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ANALYTICAL EXAMINATION OF ACORNS AND HORSE CHESTNUTS.

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IN view of the interest at present attaching to hitherto unused or little known sources of starch, we consider it may be of interest to place on record the results of a series of analyses of the common horse chestnut (*Æsculus hippocastanum*) and acorn (*Quercus robur*).

THE HORSE CHESTNUT.—A certain amount of work has been published on the horse chestnut, but mainly in connection with the study of the glucosides. The carbohydrates have not received much attention, due, no doubt, in a measure, to the difficulties which early workers experienced in the estimation of such substances as starch. In Weende's *Jahresbericht* (1857, 2, 84) chestnuts are stated to contain 17 per cent. albuminoids and 35 per cent. of starch. Jaquelin (*Centralb. Agric. Chem.*, 1879, 8, 952) found 28 per cent. of starch, 11 per cent. of cellulose and pectin, 0.1 per cent. of fat, 4 per cent. of resin and oil; 1.25 per cent. of mineral matter, 12 per cent. dextrin, 1.6 per cent. sugar, and 42 per cent. of water. J. Hanamann (*Bied. Centralb.*, 1885, 14, 263) gives the following maximum and minimum values for partially dried horse chestnuts:

	Water.	Protein.	Fat.	Matter convertible into Sugar.	Starch.	Ash.
Maximum ..	10.2	8.7	7.1	76.4	35	2.5
Minimum ..	7.1	6.6	5.1	72.9	28	2.2

E. Laves (*Chem. Centralb.*, 1903, ii., 1133) found 77.2 per cent. of "extract substances free from nitrogen" in the dried nuts; of this amount 50 per cent. consisted of insoluble carbohydrates, 14 per cent. of cane sugar, 13 per cent. of glucosides, and 0.2 per cent. of tannin. B. Tomei (*Chem. Centralb.*, 1904, ii., 346), working

on freshly peeled chestnuts containing 53.75 per cent. of moisture, found 0.5 per cent. of dextrose and 8.01 per cent. of starch.

S. J. M. Auld (*J. Soc. Chem. Ind.*, 1913, **32**, 173) investigated the horse chestnut from the point of view of a feeding material for farm animals. He found that the total nut with a moisture content of 3.04 per cent. contained 73.97 per cent. of "non-nitrogenous extractive matter." This, however, was a figure obtained by "difference," and no actual estimation was made of the carbohydrate content.

In a paper entitled the "Utilisation of Horse Chestnuts," recently published by A. Goris (*Comptes rend.*, 1917, **165**, 345-348), the following percentage composition of the kernel is given: Fat 2 to 3, nitrogenous matter 6 to 7, starch 20 to 30, besides bitter substances of the saponin group and colouring matters; but, contrary to the statements of some authors, the chestnut does not contain æsculin or tannin. Owing to the medicinal properties of the saponins, and their bitter flavour, pulp or flour obtained from the kernel cannot be used as foodstuff without a treatment to remove them. For this purpose the author recommends washing with dilute acid—*e.g.*, a 0.1 per cent. solution of hydrochloric acid—by which treatment yields of 20 to 25 per cent. of white, odourless, and tasteless flour have been obtained in the laboratory. The starch, he states, might serve for the production of alcohol or even as food. Factories for the production of starch from horse chestnuts were formerly installed in the neighbourhood of Paris, but they were not remunerative, owing to the cost of labour and transport.

THE ACORN.—The composition of the acorn has been the subject of but little investigation. In the 1903 edition of König's handbook figures are given for moisture, protein, fat, fibre, and ash, but no mention is made of the carbohydrates present. In Wehmer's "Die Pflanzenstoffe," 1911, p. 138, the following percentage composition is cited: Fat 3 to 4, tannic acid 7, sugar 7, starch 37, fibre 3, water 32.

EXPERIMENTAL.

During the last few weeks we have examined samples of fresh chestnuts and acorns. The entire fruit of the chestnut as growing on the tree consists of 67 per cent. by weight of outer green husk and 33 per cent. of nut. The nuts are made up of 22 per cent. of brown skin and 78 per cent. of kernel (cotyledons). The whole nut (integument and cotyledons) contains 44 per cent. of water, of which 37 per cent. is found in the skin and 46.5 per cent. in the kernel. A ton of nuts, as collected, but without the green shells, will yield about 15.5 cwts. of kernel (with its moisture content), equivalent to about 8 cwts. of dry kernel. The average weight of an undried nut is 10.27 grms.

The acorn as picked from the tree consists of 16 per cent. of shell with 43.7 per cent. of moisture, and 84 per cent. of kernel with 46.4 per cent. of moisture; the whole acorn contains 46 per cent. of moisture. A ton of fresh acorns yields 16.75 cwts. of kernels, corresponding to about 8.5 cwts. of dry kernel. The average weight of the undried acorn used in our experiments was 5.67 grms.

The nuts and acorns were prepared for analysis by peeling, grating, and drying at 55° C.; they were then finely ground in a handmill. Four different samples of chestnuts and two of acorns were analysed.

	Peeled Chestnuts.				Peeled Acorns.	
	1.	2.	3.	4.	1.	2.
Moisture	2.6	3.5	1.85	2.4	1.45	3.32
Ash	2.9	2.8	2.45	2.77	2.25	2.70
Matter extracted by Ethylic Ether (Oil)	6.1	5.0	7.1	7.2	5.0	4.7
Protein N X 6.25	9.8	10.8	7.25	7.62	6.65	7.5
Reducing Sugars as Dextrose ..	3.6	9.1	3.29	1.6	4.9	8.18
Cane Sugar	8.1	11.1	7.27	17.5	1.9	0.1
Starch (Lintner)	47.8	21.9	42.8	42.2	57.1	55.7
„ (Taka Diastase)	38.4	15.2	39.0	38.2	44.3	43.40
Pentosans	4.75	—	—	5.44	3.2	—
Crude Fibre	2.0	—	—	2.6	2.2	2.28
Matter Soluble in Cold Water ..	34.9	48.4	32.56	36.2	13.2	17.24

Ash.—In the chestnut and acorn 90 per cent. of the total mineral matter is present in the aqueous extract.

Protein.—The solubility of the protein appears to vary considerably; thus, in chestnut No. 3, 30 per cent. of the total is soluble in cold water, and in No. 4, 70 per cent. In acorn No. 2, 20 per cent. only of the protein is soluble.

Sugars.—The reducing sugar (dextrose) and cane sugar were estimated in the water-soluble portion of the nuts. The cane sugar was estimated by the Clerget, citric acid, and invertase methods, and the results agreed well amongst themselves; the Clerget figures were, however, distinctly higher than the others, due probably to the hydrolysis of some of the cellular tissue, to which we will refer later. The striking variability in the cane sugar content of the chestnut may possibly be correlated with the degree of ripeness.

Starch.—Starch was estimated in the nuts, after they had been extracted with ether and water, by W. A. Davis's method, using taka diastase (*J. Agric. Sci.*, 1916, 6, 152; ANALYST, 1914, 39, 312), and also by the Thorne and Jeffers modification of the Lintner process (ANALYST, 1909, 34, 332). The first-mentioned method affords results which are probably, as will be seen later, a correct measure of the starch present, the Lintner values being somewhat high.

We endeavoured to find the reason for the discrepancy, and there is little doubt that it is due to the action of the cold hydrochloric acid on matter insoluble in water which is not starch. Some of this material was isolated by boiling the finely divided nuts with water and removing the starch by diastase; the treatment was repeated, the resulting product boiled with water and filtered, washed with alcohol and dried at 100° C. This material, which amounts to 13 per cent. or more of the dried chestnut kernels, swells up in presence of water to an extremely bulky jelly-like mass. It is apparently one of the constituent parts of the membranes enclosing the groups of starch granules. When analysed one sample of the dry material was found to have the following composition:

Protein	..	..	..	12	per cent.
Crude Fibre	..	..	..	27.3	„
Ash	..	..	..	2	„
Pentosan	..	..	..	21.4	„

On hydrolysis with 1.25 per cent. H_2SO_4 for half an hour under a reflux condenser, the reducing sugar was found to be 13 per cent., calculated as xylose. No glucosazone was obtained on heating the hydrolysed products with phenylhydrazine acetate.

When some of this material is treated in the cold with hydrochloric acid, under the conditions of the Lintner starch estimation, a reading was obtained equivalent to 15 per cent. of starch. In this connection it will be remembered that Davis (*J. Soc. Chem. Ind.*, 1916, **35**, 201), and Revis and Burnett (*ANALYST*, 1915, **40**, 429), have pointed out that matters are extracted from plant materials by acid whose optical activity introduces an error.

In using Davis's method we experienced considerable difficulty in getting all the starch into solution, and in most cases a second gelatinisation and treatment with taka diastase were necessary before the whole of the starch was converted.

Pentosans.—These were estimated as furfural by the Fehling reduction method previously described by us (*ANALYST*, 1916, **41**, 294). In the case of the chestnut 16 per cent. of the total pentosan was found in the aqueous extract.

Soluble Matter.—This was estimated in the aqueous solution. On adding up all the estimated soluble matters and deducting the sum from the total soluble matter found, there remains a difference varying from 9.5 to 23 per cent. in the case of chestnuts and 2.8 to 5.3 with acorns. We thought it possible that some of this undetermined matter was of a glucosidal character, and we therefore subjected an aqueous and an alcoholic extract of the chestnut and acorn to prolonged hydrolysis with 3.5 per cent. hydrochloric acid. In no case was any increase in the reducing power obtained, as compared with that found after inversion. Similar instances of soluble matters unaccounted for occur in malt, cocoa, etc.

Enzymes.—In the course of the examination of chestnuts we found they were possessed of considerable diastatic activity. The aqueous infusion of the nuts prepared by pounding the ground nuts with water possessed a very slight liquefying but a decided saccharifying action towards potato-starch paste.

A 2 per cent. solution of soluble starch was prepared, and some of the clear aqueous infusion of the nuts added. The conversion was maintained at 50 to 55° C. for three hours and allowed to cool overnight. The control experiment consisted of keeping the filtered aqueous infusion of the chestnuts under similar conditions of time and temperature. When analysed the conversion products, after the necessary corrections, had a specific rotatory power of $[\alpha]_{D3.93} = 148.7$, and a reducing power of $R_{3.93} = 76.1$ per cent. of maltose. The iodine reaction was blue. The conversion products were evaporated and poured into strong alcohol. From the alcoholic filtrate crystalline maltose of 95 per cent. purity separated and yielded the characteristic maltosazone. No insoluble osazone (dextrosazone) was observed.

It is apparent from these results that the diastase of the chestnut resembles

that of an ungerminated cereal. The products of the action appear to be amylo-dextrin and maltose (*cf.* J. L. Baker, *J. Chem. Soc.*, 1902, **77**, 1177).

Acorns are in marked contrast to the chestnuts, and very little action was observed when the ground nuts or their aqueous infusion was allowed to act upon soluble starch. No evidence could be obtained of the presence of a liquefying diastase.

On allowing a number of acorns to germinate until growth was well advanced, no change in the character of the diastase found before germination was observed.

Invertase was looked for with negative results in the chestnut and germinated acorn, but there was a slight indication of its action in the ungerminated acorn.

Microscopical Appearance of Acorn and Horse Chestnut Starch.—Both of these starches are very uneven in shape, some granules being small and rounded, others large and irregular, with numerous intermediate graduations in size and shape. Both have well-defined *hila* and feebly developed concentric striations. The average maximum diameter of the granules of the acorn starch is 6 to 25 μ , and of the horse chestnut 10 to 40 μ .

One of the most obvious uses for chestnuts and acorns at the present time is as a source of alcohol.

Since both the acorn and chestnut contain considerable quantities of carbohydrates soluble and insoluble in water, it is obvious that they are of value as a source of the various products of fermentation. In the case of one of these—*viz.* ethyl alcohol—we obtained the results shown below. The ground nuts were boiled with 2 per cent. H_2SO_4 under a reflux condenser for three hours, then filtered and the filtrate neutralised. The solution of sugar was then fermented for three to four days with washed brewers' yeast.

		<i>Yield of Alcohol per Cent.</i>	
		On Dry Peeled Kernel.	On Nuts as Picked.
Chestnut 1		27	11.5
" 4		27.3	11.6
Acorn 1		27.5	12.7
" 2		26.1	12.0

These percentages of alcohol are in agreement with the theoretical yield as calculated from the sum of the starch, cane sugar, and reducing sugars found by analysis, and are equivalent to a yield of 32 to 36 gallons of absolute alcohol per ton of the nuts as picked.



ABSTRACTS OF PAPERS PUBLISHED IN OTHER JOURNALS.

FOOD AND DRUGS ANALYSIS.

New Feeding-Stuffs used in Germany during the War. M. Kling. (*Landw. Jahrbuch, Bayern*, 1916, 6, 483-513; through *Int. Rev. Sci. Prac. Agric.*, 1917, 8, 892-899.)—A large number of new feeding-stuffs or substitutes have been placed on the German market since the war; analyses of some of the more important of these materials are as follows:

	Moisture.	Proteins.	Fat.	Nitrogen-Free Extract.	Crude Fibre.	Ash.
	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Rhubarb leaves	90.02	2.78	0.40	3.86	1.04	1.90
Ground dry seaweed ..	11.82	6.50	3.43	41.93	20.00	16.32
Straw fodder (with yeast and molasses)	10.82	10.75	0.32	44.99	28.10	5.02
Ground maize ears ..	9.83	3.40	0.32	49.91	34.17	2.37
Heather stalks	9.50	4.15	3.00	45.38	35.47	2.50
Ground sugar-beet seeds	—	11.63	4.42	—	—	8.96
Parsley seed	11.50	13.75	23.40	36.04	6.50	8.81
Wild radish husks ..	6.90	10.00	6.78	43.32	30.40	2.60
Brewers' grain and yeast	7.18	30.80	5.63	37.58	13.63	5.18
Washed wine yeast ..	60.33	12.86	5.47	3.80	14.62	2.92
Ground grape pips ..	13.40	10.00	7.00	35.16	29.52	4.92
Beech-nut cake	16.35	18.50	4.40	28.88	19.67	11.20*
Walnut cake (with shells)	9.55	9.50	9.00	46.29	23.70	1.96
Feeding meal (chaff, straw, grape residues, etc.) ..	9.60	7.00	2.73	39.22	29.28	12.17

* 6.5 per cent. is sodium chloride.

Other feeding-stuffs, some of which are satisfactory, consist of various mixtures of such substances as maize ears, acorns, bran, seeds of weeds, seaweed, potato pulp, crushed bones, beetroot slices, earthenut husks, etc. W. P. S.

Estimation of Bran in Flour and Bread. R. Legendre. (*Ann. Falsific.*, 1917, 10, 293-296.)—Two grms. of flour and 3 grms. of crumbs of the bread made from it are put into test-tubes with 10 c.c. of water and 10 c.c. of phosphoric acid (sp. gr. 1.453), and the tubes heated for an hour in an autoclave at 120° C., and cooled. The contents are then poured on to silk sieves (No. 120 or 100) previously moistened, and the residual brans washed with a jet of water until the washings are quite clear, and then washed back into the test-tubes, where they are allowed to separate or are centrifuged. The amounts of the two deposits should be practically equal. In the case of products such as macaroni or semolina the samples should be allowed to absorb water before the test, and the tubes should be left longer in the autoclave.

For quantitative work it is necessary to estimate the amount of water in the flour and bread, and to wash the bran with water, alcohol, and ether before drying and weighing. The method affords a rapid means of ascertaining whether a baker is supplying bread in accordance with the present regulations. The author states that in some instances part of the flour is being sifted to produce white bread, and the bran added to the remainder of the flour.

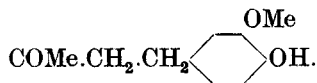
C. A. M.

Acid Content of Fruits. W. D. Bigelow and P. B. Dunbar. (*J. Ind. and Eng. Chem.*, 1917, **9**, 762-767.)—The acid present in apples, bananas, cherries, peaches, persimmons, plums, quinces, and water-melons is malic acid; citric acid predominates in cranberries, currants, and raspberries, but traces of malic acid are sometimes present. Gooseberries contain both malic and citric acid, whilst pomegranates contain citric acid alone. In the case of pears, only malic acid is found in some varieties; in others citric acid predominates. The actual quantities of the acids found vary greatly for one and the same fruit; for instance, apples contain from 0.16 to 1.68 per cent. of malic acid, and pears from 0.08 to 0.55 per cent. Traces of acids other than citric, malic, and tartaric, occur in many fruits, and it is possible that, in certain fruits, they may be present in considerable quantity.

W. P. S.

Detection of Citric Acid and Tartaric Acid. T. C. N. Broeksmit. (*Pharm. Weekblad*, 1917, **54**, 686-687, through *J. Chem. Soc.*, 1917, **112**, ii., 429.)—Citric and malic acids are oxidised by a solution of potassium permanganate in acetic acid to acetone, which can be identified by the iodoform test. The two acids can be distinguished by the fact that barium citrate can be crystallised. The acetone reaction is applicable to the detection of citric acid in tartaric acid and in lemonade syrup. The presence of tartaric acid in citric acid and in lemonade syrup can be proved by the formation of potassium bitartrate.

Pungent Principles of Ginger. Part I. A New Ketone, Zingerone (4-Hydroxy-3-methoxy-phenylethyl Methyl Ketone), occurring in Ginger. H. Nomura. (*J. Chem. Soc.*, 1917, **111**, 769-776.)—Thresh gave the name "gingerol" to the pungent principle of ginger, and Garnett and Grier (*Pharm. J.*, 1907, **25**, 118) claimed to have isolated it. The new ketone "zingerone" was obtained by extracting ginger with ether, a yield of 0.04 per cent. on the original material being obtained. On cooling and continuous agitation with a minute quantity of the solid ketone the oil solidified to a somewhat brown mass which melted at 40° to 41° C. after recrystallisation from light petroleum. The colourless crystals thus purified were found on analysis to have the formula $C_{11}H_{14}O_3$, the constitution of the new ketone being—



It yielded monobenzoyl and monoacetyl derivatives, and the existence of one methoxyl group in it was proved. By the reduction of the condensation product of

vanillin and acetone a substance identical with the new ketone was obtained, and its identity was further proved by comparing its benzoyl derivative and the oxime of its methyl ether with the corresponding derivatives of the naturally occurring ketone. Zingerone gives a red coloration with Millon's reagent, dissolves to a green-coloured solution with alcoholic ferric chloride, and reduces ammoniacal silver nitrate solution on warming. There is no visible decomposition on shaking the ketone with 2 per cent. sodium hydroxide for several hours. The phenylhydrazone and semicarbazone were not obtained in the pure state, owing to the instability of the compounds and the small quantities of ketone available for the preparation. In addition to the benzoyl derivative the preparation of several other derivatives is described.

H. F. E. H

Pungent Principle of Ginger. Part I. The Chemical Characters and Decomposition Products of Thresh's "Gingerol." A. Lapworth, L. K. Pearson, and F. A. Royale. (*J. Chem. Soc.*, 1917, **111**, 777-790.)—Garnett and Grier (*Pharm. J.*, 1907, **25**, 118; and the *Year-Book of Pharmacy*, 1909, 344) re-examined the pungent oleo-resin, gingerol, and simplified and improved the method of isolation used by Thresh (*Year-Book of Pharmacy*, 1879, 426; 1884, 516; *Pharm. J.*, 1882, **12**, 721). The present authors carried out their experiments with a large sample of an alcoholic extract of African ginger, which is the most pungent variety on the market. Even the best samples of the fractionated gingerol were almost certainly not homogeneous materials, and it is suspected that there is a tendency to polymerisation or to decomposition into simpler products. The purest samples obtained were distilled in a cathode-ray vacuum and passed over almost completely between 135° to 140° C. in the form of a clear, faintly yellow oil. Analysis of the best samples of gingerol obtained showed carbon 71.5, hydrogen 9.3, and are indicative of a purity of only about 75 per cent. The sole derivative of gingerol which was obtained in a definitely crystalline form was its monomethyl derivative, and as this was easily purified, whilst the purity of gingerol cannot be guaranteed, all conclusions as to the true composition of "gingerol" have been based on an examination of "methyl-gingerol." From the oily residue left from passing steam through the distilled gingerol there was obtained by shaking with aqueous sodium hydrogen sulphite a new ketone, for which the name "Zingerone" is proposed, having the formula $C_{11}H_{14}O_3$ (see preceding abstract), which when pure is a colourless solid dissolving freely in most of the usual organic solvents, with the exception of petroleum, and crystallises from ether in needles, rhombohedra, or large, lustrous plates melting at 31° to 34° C. It has a distinct sweet odour resembling salicylaldehyde, together with an extremely pungent taste like that of ginger itself. When warmed with concentrated mineral acids (best with hydrobromic acid), it gives a striking colour reaction: the liquid, at first faintly yellow, passes through brownish-yellow, reddish-brown to brown, then becomes opaque purple and blue in thin layers, and ultimately deep purple; on careful addition of alkali the colour becomes blue, then faintly green, and then nearly colourless. It is but slightly volatile in steam and dissolves but sparingly in water, but freely in dilute aqueous sodium or potassium hydroxides, being reprecipitated by carbon dioxide. In alcoholic solutions it gives a green colour with

ferric chloride. Zingerone has a phenolic character and is optically inactive in alcohol or benzene. Its ketonic character is evidenced by the ready formation of a crystalline phenylhydrazone (melting-point about 143° C.) and semicarbazone (needles, melting-point about 103° C.). Experiments are described which fix the composition of "zingerone" as 4-hydroxy-3-methoxy-phenylethyl methyl ketone, the oleo-resin gingerol being essentially a mixture of optically active saturated phenolic compounds derived from the residue of zingerone in association with a molecular proportion of the residue of a saturated aliphatic aldehyde which in the main constituent is *n*-heptaldehyde.

H. F. E. H.

Pungent Principles of Ginger. Part II. Synthetic Preparations of Zingerone, Methylzingerone and Some Related Acids. A. Lapworth and F. H. Wykes. (*J. Chem. Soc.*, 1917, **111**, 790-798.)—The paper describes the synthesis of methylzingerone from veratraldehyde and acetone, and some simple direct syntheses of the allied compounds hydroferulic acid and hydrocaffeic acid. Hydroferulic acid is prepared by condensing vanillin with diethyl malonate, which on subsequent treatment yields vanillylmalonic acid, and on heating hydroferulic acid. An analogous process applied to protocatechualdehyde instead of vanillin gives hydrocaffeic acid. It would appear certain that the presence of the free phenolic hydroxyl group is essential to the pungency of gingerol, zingerone, and similar compounds (see preceding abstracts).

H. F. E. H.

Comparison of Methods for the Estimation of Glycyrrhizin in Licorice Root and in *Succus Liquiritiae*. A. Linz. (*Arch. Pharm.*, 1916, **254**, 65-134, 204-224, through *J. Chem. Soc.*, 1917, **112**, ii., 430-431.)—It is only within the last ten years that the importance has been emphasised, rightly, of estimating, in addition to the glycyrrhizin, the amount of sugar, in order that adulteration of *licorice* with sugar may be detected. Since the amount of glycyrrhizic acid (glycyrrhizin) varies between wide limits, not only in different kinds of *licorice*, but even in one and the same kind at different times, the author used always the same *licorice* throughout his series of comparative experiments on the trustworthiness of the twenty-seven methods proposed for the estimation of glycyrrhizic acid. In any method, attention must be given to the following points: (1) the influence of the liquid employed as a solvent of the *licorice*; (2) the nature of the acid used as the precipitant; (3) the solubility of glycyrrhizic acid in water and in the precipitant, and the loss caused thereby; and (4) the purity of the glycyrrhizic acid when brought to the stage of weighing. All the methods are criticised from these four points of view, and the author draws the conclusion that no one of them is really trustworthy, mainly on account of the impossibility of isolating the glycyrrhizic acid in a pure state. Details are given of a method proposed by the author, which, although tedious and not strictly trustworthy, is less inaccurate than any other previously brought forward. A tabulated list of the literature on the subject from 1808 to 1913 is given, together with a classified list of the results obtained by the twenty-eight methods discussed in the paper.

Distribution of Nitrogen in Beer. J. S. Sharpe. (*Biochem. J.*, 1917, **11**, 101-111.)—The total nitrogen was estimated by the Kjeldahl method on 10 c.c. of the sample; it was found that no nitrogen existed as nitrates or nitrites. The protein nitrogen was estimated on 25 c.c. of the sample, evaporated to half bulk, cooled to 10° C., after which 10 per cent. tannic acid solution containing 2 per cent. phosphoric acid was added until no further precipitate was formed. Unless phosphoric acid is present, tannic acid alone may bring down bases along with the protein; a large excess of tannic acid must be avoided, about four volumes to one of sample is sufficient. Lead acetate, which usually precipitates the proteins, was not found satisfactory, as only about half the nitrogen was thus thrown out as compared with the tannic acid method; it is suggested that the metallic salts of plant proteins may be more soluble than those in the corresponding animal series. Acetate of copper and phosphotungstic acid must not be used for protein nitrogen, as both these reagents precipitate purine and basic bodies. The amino-acid nitrogen was estimated by the van Slyke method; amide-nitrogen is included in the figures given. The presence of purine bodies was proved by the following tests:

(1) The murexide test; (2) precipitation by ammoniacal silver nitrate and magnesia mixture; (3) precipitation after adding copper sulphate and sodium bisulphite; (4) the intense blue colour produced on adding phosphotungstic acid reagent (Folin) to the material made alkaline with sodium carbonate.

The estimation of uric acid was carried out by the new method of Folin and Denis (*J. Biol. Chem.*, 1913, **14**, 95). It involves the precipitation as a silver magnesium compound with subsequent treatment by the phosphotungstic acid reagent and comparison of the colour produced with a standard. The xanthine-like purines were determined by a modification of the Salkowski method for urine (*J. Chem. Soc.*, 1895, **2**, 538). The proteins were removed by lead acetate, the lead being then removed by sulphuretted hydrogen. The phosphates are next removed from the filtrate by magnesia mixture, after which ammoniacal silver nitrate is added, and the resulting precipitate filtered off and suspended in water, decomposed with hydrogen sulphide, and filtered. The filtrate is evaporated to a syrup and the residue treated with a little water containing 2 per cent. of sulphuric acid, which dissolves the xanthine bases, leaving the uric acid practically insoluble. The purine bases are then reprecipitated by ammoniacal silver nitrate, and either estimated by the quantity of silver in the precipitate or by the quantity of nitrogen given by the Kjeldahl method. Xanthine seems to form the greater bulk of these more soluble purines. Hypoxanthine, adenine, and guanine were tested for, but none of these was found; methylpurines were in every case absent. The total solid matter in the beer was obtained by evaporation, and the carbohydrate, after precipitation of the protein by Wiley's mercuric nitrate method, was determined by the polarimeter, the whole being calculated to dextrin. The results thus obtained are slightly low, due, according to the author, "to the maltose present having a slightly less specific rotation than dextrin." Maltosazone crystals were obtained, but no glucosazone. Lævulose was tested for with negative results (Selivanov's resorcinol test). The figures for a number of beers are given, in which the total nitrogen, protein nitrogen, amino-acid nitrogen, purine nitrogen, and the residual undetermined nitrogen, are

recorded, together with the apparent gravity, total solid matter, and carbohydrate (dextrin). The following table shows the percentage on the total nitrogen of the nitrogen combined in various forms:

	<i>Protein N.</i>	<i>Amino N.</i>	<i>Purine N.</i>	<i>Undetermined N.</i>
Tennent's Lager Beer ..	15.1	42.5	40.0	2.4
Draught Beer	37.0	24.5	33.2	5.3
Bass's Pale Ale	13.2	35.7	46.4	4.7
Younger's Pale Ale ..	25.8	46.0	25.8	2.4
Worthington's Indian Pale Ale	15.9	25.4	52.4	6.3
Allsopp's Special Stout ..	21.4	33.8	35.7	9.1
Guinness's Extra Stout ..	25.0	—	—	—

An examination of the undetermined nitrogen showed the presence of an alkaloid which seems to belong to the pyridine group. Many of its reactions are typical of "coniine," which was found by Chapman in hops (*J. Chem. Soc.*, 1914, **105**, 1895). The percentage found varied from 0.012 to 0.007 per cent. The total protein content of the beers examined varied from 0.038 to 0.185 per cent.; amino-acid nitrogen from 0.014 to 0.04 per cent.; nitrogen combined as purine compounds from 0.01 to 0.039 per cent.; while the undetermined nitrogen varied from 0.001 to 0.005 per cent. The percentage of undetermined nitrogen is not quite made up by the addition of the nitrogen combined as alkaloid and base (Betaine). Stouts appear to contain the largest amount of alkaloid; basic nitrogen amounts to only 0.0002 per cent.

NOTE BY ABTRACTOR—The original gravities of these beers are not recorded.
H. F. E. H.

BACTERIOLOGICAL, PHYSIOLOGICAL, ETC.

Biological Examination of Honey. J. Gadamer and K. Laske. (*Arch. Pharm.*, 1916, **254**, 306-345, through *J. Chem. Soc.*, 1917, **112**, ii., 395-397.)—One of the most difficult tasks of the food analyst is to prove the genuineness of bee-honey by chemical analysis, especially since solutions of very pure invert-sugar with or without raffinose, which can be used to adulterate natural honey or to prepare artificial honey, have become easily obtainable. Fiehe's reaction, which detects hydroxymethylfurfural in commercial invert-sugar, is not conclusive, and methods based on the estimation of the nitrogen and albumin in natural honey are easily evaded. Langer has shown that the honey albumin is quite independent of the plant visited by the bee, and the authors investigated the precipitin method of testing honey. Suitable anti-sera (0.2 to 0.5 c.c.), the preparation of which is described in detail, were mixed with 1 c.c. of 1 to 10 per cent. honey solutions, of 10 per cent. artificial honey solution, of 10 per cent. starch syrup solution, also 0.5 c.c. of normal dog serum was mixed with 1 c.c. of 10 per cent. honey solution;

each mixture, after the addition of one drop of toluene, was vigorously shaken and kept at 37° C. for five hours, the tubes were centrifuged (1,500 revolutions per minute) for five minutes, and the volume of the precipitate (if any) read off in millimetres. It was found that (1) preservation of the liquid during the time of the experiment is unnecessary. The presence of toluene causes the formation of emulsions and renders a quantitative separation of the precipitate by centrifuging impossible. In the absence of toluene, quantitative results are obtained. (2) An absolute constancy in the activity of the precipitating serum cannot be claimed. Different anti-sera give approximately equal amounts of precipitate, and the variations are not so great as to render the method inapplicable for quantitative purposes. (3) With a given anti-serum, the amounts of precipitate obtained from 2 per cent. and 1 per cent. solutions of a honey are by no means comparable; therefore, in examining a honey by the biological method, only the values obtained with a 10 per cent. solution should be utilised. (4) The amount of precipitate obtained from a given honey and the same anti-serum is the same during the period of one year. A specimen of genuine honey which had been kept for eleven years gave, however, only a very small precipitate. The authors are of opinion that the precipitin reaction has a real quantitative value. All honeys which fail to give a precipitate with honey albumin anti-serum are to be regarded as not genuine bee-honeys. If a precipitate is obtained and its amount corresponds with that obtained from the control honey, the honey under examination is genuine. If the amount of the precipitate is smaller than that given by the control, the honey under examination is either genuine honey which has been heated or honey which has been adulterated. The original paper contains numerous tables of results and concludes with a bibliography of the subject.

Mannan Content of the Gymnosperms. A. W. Schorger. (*J. Ind. and Eng. Chem.*, 1917, **9**, 748-750.)—Mannan, which yields mannose on hydrolysis, is present in all conifers (*Gymnospermæ*), but not in hardwoods (*Angiospermæ*: basswood, maple, birch, ash, aspen). The amount of the carbohydrate found in various species of pines varies from 1.5 to 9.2 per cent., but is usually about 5 or 6 per cent. (of the drywood); the quantity in the sapwood is generally larger than that in the heartwood. The presence of mannan in woods is of technical importance in the production of ethyl alcohol from sulphite liquor and by the hydrolysis of sawdust with catalysers.
W. P. S.

ORGANIC ANALYSIS.

Sensibility of the General Method of Extraction of Alkaloids from Water. L. Launoy. (*Compt. rend.*, 1917, **165**, 360-362.)—If 200 c.c. of the aqueous solution be rendered alkaline with sodium carbonate, extracted twice with 10 c.c. and once with 5 c.c. of chloroform, the chloroform extracts united and evaporated to dryness, the residue taken up in 1 c.c. of 10 per cent. sulphuric acid, divided into three portions, and tested with Bouchardat's, Tanret's, and Sonnenschein's reagents respectively, positive results will be obtained in every case if the original 200 c.c. of water contained as much as 0.1 mgrm. of aconitine, atropine, brucine, cocaine, colchicine,

eserine, pilocarpine, strychnine, veratrine, or conicine—that is to say, the test will detect these alkaloids in a dilution of one in two millions. G. C. J.

Estimation of Dextrose. G. Frerichs and E. Mannheim. (*Arch. Pharm.*, 1916, 254, 138-148, through *J. Chem. Soc.*, 1917, 112, ii., 393-394.)—The authors prefer Rupp and Lehmann's iodimetric method of estimating reducing sugars to the Fehling-Soxhlet method, and deny Ruoss's statement that the iodimetric estimation of the excess of the cupric salt remaining after Fehling's solution has been partly reduced by a sugar solution yields untrustworthy results, owing to the action of oxidised sugar compounds on the liberated iodine. They find that the substances produced from the sugar by the action of the alkaline copper solution have no action on iodine. The table published by Rupp and Lehmann giving the number of mgrms. of dextrose corresponding with a given consumption of $\frac{N}{10}$ thiosulphate has been incorrectly calculated, and the authors give a list of corrected values. Details are given of the application of the method to the determination of dextrose in urine.

Examination of Lubricating Oils. R. Dubrisay. (*Ann. Falsific.*, 1917, 10, 301-304.)—For determining the viscosity of lubricating oils the author employs a simple viscometer consisting of a pipette with two bulbs of a capacity of about 2 c.c. each, and having its point curved round upwards. On the stem are three marks: one, A, above the upper bulb; another, B, just below this bulb; and the third, C, just above the lower bulb; and a rubber tube with a pinch-cock is attached to the upper end of the pipette. When charged with oil, the pipette is immersed for some time in a cylinder of water at the required temperature, and is then raised so that the mark C coincides with the surface of the water. On opening the pinch-cock the oil flows into the water, and the time, in seconds, which it takes to flow from A to B affords a measure of the viscosity. The results thus obtained with various types of lubricating oils were comparable with those obtained by the use of a standard viscometer (Barbey's *ixometer*). C. A. M.

Estimation of Nitrogen in Nitro-Compounds. A. P. Sachs. (*J. Soc. Chem. Ind.*, 36, 915-916.)—The following modification of the method of Colver and Prideaux (*ANALYST*, 1917, 247), in which the reduction is effected in a sealed tube at 120° C., obviates the low results due to the incomplete reduction by the stannous chloride under the original conditions. About 0.2 gram. of the sample is weighed into a thin-walled glass tube, about 8 inches in length by $\frac{3}{4}$ inch in diameter, which is sealed at one end. After the introduction of 15 c.c. of stannous chloride solution (350 grms. of the salt in 700 grms. of 25 per cent. hydrochloric acid) the tube, together with blank tubes, is heated in an oven for two hours at 120° C., being meanwhile shaken at intervals of fifteen minutes to prevent deposition of carbonaceous matter. The tubes are left to cool, the tips then broken off, the contents washed out and made up to 100 c.c., and 10 c.c. of the liquid titrated with $\frac{N}{10}$ iodine solution (1 c.c. = 0.0002335 gram. of nitrogen). In test experiments the following results were obtained: *Nitrobenzene*—combustion 11.38 per cent., reduction 11.26 and 11.37 per cent.; *mononitrocymene*—combustion

7.89 per cent., reduction 7.88 per cent.; *m*-dinitrobenzene—combustion 16.67 per cent., reduction 16.66 per cent.; nitrated solvent naphtha—combustion 13.54 per cent., reduction 13.47 and 13.62 per cent. of nitrogen. The method is particularly suitable for routine analysis, but, as a check, an occasional blank test should be made upon a substance of known nitrogen content. C. A. M.

Percentage of Resin [Mineral Matter, and Nitrogen] in Raw Rubber.

Communication of the Netherlands Government Institute for advising the Rubber Trade and Industry. (*India-Rubber J.*, 1917, **54**, 260-261; through *J. Soc. Chem. Ind.*, 1917, **36**, 1055.)—The apparatus used for the determination of the acetone extract or the "resinous matter" of rubber is a modified Berntrop extractor; in this the extraction thimble containing the finely divided rubber is suspended by two threads which are gripped between the cork and the mouth of a wide-necked flask, the thimble actually hanging in the boiling solvent for the first two to three hours, and then being raised so as to be thoroughly washed out for one to two hours longer by the acetone falling from the condenser. For the final removal of the acetone a glass tube is introduced into the flask in place of the paper cup. The results obtained by this method accord well with those yielded by the Soxhlet extractor; for 35 samples of plantation Hevea sheet the average percentage of "resin" was 2.89, an average of 2.88 being obtained with 102 samples of plantation Hevea crêpe, whilst with hard fine Para rubber the average is also near 3 per cent. The observation of Hinrichsen and Marcusson (*ANALYST*, 1910, **35**, 131) that the resins from *Hevea brasiliensis* rubbers are optically inactive, whereas those from rubbers of other botanical origin possess optical activity, is confirmed; a difference between rubbers of various botanical origin also exists not only in the percentage of resinous matter, but also in the extent to which these resins are saponifiable; thus hard fine Para, Hevea sheet, Hevea crêpe, Castilloa, Congo, Jelutong, Dyera crêpe, and oxidised cut sheet rubbers yielded respectively 3.0, 1.8, 3.2, 18.9, 4.4, 38.1, 7.2, and 60.5 per cent. of resins, of which respectively 25.4, 48.3, 22.0, 73.7, 68.3, 83.2, 77.8, and 2.4 resisted saponification.

In comparative experiments on the extraction of balata with various solvents, higher yields of extractive matter were obtained with alcohol than with acetone; ether gave results generally exceeding those obtained with alcohol, and the addition of alcohol to the ethereal extract caused the formation of a white precipitate. Determinations of the proportion of constituents of balata insoluble in xylene indicated that these constituents coincide to some extent with those soluble in the above extraction solvents such as alcohol. With gutta-percha the alcoholic extract is lower than the acetone extract, and the conclusion is drawn that acetone is the most suitable solvent for the extraction of resins from balata and gutta-percha, the extraction being effected for three hours in the liquid and two above the liquid with the Berntrop apparatus.

The average ash for 35 samples of Hevea sheet was 0.38 per cent., and that for 102 samples of Hevea crêpe 0.30 per cent.; individual figures may range from 0.15 to 0.65 per cent.; wild Para rubber yields approximately the same proportion of ash, which, however, unlike the ash from plantation Hevea, always contains a fairly

large amount of iron, the origin of which is uncertain. In Hevea rubbers produced by evaporation of the latex the ash figure is higher, exceeding 1.5 per cent., and reaches 1.2 per cent. or more even after the rubber has been washed. Bleaching with sodium bisulphite appears to be without influence on the ash content of plantation rubbers. In inferior qualities of plantation rubbers the yield of ash may exceed that stated above on account of the presence of sand, which may be detected in the ash.

For the estimation of nitrogen in rubber by the Kjeldahl process the acid used is a mixture of sulphuric acid (sp. gr. 1.84) and phosphorus pentoxide in the proportions of 1 litre to 200 grms.; 30 c.c. of this mixture, together with one drop or 0.6 gm. of mercury, are taken to 1 gm. of the rubber; the subsequent procedure is as usual, distillation of the ammonia being effected after the addition of caustic soda solution containing sodium sulphide. Applying the commonly accepted conversion factor 6.25, the average content of protein matter in Hevea sheet or crêpe is 2.82 per cent. Rubbers produced by evaporation processes contain a higher proportion of protein, the values obtained ranging from 4.7 to 5.4 per cent.; Para rubber, however, generally gives results below 3 per cent., and sometimes even under 2 per cent., so that either the Para process is not one of simple evaporation or the composition of Brazilian latex must differ from that of plantation latex. From the observation that nitrogenous matter is invariably found in the acetone extract, although to a varying extent with rubbers of different origin, it is probable that only part of the nitrogen present consists of protein. A small quantity of nitrogenous material is also removed on extracting rubber with water at 100° C.

Polarimetric Estimation of Starch in the Presence of Other Optically Active Substances. C. Baumann and J. Grossfeld. (*Zeitsch. Untersuch. Nahr. Genussmittel*, 1917, **33**, 97-103; through *J. Chem. Soc.*, 1917, **112**, 223-224.)—The method described is recommended for products containing starch paste, dextrans and sugars. It is based on the fact that raw or soluble starch is completely precipitated by lead tannate when the latter is formed in the starch solution. Ten grms. of the material under analysis are shaken with 75 c.c. of water in a 100 c.c. flask for fifteen minutes, or for one hour if dextrans are present, and then treated with 5 c.c. of 10 per cent. tannin solution followed by 5 c.c. of basic lead acetate solution, and made up to 100 c.c. with sodium sulphate solution; 50 c.c. of the clear, filtered liquid are heated with 3 c.c. of 25 per cent. hydrochloric acid for fifteen minutes in boiling water, and, after cooling, treated with 20 c.c. of 25 per cent. hydrochloric acid and 5 c.c. of sodium phosphotungstate solution (containing 12 grms. of sodium phosphate and 20 grms. of sodium tungstate per 100 c.c.), made up to 100 c.c. with water, filtered and polarised in a 200 mm. tube. Another portion of 5 grms. of the original material is heated directly with hydrochloric acid (Ewers, *ANALYST*, 1908, **33**, 101, 481), and after addition of a further 20 c.c. of the acid and clarification with sodium phosphotungstate the filtered solution is polarised. To calculate the percentage of starch in the material the difference between the two polarimetric readings is multiplied by 5.444, a factor based on average value of $[\alpha]_D = +183.7^\circ$ for the specific rotatory power of various starches. The error of the

method does not exceed 0.2 per cent. when applied to materials containing 10 to 60 per cent. of starch together with large proportions of sucrose, dextrose, dextrans, milk, etc.

INORGANIC ANALYSIS.

Eggertz Test for Combined Carbon in Steel. J. H. Whiteley. Pp. 104. (*J. Iron and Steel Inst.*, 1917; advance proof.)—A method is described for the estimation of small amounts of carbon dioxide by absorption in ammoniacal barium chloride solution. By means of the above method the carbon content of the gases evolved in the Eggertz test was ascertained. The principal gas, carbon dioxide, is given off at a decreasing rate during several hours' heating, in amounts closely proportional to the percentage of carbon in the steels, irrespective of heat treatment except in the case of austenitic samples. A suggested new method, based on this reaction, is described. Hydrocyanic acid is slowly evolved also and originates during the solution of the sample; its amount is independent of the heat treatment and manganese or nitrogen content of the steel, but shows unaccountable variations. Only a very minute amount of hydrocarbon (and possibly carbon monoxide) is evolved when the test solution of either a normal or a quenched steel is heated. A steel containing 1 per cent. of combined carbon will yield, in the first ten minutes' boiling, 22 per cent. of the carbon as carbon dioxide, 5 to 10 per cent. as hydrocyanic acid, and 2 to 3 per cent. as hydrocarbon gas. Contrary to the results of Osmond and Werth, the "missing" carbon is not evolved as hydrocarbon or other compound in the gases; its presence in the solution is confirmed by oxidation with permanganate.

The colloidal nature of the colouring matter and the existence of two colouring compounds (or groups of compounds) are shown by the examination of the solution of the precipitate by dialysis. The two substances are termed A and B, the latter being formed from the former by the action of nitric acid; both react with the iron in the solution, which causes a change of tint and, in the case of the substance B, a large increase in the amount of colour. The rates of colour-decay on heating the test solutions and solutions of the colouring substances A and B are determined, and it is shown that the green body B is slowly changed to a colourless (or only slightly colouring) compound. The presence of colourless substances in the tests of both quenched and normal steels is also demonstrated, a greater proportion being present in quenched steel tests, and as "missing" carbon these substances are shown to be formed on dissolving. In both cases the colourless products increase in relative amount on boiling. Several reasons are given for regarding the green colouring matters present in the solutions of both normal and quenched steels as identical. Variations in the colour-values of different steels, when compared with the true carbon content, are shown to be brought about in at least two ways, one by delay in the solution of the precipitate and the other by the early formation of excess of colourless products. These two effects may overlap and their separate amounts cannot often be ascertained. The influence of the size of the carbide in the steel on the Eggertz test results has been studied. The particles of the brown precipitate are shown to resemble in shape the carbide particles from which they are formed;

as the carbide decreases in size the precipitate is more gelatinous and yields greener tints. Reasons are given showing that the presence of a green tint in the solutions of ordinary steels does not necessarily indicate the presence of "hardening" carbon in the steel. Experiments in which the steel was dissolved under varying conditions of electro-chemical attack showed that this influences the colour-value; increased voltage in some cases lowers the colour, while cold-worked samples generally give higher results.

A modification of the Eggertz test is given in which sulphuric acid is used. Variations in tint are thereby greatly reduced. The Eggertz results on quenched steels have been compared with the Brinell hardness numbers. No simple relation has been found. The Eggertz results have been correlated with the Brinell hardness of samples quenched and tempered at various temperatures. These show that the colour results are by no means simply related to the hardness. Comparison of the results given by the same steel when tempered and when air-cooled at varying rates shows that, for equal colour-values, the hardness is greater in the tempered steel, while the size of the carbide is much less. The colour-value of a steel is shown to be greatly influenced by the following:

A. The heat treatment and composition of the steel as they affect the size and shape of the carbide particles.

B. The electrolytic action in dissolving. As drillings usually give higher results than cut pieces, it is very probable that cold-work affects the result by changing the electro-chemical action.

Although the form in which the carbon exists in quenched steels has not been definitely ascertained, the evidence advanced throughout the paper strongly indicates that it is still present as cementite.

G. C. J.

Estimation of Carbonates. J. F. Barker. (*J. Ind. and Eng. Chem.*, 1917, 9, 786-787).—An instrument is described and illustrated by means of which carbon dioxide can be estimated within 0.1 per cent. on the sample, without the use of a balance. The instrument resembles a hydrometer spindle in shape, the stem being a graduated tube open at the top and extending to the lower half of the bulb, which is separated from the upper part, but can be put in connection with it by turning a cock. This upper part has a tubulure and stopper and is charged with 40 c.c. of hydrochloric acid (sp. gr. 1.15). It is then stoppered. The graduated stem, which is detachable about an inch above the bulb, is disconnected, and a 10-grm. weight, in the form of a T, the upright of which descends into the bulb, is used to sink the bulb in a vessel of water. The inch of non-detachable stem has several graduations, and that one on a level with the water is noted. The weight is removed and portions of the sample introduced into the lower half of the bulb through the stem until the instrument is once more immersed to the same mark. The graduated stem is now attached and water dropped into it until the zero mark is coincident with the water-level. The instrument is lifted out of the water, the cock connecting the two halves of the bulb is opened, and the instrument returned to the water. It gradually rises as the carbonate is decomposed, and when it comes to rest the percentage of carbon dioxide is read off directly from the division on the stem coincident with

the water-level. The maker's name is not given, but the instrument was designed by the author at the New York Agricultural Experiment Station, Geneva, N.Y. The cost of the outfit, when it is offered for sale, will be less than £2. G. C. J.

Solubility of Calcium Carbonate in Boiling Water. A. Cavazzi. (*Gazz. Chim. Ital.*, 1917, 47, 49-63.)—Various statements have been published of the solubility of calcium carbonate in water at 100° C., as, for example, 0.111 grm. (Frese-nius), 0.143 grm. (Pollacci), 0.034 grm. (Hofmann), and 0.036 grm. (Weltzien) per litre. The author's experiments show that this discrepancy is due to the fact that calcium carbonate is slowly dissociated by boiling water, with the loss of carbon dioxide. For this reason it is not possible to obtain a solution containing only calcium carbonate in boiling water. This dissociation does not continue indefinitely, and may be checked by adding to the boiling water in which the calcium carbonate is suspended about 15 c.c. of a solution of lime (saturated at the ordinary tempera-ture). The substance found in the solution after long-continued boiling of calcium carbonate with water consists almost entirely of free lime. Apart from the duration of boiling, other factors which have an influence upon the proportion of free lime which dissolves are the volume of the liquid and the concentration of the solution. The addition of a small quantity of sodium carbonate prevents the dissociation and the solution of calcium carbonate in boiling water. Advantage may be taken of this in estimating calcium in the form of carbonate. The precipitate is washed with boiling water containing 0.05 grm. of anhydrous sodium carbonate per litre. It is then treated with standard hydrochloric acid until completely dissolved, and the excess of acid titrated with standard sodium hydroxide solution, with methyl orange as indicator. The error due to the sodium carbonate solution retained by the precipitate (about 2 c.c.) is negligible. Calcium carbonate produced by chemical reactions in aqueous solutions at low temperatures forms supersaturated solutions, the stability of which depends mainly upon the concentration and the temperature.

C. A. M.

Determination of Explosibility of Pyrites and Estimation of its Available Sulphur and Sulphur in Cinders. C. R. Gyzander. (*J. Ind. and Eng. Chem.*, 1917, 9, 776-780.)—For the determination of explosibility, the author takes about 200 grms. of the sample, crushed to a definite size—for example, to pass a $\frac{7}{16}$ -inch screen but remain on a $\frac{5}{16}$ -inch. The sample is heated with a large Méker burner for thirty minutes and again screened. If explosible, some or even the whole of the sample will now pass a $\frac{5}{16}$ -inch screen. Further information is given by grading the exploded sample, weighing the fractions retained by various screens. The results are compared with those given by a sample the behaviour of which in the works is known. In the author's opinion, the only trustworthy method of esti-mating the "available" sulphur content is the determination of the rate of change of the ore under standard conditions, and comparison of the result with that obtained in a similar test with an ore that works normally and the available sulphur of which is known. For determining the rate of change, the author heats 2 grm. portions of the ore, crushed to 50-mesh, for varying intervals of time in an electric furnace

at 1,000° F. Convenient intervals of time for the purpose are fifteen, thirty, and forty-five minutes. The sulphur in the burnt pyrites is then estimated and the rate of change of the ore calculated for comparison with that of a normal sample.

G. C. J.

NOTE.—The explosibility is generally due to the occurrence of liquid CO₂ in small cavities.

Volumetric Estimation of Molybdenum and Vanadium in Steel. Travers. (*Compt. rend.*, 1917, 165, 362-364.)—The steel is dissolved in concentrated hydrochloric acid, or better in 5 per cent. sulphuric acid, and iron is oxidised by addition of solid potassium permanganate without using an excess, and separated by pouring the solution into boiling alkali hydroxide solution. The mixture is made up to known volume, filtered, and an aliquot portion taken for the estimation of molybdenum or vanadium. It is diluted and made acid with hydrochloric acid so that about 1 per cent. of free hydrogen chloride is present, cooled, reduced with an excess of a standard solution of titanous chloride, such that 1 c.c. = 0.001 gm. iron, and the excess of titanous chloride is estimated by titration with standard ferric chloride solution (1 gm. iron per litre) using thiocyanate as indicator. In solutions of the acidity prescribed above, MoO₃ is quantitatively reduced to Mo₂O₅ by titanous chloride, provided the concentration of molybdenum does not exceed 0.05 gm. per litre. With higher concentrations of either acid or molybdenum the re-oxidation of the Mo₂O₅ by ferric chloride ceases to be negligibly slow. Similarly, titanous chloride reduces V₂O₅ to V₂O₄. If both molybdenum and vanadium are present the method now described plus a direct estimation of vanadium enables one to estimate molybdenum with sufficient exactness (within 2 per cent. on the molybdenum). The author prepares titanous chloride by the action of carbon tetrachloride vapour on rutile at 450° C. The liquid distillate is acidified with concentrated hydrochloric acid, decanted from any carbon tetrachloride, and reduced with zinc. The presence of zinc chloride in the resulting titanous chloride solution is of no consequence.

G. C. J.

Estimation of Nitrate in Sewage by Means of *o*-Tolidine. E. B. Phelps and H. L. Shoub. (*J. Ind. and Eng. Chem.*, 1917, 9, 767-770.)—The method depends on the coloration obtained by the action of nitric acid on *o*-tolidine in sulphuric acid solution; the presence of chlorides favours the reaction. Twenty-five c.c. of the sample are boiled for thirty seconds with the addition of 0.5 c.c. of sodium hydroxide solution containing sodium chloride (5 grms. of sodium hydroxide and 1.5 grms. of sodium chloride per 100 c.c.), the mixture is cooled, and 1 c.c. of the clear liquid evaporated to dryness in a porcelain basin. To the residue is added 0.2 c.c. of *o*-tolidine solution (0.4 gm. of the substance in 100 c.c. of $\frac{N}{4}$ hydrochloric acid) and then 0.5 c.c. of concentrated sulphuric acid; after five minutes the acid is mixed with the other contents of the basin, 5 c.c. of water are added, the solution is transferred to a tube, diluted to 10 c.c., and the coloration obtained compared within

five minutes with standards made up at the same time and in the same way. The sewage must not contain free chlorine or hypochlorite.

W. P. S.

Determination of Ozone and Oxides of Nitrogen in the Atmosphere.

F. L. Usher and B. S. Rao. (*J. Chem. Soc.*, 1917, **111**, 799-809.)—This investigation arose from the observation that in tropical climates rubber articles and cotton and silk fabrics perish, and certain colouring matters are bleached far more rapidly than in temperate latitudes even when not exposed to light, and it was thought that some chemically destructive substance might be present in the air in greater quantity in hot climates. Such a substance might well be ozone, since its formation has been observed as the product of the action of ultra-violet light on oxygen—tropical sunlight being particularly rich in actinic power. The authors criticise adversely the analytical methods employed in previous work dealing with the estimation of ozone in the atmosphere (Hayhurst and Pring, *J. Chem. Soc.*, 1910, **97**, 868; and Keiser and McMaster, *Amer. Chem. J.*, 1908, **39**, 96). The principle of the method advocated by the authors depends on the reaction between ozone and alkali nitrite in aqueous solution, a reaction found to take place quantitatively according to the equation $O_3 + NaNO_2 = O_2 + NaNO_3$. Two samples of air are taken and collected in 7-litre stoppered bottles. One sample is admitted through two tubes containing respectively chromic acid and powdered manganese dioxide, and the other through a tube containing chromic acid only. The samples thus collected are shaken with a dilute standard solution of sodium nitrite made slightly alkaline, and the nitrite content of the bottles is subsequently determined colorimetrically by the Griess-Ilosvay method. The first sample of air contains only nitrogen peroxide, the ozone and hydrogen peroxide having been destroyed, and the increase in the quantity of nitrite in the bottle is equivalent to the nitrogen peroxide absorbed. The second sample contains ozone and nitrogen peroxide, and the difference between the quantities of nitrite in the two bottles after shaking is equivalent to the ozone present. The following facts were established in the course of the experiments: (1) When purified air is shaken with water or an aqueous solution for one hour no detectable quantity of ozone is produced. (2) Ozone at a great dilution is not appreciably destroyed when shaken with water for one hour. (3) Hydrogen peroxide present as vapour in air is completely destroyed by passage of the air, at a rate not exceeding 1 litre per minute, through a chromic acid tube. (4) Ozone is completely destroyed by passage through a tube containing asbestos-wool mixed with manganese dioxide. (5) Ozone is not affected by passage over chromic acid. (6) Nitrogen peroxide is not absorbed from air containing it by solid chromic acid or by manganese dioxide, provided the latter contains no alkali or manganous oxide. (7) $\frac{N}{400,000}$ sodium nitrite solution undergoes no alteration in strength by shaking for two hours with purified air. (8) If air containing nitrogen peroxide is passed through a tube of manganese dioxide (*a*) alone, and (*b*) with ozone, the amount of nitrogen peroxide recovered is in each case the same as that which was introduced.

The presence in air of traces of ammonia, sulphur dioxide, and hydrogen sulphide does not interfere with the estimation of ozone and nitrogen peroxide, since

all three gases are completely absorbed during passage through the chromic acid tube. Other impurities likely to be present in air are probably without any effect on the process. Chlorine or hydrochloric acid would make the estimation of nitrogen peroxide impossible, but would not affect that of ozone.

As the result of fourteen complete determinations it was found that on no occasion was any ozone present, and, with two exceptions, no one of the three substances looked for was found in a quantity exceeding 1 in 20 millions. Nitrogen peroxide was twice found to be present to the extent of 1 part in 5 millions and 1 in 4 millions respectively. The twelve negative results show the trustworthiness of the process adopted, for in spite of its delicacy (the Griess-Ilosvay reagent being sensitive to 1 part of nitrogen peroxide in 56 millions of air) it is possible to obtain, with care, concordant results. It is probable that ozone and nitrogen peroxide never occur together in the atmosphere.

H. F. E. H.

Estimation of Phosphorus in Cast Iron. A. Cavazzi. (*Annali Chim. Applic.*, 1917, 8, 1-6.)—A weighed quantity (5 grms.) of the finely divided sample is washed with ether, and treated with 60 c.c. of dilute nitric acid (1 : 1), finally with the aid of heat, until all action ceases. It is then mixed with 15 to 20 c.c. of dilute sulphuric acid (containing 8 to 9 c.c. of the strong acid), and gently boiled until a semi-solid residue is obtained and white fumes of sulphuric acid appear. The temperature is then raised so that the wire gauze beneath the basin is of a dull red heat. Under these conditions the ferric sulphate does not reach 210° C., although it could be heated to 350° C. without decomposition. During the heating it is stirred with a glass rod until the mass becomes friable and of a yellowish-grey colour, and no further acid fumes are emitted. It is then cooled and treated with 40 c.c. of a solution of 20 c.c. of strong hydrochloric acid, 5 c.c. of strong nitric acid, and 15 c.c. of water, and the solution gently boiled until concentrated to about a third of its volume, then diluted with 50 c.c. of water, cooled, and filtered. The residue of silica and graphitoid carbon is washed six times with water acidified with nitric acid, the filtrate and washings evaporated until viscous, treated with about 4 c.c. of nitric acid, and moderately heated so as to expel all traces of hydrochloric acid, without making the ferric sulphate difficult to dissolve in dilute nitric acid. After cooling, the paste-like mass is treated with 30 c.c. of a mixture of 5 c.c. of fuming nitric acid (sp. gr. 1.40) and 26 c.c. of water, or 15 c.c. of acid of sp. gr. 1.153 diluted to 30 c.c. with water, and the resulting solution diluted to about 50 c.c., treated with a solution of 15 grms. of ammonium nitrate in 25 to 30 c.c. of water, and heated to boiling. A boiling solution of 2 to 2.5 grms. of ammonium molybdate in 50 c.c. of water is now added, all at once, with constant stirring, and the mixture kept at 80° C. for about thirty minutes. The precipitate is washed four times by decantation with a solution of 25 grms. of ammonium nitrate and 20 c.c. of nitric acid (sp. gr. 1.153) in 500 c.c. of water, the washings being poured through a filter. It is then dissolved in 10 c.c. of dilute ammonia solution (1 : 2), and the solution treated with a solution of 5 grms. of ammonium nitrate in 20 c.c. of water and of 1 gm. of ammonium molybdate in 30 c.c. of water, then heated to incipient boiling, and treated with 20 c.c. of boiling nitric acid of sp. gr. 1.153. The phosphomolybdate

from this second precipitation is sufficiently pure for the analysis. It is allowed to stand for thirty minutes, filtered by decantation, and treated drop by drop with dilute ammonia solution (1:4) until dissolved, the filter being subsequently washed with water into the ammoniacal solution. After cooling, this solution is treated with dilute hydrochloric acid (1:3), until the precipitate only just redissolves when the liquid is stirred, and is then treated with 10 to 20 c.c. of magnesia mixture prepared by dissolving 55 grms. of magnesium chloride and 0.105 gm. of ammonium chloride in a litre of water containing a little hydrochloric acid, heated nearly to boiling, and treated, drop by drop with constant stirring, with dilute ammonia solution (1:4) until a slight turbidity appears and the odour of ammonia is perceptible. The liquid is now cooled, sufficient strong ammonia solution is added to increase the original volume of the solution by 20 to 25 per cent., and, after standing for thirty minutes, the precipitate is separated, washed, and converted into magnesium pyrophosphate in the usual way.

C. A. M.

Cobalti-nitrite Method for Estimation of Potash. R. C. Haff and E. H. Schwartz. (*J. Ind. and Eng. Chem.*, 1917, 9, 785-786.)—The authors estimate potash in natural silicates, cement clinker, and by-products of the cement industry, rich in potash, as follows:

The sample (0.5 to 2 grms., according to its potash content) is mixed with 0.2 to 0.5 gm. of ammonium chloride, transferred to a platinum crucible containing 2 grms. of calcium carbonate, covered with 2 grms. calcium carbonate, and ignited according to J. Lawrence Smith's directions. The product is slaked, extracted with hot water, and the filtrate acidified with 5 c.c. acetic acid and evaporated until odourless. The residue is taken up in a little hot water, 10 c.c. of the cobalt reagent are added, and the mixture evaporated to a pasty consistency. The reagent is made by dissolving 220 grms. sodium nitrite in 400 c.c. water, and 113 grms. cobalt acetate in 300 c.c. of water and 100 c.c. acetic acid; the solutions are mixed, the container exhausted and left overnight, and the mixture is finally diluted to 1,000 c.c.; it is kept in the dark and not used if over two weeks old. The cooled, pasty mass in the dish is taken up in 30 c.c. water, filtered off on a Gooch crucible, washed once with cold water, transferred to a beaker containing a measured and more than sufficient volume of $\frac{N}{5}$ permanganate and diluted to 250 c.c. The mixture is heated on a steam bath for fifteen minutes or until a decided black colour appears. It is then acidified with 10 c.c. dilute (1:1) sulphuric acid. A measured amount of $\frac{N}{5}$ oxalic acid, more than sufficient to react with the undecomposed permanganate, is added, and the solution titrated back with permanganate.

W. P. S.

Method of Incinerating Organic Materials for the Estimation of Potassium. P. L. Blumenthal, A. M. Peter, D. J. Healey, and E. J. Gott. (*J. Ind. and Eng. Chem.*, 1917, 9, 753-756.)—To prevent loss of potassium salts by volatilisation during ignition it is recommended that the organic substance be treated with nitric and sulphuric acids and evaporated to dryness before incineration. The quantity of sulphuric acid added should be sufficient to convert all the inorganic elements present into sulphates and also to act, in addition to the nitric acid, as an oxidising agent for the carbon.

W. P. S.

Bromine Content of German Potash Salts. L. W. Winkler. (*Zeitsch. angew. Chem.*, 1917, **30**, 95-96; through *Int. Rev. Sci. Prac. Agric.*, 1917, **8**, 841-842.)—The following percentage amounts of bromine were found in various German potash salts: Sylvine (six specimens), 0.118 to 0.300; Carnallite (thirteen specimens), 0.143 to 0.356; Sylvinite (three specimens), 0.085 to 0.331; Hartsalz (two specimens), 0.027 and 0.052; Bischofite, 0.467; Tachydrite, 0.438. W. P. S.

APPARATUS, ETC.

Apparatus for Electrometric Titration depending on the Change of Oxidation Potential. G. L. Kelley, J. R. Adams, and J. A. Wiley. (*J. Ind. and Eng. Chem.*, 1917, **9**, 780-782.)—The apparatus usually employed for this purpose consists of a number of separate parts, many of which are not well adapted for the purpose. In the apparatus now described, the parts have been selected to give the greatest efficiency in such work and are combined as a unit in a single instrument, which can be moved about the laboratory readily and requires for its operation only the connection of a plug with an electric-light socket. It is complete in that it carries a potentiometer system, a motor for the operation of the stirrer, and two burettes for the oxidising and reducing solutions. It consists essentially of a wooden box with a metal upright carrying the motor, burettes and electrodes. In the box are two dry cells, an adjustable resistance and a reflecting galvanometer of sufficient sensitiveness and very short period. On the upper surface of the box is a ground-glass plate on which the light from the galvanometer is thrown. A knob on top of the box permits of adjusting the zero point of the galvanometer and one on the side controls the resistance. A plug and resistance coil, also on the side, make it possible to vary the resistance and so increase the range of potentials over which the adjustable resistance may be made to operate. The standard carries the burettes, the electrodes and the motor for driving the stirrer. In addition, provision has been made for a reservoir of the electrolyte which is used in the calomel cell to make conveniently possible, without change in its potential, the displacement of the impure electrolyte which may have accumulated in the tip of the calomel electrode. This is accomplished by opening the stopcock at the top of the electrode enough to let one or two drops pass. A hard rubber pan, carried on an adjustable support, serves to centre the beaker in which the titration is made, and because of stops prevents carrying the beaker high enough to strike the electrodes or stirrer. Two switches are mounted on the box. One controls the motor and galvanometer light, and the other throws in the potentiometer circuit. All connections, except to dry cells, are soldered.

To operate the instrument, a beaker containing the solution to be analysed is placed on the rubber pan, and the support raised and locked in position. The switch controlling the galvanometer light and motor is then closed. The other switch closes the potentiometer circuit, and a slight turn of the knob controlling the resistance is sufficient to bring the beam of light from the galvanometer on to the scale. In titrating a series of solutions at one time, this latter adjustment need be made only once. During the operation, which is quick, certain and convenient, the

was screwed into the sieve support. By having two cylinders fitted snugly together as shown, and by removing the threaded part of the joint to the top of the combination, this loss has been completely eliminated. When the inner cylinder is screwed down tightly against the sieve, the contact surface between the two cylinders does not even become moist for more than $\frac{1}{2}$ to $\frac{3}{4}$ inch above the sieve, unless a large number of samples are run without stopping to clean the press. This style of construction also permits making the threads quite coarse, thereby facilitating the quick separation of the two cylinders for cleaning. The sieve, D, which is of steel, should have the $\frac{1}{16}$ -inch holes slightly countersunk on one side. For all except the most refractory materials, a very fine pulp can be obtained by placing a disc of thin perforated copper over the steel sieve, the latter being put with the countersunk side next the copper. Copper with holes of $\frac{1}{18}$ inch running 24 to the lineal inch serves well. This fine sieve has been used regularly in the preparation of potato samples, and gives equally good results with sugar beets and apples.

The press is described in greater detail in the paper, but the author makes an offer of blue prints of complete working drawings to anyone interested, as no arrangements have yet been made for the manufacture of the apparatus commercially. The press now in use was made at a cost of about £11 in the United States Navy Yard, Washington.

G. C. J.



GOVERNMENT REPORT.

REPORT OF THE COMMITTEE OF COUNCIL FOR SCIENTIFIC AND INDUSTRIAL RESEARCH.*

THIS is the Second Annual Report issued by the new Research Department, which, under all the disadvantages of the strain of war and the shortage of workers is trying to provide a permanent basis for research in this country and to co-operate with similar attempts in the Dominions.

The Report indicates that there are three ways of organising industrial research. The simplest is the case where a single firm can work out a problem and itself fully exploit the results. In most cases, however, problems of industrial research will concern many firms, sometimes many industries; they will require the expenditure of large sums of money and the co-operation of many workers for long periods of time. But, if successful, the results will be of immense value.

Most individual firms cannot undertake this long and costly process. Yet why should the State pay for the whole cost of winning new knowledge which will be valuable to business men? It is hoped that the way out of this dilemma will be found by the establishment of "trade research associations," to be constituted as needed for each industry or group of industries, on which are to be represented, when possible, capital, management, science, and labour, and which are to be aided out of the million grant to be administered by the Department for the express purpose

* To be purchased through any bookseller, or directly from H.M. Stationary Office, Imperial House, Kingsway, price 3d. (by post, 4d.).

of establishing such research associations. One association is just about to be constituted for the cotton industry; others are being brought into existence for the wool, flax, shale oil, and photographic industries.

There are also many cases where the problem is so complex or else so immediately concerns the consumer rather than the producer that co-operation between manufacturing firms is not possible. This is obviously the case with fuel. Hence the establishment of the Fuel Research Board, which, under the direction of a distinguished man of science, Sir George Beilby, will itself conduct research. So, too, with the problems of fire-resisting materials and the determination of standards and constants. All this is direct work for the whole community acting through its special organ of research. It is interesting in this connection that the Royal Society has recently negotiated with the Department the handing over of the financial responsibility for the conduct of the National Physical Laboratory, where investigations of national importance are constantly going on.

The main lines of policy of the new Department are being slowly worked out. But it is also not neglecting immediately pressing problems. In glass, for instance, a great deal has been already done; three completely new kinds of optical glass have been discovered by Professor Jackson. A research on light alloys (aluminium, zinc, copper) will be of the utmost importance for the future of aeronautics. A new hard porcelain from purely British materials has already been produced. Researches into the recovery of tin are expected to save the Cornish tin industry £30,000 a year. A large number of other researches are being aided or carried out by the Department.

The Universities will take their place in the new social tissue whose pattern is now being woven. At a considerable number of them researches aided or initiated by the Department are now going on. At the Universities, too, the future research workers receive their training; and thirty-six (who would otherwise have drifted into immediately remunerative work) were aided by grants from the Department in 1916-17.

The Report ends by noting the altered attitude of manufacturers and men of business towards the claims of research and education, and reiterates the conviction that a sure advance in industrial science can only be made when the field of work is adequately surveyed beforehand, and an organised plan of attack worked out.



REVIEWS.

REPORT OF THE ROYAL ONTARIO NICKEL COMMISSION, WITH APPENDIX. Printed by order of the Legislative Assembly of Ontario. Toronto, 1917. To be obtained on application to the Deputy Minister of Mines, Toronto.

After two years of assiduous labour, the Royal Ontario Nickel Commission, under the chairmanship of Mr. G. T. Holloway, has issued its Report, in the form of an important volume comprising some 920 pages. That this work is a storehouse of information on all matters concerning the occurrence and distribution of nickel

ores, the metallurgy of nickel, and the various industrial uses of the metal and its alloys and compounds, goes without saying, and there is little doubt that it will form the standard work of reference on these subjects for a considerable time to come. Of the conclusions reached by the Commissioners, by far the most important may be summarised by the statements that the nickel deposits of Ontario have nothing to fear in the way of competition from the known deposits of any other country, and that any of the processes now in use for refining nickel can be worked quite successfully in Ontario. Here it need only be said that these are the conclusions which have been reached by all previous independent students of the subject, and that their correctness can hardly be questioned.

Another conclusion of the Commissioners, that the present system of mining taxation in Ontario is just and equitable and is the best system for this Province, is more open to question; in dealing with this subject the Commissioners appear to have inquired less exhaustively than in most other portions of their task. For example, in discussing the methods employed in the various States of the United States of America they have overlooked entirely the method of the State of Wisconsin; they might have studied with much advantage the work of Mr. W. L. Aglow, "A Study of Methods of Mine Valuation and Assessment," which gives a careful comparison of various principles of assessment, and notably of the Finlay and the Equated Income methods. No doubt the subject of the assessment and taxation of mining properties presents many difficult problems, and it may well be that a rough-and-ready method such as is used in Ontario may sufficiently meet the case, but it is hard to see how any method can be described as "just and equitable" which treats mining properties on the same footing as ordinary assets and takes no account of the all-important fact that a mine is essentially a wasting asset. In dealing with the depreciation of plant and equipment, the Commissioners state their opinion that the present rate of 10 per cent. is too low, and that it should be 15 per cent.; they have, however, omitted to state whether they intend such depreciation to apply to the original value or to the diminishing value of the plant in question.

A very valuable section of the Report deals with the commercial uses of nickel alloys, and the careful study that has been made of the properties of nickel-steel and nickel-copper-steel should be productive of important results; a good account is also given of high-nickel steels, such as Invar, which are being increasingly employed for special purposes. Another very important section is that devoted to the metallurgy of nickel, including the refining of the matte, the various processes in use being well and clearly described.

It may safely be asserted that it would be a fortunate thing indeed for this country if all Royal Commissions would justify their existence by the production of work of as much national value as stands to the credit of the Royal Ontario Nickel Commission.

H. LOUIS.

It is with feelings of profound sorrow that the reviewer has to chronicle the death of the Chairman of the Nickel Commission, whilst the above review was passing through the press. To his personal sense of the loss of an old and valued friend is superadded the deep regret that British metallurgy should thus early be deprived

of the services of so able, earnest and conscientious a worker. The Report of the commission, particularly as regards the metallurgical portion, was largely Mr. Holloway's own individual work, and will remain as a monument to the high standard of his scientific and technical attainments.—H. L.

ARTIFICIAL DYESTUFFS. By ALBERT R. J. RAMSEY and H. CLAUDE WESTON.
London: George Routledge and Sons, Ltd., 1917. Price 3s. 6d. net.

While the undulations of the mannequin are not condemned as a national disservice, and petrol is still sometimes used for pleasure only, it may appear ungenerous to question the utility of another volume on artificial dyestuffs. At the present time, however, when scientific societies are called upon to pay three times the normal price for the paper on which original communications are presented to their members, the reading public is entitled to expect that new books should either relax the mind wholesomely or instruct it accurately.

With the best will in the world it is unfortunately not possible to say that the volume under review achieves one or other of these purposes with any success. The preface declares the authors' aim to be providing the foundation of the necessary knowledge for an understanding of the industrial processes involved in the manufacture of synthetic colouring matters, but the chemistry of the subject is presented loosely and inaccurately. Any good textbook would therefore be better for the student of chemistry, and the "business men who are interested in the development of the manufacture of artificial dyestuffs" could scarcely escape bewilderment by this one.

The graphic formulæ stand out as a prominent example of inconsistency. The authors do not appear to have made up their minds regarding the use of the benzenoid hexagon in the Kekulé form, and it is not at all clear from their description of the benzene ring that they fully grasp the idea which underlies this representation, for they state that "each carbon atom is linked to its adjacent carbon atoms by triple bonds." This is not the sense in which the expression "triple bond" is always employed, and the fact that this novel application is not a slip appears from the statement, made in connection with the azine group, that "each atom in this ring is linked to its neighbouring atoms by triple bonds." Another regrettable incident among the formulæ is one in which aminoazobenzene has been rather unlucky, being represented to the unwary student as a derivative of diphenyl, a peculiarity repeated later in connection with the disulphonic acid.

The method of introducing the subject of direct cotton dyes is misleading, as it would appear that they first came into prominence as derivatives of 2: 5: 7-aminonaphtholsulphonic acid, secondly in connection with primuline, and only casually in relation to benzidine and similar diamines, whereas the usual and chronological statement gives the benzidine derivatives priority.

The treatment of alizarin presents some depressing features. Referring to anthraquinonesulphonic acid, the authors use the following sentence: "This acid is obtained diluted with water, and is subjected to the action of a filter-press, and neutralised with caustic soda, and again passed to the filter-press." Moreover, the sodium salt, which is commonly known as silver salt, is here called "soda salt," in

inverted commas, whilst later, on the same page, a liquid is "run off and washed." It is perfectly true that liquids are sometimes washed, but this one is not.

Evidence of haste in preparing the volume is to be found in such mistakes as *p*-diaminodiphenylene for *p*-diaminodiphenyl, phosphorous for phosphorus, tetramethyldiaminodiphenylmethane for tetramethyldiaminotriphenylmethane, economic for economical, oxidability for oxidisability, sulphurous acid for sulphuric anhydride, diazo for disazo, and triazo for trisazo; the hoary misrepresentation of the anthracene formula, familiar to all those who have to correct examination papers in elementary organic chemistry, is also to be found in this book.

M. O. FORSTER.



LAW REPORT.

The Sale of Milk. Andrews v. Luckin. High Court of Justice, King's Bench Division. (*The Times*, October 26, 1917.)—This case stated by Justices for the borough of Hastings raised a question of the liability of the vendor of milk under the Sale of Food and Drugs Acts.

Mr. J. A. R. Cairns appeared for the appellant; the respondent was not represented.

An information was preferred by the appellant, an inspector of nuisances for the borough of Hastings, against the respondent, a farmer, for that on May 18, 1917, he (the appellant), in the borough of Hastings, did procure at the place of delivery—Hastings railway station—a sample of milk in course of delivery by the respondent to one Frowd, the purchaser thereof, in pursuance of a contract of sale, and upon analysis such sample was found to be not of the nature, substance, and quality of the article demanded, but had been sold to the prejudice of the purchaser within section 3 of the Sale of Food and Drugs Acts Amendment Act, 1879.

The Justices dismissed the information.

At the hearing it was proved or admitted:

(1) That the appellant in his official capacity attended at Hastings Station on May 18, 1917, and was present when a train arrived bringing a churn of milk consigned from the respondent to Frowd. The churn was about to be delivered by the respondent to Frowd under a written contract of sale under which it was provided, *inter alia*, that milk should be delivered twice daily at Hastings railway station, that railway charges should be paid by the respondent, and that the respondent warranted the quality of each delivery;

(2) That the appellant took a sample of milk from the churn, and upon analysis the sample was found to be deficient in fat and in solids other than fat;

(3) That the churn of milk was conveyed by an employee of the respondent to Hellingly railway station, nineteen miles from Hastings, and was left there as usual, and was subsequently conveyed to Hastings by train;

(4) That the churn when it left the respondent's premises and when it was deposited at Hellingly Station contained genuine milk as it came from the cow;

(5) That the churn was not locked in such a way as to render it impossible for anyone to tamper with the milk while it stood at Hellingly Station or during transit by rail, and there was no evidence to show that it had not been tampered with between the time when it was left at Hellingly Station and its arrival at Hastings Station.

Under the Sale of Milk Regulations, 1901, issued by the Board of Agriculture, where a sample of milk contains less than 3 per cent. of milk fat it shall be presumed for the purposes of the Sale of Food and Drugs Acts, until the contrary is proved, that the milk is not genuine by reason of the abstraction therefrom of milk fat or the addition thereto of water. Under the same Regulations, where a sample contains less than 8.5 per cent. of solids other than fat there is a similar presumption that the milk is not genuine.

The milk in this case was deficient in both respects.

For the appellant it was contended (1) that the presumption under the Regulations had not been rebutted by the respondent, as there was no evidence to show what happened to the churn of milk from the time when it left Hellingly Station until its arrival at Hastings Station; (2) that the respondent's liability did not cease until the arrival of the milk at the place of delivery.

For the respondent it was contended (1) that the milk was genuine when it passed out of his control on being deposited at Hellingly Station, and that it was unreasonable to convict him in consequence of the lack of evidence as to what happened to the milk after it passed out of his control; and (2) that the analysis was consistent with the milk's being genuine milk as it came from the cow.

The Justices considered that as the milk was genuine milk as it came from the cow when delivered to the railway company the respondent was free from liability, and they refused to convict.

Mr. Cairns submitted that the respondent was liable to conviction; by the contract the property in the milk was not to pass until the churn reached Hastings Station.

JUDGMENT.

MR. JUSTICE DARLING said that the case ought never to have been stated, and would not have been if people would only take the trouble to look at the relevant authorities. The case was absolutely concluded by the judgments in *Parker v. Adler* (15 *The Times* Law Reports, 3; [1899] 1 Q.B., 20). The respondent was clearly liable to be convicted, and the appeal must be allowed.

The other members of the Court agreed.

Solicitors: Messrs. Lydall and Son, for Mr. Percy Idle, Hastings.

