperial	0·070	47×47	2535
C	Excelsior	0·083	47×47	2535 (faint)
D	Imperial	0·081	43×43	2482
E	Lion	0·080	41×41	2482
P	Newspaper	0·070	—	3984
Q	Kraft paper	0·101	—	4339 (faint)
R	Wrapping paper	0·077	—	3125
S	Writing paper	0·069	—	3125

It was found that sun-heat or heat from a red-hot ball passed through the tracing cloth to a much less extent than through glass or vita-glass, so that it is possible to screen off much of the heat and yet retain most of the ultra-violet light.

D. G. H.

Accelerated Exposure Test for Varnishes and Lacquers. H. V. Hansen. (*Ind. Eng. Chem.*, 1928, **20**, 1384–1385.)—The test panels are subjected to the action of ultra-violet light while they are in alternate wet and dry conditions. The apparatus used is shown in the illustration (not drawn to scale).



The 4-litre bottle *A* is filled with water and inverted over the basin *B* so as to yield a constant water level, *W*. A siphon *C* conducts the water to the funnel *D*; the tap *g* regulates the flow of the water at any desired rate into the funnel *F* and thence into the 300 c.c. bottle *H*. A piece of muslin, *f*, is tied over the end of *C*, and the funnel *D* contains a filter paper, these arrangements being necessary to remove traces of dust which may settle in the basin *B*. On reaching the level *J*, the water siphons over into the tray *K*, containing the test panels, and situated under the carefully shielded lamp *L*. The water is discharged through *M* into the flask *N*, and then into a similar flask *O*, the inlet p ipe to the latter being also fitted with a muslin filter, *f*, to remove particles of dust which would otherwise clog the tap *P*. The tap *E* should deliver about 60 drops per minute, the bottle *H* should empty into *K* in about two minutes, and the tap *P* is so adjusted that the tray *K* empties in fifteen minutes. There should be a fall of about 0·5 metre between *K* and *N*. A cycle of ninety minutes wet and thirty minutes dry for the test panel is then attained. A period of twenty-four hours in the apparatus corresponds roughly to about two weeks of outside summer exposure. The test panels should be examined periodically for the first signs of cracking, blistering or other indication of failure.

W. P. S.

Reviews.

PRINCIPLES AND APPLICATIONS OF ELECTROCHEMISTRY. In two volumes. Vol. I. PRINCIPLES. By H. JERMAIN CREIGHTON. Second edition, revised and enlarged. Pp. xvi+488. New York: Wiley & Sons; London: Chapman & Hall. 1928. Price 20s. net.

In view of the importance of the subject, the number of books on electrochemistry, good and indifferent, is small. Prof. Creighton's book belongs decidedly

to the first category. It is clearly and accurately written, and gives not only an excellent review of the subject suitable for the student, but also a large amount of detail, in the form of tables, curves, literature references and descriptions of experimental methods, which makes it a valuable work of reference to the analytical chemist who has occasion to use electrical methods, the application and importance of which has increased very considerably during the last few years.

In this connection the detailed and critical descriptions of the accurate measurement of current by coulometers, of conductivity measurements, and of potentiometric titrations may be mentioned. In some cases, as in the description of conductimetric titrations and the determination of hydrogen ion concentrations, the descriptions of the methods are rather brief, and these will no doubt be dealt with more fully in the second volume. In all cases, however, a clear statement of the theory of the methods is given.

The Activity Theory and the Debye-Hückel theory of strong electrolytes are explained in sufficient detail, and here, as throughout the book, the mathematics is kept as simple as possible, and can be followed with an elementary knowledge of the calculus. Even without this, the results are so clearly stated that the reader will have no difficulty in following the use of the formulae. There is a good chapter on the theory of indicators.

The book may be recommended as an intelligible and practical account of the subject.

J. R. PARTINGTON.

PHOTOMETRIC CHEMICAL ANALYSIS. Vol. I. COLORIMETRY, by JOHN H. YOE, Ph.D. Pp. xxi+771. London: Chapman & Hall, Ltd. Price £2 2s. 6d. net.

"The rapid growth of colorimetry and nephelometry has created a demand for a comprehensive reference work on these two methods of chemical analysis. . . . During the past twenty-five years many new colorimetric methods have been developed, so that now most of the more common elements, a number of the less common ones, and many organic compounds may be determined by means of the colorimeter. The literature numbers several thousand references. Nephelometry," which is to be dealt with in Volume II, "on the other hand, is a comparatively new science. It had its beginning in the nineties when Richards used it as a means of making corrections in certain atomic-eight determinations."

This work appears to be the first to deal with these subjects so comprehensively. The author, who is a professor of chemistry in the University of Virginia, has certainly done justice to his theme, especially from the practical point of view of the analyst and the works chemist. There is little of theoretical interest, although avenues to this aspect of the subject are opened by references to instruments and literature. This is not to be regretted, since frequent correlation of practice with theory would repel the average reader of a book having as its chief aim the introduction of quick and convenient methods. However, those

who wish to explore this field will find suggestions in the references to spectroscopy and in the copious bibliography.

The book is divided into four parts. The first deals with general principles, instruments and apparatus, calculation of results, errors, and very full directions for using a precision colorimeter.

Part II comprises twenty-eight chapters covering nearly 300 pages, each chapter being devoted to a study of the methods for determining a single element, except in five cases. The general scheme may be illustrated by the chapter on Aluminium, which occupies fourteen pages. (*a*) Determination of Aluminium by "Aluminon":—The principles of the test are defined; then follows a list of the ten necessary reagents with directions for preparing the special ones; "Procedure" fills a page and a quarter, and three pages of "Notes" dealing with questions of sensitivity, "snags," influence of other elements, etc. (*b*) Determination of aluminium in non-ferrous material by "Aluminon." The general treatment is similar to that of (*a*); under "Procedure" three "Methods" are given. (*c*) Determination of aluminium by Alizarin-S, receives adequate attention, although in less than two pages. (*d*) Determination of aluminium by haematoxylin is dealt with in similar manner. Little is left for the average reader to discover.

Part III surveys "Organic" and Part IV "Biological" materials. The treatment is similar to that already described, but generally not nearly so full.

The volume closes with a descriptive Bibliography occupying 84 pages. The references are classified under the respective subjects. For example, 26 under aldehyde, 19 under bismuth, 128 under iron, all with some notes revealing the scope or main practical theme of the paper. It would be an improvement if, in the second edition, which one may confidently anticipate, the bibliography were divided into two sections: (*a*) Those papers dealing with Colorimetry generally, and (*b*) those concerned with single substances. At present it is easy to miss the papers of wider interest classified under "Errors" "Sensitiveness," etc.

S. JUDD LEWIS.

VOLUMETRIC ANALYSIS. Vol. I. THEORETICAL PRINCIPLES OF VOLUMETRIC ANALYSIS. By I. M. KOLTHOFF, in collaboration with H. MENZEL. Authorised translation from the German by N. H. FURMAN. Pp. 289. London: Chapman & Hall. Price 15s.

The German original of this book has established itself as a standard work; the present translation appears to follow it very closely; in some places, in fact, so closely as to prejudice the English style. The translator could easily have improved on such expressions as "the reaction runs slowly," "you will perceive a precipitate," and "if you add a little potassium permanganate." On page 135 the phrase "Yet they are responsible for many kinds of errors," appears as a complete sentence. One of the chief deficiencies of the German edition is the absence of an index; this has been made good in the translation by the addition of both author and subject indexes.

S. GLASSTONE.

FIXATION OF ATMOSPHERIC NITROGEN. By FRANK A. ERNST. Fixed Nitrogen Research Laboratory, U.S. Dept. Agric. Industrial Chemical Monographs. Pp. 154. London: Chapman & Hall. Price 12s. 6d.

In this volume a brief description is given of the three principal methods employed for the fixation of atmospheric nitrogen, the arc, the cyanamide and the ammonia processes, respectively, together with an account of the bye-products of ammonia, a review of the world-trade in nitrogen, and a bibliography of the more important articles on this subject.

In his foreword the author states that the book is not intended for the scientist or technician, but for the teacher and student, for the business man and banker.

Efforts of this kind are to be welcomed not only for the purpose of popularising science but also of drawing the attention of the man in the street to scientific facts which play an unsuspectedly important part in his economic life. One is inclined to think that the style of the volume errs a little on the technical side, for it ever to qualify as a "best seller," but it is written clearly and with vigour, it is well printed, and contains excellent diagrams. Statistics are somewhat elusive entities, and the present position of Great Britain with regard to fixed nitrogen is somewhat more satisfactory than the author would lead us to believe.

ERIC K. RIDEAL.

CREATINE AND CREATININE. By ANDREW HUNTER, M.A., M.B., F.R.S.Can., Professor of Biochemistry in the University of Toronto. Pp. vi+281. Monographs on Biochemistry. London: Longmans Green & Co., Ltd. 1928. Price 14s.

Creatine was discovered by Chevreul in meat extract in 1832, but it was only in 1904, after Folin had elaborated a quantitative method for the estimation of this substance that its importance became evident. This is particularly shown in the excellently written chapter (VIII) of the book under review, which goes to show the importance of creatinuria during growth, in women (during and after pregnancy), in starvation, in fasting, during carbohydrate privation, acidosis, high protein feeding, and in diseases affecting the muscles. This chapter is most fascinatingly written, and Professor Hunter, who has himself contributed much work on these questions, is to be congratulated on it.

In a similar manner praise must be given to other chapters which deal with the discovery, the synthesis and constitution of creatine and creatinine, the chemistry of these two substances and their derivatives, their preparation and quantitative estimation, their biological distribution (mainly based on Folin's quantitative methods), their output coefficient and metabolic significance, their physiology and origin. The last-named chapter, dealing with the origin of creatine and creatinine, although of necessity highly speculative, makes interesting reading, if only in showing how little we really know of the origin and fate of the chemical

products which take part in the metabolism of the normal as well as the abnormal organism. However, Professor Hunter has succeeded in throwing light even on this field, and this with remarkable caution.

Reference must also be made to the bibliography of 30 pages and the excellent index, which seems to be free of error, which can very rarely be said of the indexes to scientific books. M. NIERENSTEIN.

FERTILISERS AND FEEDING STUFFS ACT, 1926. By H. J. JOHNS. Pp. 185. London: Butterworth & Co. Price 10s. 6d. net.

This book reproduces the Fertilisers and Feeding Stuffs Act, 1926, and also contains an explanation of many of its provisions. As the author was the secretary of the various committees whose work finally resulted in the Act and its Regulations, there probably was no one more fitted for the task of writing an explanatory work on the provisions of the Act.

The responsibilities and duties of a seller, and the necessary steps to be taken by a purchaser to avail himself of the protection afforded by the Act, are clearly set out. Few can deny that the provisions of the Act are cumbersome. But in the sale of fertilisers and feeding stuffs there appear to be so many interests involved, that to render fraudulent sales punishable, without great inconvenience to the trade generally, presents an almost insurmountable difficulty. Therefore, marks, statutory statements, and labels containing particulars, etc., came into existence, and whilst the introduction of these terms may have been difficult to understand in the past, the necessity and the reason for them is made clear, and the duties of the manufacturer and merchant respecting them outlined in the work.

Probably to the analyst the most important pages dealing with the main provisions of the Act are those which contain a tabled summary of offences. It cannot be denied that, unless close touch is kept with the Act, difficulty will be experienced in ascertaining what omissions, etc., constitute an offence, and what action should follow an offence after detection. The summary referred to above gives very concisely the necessary procedure in all circumstances. The Schedules of the Act are printed in full and are self-explanatory. The Regulations made under the Act occupy nearly 40 pages, and they contain the practical portion of the work devolving upon an official agricultural analyst. The analytical processes contained in the Regulations of the Fertilisers and Feeding Stuffs Act, 1906, have been, to a large extent, reproduced in the more recent Regulations, but in a number of instances alternative processes have been included. The work terminates with an appendix containing the circular letters which have been distributed by the Ministry.

The book is of unquestioned importance to all officers concerned with the administration of the Fertilisers and Feeding Stuffs Act. It lucidly explains the provisions of the Act and embodies all the official information relative thereto, to date. F. W. F. ARNAUD.