THE ANALYST

Volume V

1880

W. Heffer & Sons Ltd.
Cambridge, England
Johnson Reprint Corporation
New York 3, New York

Reprinted photographically in Great Britain by
Lowe & Brydone (Printers) Ltd. for W. Heffer & Sons Ltd., Cambridge

Distributor for North Central and South America
Hawaii and the Philippines :

Johnson Reprint Corporation
New York 3, New York

The original numbers of *The Analyst* from which this reprint was produced were kindly loaned by T. McLachlan, Esq., D.C.M., A.C.G.F.C., F.R.I.C.

The Analyst,

INCLUDING THE PROCEEDINGS OF

THE "SOCIETY OF PUBLIC ANALYSTS."

A MONTHLY JOURNAL FOR THE INFORMATION OF THOSE INTERESTED IN THE PURITY OF FOOD AND DRUGS, AND IN GENERAL ANALYTICAL AND MICROSCOPICAL RESEARCH.

EDITED BY

G. W. WIGNER, F.I.C., F.C.S., LONDON AND AMERICA,

ONE OF THE

Hon. Secretaries of the Society of Public Analysts:

AND

J. MUTER, Ph.D., F.I.C., F.C.S.,

President of the Society of Public Analysts.

VOL. V.

1880.

LONDON:

Published for the Proprietors, by Messrs. BAILLIERE, TINDALL & COX,

King William Street, Strand, W.C.

INDEX.

M

N

O

P

T

U

V

W

Y

THE ANALYST.

JANUARY, 1880.

SOCIETY OF PUBLIC ANALYSTS.

The Annual Meeting will be held at Burlington House, on Wednesday, the 14th inst. The Annual Dinner will take place the same Evening. Particulars will be sent to Members as usual.

NOTE ON THE EXAMINATION OF COFFEE.

By Alfred H. Allen.

Read before the Society of Public Analysts, on 19th November, 1879.

In a series of articles on "Chemistry applied to the Detection of Adulteration," published during 1874 and 1875, I described three methods as likely to be of service for the approximate determination of chicory in samples of mixed coffee.* Since the date of their publication I have acquired a large amount of additional experience in their use, and have arrived at the following conclusions.

In brief, the three methods suggested as applicable for the determination of chicory in coffee were as follows:—

I. Determination of the soluble ash.

II. Comparison of the tint of an aqueous solution of the sample with that furnished by similarly treating a standard specimen.

III. Determination of the density of a 10 per cent. infusion in hot water.

With respect to Method I., which in the paper referred to was merely suggested as of possible value, experience has shown that it is only capable of furnishing results of the roughest possible kind. This fact is due to the variations in the percentage composition of the ash of both coffee and chicory, as well as to differences in its total amount. In twenty samples of roasted genuine coffee recently examined, the total ash varied from 3·78 to 4·87 per cent. This last result was very exceptional, the next highest being only 4·39 per cent., while the average of the whole twenty samples was 4·04 per cent.† The soluble ash varied in thirteen samples from 2·52 to 3·50 per cent., the average being 2·97 per cent. If the total ash be taken as 100, the highest proportion of soluble ash met with was 84 per cent., with the exception of the sample yielding 86 per cent., referred to in the above-mentioned paper. The lowest percentage of soluble matter found was 60 per cent. of the weight of the ash, while the average is 73·5 per cent.

These differences are in themselves sufficiently great, but they are exceeded by those exhibited by chicory, owing to the considerable and very variable proportion of silica present in the latter substance. The proportion of actual sand in commercial chicory varies from a trace, up to 4·5 per cent., a difference quite sufficient to invalidate deductions made from the proportion of soluble ash. By deducting the sand from the

* *Chemical News*, XXIX., 140.

† The total ash of coffee has been determined by Dragendorff, who found a minimum amount of 3·83 per cent. and a maximum of 4·87. The average ash of the twenty-five samples examined was 4·41. Why there should be so wide a difference between Dragendorff's and my own results I am unable to conjecture. I have no reason to suppose that partial volatilization has occurred.

total ash, and considering the number thus obtained to be the true ash of the sample, more concordant results are obtainable, but the variations are still too large to allow of the method being employed for any purpose beyond a check on the proportion of chicory in a mixture.

Method II., depending on the colour of the infusion, is capable of giving rapid and fairly reliable estimations of the proportions of chicory present in mixed samples, but in practice it is open to the very serious objection that a standard mixture of various coffees and chicories is apt to undergo a change which gravely affects the colour of the infusion. By comparing the infusion of the sample with a permanent coloured solution, such as can be prepared by mixing the sulphates of iron, cobalt, and copper in suitable proportions, the above-named annoyance and source of error may be wholly avoided, and the method again becomes very valuable. I am unable to perceive any advantage in the method of working suggested by Dr. Leebody* over that originally described by me.

Method III., which is based on the difference in the density of similarly prepared decoctions of coffee and chicory, is one which further experience has proved to be very valuable. The weak point in the method as originally suggested by Graham, Hofmann, and Campbell was that these chemists prepared their solution by treating a known weight of the sample with ten times the quantity of cold water, and then gradually raised the liquid to the boiling point. By operating in this manner there is no certainty that the sample will be completely exhausted, and hence accurate comparison of different samples is difficult or uncertain. As a matter of fact, I have reason to think that exhaustion of the sample is *usually* tolerably perfect, but it is evidently preferable to boil well, filter, and wash the residue with hot water till the filtrate measures 10 c.c. for every 1 gramme of the sample operated on.

By operating in the old manner, Graham, Hofmann, and Campbell obtained, from roasted coffee, 10 per cent. decoctions which varied in density (at 60° F.) from 1008·0 to 1009·05, the average of the eight samples being 1008·7, a result identical with the mean of those obtained by me in 1874.

By the exhaustion modification of the process, I have recently obtained the following results from genuine roasted coffee.

	Description of Coffee.	Density of Decoction.
1.	Plantation	1008·4
2.	,, ...	1008·0
3.	Fine Plantation	1007·1
4.	,, ...	1008·4
5.	Ceylon	1008·0
6.	Costa Rica	1008·1
7.	East India	1008·7
8.	Unknown origin	1007·1
9.	,, ...	1007·4
10.	,, ...	1008·2
11.	,, ...	1008·0
12.	,, ...	1006·8
13.	,, ...	1008·5
14.	,, ...	1007·8
		Mean 1007·9†

* *Chemical News*, XXX., p. 248.

† It will be observed that Graham, Hofmann and Campbell's method gives slightly higher density results than that by exhaustion. Either this is due to a change in the volume of the liquid, or more probably to a slight loss by evaporation when the infusion is made by raising the liquid to the boiling point, instead of making the bulk up after cooling.

These results show conclusively that the density of coffee infusions is remarkably constant, never exceeding 1009.

On the other hand, 10 per cent. decoctions of chicory are of considerably higher density, and exhibit greater variations among themselves. Thus: Graham, Hofmann and Campbell obtained :—

English Chicory	1021·7
Yorkshire „	1019·1
Guernsey „	1023·2
Foreign „	1022.6
Mean	1021·65

I have recently obtained by the exhaustion plan :—

Yorkshire Chicory, under roasted	1025·9
„ „ same sample, highly roasted	1019·0
Unknown origin	1021·1
„	1020·0
„	1023·4
Mean	1021·9

In calculating the proportion of chicory in a sample from the density of the infusion, it is of course desirable to err on the safe side, and this is done if we take the density of the chicory rather above than below the truth. From a consideration of the whole of the results, both recently and in 1874, I adopt 1023 as the normal density of chicory decoction, and by taking that of coffee at 1008·5, we cannot get far from the truth. If d be the ascertained density of the 10 per cent. decoction, and C be the percentage of coffee in the sample, then $C = \frac{(1023\text{-}d)\ 100}{14{\cdot}5}$

Practically, as close an approximation as the above is obtainable by reckoning 7 per cent. of chicory for every degree of density over 1008·5.

In practice, the determination of the density of the infusion may be employed to ascertain the purity of a sample of coffee, a very small admixture of chicory causing an appreciable increase. Of course, however, all such methods are, in the case of coffee, mere adjuncts to the microscopical examination, by which the smallest admixture of chicory can be detected with the greatest facility. Personally, I prefer to examine with the microscope the residue left after boiling the sample in water, the troublesome colouring matter being thus removed without in any way interfering with the characteristic structure of the particles of chicory.

One of the many beneficial results of the appointment of Public Analysts has been to render nearly obsolete the various additions to coffee that were once far from uncommon. I have never officially examined a sample of coffee containing any admixture other than chicory, though I have invariably looked for leguminous seeds, cereals, &c.

The search for cereals, leguminous berries, and foreign matters other than chicory, is most readily effected by boiling the sample with water and testing the strained solution for starch. The liquid is allowed to become perfectly cold, and is then mixed with dilute sulphuric acid, and a strong solution of potassium permanganate added gradually till the colouring matter is nearly destroyed. The addition of solution of iodine then

renders the recognition of any starch certain. There is no difficulty in detecting 1 per cent. in this way. A certain famous sample supposed to contain acorns gave no reaction by the above test, but after the addition of 2 per cent. of roasted acorns the test showed the presence of starch very clearly. In examining such a sample under the microscope, it is desirable first to extract all the fat with ether, and the colouring matter with methylated spirit, when the starch granules and other structures are readily perceptible.

The adulteration of coffee with mineral substances appears now to be completely obsolete, but I invariably determine the ash as a precaution.

The cold water test for chicory is convenient but occasionally misleading. As a preliminary test it is of some service.

In sorting coffees for further examination I now make the following tests :—

(*a.*) Treatment of the sample with hot water, and determination of the density of the 10 per cent. infusion, which should not exceed 1009.

(*b.*) Search for starch in strained infusion, which should give negative result.

(*c.*) Examination of the insoluble residue under the microscope.

(*d.*) Determination of the ash, which ought not to exceed 5 per cent.

Dr. Bartlett had had considerable quantities of chicory sent to him, and with the exception of four or five they had all been adulterated with some other matter. He had therefore endeavoured to set up a standard for himself, and had been quite puzzled, as the samples had varied so much more among themselves than was the case with the chicory itself. If they introduced charlot into chicory and coffee a difficulty was experienced. Where for the sake of cheapness coffee was adulterated with chicory, the chicory used would be very likely to be itself adulterated with charlot.

Mr. Hehner referred to the practice of adulterating coffee with ground date stones, and said the microscopical structure of ground date stones was not so very different from coffee, and that a mixture of coffee, chicory and date stones might give the same density as genuine coffee. As to charlot root there was one excellent test, and that is the taste. In the dried fragments it could be detected with great ease, but when once ground up it could not be detected so readily.

THE ANALYSIS AND COMPOSITION OF ENGLISH BEERS.

By T. A. Pooley, B.Sc., F.C.S.

The complete analysis of so complex a fluid as beer is attended with considerable difficulty, and the methods at our disposal are by no means so perfect as we might desire ; it is, however, a subject of considerable importance, and it is therefore surprising that so few analyses have been published. Our text-books give the compositions of several kinds of foreign beer, but the analyses of English beers have been few and far between, and relate principally to the determination of two or three of the principal constituents, such as the alcohol, extract, and ash. Believing that a comparative examination of various beers brewed in different parts of the kingdom under various systems and with a variety of materials would be interesting, I have lately occupied myself in performing such a series of analyses, and in this and some succeeding papers, it is purposed to lay the results obtained before the readers. The

object in view was to ascertain the exact proportions of all the more important constituents in the typical descriptions of beer brewed in this country, in order that a comparison may be made as to their respective values as foods and wholesome stimulants. Adulterants have not been especially sought for, as they are rarely, if ever, added by brewers, but the results may be of some value to brewers, who may, by comparing the analyses of beers taken direct from the brewery with those taken from retailers, be able to ascertain whether their products are offered to the public in the state of purity they ought to be. These investigations have been undertaken in no prying spirit, but simply to ascertain the exact composition of many varieties of beer; the results will naturally lead to certain deductions as to the nature of the materials used in the manufacture of each kind of beer, for that is one of the objects of the investigation, and it will be of considerable interest to trace the influence of the mineral constituents of certain brewing waters on the chemical composition of the resulting beers. This subject was taken up some time since by Mr. C. Estcourt, of Manchester, who read a paper upon the desirability of fixing some standards of value for beer, before the Society of Public Analysts at their meeting at Dublin last year,* but I cannot find that his investigations have been proceeded with; his results are, however, interesting, and I shall have occasion to refer to them again. Some analysis of Burton Ales and Dublin Porter were also made last year by Messrs. Lawrence and Reilly, and their results were communicated to the Royal Irish Academy. In the analyses which will be given in these papers, it is proposed to take a wider field, and to examine the products of many breweries in different parts of the country; for this purpose I have already either been supplied with, or promised, samples by many brewers, and I trust to the kindness of others in assisting me in the same way. No analysis of any sample of beer obtained from a brewery will be published without the consent of the proprietor, and the analyses of samples obtained from retail establishments will be described in the same way as they were bought.

To enter into a detailed and elaborate description of the processes employed in the analyses would be somewhat out of place in these pages. No claim is made to any originality of method, for as a rule, the best methods as laid down by well-known authorities on chemical analysis, have been closely followed, but when the exigency of the occasion require it, a modification has been introduced. The determinations usually made have been as follows:—Specific gravity—Original gravity—Carbonic acid—Alcohol—Extract—Acetic acid—Glucose—Dextrine—Lactic acid—Ash, including silica, ime, phosphoric acid and chloride of sodium—Nitrogen, and the corresponding quantity of albumenoid bodies.

The methods at our disposal do not enable us to determine with anything like precision the quantities of hop extract, resin and oil, or such substances as tannic acid, glycerine, and fatty bodies, and, therefore, except in a few particular instances these determinations have not been attempted. I will now describe in as short a manner as possible the general method of analysis employed, leaving to future papers some special remarks on the various precautions which have to be taken to ensure correct results.

Specific Gravity.—This has always been determined by the specific gravity bottle,

* THE ANALYST, vol. iii., p. 325.

and not by the saccharometer, as the last-named instrument scarcely gives sufficiently accurate results when great precision is required, on account of the impossibility of preventing the bubbles of carbonic acid gas from adhering to the bulb and stem of the instrument. The most convenient sized bottle is one holding 1,000 grains of pure distilled water at 60° F., which before use must be carefully cleaned and dried; although not absolutely necessary, it is convenient to have a weight which is the exact counterpoise of the bottle when empty; then by simply filling the bottle with the beer to be tested and weighing it, the specific gravity is ascertained. The bottle should be provided with a small stopper having a capillary tube through it; in this way great exactness of quantity can be ensured. It is of course of the utmost importance to take the specific gravities of different samples of beer at precisely the same temperature, and for this purpose 60° F. is the most usual standard, and the one I have always adopted. The specific gravity of English beers varies considerably between 1,003 and 1,012, but 1,012 is about the average.

Original Gravity.—This is the term employed to indicate the strength of the wort from which the beer was made, and is determined by the method which is now familiar to most brewers; it consists in distilling a known volume of the beer until at least one-half has distilled over, and then diluting both distillate and residue with distilled water to the same volume as that of the beer used; the specific gravity of each is then taken, and by reference to tables compiled for the purpose, the percentage of alcohol and extract can be ascertained; we are acquainted with the exact amount of malt extract necessary to produce a given quantity of alcohol, and therefore by adding this to the extract left after distillation, we arrive at the total extract originally present in the wort before fermentation. A correction has to be made for any acetic acid contained in the beer, but in sound samples this correction is very insignificant. Great care must be taken in observing temperatures, as the specific gravity of a fluid varies considerably with every alteration of temperature; 60° F. is the usual standard; and all the determinations of specific gravity referred to in these papers have been made at this temperature. The specific gravities have been taken by means of the bottle and not by the saccharometer, and the weighings have been made on a balance of very delicate construction. An error in taking the specific gravity of beer is liable to arise in consequence of the presence of excess of carbonic acid, and therefore it is as well always to make the determinations in the beer after it has been well shaken to remove the excess of gas.

Carbonic Acid.—This is a gaseous constituent which ought always to be present in beer, as the pleasant fresh taste of this beverage is due to this gas. The quantity varies very considerably; in bottled beer it is usually present in excess, but in cask beer the quantity is much smaller, and in some cases, where great flatness prevails, almost absent. The determination of carbonic acid is of interest under some circumstances, but as the proportion alters so rapidly when beer is exposed to the atmosphere, these determinations have but little value for the purpose of comparing one sample with another. In making an analysis of beer, it is well to previously remove any excess of carbonic acid gas by shaking the beer in a stoppered bottle until no further pressure is exerted on the stopper; in this way all the gas is not removed, but different beers are

brought to the same standard as far as relates to their gaseous contents, and the results then obtained have some value for comparison.

In the analyses that will be given in future papers, all beers will have been thus treated, except in some cases of which special mention will be made. In case the determination of carbonic acid is necessary, the following method may be employed. A known quantity of beer, say 100 cubic centimetres is placed in a good sized glass flask connected by means of a cork and bent tube with a vessel containing a quantity of a solution of hydrate of baryta. This vessel must be carefully protected from the atmosphere in order that no carbonic acid is absorbed from that source. Upon heat being applied to the flask, the gas is gradually expelled, and having to bubble through the baryta water is all absorbed, with the formation of carbonate of baryta, which, being insoluble in water, separates in the form of a white powder. After all the gas has been expelled, this precipitate is filtered off and washed thoroughly, and is weighed in a platinum crucible with the usual precautions; 197 parts of carbonate of baryta are equal to 44 parts of carbonic acid gas, and therefore by a simple calculation it is easy to ascertain the quantity of gas present in the 100 cubic centimetres of beer employed in the experiment. Great care must be taken that the gas is not given off too rapidly, otherwise some of it may escape absorption in the baryta water, and in filtering off the precipitate rapidity is important, otherwise there may be absorption from the atmosphere. As it is impossible on the present occasion to find space for the remainder of the description of the method of analysis employed, I will conclude with giving the results obtained with one sample of beer.

Analysis of sample of 4d. beer obtained from a publichouse in Messrs. Truman, Hanbury & Co.'s trade :—

Specific gravity of beer	1012·16	
,, ,, distillate	992·45	
,, ,, residual extract	1019·75	
Original gravity of beer	1050·97	= 18·36 lbs. per barrel.
Alcohol		4·200 per cent.
Total extract*		4·810 ,,
Acetic acid		·034 ,,
Carbonic acid		·132 ,,
Water by difference		90·824 ,,
		100·000 per cent.

*Total extract contains the following constituents :—

Glucose		1·390 per cent.
Dextrine		2·060 ,,
Lactic acid		·058 ,,
Ash containing Phosphoric acid	·046	·476
Ash containing Lime	·603	
Ash containing Chloride of sodium	·115	
Nitrogen	·029	
equal to albuminous substances		·204 ,,
Extractive matters of the hop, fatty bodies, glycerine, &c., by difference		·622 ,,
		4·810 per cent.

In the next paper the description of the method of analysis employed will be concluded, and further examples of the results obtained will be given.—*Brewers' Guardian.*

NEW METHOD OF DETERMINING IODINE IN THE PRESENCE OF CHLORINE OR BROMINE.

E. Donath.

(Zeitschr. f. Anal. Chem. XIX., p. 19).

A solution of pure chromic acid added to a solution of an iodide liberates the whole of the iodine, whilst it is without action upon chlorides or bromides. On distilling the liquid containing the precipitated iodine the whole of the latter readily passes into the distillate, wherein it can be determined by titration with standard hyposulphite.

25 c.c. of a solution of KI, which furnished 0·6210 and 0·6220 of Ag. I, and therefore contained on the average 0·3358 of iodine, was distilled with 50 c.c. of a chromic acid solution of 2½—3 per cent. strength, until no more violet vapours could be observed. The distillate required 26·2 c.c. of deci-hyposulphite, corresponding to 0·3327 grams of iodine. In two other experiments, 0.3352 and 0.3327 were obtained.

1 gram. of K. Br. distilled for a few minutes with 50 c.c. of the same chromic acid solution furnished a distillate which consumed but 0·2 c.c. of deci-hyposulphite solution. On continuing the distillation until about one half of the total liquid had gone over, appreciable quantities of bromine were present in the distillate; hence, the operations must be conducted with dilute liquids if bromine be present.

Neither K Cl nor Na Cl yielded the slightest quantity of chlorine.

Hence the method is well adapted for the separation of I. from Cl., and in a less degree from Br.

It is similar in principle with that described by *Duflos* (Apothekerbuch), and in which ferric salt is employed to liberate the iodine.

O. H.

REVIEWS.

How to Use a Galvanic Battery.

By Dr. Tibbitts. London: Churchill.

This small volume is more strictly medical than chemical, but the author has treated his subject in such a bold and masterly way, that it really takes it out of the domain of an exclusively medical work. Starting with the idea—in which we fully agree—that a medical man is perfectly qualified for his work without being an electrician, the author follows out his aim of giving a manual for those practitioners who desire to use electricity, which shall give general guidance for its judicious application to curative purposes. He lays special stress on the uselessness, and in some cases the injury which is effected by the reckless application of currents of unknown strength to delicate organs which have already been rendered over-sensitive by disease. It is true that the directions which Dr. Tibbitts gives are not nearly so complete as could be wished, but he has certainly succeeded in warning others against trying electrical experiments in reference to which they have but a small proportion of the information that he has evidently acquired; and he has the courage of his opinions in advising medical men, who know but little of the subject, to send their patients to professed electricians for the special treatment.

A Treatise on Waterworks for the Supply of Cities and Towns.

By S. Hughes, C.E. London: Lockwood & Co.

This is a reprint of an old book with additions. We might, perhaps, find fault with the title, as it is scarcely complete enough. An ordinary reader would hardly search for information as to geological strata, and for tabulated statements as to a large number of the most important deep wells which have recently been sunk, in a book bearing this title, and yet the information compressed under these heads is of the most valuable character for reference, and is put together in such a form as to be easily available. The sections on pumping machinery, gauging rivers and streams, and filtration on a large scale do certainly belong specially to waterworks, and they are as complete and satisfactory in their way as the others to which we have alluded. The book is a very useful one and well worthy to hold a place in Weale's well-known series.

Lectures on Infectious Diseases, Air, Sewage, &c.

By Dr. J. Russell and Dr. W. Wallace. Glasgow: Maclehose, St. Vincent Street.

It is very seldom that a Town Council orders the printing of any lectures or other book which contain really valuable scientific information, but in this case we have a marked deviation from the ordinary rule. The volume under notice consists of lectures which were delivered by Dr. Russell and Dr. Wallace, at Glasgow, in the latter part of 1878, and which have now been published for more general circulation. The part with which we have to do relates more especially to the four lectures by Dr. Wallace on Air, Water, Sewage, and Food. He has treated his subjects in a thoroughly careful way, and, as far as the limits of space would allow, in an exhaustive manner. There are many points in connection with the Food lecture which are well worth careful reading, and show that the lectures have not been published simply as ordinary matter intended to instruct the masses, but as chemical studies, including a considerable amount of genuine work. The lecture on Sewage necessarily contains less original matter, because the subject has been so thoroughly threshed out during the last ten years. that there really is nothing to be said until some one invents a new process. Dr. Russell's lectures are illustrated with a few enlarged micro-photographs, such as human blood in various stages of disease, which are well worth attention.

REMARKABLE EXPLOSIONS.

Explosion of a Diamond.—At a recent meeting of the Academy of Natural Sciences of Philadelphia, Professor Leidy exhibited a black agate sleeve button, which had set in it centrally, raised in a gold setting, a rose diamond, about 7mm. broad. It had been submitted to him by Mr. Kretzmar, a jeweller, who informed him that the person who wore it was recently leaning with his head upon his hand on a window ledge in the sun, when the diamond exploded audibly and with sufficient force to drive a fragment into his hand and another into his forehead. On examining the diamond the fractured surface, following a cleavage plane, exhibited apparently the remains of a thin cavity such as is sometimes to be seen in quartz crystals. The fracture also exposed a conspicuous particle of coal. Professor Leidy thought that the explosion had been due to the sudden expansion of some volatile liquid contained in the cavity, as frequently occurs in cavities in many minerals. Mr. Goldsmith thought it possible that the liquid was carbonic acid, as he was impressed with the idea that diamonds originated from this material in the liquid condition.

Explosion of Carbonic Acid.—Attention was recently directed in the French Academy to a case of explosion of carbonic acid which occurred in July last in one of the coal pits of Rochebelle (Gard). The

coal strata there are much dislocated, and the carbonic acid, generated plentifully in the neighbourhood, and finding its way through natural passages, seems to have accumulated in certain parts with sufficient tension to explode with two loud detonations, driving a large quantity of fine coal into the galleries. Three men were asphyxiated, and two others were only able to throw themselves in a swooning state into the cage and be hauled up. That no flame was present (as in explosions of fire damp) is proved by the absence of burns on the bodies of the victims, the fact that blasting cartridges did not go off, &c. The gas is thought to have arisen from sulphuric acid (produced through oxidation of a stratified mass of pyrites) dissolving in subterranean waters, and finding its way down to triassic limestone.

In the works of M. Kuhlmann lately an alembic of platinum, about 90 centimètres diameter, used for producing daily some 6,000 to 7,000 kilog. of concentrated sulphuric acid, was exploded, the component pieces being shattered and thrown out, with bricks of the fireplace, 20 to 30 mètres in different directions. Fortunately a slight hissing was observed a few seconds previously, so that the workmen had time to escape a terrible fate. The nature of the explosion M. Kuhlmann supposes to be as follows:—This platinum apparatus was being cleaned; some 30 to 40 kilogrammes of concentrated sulphuric acid had been left in it; on this some water had been admitted through the siphon, and the whole had been gently heated three or four hours. It is known that mixing sulphuric acid with water produces a good deal of heat; in the present instance, combination is thought to have taken place instantaneously, at a pretty high temperature, generating a large amount of vapour. From *data* furnished by Fabre and Silbermann, it appears that 40 kilogrammes of acid at 18 deg., with water, is capable of producing instantaneously 18 to 20 cubic mètres of vapour, and this is sufficient to explode a platinum vessel of about 300 litres capacity and only 2 to 3mm. thickness. As the combination occurred at about 100 deg., the force would be greater. M. Kuhlmann has repeated the explosion several times in laboratory experiments, and he finds that it always occurs with great violence where the quantity of water is at least ten equivalents for one of acid. In presence of the difficulty of mixing these two substances, which have a very great affinity, but the density of which is so different that they may remain several hours one on the other without mixture and consequent combination, the need of cautious management is obvious.

LAW REPORTS.

COURT OF APPEAL.

Label as to mixture of Chicory and Coffee no protection to vendor if Pure Coffee asked and paid for. Conviction by Magistrates affirmed on appeal:—

LIDDIARD *v.* REECE.—In this case heard in the Queen's Bench, on 29th Nov. last, before Mr. Justices Lush and Manisty, a question of some general interest, having reference to the mixing of chicory and coffee was raised. The case was that a grocer had sold half a pound of an article of food called coffee to the prejudice of the purchaser, "the same not being of the nature, substance, and quality of the article demanded by the purchaser," contrary to the terms of the Act 38 and 39 Vic., cap. 63. The case was stated thus by the magistrates:—"Upon the hearing of the aforesaid information it was proved on the part of the respondent and found as a fact that on the 23rd of May, 1879, one Stephen Shepherd, a police-constable of the Berks Constabulary, stationed at Reading, went to the appellant's grocer's shop in Faringdon, in plain clothes, and asked one of appellant's assistants to supply him with half a pound of coffee. The assistant took a quantity of what appeared to be coffee from the bulk contained in a canister and weighed it, after which it was wrapped up in paper and delivered across the counter to the purchaser, who paid 9d. for the half pound, this being the full price for pure coffee. The purchaser then asked the assistant to call his master, the appellant, which he did, and the appellant came to the purchaser, who then informed him that he had purchased the article for the purpose of having it analysed. The appellant thereupon, while the packet was still on the counter, called the purchaser's attention to a label affixed to the outside of the paper in which the article was wrapped, on which the purchaser noticed for the first time the following printed words,—'This is sold as a mixture of chicory and coffee.' (A *fac-simile* of the paper and label was annexed). The words were printed in distinct and legible characters, and the label was affixed in a conspicuous position on the outside of the package. The purchaser then said he had asked for 'coffee' and not coffee and chicory. He then, in pursuance of the provisions of the 14th section of the said Act of the 38 and 39 Vic., cap. 63, informed the appellant of his intention to have the article analysed by the Public County Analyst, and offered to divide the same into three parts, and deliver one of such parts to the appellant; but this the appellant

did not require him to do. The purchaser had no suspicion that he had received anything but pure coffee until his attention was drawn to the label by the appellant. The article was afterwards, on the 24th of May, 1879, submitted for analysis to Mr. W. F. Donkin, of the University Museum, Oxford, the Public Analyst for the county of Berks, who by his certificate, dated the 27th of July, 1879, which was given in evidence by the respondent, declared the result of his analysis in the following terms,—'I am of opinion that the said sample is a mixture of about 60 parts coffee with about 40 parts chicory.'. The appellant was represented by a solicitor, who submitted that the appellant was protected by the 8th section of the Act, with the terms of which he had fully complied by having at the time of delivering the article supplied to the purchaser a notice by a label, distinctly and legibly printed, that the same was mixed, and the appellant's solicitor cited and relied on the case of 'Sandys, appellant, *v.* Small, respondent,' decided in the Queen's Bench Division on the 26th of June, 1878 (3 "L. R.," Q. B., 449,) in support of his contention, and urged that on the authority of this case it was unnecessary to call the attention of the purchaser to the label. The 8th section of the Act provides that 'no person shall be guilty of any such offence as aforesaid in respect of the sale of an article of food or a drug mixed with any matter or ingredient not injurious to health, and not intended fraudulently to increase its bulk, weight, or measure, or conceal its inferior quality, if at the time of delivering such article or drug he shall supply the person receiving the same notice by a label distinctly and legibly written or printed on or with the article or drug to the effect that the same is mixed.' We, however, having regard to the fact that the purchaser asked for coffee, and was supplied with an article consisting of only 60 per cent. coffee and 40 per cent. chicory, without having his attention called to the label, and without, in fact, seeing it until the purchase was completed, and also to the fact that the price he paid for the said article was a usual and fair price for pure coffee, and much more than would have been given for coffee mixed with chicory to the above extent, and also conceiving that the case cited by the appellant's solicitor, which referred to a mixture of water with whisky, was not applicable to the case before us, were of opinion that the article sold was so mixed with intent fraudulently to increase its bulk, weight, and measure, and considered that, therefore, the appellant was not protected by the said 8th section of the Act, and we convicted him in the mitigated penalty of £5 and costs as before mentioned. The questions of law arising on the above statement for the opinion of this Court are :—Whether the admixture of chicory with coffee to the extent of 40 per cent., the same being sold at the usual price of pure coffee, is to be considered a mixture of an ingredient or matter intended fraudulently to increase its bulk, weight, or measure within the meaning of the 8th section of 38 and 39 Vic., cap. 63, so as to deprive the appellant of the protection that would otherwise be afforded him by the said section. And whether, assuming this question to be answered in the negative, after the completion of the sale and delivery of any mixed article sold as pure, but before its removal from the counter, the seller can avail himself of the protection afforded by the latter part of the section by calling the purchaser's attention to the notice of mixture printed on the label. If the Court should be of opinion that such conviction was legally and properly made, then the said conviction is to stand; but if the Court should be of opinion otherwise, then the said information is to be dismissed." Mr. Mellor, Q.C., and Mr. Latham were for the appellant, the grocer who was convicted; Mr. Lawrence and Mr. H. D. Green were for the complainant, in support of the conviction. The Court after hearing the counsel for the appellant, without calling on the other side, affirmed the conviction. Mr. Justice Lush said that they quite agreed with the magistrates in their finding. No one could tell the proportion of chicory. Mr. Justice Manisty said that the mixture was sold for the full price of coffee and suppose the purchaser could not read? Conviction affirmed.

Milkmen selling Milk in the Street, bound to serve Inspectors when required. Convictions for refusing :—

Mr. Marsden, the Vestry Clerk of Camberwell, attended at the Lambeth Police Court in support of summonses taken out against tradesmen for refusing to serve the inspectors appointed by the Vestry. The matter was first before the Court a fortnight back, when, after hearing some evidence, Mr. Chance considered there was some doubt on a point of law, and directed a remand. The first case called on was that of John Parker, dairyman, of Hanover Street, Peckham. Evidence was given showing that Inspector Fisher had asked a servant of defendant, who was selling milk in the street, to serve him with a pint of milk. The defendant's servant declined to serve the inspector, stating that all he had was ordered for regular customers. Mr. Chance, after hearing arguments put forward by a gentleman from the office of Mr. Ricketts for the defendant, said he had fully made up his mind that the inspectors were, under the Act, bound to be served in the street, but he would adjourn this case in order to have the man in defendant's employment summoned, so that both matters might be dealt with. Mr. Chance said

there were other cases before him that day, and he wished to say that he had well considered the sections of the amended Act. It would no doubt be a great difficulty to ascertain if milk was adulterated, if a man carrying it through the streets to serve regular customers, refused to serve an inspector. It appeared to him that the amended Act was intended to meet a difficulty which previously existed. The Act also was a protection to the customer who might have ordered milk, and who otherwise would be at the mercy of the parties who served him. If such a law was not carried out, large quantities might be sold without the inspectors being able to ascertain if it was pure or not. If he gave force to the argument used by the gentleman who appeared for the defendant, the Act might become nugatory. He certainly should convict in such a complaint, but would grant a case for the opinion of a Superior Court if asked for. He intended to hold that an inspector had a right to ask and be served with milk in the street. William Jenkins, cowkeeper, of Cornwall Road, Peckham, was summoned for refusing to serve Inspector Fisher. On the 18th ult. the inspector met the defendant, with some milk, and asked him to serve him with a pint, and told him he wanted it for analysis. The defendant was driving a horse and cart, and drove on. He followed and again asked to be served. The defendant wanted to serve him out of a particular can, but the inspector wanted it out of another. The defendant then said first that it was "All ordered," and afterwards, when he found the inspector was putting down his name and address, said, "Well, the other can contains milk and water." Mr. Chance, after hearing corroborative evidence, said it was a bad case, for the defendant knew well he was carrying for sale a can of milk and water. He ordered him to pay a fine of £5 and costs. George Barnes, Loder Street, Peckham, milkseller, was also summoned for a similar offence. When asked by Inspector Fisher for a pint of milk, he made the usual excuse that all he had was ordered. Mr. Chance said such an excuse would not avail, as he had before remarked, and the Act would be carried out. He ordered the defendant to pay a penalty of 40s. and costs.

NOTES OF THE MONTH.

On November 28th, in the Court of the Queen's Bench, before Justices Lush and Manisty, as shortly mentioned in our last number, a case was decided which, according to a trade contemporary, "distinctly marks a new departure" in the law of adulteration. The facts of the case, as stated by the respondent magistrates whose decision was appealed against, were as follows:—A police-constable went into a grocer's shop and asked for "half-a-pound of coffee," which was duly taken from a canister, weighed, wrapped up, and delivered across the counter, while the sum of 9d. was charged and paid, such being the price of good coffee at 1s. 6d. per lb. On the constable stating that the article was for analysis, the proprietor came forward, and while the packet was still on the counter the latter called the constable's attention to the fact that it was a mixture as indicated by the words printed on the paper, "This is sold as a mixture of chicory and coffee." On analysis the article was found to contain, coffee, 60 parts, and chicory, 40 parts, and the correctness of this result was not disputed by the defendant; but he relied on the 8th section of the Act, providing that a person selling a mixture may label the same and so be exempt from punishment. The Magistrates, however, held that in the present case the purchaser's attention had not been called to the label in reasonable time, and moreover they considered that, seeing the purchaser asked for coffee and paid the price of coffee, he should be protected against being served with a mixture which he did not desire, and they therefore convicted the defendant, who now appealed. The Court, after hearing the appealing counsel, and without requiring any reply, unanimously upheld the conviction, and in doing so, Mr. Justice Manisty particularly commented on the fact that coffee was asked for and that the full price of pure coffee was paid for the article.

The decision, based as it is on principles of fairness and justice, of course gives umbrage to the *Grocer*, who fights hard for the right of a man to sell an inferior article at the price of the best whenever he can get a chance by sticking on a label, which, in 99 cases out of 100, would never be noticed by the purchaser. How often there must have been a chuckle of quiet delight when this was done (as indeed it is daily), but now the chuckle is changed into a groan of dismay, and the periodical in question waxes wroth, and has a little quiet dig at the analyst whose decision was *not* disputed and who had done nothing but his simple duty. A long article is devoted to showing how the unfortunate tradesman's defence is cut from under him, and that the Act was meant to protect him in this style of dealing. How much better would it be if the *Grocer* encouraged its constituents in business habits, and told them what the law demands, namely, that when a grocer is asked for "half-a-pound of coffee" he should honestly sell "half-a-pound of coffee," and neither dodge his customer by giving short weight or adding chicory.

Both in the article and in the letters on the subject published in the *Grocer*, the real gist of the case is entirely omitted, namely, that *coffee was asked for and the full price of pure coffee paid*, and yet a mixture was sold. What the Court has ruled has no reference whatever to a man who openly sells a mixture as such, but it is that the 8th section of the Sale of Food and Drugs Act should be no protection to deliberate attempts at fraudulently supplying a mixture when a pure article is asked and paid for.

The great difficulty as to morality is that no one likes to begin to practise it, lest his neighbour over the way should get an advantage. If, however, trades organs would only encourage it a little more, perhaps we may come to the happy day, when, in reply to a demand for 1s. coffee, the salesman will say, "Real coffee cannot be sold at less than 1s. 6d., but you will find this 1s. mixture very good." A little of this straightforward dealing and the public would soon learn the fact, and ask for "coffee" or "mixed coffee" according to their means or their taste. Surely it is better to agree to such a course than to spend money on attempts to legally bolster up the right of practising tacit deceit, and it would save the necessity of reading diatribes on analysts and other such pabulum calculated to encourage what is now legally condemned.

The great case of the Norwich Baking Powder—which it seems is a mixture of alum and bi-carbonate of soda, has been decided against the manufacturers, and appealed. Our readers who perused the report in our last number will doubtless watch with interest the evidence to be given on appeal. Mr. Sutton was actually, and Dr. Tidy is, it seems, expected to be, called for the defence, both having given certificates that it was quite uninjurious. Supposing an inspector in either of their districts bought some bread, and they, not knowing that this powder had been used in making it, certified to the article containing 118 grains of alum per 4-lb. loaf (which it was stated in court that a loaf made with the article would contain), what an amusing scene might be made in the witness-box when it was proved that the alumina got in through the employment of the very compound they had previously declared perfectly allowable. It is evident that if this appeal succeeds, there is an end to any prosecution for adding alum to bread, as the baker would only need to say he did not use alum, but

Norwich Baking Powder. We think that Public Analysts would be wiser (even at the cost of sometimes losing good fees) to decline giving evidence in any disputed cases. There are plenty of men—not Public Analysts—who would only be too thankful to get employed in such affairs, and the individual action of any public man would not be thus cramped. If really consistent in their views, then the public in certain districts must be content to eat what is elsewhere deemed undesirable, merely because the analyst has publicly bound himself to an opinion on the subject which might be afterwards used to impair the efficiency of his evidence in official prosecutions.

Our readers will note with interest the final decision of Mr. Chance, the magistrate for Lambeth, as to the right of inspectors to demand samples in the street, and we are glad to find he has not adhered to the opinion which we commented upon last month. To look after the milk thus sent out to customers, as well as that sold over the counter, is the only true way of ensuring that the public get what they pay for.

NOTICES TO CORRESPONDENTS.—X. Y. Z.—We agree with your remarks as to the imperfection of the publication in question, and have already pointed them out, and we know that an effort has in consequence been made to improve it. We have not space this month for your letter. Dr. SWETE.—Our matter was all in type before your letter arrived.

RECENT CHEMICAL PATENTS.

The following specifications have been published during the past month, and can be obtained from the Great Seal Office, Cursitor Street, Chancery Lane, London.

1879. No.	Name of Patentee.	Title of Patent.	Price
1592	W. Müller	Manufacture of Ammonia from Nitrogen of Atmospheric Air and Hydrogen	6d.
1622	R. C. Thompson	Producing Electric Light	2d.
1635	J. MacKenzie	Electric Light Apparatus	6d.
1661	J. C. Mewburn	Preparation of Starch and Dextrine	4d.
1673	J. J. Sachs	Extraction of Fatty Matters	2d.
1698	H. A. Bonneville	Dephosphorization of Iron	4d.
1703	J. Townsend	Obtaining Soda and Potash	4d.
1705	A. Steenberg	Manure	2d.
1733	R. S. Ripley	Treating Illuminating Gas	6d.
1783	F. C. Glaser	Manufacture of Sugar	4d.
1791	J. S. Sellon and H. Edmonds	Electric Lamps	2d.
1692	Ditto	Regulating Electric Currents	6d.
1949	Ditto	Apparatus for Generating Electric Currents	2d.
1795	A. M. Clark	Safety Cheque	2d.
1808	H. J. Haddan	Gas Governors	4d.
1842	W. R. Lake	Machinery for Crushing Phosphates	4d.
1855	J. B. Spence	Treatment of Metallic Sulphides	4d.
1865	H. Parkes	Manufacture of Compounds of Nitro-Cellulose	4d.
1869	A. Scott and T. R. Ogilvie	Purifying Saccharine Substances	4d.
1970	J. Fordred	Treatment and Purification of Cod Liver Oil	4d.
2652	C. W. Siemens	Electric Lamps	2d.
4103	W. Morgan Brown	Electric Batteries	6d.

BOOKS, &c., RECEIVED.

Annals of Chemical Medicine, by Dr. Thudichum; How to use a Galvanic Battery, by Dr. Tibbitts; Water Works for Cities and Towns, by S. Hughes; Blowpipe Analysis, by Landauer; A Year's Cookery; The Chemist and Druggist; The Brewers' Guardian; The British Medical Journal; The Medical Press; The Pharmaceutical Journal; The Sanitary Record; The Miller; Journal of Applied Science; The Boston Journal of Chemistry; The Provisioner; The American Dairyman; The Practitioner; American New Remedies; Proceedings of the American Chemical Society; Le Praticien; The Inventors' Record; New York Public Health; Philadelphia Printers' Circular; The Scientific American; The American Traveller.

THE ANALYST.

FEBRUARY, 1880.

SOCIETY OF PUBLIC ANALYSTS.

THE ANNUAL MEETING of this Society was held on the 15th January, at Burlington House, Piccadilly, the President, Dr. Muter, in the chair.

The minutes of the previous meeting were read and confirmed.

The President delivered his Annual Address as follows :—

Gentlemen, it is customary for the retiring President of our Society to say a few words of farewell, coupling them with remarks upon the general position of the Society and the working of the Act of Parliament under which we all hold office. I am glad to say that the past year, so unfortunate to many both at home and abroad, has been comparatively gentle to us, seeing that we have only lost two members by death, namely, Messrs. H. Goode and J. Whitla, with neither of whom had I the pleasure of a personal acquaintance, but I have understood from those who had, that they were men making their mark on the sands of time, now alas, too soon washed out by the tide of eternity. During the year one member has resigned, and two have been struck off by the Council for non-payment of their fees, but to make up for this loss five new members have been elected, thus keeping " our balance true " up to the moment. So that we stand now with 90 members and 12 associates, being a total gain of 2 in the last 12 months. We are also more fully endowed with that very necessary article called " worldly dross " by those who have not got it, seeing that although our payments have increased by £18 on account of THE ANALYST, we have still a balance at our bankers which is £2 better than last year. Gentlemen, our Society is not and never can be large, because it is limited to a certain class, and owing to the vast preponderance of country members our meetings may not be very numerous, but still we have a distinct *raison d' être*, and we carry that out to the letter. You will excuse me imitating Mr. Silas Wegg, and " dropping into poetry " unconsciously, but after all it is something to boast of that we do act up to our aspirations, which is more than can be said of all other scientific associations. We do not pretend to elevate the morals of our members and then find ourselves helpless when cases arise requiring such elevation, neither do we pretend to raise the fees receivable for work done and then find that we have upon our Council some most notorious offenders in that respect, nor do we get up discussions on subjects specially the province of other societies, and end them in smoke. What we do profess we carry out, namely, to improve the process of analysis in all matters relating to food. Germany is and has always been looked up to as the foster-mother of general chemical discoveries, but for research in our special subjects we must look at home ; and everyone must admit that Great Britain is up to the present the source of special food research, and that all which has been done has been mainly attained by the members of the Society of Public Analysts. During the last year we have had either read here or published in our journal (THE ANALYST) no less than 41 memoirs, relating to our branch of the chemical profession, and that, remember, all carried out, not by wealthy *dilletanti* or men receiving grants from

research funds, but by persons daily and actively engaged in carrying out the complex and tedious duties thrown upon them by an Act of Parliament. Let us, gentlemen, strive to keep the position so nobly attained, and let us one and all resolve to do more and more every year in the grand cause of the advancement of our art, so that we may keep pace with our enemies, the adulterators, and let the public of Great Britain have that most precious of boons, namely, pure food and drugs.

As regards the Act and its working we must congratulate ourselves that, oiled by the good lubricator—time, our wheels move smoother every year. More and more our processes and modes of interpretation of results continually receive general acceptance, and closer do we and our Appeal Court at Somerset House draw to each other. I believe sincerely that Mr. Bell and his colleagues try most earnestly to elicit the truth, and were they only freed from the absurd restriction which prevents their coming amongst us and letting us know their standards and experimental results, there would hardly ever be the difference of a decimal point between our conclusions and theirs. We must, however, trust to time, and I can only hope the day is not far distant when the heads of the Somerset House Laboratory will be found enrolled among us, and helping, as we do, to disseminate the knowledge of food analysis, instead of being compelled to keep their results locked up through a piece of Government red tapeism. The amended act of last session has proved a great public good in the case of peripatetic vendors of food, who were before enabled to carry on, without fear, the most barefaced schemes of adulteration; and the recent decision of the High Court to the effect that if a man asks for an article and pays the full price for it he is distinctly entitled to receive that article in a state of purity, notwithstanding any declaration or notice to the contrary, is a distinct advance in equity in the interests of the public. Gentlemen, with these few words I will bid you *adieu*, hoping that we may all meet again at our next anniversary improved in knowledge and with the full consciousness that we have each given our stone to the grand cairn of the science of food analysis now being erected in our midst, so that our successors in the next generation may have reason to be thankful for the establishment of the Society of Public Analysts.

Mr. Allen proposed a vote of thanks to the President for his address, and hoped that it would be published not only in THE ANALYST but in other journals, as it showed what a large amount of real scientific work Public Analysts had done within a very short time.

Dr. Dupré, in seconding the vote, expressed a similar hope, and said that if their fellow chemists in England once became aware of the good work they were doing, the Society would rise considerably in their estimation. He took the opportunity of saying that he thought there should be a little more *esprit de corps* among the members, which was one of the greatest reasons for establishing the Society. He also said that as no analyst could pretend to know everything, it would be very wise if a member, when he had an article with which he was little acquainted, would write to the secretaries, who would always know the best member to give any required information.

The proposal having been unanimously agreed to, Dr. Muter returned thanks.

The President proposed that the thanks of the Society be given to the Council of the Chemical Society for the use of their rooms for meetings, which was unanimously agreed to.

The President proposed a vote of thanks to the Members of Council for their attention to the business of the Society during the past year, which was also agreed to.

The President proposed a vote of thanks to the Secretaries, Messrs. Heisch and Wigner, for their services during the past year, which was also agreed to.

Mr. Angell and Mr. West-Knights were appointed Scrutineers to examine the voting papers for the election of Officers and Council, and they reported that the following were elected:—

President.

J. Muter, Ph.D., M.A., F.C.S.

Vice-Presidents.

A. Dupre, Ph.D., F.R.S., F.C.S.

J. W. Tripe, M.D.

A. Wynter Blyth, M.R.C.S., F.C.S.

Treasurer.

C. W. Heaton, F.C.S.

Hon. Secretaries.

Charles Heisch, F.C.S.

G. W. Wigner, F.C.S.

Other Members of Council.

J. Carter Bell, F.C.S.

J. Campbell Brown, D.Sc., F.C.S.

C. A. Cameron, M.D., F.R.C.S.

Bernard Dyer, F.C.S.

Otto Hehner, F.C.S.

W. Morgan, Ph.D., F.C.S.

W. Wallace, Ph.D., F.C.S.

The names of those Members of Council who did not retire this year, are—

M. A. Adams, F.R.C.S.

A. H. Allen, F.C.S.

H. C. Bartlett, Ph.D., F.C.S.

A. H. Church, M.A., F.C.S.

F. Maxwell Lyte, F.C.S.

The Scrutineers also reported that Professor C. R. C. Tichborne, Ph.D., F.C.S., Public Analyst for Longford County, and President of the Irish Pharmaceutical Society, was elected as a Member.

Mr. T. P. Bruce Warren, analytical chemist, was proposed as a Member, and Mr. L. Stansell, assistant to Mr. C. H. Piesse, as an Associate.

Mr. Wigner read a paper by himself and Professor Church on "Two Ancient Samples of Butter."

A paper by Mr. Carter Bell, "On the Composition of Unfermented Wines of Commerce," and one by Mr. W. M. Hamlet, "On the Estimation of Fat in Milk," were also read.

After the meeting the members dined at the Café Royal, and passed a pleasant evening together.

The next Meeting of the Society will take place at Burlington House, on Wednesday, the 18th February.

ON TWO ANCIENT SAMPLES OF BUTTER.

By G. W. Wigner, F.C.S., and Professor Church, M.A., F.C.S.

Read before the Society of Public Analysts, on 14th Jan., 1880.

The specimen of Irish bog-butter which we have submitted to analysis cannot be traced with any certainty to a particular locality. There is no doubt, however, that it is a perfectly authentic specimen, some centuries old; indeed, we should probably be right in concluding its age to be not less than 1,000 years.

Whether the specimens of ancient butter found in the bogs of Ireland, and occasionally in those of the Faeroe Isles, and of Scotland, were originally inhumed for the sake of security, or for their preservation and ripening, we have no means of ascertaining. They are inclosed in rough wooden vessels, square, oblong, or cylindrical, sometimes consisting of a hollowed tree trunk. A fine example of the last-named form is preserved in the museum of the Royal Irish Academy, at Dublin, and is figured and described on pages 212 and 268 of their museum catalogue. For the history and archæology of bog-butter, reference may be made to Dr. Wilde's paper in the proceedings of the Royal Irish Academy, vol. vi., p. 369, where will be found a list of the authorities who have discussed the subject.

Bog-butter has been chemically examined by Prof. E. Davy in 1826 *(Proc. Roy. Dublin Soc.)*; by Williamson *(Ann. Ch. Pharm., 1845, liv., 125)*; and by Brazier *(Chem. Gaz., 1852, 375)*. Brazier concluded that it mainly consisted of an acid, having the same composition as palmitic acid, and melting at 53° C.

We will describe the physical and chemical characteristics of the sample we have examined. It weighs nearly five pounds. In shape it is an irregular oval, about twelve inches by eight inches, and six inches thick. The surface is deeply indented in many places, and some of these indentations present such an appearance as would be produced by the pressure of the stave of a cask. The general appearance of the sample leads to the opinion that it has been enclosed in a rough cask or tub of an oval form, and as that decayed, an irregular pressure has been brought on to the substance. There are several clearly cut cylindrical holes through the sample: these holes are much like those which would be produced by a cork-borer or a cheese-taster. The surface of the sample bears a resemblance to a very old and dirty cheese. The interior is of an almost sandy colour, and although somewhat like cheese in texture, it is more friable and pulverulent. It has a slightly greasy feel to the fingers, and a slight but distinct odour of cheese, not butter.

A small portion from the inside of the mass was examined microscopically. A few fragments of foreign matter did polarize, but the bulk of fat did not, and no trace of crystalline structure could be detected. A good deal of foreign matter, partly curd, was seen.

The sample fused very slowly, even at 212° (100° C.), and the curd and foreign matter separated with considerable difficulty. The fat which adhered to the curd was removed by washing with ether, but was not used in the subsequent analysis of the fat. The original sample contained:—

Moisture	1·40 per cent.
Curd, fibre, and other matters insoluble in ether	3·98 ,,
Ash*	·32 ,,
Fatty Matters	94·30 ,,
	100·00

*Containing Chlorine ·033 = Chloride of Sodium ·054.

The curd was microscopically examined. It contained a considerable proportion of vegetable matter, and some large fragments of wood, the structure of which was too much destroyed to enable the species to be identified. The largest of these fragments was nearly a quarter of an inch long. The curd also contained some fungoid growths

and mycelium. A considerable proportion was, however, clearly of animal origin; many fragments of muscular tissue were found, and some hairs. These were quite sufficient to prove the fact, that the fat itself was of animal origin, although it was mixed with some proportion of vegetable matter, which was probably derived from the bog.

This curd and other matters insoluble in ether gave the following results:—

Nitrogen by soda lime process	3·64 per cent.
= Casein	23·05 ,,
Ash	8·70 ,,
Containing Chlorine	·82 ,,
= Chloride of Sodium	1·35 ,,
Fibre (crude Cellulose)	27·60 ,,

The fatty matter, after separation from the curd, was very dark coloured. It contracted greatly when cooling, and was almost or quite as hard and resonant, when struck, as a good sperm candle.

Its melting point was 121° F. (49·5° C.).

Its specific gravity, taken at 155° and compared with water at the temperature of 100° F. (38° C.), was 875·4.

Assuming that the ratio of expansion is fairly accordant with that found in the fats previously examined by one of us*, this would correspond to an actual density of ·902 at 100° F. (38° C.).

The fat was saponified with alcoholic soda in the usual way, the soap decomposed with acid, and the washings containing the soluble fatty acids distilled.

The whole of the processes were carried out by flask washing, to avoid loss.

The following results were obtained:—

Volatile fatty acids, calculated as butyric	·06 per cent.
Soluble fatty acids, not volatile	·42 ,,
Insoluble fixed fatty acids	99·48 ,,
Glycerin	Minute traces.

The insoluble fatty acids were converted into lead salts, and the oleate of lead separated by ether. The results were:—

Oleic acid	9·0 per cent.
Stearic and palmitic acids	91·0 ,,

The distillate certainly had a faint, though of course very slight, smell of butyric acid; enough however to prove its presence.

The traces of glycerin were far too small to admit of any approach to estimation.

It is interesting to observe how complete has been the decomposition of the original glycerides of the butter, both the resulting glycerin and the soluble fatty acids set free, having been almost entirely removed by the action of water only at a low temperature. Time has been an important factor in the change.

The other sample of butter is much older. It was taken some time ago from an Egyptian tomb, which probably dates from about 400 or 600 years before Christ. The sample is therefore nearly 2,500 years old. It was contained in a small alabaster vase, and had apparently been poured in while in a melted state.

The vase was brought by Lord Prudhoe from the Delta. It bears an inscription

* The Analyst, vol. iv., p. 183.

in hieroglyphics, indicating that it was once the property of *Hasheps*, a queen of the 18th dynasty. It is quite possible that the butter was once perfumed, serving the purpose of an ointment; but if so, every trace of such perfume has vanished.

In appearance, colour, smell, and taste, it corresponds closely with a sample of slightly rancid butter.

The quantity at our disposal—some six grains—was so small, that it was only possible to apply a few tests.

Under the microscope the sample polarized distinctly.

It was entirely soluble in ether.

It melted readily, and showed no infusible residue.

It was practically free from moisture and from ash.

The fusing point was 127·5° F. (53° C.).

A small quantity was saponified, and the soap was decomposed in a small flask.

The soluble fatty acids were found to be 8·0 per cent. by direct weighing.

The washings containing these soluble acids, had, when warmed, a distinct odour of butyric acid. Any attempt at the estimation of the proportion, on such a small quantity, would of course have been useless.

The insoluble fatty acids weighed about 86 per cent.

The figures, as far as it has been possible to obtain them, indicate that this sample has not undergone any notable decomposition during 25 centuries. This stability must, in all probability, be attributed to the fact of the butter having been melted and sealed, so as to secure it against atmospheric influences. In this respect it presents a marked contrast to thé bog-butter previously referred to.

Mr. Hehner said he had a lingering doubt in his mind as to how it could possibly be proved that it was ever butter. It might have been some other animal substance; it looked like chalk now, but it might have been cheese, which under certain circumstances is transformed into fat.

Dr. Bartlett thought they had never had a specimen of ancient cheese presented to their notice, but in fragments of ancient cheese they found something very different to that then before them. The oldest cheese he was acquainted with was some that was contained in a screwed up flask, recovered from the *Royal George*. It had dried up into a perfectly solid mass, containing only a small amount of fat. He thought the large amount of fatty acids would lead them to suppose that that was not originally cheese.

The appearance of adipocere, such as is found in coffins, is not at all dissimilar to that. Adipocere is said to be produced by the action of running water on animal flesh.

Mr. Blyth said that putting on one side the chemical evidence, they certainly had marks very similar to what a stave would make, and besides that the presence of hair. He thought the evidence pointed to it being butter rather than anything else. With regard to the holes he suggested that they might have been made by some boring insect or beetle.

Mr. Angell said the only thing which struck him with regard to the examination was the amount of the curd, which was rather indicative to his mind of fatty degeneration.

Mr. Wigner, in reply, said that as to the older sample, the alabaster vase was

recently opened in the presence of two or three gentlemen. Mr. Church took this sample and it has not left our charge since. Its age, therefore, was undoubtedly what it was represented to be.

With regard to the sample of bog-butter, it had been suggested that it was cheese, but those who had studied the subject were aware that cheese had been repeatedly found in these Irish bogs, and that it was not found in cases or tubs as the butter is, but invariably showed signs of having been wrapped in a kind of canvas or cloth, the characteristics and form of cheese being to a great extent preserved; neither would it be reasonable to expect such perfect conversion of cheese into fatty acids. The possibility of its being adipocere was negatived by the analysis. Adipocere contained much lime and phosphoric acid, and the sample was almost absolutely free from these constituents. Dripping, or some other animal fat, might have undergone a similar decomposition to that of the present sample, but there was nothing to indicate that the theory of dripping was more probable than that of butter. On the contrary, the results of the microscopical examination, and the percentage of true casein found, pointed distinctly to butter.

LAW REPORTS.

THE NORFOLK BAKING POWDER CASE.

Alum in Baking Powder.—The Conviction Quashed with Costs.

WARREN *v.* PHILLIPS (inspector). This was an appeal at the Cambridge Quarter Sessions, before the Recorder, J. R. Bulwer, Esq.. Q.C., M.P., against a decision of the magistrates who convicted Messrs. Warren of selling a certain article of food, baking powder, mixed with a certain ingredient, alum, so as to be injurious to health.*

The appellants were represented by Mr. T. C. Blofeld and Mr. Horace Browne; while Mr. Cockerell and Mr. Turner appeared for the respondent.

Mr. Cockerell opened the case for the respondent. The proceedings before the magistrates were, he said, taken under the 3rd section of the Sale of Food and Drugs Act, 1875, for selling an article of food, namely, baking powder, mixed with an ingredient that rendered it injurious to health. The third section made it an offence to "mix, colour, stain, or powder any article of food with any ingredient or material so as to render the article injurious to health, with the intent that the same may be sold in that state." The interpretation clause described "food" as every article used for food or drink by man other than drugs or water. The facts under which the conviction in the baking powder case took place were these:—Some proceedings having been taken against a baker for the adulteration of certain buns sold by him, and it being alleged by him in defence or mitigation that the adulteration was caused by the use of this Norfolk Baking Powder, it was thought desirable and necessary to test the validity of the sale of that powder by having an analysis made of it as sold by the dealers in Cambridge, and that analysis led to these proceedings being taken; but although Messrs. Warren were the nominal defendants, yet substantially the real defendants then and the real appellants now were the manufacturers of this powder, Messrs. Smith & Sons, of Magdalen Street, Norwich, who were in a very large way of business. He might say, too, that there were several other gentlemen in the same way of business in Norwich, who took an interest in this matter, and they had combined together to test the question whether this baking powder did contain any ingredient which was injurious to health so as to bring it within the provisions of the Act of Parliament. A quantity of the powder having been purchased it was put before the Public Analyst, whose certificate he handed in to the Recorder.

Mr. Blofeld said the appellants would not dispute the analysis being approximately correct, but he would hand up to the Recorder the actual ingredients. There was only one thing omitted. Learned counsel then handed up the analysis to the Recorder, observing that he did not wish it to be made public.

Mr. Cockerell then proceeded with his address, and said that speaking roughly the quantity of alum contained in the powder was about one-third of the whole, and the question for the Recorder to decide was whether that quantity made the powder injurious to health.

* *See* THE ANALYST, vol. iv., p. 231.

The Recorder pointed out that in one of the analyses the alum was described as crystallized potash alum, and in the other as burnt alum.—Mr. Cockerell said burnt alum was double the strength of the other.

Mr. Blofeld: The Public Analyst here made a little mistake before the magistrates in saying that it was burnt alum instead of crystallized.

Mr. Cockerell then drew attention to the directions for using the powder—one teaspoonful to a pound of flour, and which especially recommended it to housekeepers for use in bread, while for Norfolk dumplings, it was the only means of securing lightness and digestibility; its use ensured exactly the contrary, since it rendered bread indigestible by hardening the gluten of the flour, which produced constipation and other ills.

The Recorder said the conviction set forth that the appellants, "George and Edward Warren, did sell a certain *article of food*, to wit, baking powder, mixed mith a certain ingredient, to wit, alum, so as render such article injurious to health." Therefore they had first to ascertain what was the *food* that was mixed with the alum? The charge was "*food*, to wit, *baking powder*, mixed with a certain ingredient, to wit, alum." Therefore the "article of food" was the baking powder.

Mr. Cockerell: That is my contention.

The Recorder: But the baking powder, from the analysis you have handed to me, is not complete *without* the alum. The alum is a part of the baking powder. First of all before you get the thing that is mixed you must get the *food*.

Mr. Cockerell: The food is the baking powder. I say alum is no part of the baking powder necessarily. Baking powder ought to contain no alum.

The Recorder: But you have got the powder that the man sells.

Mr. Cockerell: It is sold as baking powder.

The Recorder: What of that? Suppose for argument that I sell chalk and arsenic mixed together and advertise it as baking powder, is it to be said that I adulterate an "article of food," chalk, by the arsenic, or the arsenic by the chalk? Let us go by steps. Where is your article of food that is adulterated? The article of food becomes extinct by the adulteration. Where is your article of food without the alum? Bicarbonate of soda and other matters. Is bicarbonate of soda an article of food?

Mr. Cockerell: I say that baking powder is an article of food, commonly sold by these people and by various others, but alum is not a necessary part of that powder, which ought not to contain any.

The Recorder: Is there anything known as baking powder?—Mr. Cockerell: Oh, yes.

The Recorder: If you will give me evidence of that I shall be glad. I never heard of baking powder beyond what chemists advertise as such, any more than I know of aperient draughts which may contain no one knows what. Is there such a thing known as baking powder?—Mr. Cockerell: Yes, known to the public.

The Recorder: I mean as an article of food.—Mr. Cockerell: Of course people don't eat baking powder. Everybody knows what it ought to be.

The Recorder: You can only know what baking powder is by analysing it. Suppose A sells a particular compound and calls it baking powder, which is to produce certain effects if used in cookery; B makes up a certain other mixture and calls that baking powder; while C, D, and so on, proceed in like manner. They are all called baking powder.

Mr. Cockerell asked if the word "mix" did not bring the baking powder under the section.

The Recorder: The Act says "No person shall mix *any article of food*." You must first of all get your food.

Mr. Cockerell: I say the alum ought not to be there, and that the powder is mixed improperly.

The Recorder: Then you are driven to the other alternative—that the bi-carbonate of soda and the rest of the ingredients are an article of food.—Mr. Cockerell: When compounded as baking powder.

The Recorder: Suppose I go to a druggist's shop and ask for an aperient draught, and it is composed of rhubarb and magnesia, is the chemist to be convicted for adulterating rhubarb with magnesia, or magnesia with rhubarb?—Mr. Cockerell: You get what you want.

The Recorder: No, I don't; I ask for an aperient draught. If the inspector had gone and asked for bi-carbonate of soda, and they had given him the soda mingled with crystallised potash alum, there would have been a case directly.—Mr. Cockerell said the effect of the learned Recorder's construction of the Act would make it inoperative altogether.

The Recorder: No; if a baker chooses to mix some noxious compound—mind, I don't say this is—with his bread and sells it he is liable. I am only calling attention to the matter just to have my mind clear upon it.—Mr. Cockerell said no question of this kind had ever been raised. We treat baking powder as an article of food.

The Recorder: Then I shall want you to tell me what baking powder is.—Mr. Cockerell: My medical witnesses will tell you what this particular baking powder is, and what baking powder ought to be without alum, but that is put in because it is cheaper. It is admitted that the powder is to be put into articles of food. In the course of further argument the Recorder said even if the powder became injurious to health when put into food it was not an article of food.

Mr. Cockerell also said that the rice flour was an article of food.

The Recorder: I don't know what evidence will be given upon it, but I should have thought the rice was only a medium or padding.—Mr. Blofeld said that was so.

Mr. Cockerell said he had asserted his contention, and he did not know whether the Recorder intended to express his opinion on the point.

The Recorder said he was hardly in a position to do so yet without some evidence upon it.

Mr. Blofeld said the point was if the rice-flour was an article of food whether it was rendered injurious to health by the alum.—Mr. Cockerell then called

Mr. J. W. Knights, Public Analyst for the borough and county of Cambridge, F.C.S., &c., who deposed that from the experiments he had made with the baking powder he was of opinion that when mixed with the flour it rendered the gluten of the flour and the soluble phosphate contained in the flour insoluble. When a teaspoonful of the powder was mixed with a pound of flour and water added, it would liberate the carbonate acid gas and render the soluble phosphates contained in the flour insoluble, by forming phosphate of alumina, which is insoluble. It would render the phosphoric acid insoluble. He believed an adult in health required 50 grains of phosphoric acid per day. Phosphoric acid was derived from bread and other articles of consumption; in some cases chiefly from bread. Bread made with this powder, as directed, would give less soluble phosphoric acid than there should be by 7-10ths. 7-10ths of the phosphoric acid would be rendered unavailable, and he should presume the bread would be less nutritious. With children the effect would be the same, but to a greater degree. It would impair digestion.

Cross-examined by Mr. Blofeld: That is a chemical opinion that I have formed.

With regard to the powder rendering the gluten of the flour less soluble is that mere opinion formed by your experiments in your laboratory?—Yes.

Have you actually made bread?—Yes.

But the hardening of the gluten of which you speak is not the result of anything apparent to the eye, but your opinion formed upon your experiments?—It is actually apparent to the eye. I have not my laboratory here or I could show you experiments, but it takes time to make them.

As to rendering the phosphoric acid insoluble, what authority have you for stating that a man in health requires 50 grains of phosphoric acid in the 24 hours?—I saw it so stated in a medical work—"Parke's Treatise on Practical Hygiene," I think. That is the only authority I can remember. I have looked at no others.

Are you aware that the body rejects as much as from 75 to 100 grains of phosphoric acid per day?—It rejects a very large quantity.

May I take it that that which the body rejects is what the body does not require to assimilate?—Certainly, but I am not a medical man. When the bicarbonate of soda and alum are mixed with water effervescence takes place and carbonic acid gas is given off. The residuum from the alum is hydrate of alumina, that from the soda is sodic sulphate or sulphate of soda.

So that when the bread is made with this powder there is no alum in it and no bicarbonate of soda; they both cease to exist?—Yes.

By the Recorder: This change takes place when water is added. In the presence of flour the case is somewhat different. The bicarbonate of soda and the alum effervesce in the dough, and there is a residuum from each, but the hydrate would become phosphate.

By Mr. Blofeld: When mixed with the flour and moisture I should say the phosphate of alumina is formed immediately, and not hydrate first, but I cannot say that positively. It is necessary, to change the hydrate of alumina into phosphate, that there should be actual contact between the hydrate and the phosphoric acid in the flour.

How is the little hydrate of alumina there would be in a 1lb. loaf to come into contact with all the grains of phosphoric acid to be found in the dough, so as to form it into phosphate of alumina?—Because it is mixed in a dry state. Phosphate of alumina is perfectly well known to be insoluble in water. I believe phosphate of alumina is not soluble in the gastric juices, but that is a question for a physiologist and not a chemist. It is perfectly insoluble in acetic acid. It is soluble in hydrochloric acid, and the gastric juice is suppose to contain that. I do not believe the gastric juice is practically a

weak solution of hydrochloric acid. I have heard that no hydrochloric acid exists in the gastric juice in a free state. I forget where I read that, but it was not in a newspaper. I have no authority for the assertion that the gastric juice is not equivalent to hydrochloric acid. The injurious effect of this baking powder does not depend upon the assertion that phosphate of alumina is insoluble in the stomach.

If it is soluble in the stomach what harm could it do?—It would probably have an astringent effect.

You would not undertake to say that positively, would you?—No, I am not a doctor.

The Recorder: Does a minute quantity of alum in bread make it injurious to health; I have heard that it rather improves it?—I think it is no improvement. However small the quantity there is a corresponding quantity of phosphoric acid rendered insoluble.

By Mr. Blofeld: I cannot cite any case where injury has been done to health by the use of a small quantity of alum. Alum is very little prescribed except for use externally and as a gargle.

Mr. Blofeld then produced two small boxes containing gluten, one of which he said contained no phosphate, the other had in it five times as much as could possibly be found in any bread made with this baking powder. He handed the two to witness and asked him if he could see any difference between the two. Witness: I can see no difference, but I could tell the difference in my laboratory. The hardening of the gluten would not be perceptible to the touch or to the eye without experiments, and I could not tell which box contains the phosphate of alumina and which does not.

By the Recorder: Bakers use alum to make bread look nice. To make bread rise, cream of tartar is equally efficacious with alum and is frequently used. The rice flour in this powder is, I believe, merely added to keep the composition dry and in a friable state.

It is no part of the baking powder?—It keeps the powder in a powdery state, and so far as the effects of the bicarbonate of soda and the alum are concerned it is not necessary that it should be there.

Mr. Blofeld: All articles of food contain phosphoric acid do they not?—A great many do, such as milk, beer, meat, fish, &c., almost all practically. A pound of flour contains about 12 grains of phosphoric acid, and a pound of flour would make up into about 1½-lb. of bread. Have not ascertained how much phosphoric acid there would be in 1½-lb. of bread, but it certainly would not be lost in the baking; it would not volatilise.

Mr. Blofeld: I shall show you that the proportion would be very much less.—In that case it would be only as phosphate of lime. In Cambridge water there is a good deal of lime but not much magnesia. The bread here must be made up with water containing lime. Phosphoric acid has an affinity for the lime, that is, assuming the absence of the baking powder. I do not think the phosphoric acid in the bread would combine with the lime first and leave the alumina till all the lime had been used up. I ascertained how much phosphoric acid there was in a pound of flour by analysis, and I found it to vary from 10 to 12 grains, I think. I speak doubtfully as I have not calculated the average.

The Recorder: How long would it take to kill a man if he ate an ordinary quantity of bread daily made with this baking powder?—A man in health and with good digestion would possibly live some time.

The Recorder: Have you ever heard an instance of anybody having a fit of indigestion from eating bread made with this powder and clearly traceable to it?—No. I have come into contact with no case, but I should judge, from my chemical knowledge, that indigestion would follow. The effect of either hydrate or phosphate of alumina would be to harden the gluten. Baking powder can be made with many other ingredients besides bicarbonate of soda and alum.

As a chemist, in how many ways could you make baking powder?—Four or five ways probably. By combining an alkali with an acid, baking powder is formed. Only three or four ways would be unobjectionable.

There is no such thing as baking powder, is there, beyond the fact that a man fancies the name and gives it to what he makes?—There is no recognized formula for making baking powder.

You might make it as you would make an aperient draught?—Yes; it is not known in the British Pharmacopœia. It is what men choose to call it. It might be termed "Substitute for yeast powder," or "Norfolk dumpling powder."

Mr. Matthew Moncrieff Patteson Muir, Prælector of Chemistry in Caius College, Cambridge, then gave the effect of an experiment that he had made with a mixture like that contained in the baking powder with phosphate of soda instead of flour, and said he found insoluble phosphate of alumina. He also made an experiment with half-a-pound of flour free from alum, treated it with water, and found the water contained a large quantity of phosphoric acid. He also mixed half-a-teaspoonful of the baking powder with half-a-pound of flour, treated it as before, and found the water contained very small quantities of phosphoric acid. Witness was about to give the result of experiments made with bread

in which was mixed the Norfolk baking powder and bread made with another baking powder, but Mr. Blofeld objected to a comparison between baking powders. Witness then described an experiment he had made with the Norfolk baking powder when made into bread according to directions, and said he found about 1¼ grains of soluble phosphoric acid to the lb. of flour used in the bread. In an experiment he had made with yeast bread he found about 3 grains of soluble phosphoric acid to the half-lb. of flour, or, in round numbers, four times the quantity. He tested the bread with hydrochloric acid of 2-10ths per cent. strength at a temperature of 100° Fahr., with the results he had given. The reason for taking that particular kind of hydrochloric acid was because that was taken as the average strength of the hydrochloric acid in the gastric juice. He then stated that he composed a mixture like the baking powder prepared, a quantity of gluten from flour, digested it with half a litre of 2-10ths per cent. strength hydrochloric acid for 50 hours, and found that there was 20 per cent. less of the gluten dissolved than there was in a similar quantity heated without alum, soda, &c. Then he made a further solution with a mixture of dextrine—a modified form of starch which might be taken to represent the starchy matter in flour—with water, and added a solution of alum and a solution of phosphate of soda. The phosphate of alumina which was precipitated carried with it the greater portion of the previously soluble dextrine. In experimenting with a loaf made of the same powder he determined the quantity of phosphate of alumina existing was 25 grains per 4-lb. loaf; that was about 5 grains to the ½-lb. loaf. Witness then corrected himself, and said he made a mistake in his calculation, he should have said about 3·03 in the ½-lb. loaf. From these experiments he should say the effect of this baking powder made into bread was that the alum in powder was wholly decomposed, with the production of phosphate of alumina and sulphate of soda. This phosphate of alumina, he added, rendered the gluten and the dextrine less soft.

By the Recorder: I could form no idea of the effect of a man eating an ordinary quantity of bread for a year made with this baking powder because I have no medical knowledge.

Cross-examined: The soluble phosphoric acid is present in the flour in the form either of phosphate of potash or phosphate of soda. The presence of an alkali in the bread would affect the colour and make it brown or a yellowish brown if in a large quantity. The presence of 6 grains of alkali in a 4-lb. loaf would probably give it a yellow tint. I should expect to find an objectionable discolouration from the presence of 5 or 6 grains in a 4-lb. loaf. Blyth in his "Manual of Chemistry" is my authority for giving the average amount of phosphoric acid in a pound of flour as 12 grains. I should be surprised to find that there are 28 grains. Perhaps you are dealing with phosphate of potash and I am dealing with phosphoric acid, known to chemists as P2. O5., but if we mean the same thing I should be surprised to find that number of grains. Supposing phosphate of soda and alum in bread in an uncombined state the treatment by water would effect their combination and produce the phosphate of alumina.

Therefore your very experiment may have produced phosphate of alumina?—Yes. If a man eats ¾-lb. of baking powder bread a day he would get into his system—if laboratory experiments are correct—2¼ grains less of phosphoric acid than he would by the use of other bread. I know the system ejects phosphoric acid to a certain extent, but I can't give figures. I did not know it was more than 50 grains. On the other side of the coat of the stomach there would be blood, which is alkaline, with the wall and membrane between the two.

That being the case would not the phosphoric acid filter out of the phosphate of alumina through the intervening wall into and combine with the alkaline blood in the system?—That is a question that could only be determined by direct experiment. I would not be surprised to have either result. I think one may infer that the gastric juices are equivalent to a weak solution of hydrochloric acid. I made my experiments upon that assumption. The dextrine I used I obtained from chemical dealers. There are as many as ten kinds of dextrine. It is made from flour. There are dextrines altogether pure that vary in their reactions.

In re-examination by Mr. Cockerell, witness said that he did not admit the correctness of the supposition that if the phosphate of soda and the alum and bread were in an uncombined state his experiment might have produced phosphate of alumina; the phosphate of alumina was in the bread previous to his experiment.

By the Recorder: I know of no formula for the term baking powder. Baking powders do not produce fermentation, but yeast does. Baking powder produces carbonic acid gas without fermentation. I could make perhaps a dozen baking powders wholesome or unwholesome, and might make two or three that were wholesome. The powder would be equally efficacious without the ground rice.

Mr. Blofeld said the manufacturer informed him that the object of introducing the ground rice was to keep dry the alum and the bicarbonate of soda, both of which might have some moisture about them.

Witness added he would think the mixture would be improved by the ground rice. Other things might be found, but ground rice was quite as good as anything else.

Dr. J. B. Bradbury, Linacre lecturer in physic at St. John's College, F.R.C.P., and one of the physicians at Addenbrooke's Hospital, deposed that from what he had heard from the experiments of the last two witnesses, he should say the effect of the powder used in bread would be to rob the dietary of a certain amount of soluble phosphate which was essentially necessary to nutrition. He agreed with the other witnesses as to the amount of phosphoric acid required for a healthy adult every 24 hours, and as to the amount contained in a pound of flour. In answer to the Recorder, the witness said that people suffered from indigestion who did not eat bread. They got their phosphoric acid from meat, milk, &c. Baking powder produced the same effect as aërating the bread, which was done by forcing carbonic acid into the dough by machinery.

Bread made with yeast disagrees with some people. Practically speaking, is there any fault to be found with bread made with this baking powder?—I should say people might partake of it occasionally with impunity, but if they were to eat it constantly, and especially if they were chiefly to live upon it, it would have a deleterious effect. It would produce indigestion even in a man who led a regular life.

How long has this baking powder been in use?

Mr. Blofeld: Thirty-nine years, and many millions must have eaten bread, &c., made with it.

Dr. Bradbury: It leaves no record how many people have died. There are many diseases one cannot fathom. Stone is very common in Norfolk, and it is not very easy to fathom the cause of it.

The Recorder: Baking powder does not produce stone, does it?—Witness: Indigestion does.

The Recorder: I should have thought the water of Cambridge would have produced more.

By Mr. Cockerell: The use of the powder in bread would have a greater effect upon invalids and children, and taken constantly it is injurious to health in my opinion.

Cross-examination: Many suffer from eating bread made with yeast. People get bad yeast sometimes. Some people buy what is called German yeast, but that is not because the ordinary yeast is scarce, but because the other is more convenient to obtain.

Mr. Blofeld then drew the attention of the witness to Mr. Sutton, and asked if he looked in moderately good health.—Witness: Fairly good.

The Recorder: You had better ask Mr. Sutton now what he thinks of Dr. Bradbury.

Mr. Blofeld said Mr. Sutton stated before the magistrates that he had eaten things made with this baking powder for many years.—Mr. Sutton: And I never suffered from indigestion.

Mr. Cockerell: Mr. Sutton has sovereign remedies for that.

Cross-examination continued: A man eating bread made with this baking powder would be the worse for it at the end of five years.

Is bread made with this baking powder anything like so indigestible as new cheese?—New cheese would suit one person who would not suffer at all, while others would suffer.

The Recorder: Ask him if it is as indigestible as plum-pudding.

Witness: Plum-pudding is not made with baking powder, but it is indigestible.

Mr. Blofeld: Is bread made with this baking powder one-hundredth part as indigestible as new cheese?—I think it would be one-hundredth part.

A little more?—A little more.

Do agricultural labourers who eat a great deal of cheese often suffer?—They have many complaints. I wouldn't put a stop to making cheese, but I would put a stop to eating it.

Your evidence with respect to this baking powder is founded on the assumption that the phosphate of alumina is insoluble in the stomach?—Not altogether, but chiefly.

And if I satisfy you that the phosphates are not insoluble in the stomach your opinion would be altered or modified?—It would.

In answer to questions by the Recorder, witness said that 50 grains of phosphoric acid were excreted by a healthy man in 24 hours, and these had to be supplied, and that if a man were deprived of the component parts of the phosphoric acid he would be injured to that extent.

Dr. Paget, Regius Professor of Physic in the University of Cambridge, F.R.S., F.R.C.P., &c., deposed that having heard the evidence of Messrs. Knights and Muir, and assuming that their experiments were correct, the effect of a person in ordinary health eating an ordinary quantity of bread made with this baking powder would be that in the course of time digestion would be impaired. Going on the experiments of Mr. Muir, that it has the effect of rendering less soluble the dextrine and the gluten of the bread, he should certainly be of opinion that it would render them less digestible, and so far injurious to health. In children the effect would be more marked, and with persons who had weak

stomachs and were troubled with dyspepsia or feeble digestion it would be positively injurious. Questioned on the amount of phosphoric acid required to be taken into the system by a person in good health every 24 hours, the professor stated that to keep a person in health he must take as much of an ingredient, if it were a constituent of the body, as went out of him, and assuming it to be correct that 50 grains of phosphoric acid went out daily, he required to have a like amount introduced.

Mr. Blofeld: Do you imagine that the loss of 2½ grains of phosphoric acid through eating 1½-lb. of bread would be injurious to any man's health?—Not if a man got other food. If a man were to get 2½ grains of phosphoric acid less every day than passed out of him it would very soon be a serious matter.

If I neutralise 2½ grains of phosphoric acid which I should otherwise get should I be one whit the worse off than before?—Probably not; probably you take more phosphoric acid every day than is good for you.

Mr. Blofeld: I hope you confine your remarks to phosphoric acid. But take anyone else in this court; would any man eating this bread be sensibly damaged?—I hope not, because I should hope everybody gets as much food as would compensate him for the loss of the phosphoric acid he requires. If he gets meat, cheese, eggs, milk, and other things in fair quantities the loss of that small amount of phosphoric acid would be of very small moment indeed. The articles I have mentioned contain phosphoric acid, and fish and cheese in very large quantities, vegetables in less quantity. At this moment I cannot think of any article of food that does not contain phosphoric acid. My opinion that bread made with this baking powder is injurious is based upon the fact spoken to by Mr. Muir that it renders less soluble the gluten and dextrine of the flour.

Not as diminishing phosphoric acid?—I said nothing about that. I think it is a disadvantage that it should harden the dextrine. I should not say it was injurious to health except in the case of those who had to live on bread alone.

Baking or roasting meat makes it less digestible than if it were boiled?—Yes, provided it be not boiled too much. Roast goose would no doubt be injurious to the health of a dyspeptic person. If you were to eat it daily during the year you would find evil effects from it.

The Recorder: Would you say in the words of the Act of Parliament that bread made with baking powder was an article of food injurious to health?—I would not venture to say it except in the case of persons of weak digestion. We have not sufficient exact experience I think in regard to persons in ordinary good health to give an opinion on the matter. There is experience of alum in bread being injurious to health.

That would depend upon the quantity in the bread?—The larger the quantity the worse the effects.

Is alum always injurious?—Taken repeatedly I should say it would be. I should say if any practical physician were asked if he would allow any person to take even a few grains every day of his life for a time he would not only advise to the contrary, but would say probably it would cause some disorder of the stomach before long. It is scarcely ever prescribed except externally.

Mr. Blofeld then addressed the Court on behalf of the appellants, and pointed out the importance of this case to a large trade which had been carried on in Norwich, in other parts of the kingdom, and in America, for nearly 40 years. This alum baking powder had been in use almost as many years as he had lived, and not a single objection had been made to it by any human being during that time till proceedings were taken at Cambridge; it was reserved for Mr. Knights, the analyst employed by the Corporation of Cambridge, to discover what had remained a secret to generations of medical men and analytical chemists. Millions upon millions must have used it and there had been no complaint, and he defied his learned friend, Mr. Cockerell, to produce any single human being on the face of the earth to whom the use of this powder had given indigestion. Such a case could not be found. The legal points arising in this case he could not have put so well as the learned Recorder had done, but he urged first that baking powder was not an article of food, and that it had not been proved that anything had been mixed with the baking powder to adulterate it because the baking powder was the thing itself. Yeast if partaken of would be injurious to health, but he imagined that no one would contend that the man who sold yeast would be liable to conviction under this Act. Probably if a man took a pint of yeast he would blow up. Yeast was used in the preparation of drink, but it was not an article of food. And so baking powder was not an article of food—it was used in the preparation of food, but in the bread it ceased to exist; it became something else, a small residuum and the sulphate of soda. As an analagous case the learned counsel referred to the gasogene in which two powders were placed, water applied, and the powders vanished, while the water became aërated. The powders were not used as articles of drink, but for evolving gas, after which they ceased altogether. It would be quite as reasonable to summon Mr. Deck, the chemist, of Cambridge, for selling these powders, the one in a blue and the other in a

white paper, that produced this aërated water, as it was to charge Messrs. Smith & Son, of Norwich, with selling baking powder as an article of food. He could suggest many other things, such as flavouring of bitter almonds which was more or less a poison. Here was an article that was injurious to health, and it was mixed in jellies, but was Mr. Litchfield, of Cambridge, to be proceeded against because he flavoured jellies with bitter almonds? What the respondents had to show was that the article of which they complained was rendered injurious to health by the mixture of alum. The baking powder——

The Recorder: Do not call it baking powder; call it the constituents of it. There is no such thing as baking powder. There must be something analogous to the alum; we have no powder without the alum. You have got according to this an answer to the case, but in deference to others, I have occupied more than five hours to investigate this case, and if the parties wish I will take it further, but, as I said at starting, it appears to me you must first of all get an article of food which is to be so mixed with an ingredient as to make it unwholesome and injurious to health. The baking powder is not baking powder without the alum.

Mr. Cockerell said he could only repeat what he had said at the commencement of the case.

The Recorder added that he was not speaking in derogation of the safety of the public, but he had to administer the law, and it must be remembered that this was a penal law which was to be construed strictly, and not to be extended to cases which the Legislature had not in contemplation. He then took the points raised by Mr. Blofeld as follows:—That the powder, including all these ingredients, is not an article of food; if an article of food, taking all the ingredients together, nothing has been mixed with it; that the ingredients when mixed and used for food cease to exist; that baking powder without the alum is not an article of food.

Mr. Blofeld further argued that the meaning of the Act was that anything injurious to health should be actively injurious, and that the presence of something that merely robbed an article of food of some small quantity of nutrition would not be considered injurious to health, and this baking powder, he contended, used according to the directions, was not injurious to health. The object of its use in bread was to evolve carbonic gas and make the bread light; in ordinary this was done by yeast, and in aërated bread the gas was forced in by machinery. All baking powders were compounded on the principle of combining an alkali with an acid. For instance, Borwick's baking powder was tartaric acid and bicarbonate of soda; water was added, and effervescence took place, and all the original constituents practically vanished and left something else. The objection to powder containing tartaric acid was that the effervescence was almost instantaneous, whereas superiority was claimed for the Norfolk baking powder because the effervescence was much slower. The cream of tartar and bicarbonate of soda were employed, and there was a way of making powder with hydrochloric or muriatic acid, which was a caustic and corrosive poison, and of course it would be a most deleterious thing to get into the stomach. But as soon as it combined with the bicarbonate of soda, the hydrochloric acid vanished, and what was left was common salt, which was perfectly innocuous. In the Norfolk baking powder the alum was used, and as soon as alum was combined with bicarbonate of soda and water was applied effervescence took place, the alum and soda vanished, leaving alumina and sulphate of sodium. When one looked at the dictionary, one found alumina to be an inert earthy matter, the chief constituent of clay, and a constituent of all cereals. So that in all breads alumina would be found, whether alum was used or not. Learned counsel then produced a tube containing six grains of alumina, and said that one of his witnesses, Dr. Beverley, with a view of testing its effects, had swallowed 20 grains of it. There was no effect, and learned counsel had no doubt he would take 20 grains a-day for a long time.

The Recorder: The doctor would carefully prepare himself with an antidote probably.

Mr. Blofeld proceeded to say that in Pereira's great medical work it was recommended that alum should be administered to children suffering from looseness of the bowels and flatulency in doses of from 60 to 120 grains during the 24 hours. Learned counsel was not there to defend the use of alum in bread. It was used in bread to enable the bread to absorb more water, and so increase the weight, while it gave a good colour to bad flour, and so enabled the baker to perpetrate a fraud. Whether alum was injurious to health was an open question, but he was well warranted in saying that there was no recorded case in the world of poisoning by alum, let the quantity taken be ever so great, and he questioned whether there was any case of alum being injurious to health in any way. It was an astringent they knew, but there was no case on record of its being injurious. People thought the alum in this powder went into the bread, but this was a mistake, for in the bread alum ceased to exist, and so far as using the powder to make bread white was concerned, if too much of it was used the bread would be discoloured, and it would make good flour look bad. Then as to what was left after the alum had come in contact with the potash and bicarbonate of soda, the appellants contended that it was

hydrate of alumina and not phosphate, and they had procured the opinion of the most eminent men in the kingdom on the point. Even supposing that phosphate of alumina was found, which he did not admit, then he should show that it was not insoluble in the gastric juice. He should produce an experiment which showed that the alumina was perfectly soluble in an acid like that composing the gastric juice, but it was not only soluble in the gastric juice, but in a variety of other things. His witnesses had paid the greatest attention to the evidence given by the skilled witnesses called on the other side, but they would undertake to say that not the smallest harm in the world could be done to any human being by the use of this baking powder.—Learned counsel then called

Mr. Fras. Sutton, F.C.S., F.C.I., Public Analyst for Norfolk and other places, consulting chemist to the Norfolk Chamber of Agriculture, and author of several analytical works. He deposed that when the baking powder was mixed with the alum it became hydrate of alumina. He did not believe that in bread made with this baking powder phosphate of alumina was found, and it was a very difficult thing to prove that it was. If it were so formed it was believed that it would be soluble in the gastric juice.

Mr. Blofeld: Is it what you would call a strong or a weak chemical combination?—Weak, which means that it is not hard to dissolve or to decompose. Many fluids would decompose it.

It is said that the alumina found in bread neutralises a certain amount of phosphoric acid in the bread; what do you say to that?—It may possibly do so, some portion of it. Supposing it contains phosphate of alumina the fluids of the stomach decompose that phosphate of alumina, and the result would be that the person would be none the worse for it. I have tested bread made with baking powder and bread made with yeast to ascertain the amount of phosphoric acid in each. I made two loaves, or had them made under my superintendence, one with yeast and the other with the Norfolk baking powder. The yeast bread on treatment with cold distilled water gave me 3·04 grains of phosphoric acid dissolved by the water. These were 4lb. loaves. The bread made with baking powder gave me 2·32 grains, being a difference of 72-100ths of a grain in a 4lb. loaf, or 17½-100ths of a grain in a 1lb. loaf.

It is said that the use of baking powder hardens the gluten and the dextrine?—My opinion is that it has no such effect in bread. I have tried an experiment to see if it did by mixing phosphate of alumina with gluten, but I have made no experiment with dextrine. I do not agree that phosphate of alumina renders the gluten less soluble from the experiments I have made. My experiment was to mix the phosphate with the gluten in a very large excess. In one of the boxes produced I have got gluten without phosphate, and in the other the same quantity of gluten with phosphate added in five times the proportion that would be found in the baking powder, and the condition is not altered in the least.

The Recorder: Have you tested its solubility?—No, I did not think it was fair to make such a test with hydrochloric acid. It is not soluble in water, but it is soluble in the juices of the stomach.

By Mr. Blofeld: Hydrochloric acid has not got the salivary fluids or the pepsine in it. Hydrochloric acid is only one of the ingredients, and is but a feeble reproduction of the gastric juice. It is like the gastric juice, leaving out the most important parts. The salivary fluids are particularly necessary for the digestion of all kinds of food, like bread and so on.

You would not be surprised to find that Mr. Muir's experiments were correct, and yet that if the phosphate got into the gastric juice it would do no harm?—Not at all. I may also say that a very high authority, Mitscherlich, of Berlin, states that compounds of gluten with alumina are perfectly soluble in the juices of the stomach.

Will you tell us the result of the experiment you have recently made with two pigs?—Two healthy pigs, of about 5 st. weight each, were purchased and placed in a pen with a boarded floor to prevent them getting earth, which contains alumina. For eight clear days they were fed upon bread made with this Norfolk baking powder in proper proportions mixed up with warm water to a very soft sloppy consistence so as to give the best chance for the formation of phosphate of alumina. They consumed in the eight days 91lbs. of flour, and at the end of 28 days I went and saw them killed.

The Recorder: They did not die as the result of the treatment?—Oh no, sir. The pigs had thriven well during that time and their internal appearances were perfectly healthy, as was admitted by the butcher as well as myself. I had removed the stomach and the whole of the bowels, and had them tied up and sent to my laboratory where I examined them. I opened one stomach where the pigs were killed, and they had the mixture of the powder then in a sloppy condition. I removed separately the contents of the upper portion of the bowels, the second stomach, and also the contents of the lower bowels, or rectum. I took equal portions from the two sets of bowels for each pig, keeping the two uppers separate, and the two lowers separate. I then dried down these separate portions of fœces in platinum vessels, and then burned off the organic matter, with the addition of small quantities of potash to prevent the reduction of the phosphoric acid; the result would be the ash, in fact, of the

fœces, and would contain the whole of the phosphoric acid and other mineral matters present. I then made an analysis of the ash to find the ratio between the alumina and the phosphoric acid. The analysis of the upper bowels showed phosphoric acid 2·24 per cent., oxide of iron 1·08, alumina 3·68, lime 0·9, magnesia 0·4, sulphuric acid 0·274, the remainder was unconsumed carbon, alkalis, &c. In the case of the lower bowels the proportions were phosphoric acid 2·43, oxide of iron 1·18, alumina 4·91, lime 1·13, magnesia 0·54, sulphuric acid ·343. On the assumption that the whole of the phosphoric acid is combined with the alumina, the excess of alumina in the upper portion of the bowel was 2·07 per cent., and in the case of the lower bowel 3·15 per cent. But it is an open question whether the whole of the phosphoric acid is combined with the alumina, because the other things present, which are stronger bases, keep it entirely to itself. The inference to be drawn from the experiment is that the gastric juice in the stomach takes all the phosphoric acid it requires, and if the phosphate of alumina is there at all the gastric juices absorb the phosphoric acid out of it if it is required, leaving the hydrate of alumina in the bowel to be rejected with the fœces. That experiment is a guide to what goes on in the human stomach, and I look upon it as an analogous case.

By Mr. Cockerell: Is alum in bread injurious?—*Per se*, I do not think it should be allowed, because it opens up a way for fraud. Apart from that I do not think a little of it used would be injurious. I do not think 40 grains in a 4-lb. loaf would be injurious. That is my private opinion; I am not giving a medical opinion on that point. Chloride of alumina would be objectionable in a large quantity.

The Recorder: I suppose you might evolve poisonous things out of a mutton chop?—Oh, yes.

By Mr. Cockerell: Mr. Muir produced his phosphate of alumina in conjunction with the gluten; mine was produced the same way as it would be in the bread. I extracted the gluten from the flour in a pure state. The effect of hardening the gluten in any way would be to make it tough like leather. It is of no use my making experiments that do not go on in the stomach. Those made by Mr. Muir were merely a waste of time and nothing more.

By the Recorder: I do not dispute the accuracy of Mr. Muir's experiments as he made them. My opinion of Mr. Muir's experiments as a chemist is a very high one, and I think he is a very admirable experimenter.

By Mr. Cockerell: Mr. Muir's experiments and mine are not comparable because he used hydrochloric acid, which is not all that the gastric juice contains, and my experiment was with the natural juices. Eight days' feeding of the pigs was fixed upon in order that they might get rid of the food they had had before and fill themselves with the bread. It was an improved diet for them. The food had no prejudicial effect whatever upon the lining of the stomach. I have used this baking powder for years for all kinds of pastry, cakes, &c.

By the Recorder: I have had no reason to complain of its having given dyspepsia, indigestion, or anything of the kind, nor have my wife or family.

By Mr. Cockerell: My chief article of nutrition is not bread, but my children live mainly upon bread food. We do not make bread with the baking powder; we prefer yeast bread.

The Recorder: Possibly a person living on this bread might suffer ill-effects from it, but would not a man suffer ill-effects who had nothing to eat but yeast bread?—It would be very injudicious in any one to live upon it.

Can you, after making these experiments, conscientiously say that you think there is nothing in this baking powder that is injurious to health?—I do not think there is, and I gave that opinion seven years ago.

You know the words of the Act of Parliament. Can you say, as a skilled witness, that there is nothing injurious to health in it?—I certainly do say so, and I would not allow it to be used in my house if I thought otherwise.

The Recorder asked if there was any need to go further after what this gentleman had said. This was a penal enactment, in which the first offence rendered a person liable to a penalty of £50, and the second to imprisonment, with hard labour, for a period not exceeding six calendar months. Could he be expected to confirm this conviction when a skilled witness like Mr. Sutton (for whose opinion he had the highest esteem) declared upon his oath that there was nothing injurious to health in the use of this baking powder, raising the question even upon the merits, without the question as to whether the case came within the statute?

Mr. Blofield said he should like to call Dr. Thudicum and Dr. Tidy in fairness to Messrs. Smith and Sons.—The Recorder assented, and

Dr. J. L. W. Thudicum, F.C.P., Lond., F.C.S., deposed: I have been frequently consulted on hygienic questions by the Government and by Boards of Health.

Mr. Blofeld: You have been present throughout this trial, and, having heard all the evidence that

has been given, and the experiments that have been made by Mr. Muir and those of Mr. Sutton, and his experience of this baking powder, is there in it in your opinion anything that is injurious to health?—In my opinion there is nothing injurious in the use of this baking powder.

Assuming that phosphate of alumina is formed in the stomach, would it or would it not be decomposed in the gastric juices in the stomach?—It would be entirely decomposed by the gastric juices in the stomach.

Do you admit that these is phosphate of alumina there?—I merely assume that there is for the purpose of this argument.

Is it your opinion that there is or is not?—It is not proved that there is.

By the Recorder: The decomposition would take place without any extra effort of the gastric juice. The difference it would make by its presence would be inappreciable.

By Mr. Blofeld: The hydrate of alumina in the bottle produced is perfectly harmless.

The Recorder (to Mr. Sutton): How much do you say you produced from a 2lb. loaf?—Six grains.

Dr. Thudicum: That rests upon the evidence of Mr. Sutton, and I coincide with it. It is perfectly harmless.

Mr. Blofeld: Dr. Beverley may have taken 20 grains?—He might.

You have heard a good deal said about the diminution of the phosphoric acid absorbed into the system by the use of this baking powder, will you give us your opinion?—The diminution of phosphoric acid in the human body by the use of this baking bowder would be quite inappreciable, and would be of no consequence whatever to the body.

You heard Mr. Sutton give his evidence as to the experiment he made with the two pigs and the conclusion he came to. Do you agree with the conclusion he drew?—I agree with them, and think they are physiologically stronger than he put them.

The Recorder: You think the experiment was a satisfactory one?—Very so.

Mr. Cockerell, addressing the Recorder, said he took it that he had decided the case, and as he (Mr. Cockerell) did not apprehend he should be able to alter the Recorder's view of the matter it would be absurd for him to take up more time.

The Recorder said it was satisfactory to find that there was not so much difference between the gentlemen on the one side and on the other. No one disputed the accuracy of the experiments made, but upon the one side hydrochloric acid was used, and on the other side it was said by a very able gentlemen that this acid was only one of the component parts of the gastric juice, and the experiment he made was strictly analogous to what took place in the human system.

Dr. Charles Meymott Tidy, M.B., F.C.S. (Professor of Chemistry, and of Forensic Medicine at the London Hospital, Medical Officer of Health for Islington, and late Deputy Medical Officer of Health for the City of London, &c.), was next sworn and examined by

Mr. Blofeld: The first question is as to phosphate of alumina being formed. Do you agree that it is formed in bread by the use of this baking powder, or is it an open question or not?—I think it is very improbable that the phosphate of alumina is formed at all, because in order to form phosphate of alumina you must have actual contact between the phosphoric acid and the alumina, and I cannot see how that can be brought about under the ordinary conditions of digestion, and even granting that it occurs—and I don't think it makes the slightest difference in the case—even supposing that it does occur, I know, as a matter of fact, that the phosphate of alumina is soluble in the gastric juices in weak acid solutions, and I know that when phosphate of alumina is in solution of that nature with the membrane between and the alkaline blood on the other side the whole of the phosphoric acid filters through into the blood. I know that as a laboratory experiment, and I know if that occurs as a laboratory experiment it occurs much more rapidly in the living tissue.

Can you see anything on earth in the use of this baking powder which can be injurious to health?—No; most certainly not. I should like to say, in giving my opinion with respect to this powder, that I do not wish to express any opinion about alum in bread as a means of fraud. I conceive alum ought not to be used in large quantities, as it is not on the question of injury to the health, but for the reason that bread holds a larger quantity of water and bakers can use a very inferior quality of flour. I am only giving my opinion of this baking powder and not of the alum in bread-making.

Mr. Cockerell: Nor of the use of alum at all?—I do not give it, but simply as alum leads to fraud.

The Recorder: You think there is nothing injurious in this powder?—No, in the proportions in which it is possible to use it. It might be said, "Couldn't you put in a large quantity of this powder?" but this could not be done as it would spoil the bread entirely. Therefore it is utterly impossible to my mind that this powder could be used for the purpose of fraud from the point of view from which I put alum forward and from which alum is occasionally used.

Mr. Blofeld said he had Dr. Beverley here, but he did not think, after the evidence that had been given, it was necessary to call him. That was his case.

The Recorder, in giving judgment, said: It is unnecessary for me to express any opinion upon the legal point as to whether this case falls within the Act of Parliament; but if my opinion is worth anything to anybody I still adhere to the opinion I have already expressed, that it does not come within the Act for reasons, some of which I have already given. I decide this case upon its merits and upon the evidence. After the evidence we have just heard I do not think this baking powder is an article of food, or that bread made with it becomes an article of food injurious to health, and as a matter of fact, I find in favour of the appellants.

Mr. Blofeld: I have to ask for costs.

Mr. Cockerell: I never heard of any costs being given against magistrates. We come here to uphold the decision of the magistrates.

The Recorder: Who is the respondent?—Mr. Cockerell: Mr. Phillips, the provision inspector.

The Recorder: Who put the law in force?

Mr. Cockerell said proceedings were taken against the sellers of this powder at Cambridge, in consequence of a conviction that took place there of a man for selling buns made with this powder. The magistrates threw out a hint that proceedings should be taken against the sellers of the powder.

Mr. Blofeld said the buns in question could not have been made with this baking powder.

The Recorder also said that they could not have found alum in the buns if they were made with this powder.—Mr. Cockerell: They did not say it was alum.

Mr. Blofeld: They did say so, and here is the conviction to prove it. (Conviction handed in.) The persons who started these proceedings were a committee connected with the Corporation and not the magistrates.

The Recorder: I should be loth to make an order for costs, especially against Mr. Phillips, a public officer put forward by the Corporation to look after the health of the town, but if the conviction were sustained I see that the costs Mr. Phillips would have received from Messrs. Warren would have been £10 1s. Ordinarily speaking I should not think of giving costs against the magistrates nor against a public officer, but I should like to know the circumstances under which this prosecution was instituted.

Mr. Cockerell said he had stated the circumstances.

The Recorder—Where will the costs come from?—Mr. Cockerell did not know.

Mr. Horace Browne said they would come out of the Corporation. His learned friend Mr. Cockerell was being instructed by the Town Clerk.—After further opposition on the part of Mr. Cockerell,

The Recorder said: I do not see why the usual results should not follow upon a successful appeal. I quash the conviction, with costs. The costs allowed amounted to £100.

Mr. G. D. Macdougall has been appointed Public Analyst for Perthshire.

Mr. J. Napier has been appointed Public Analyst for the Borough of Ipswich, and also for East Suffolk.

Mr. J. Carter Bell has been appointed Public Analyst for Stalybridge.

REVIEWS.

A Year's Cookery. By Phillis Browne. Cassell, Petter & Galpin.

Cookery becomes more and more a question of chemistry, and the waste of food is, by this means, becoming reduced; therefore when a cookery book makes any claim to scientific accuracy it is a fit subject for review in our columns. The preface to this work says: "No work of the kind on this plan exists. I have specially addressed myself to people of moderate income, with moderate kitchen help and ordinary domestic utensils." It is seldom that we find such a bold statement as the *raison d'être* for a new book, but after carefully reading it through from beginning to end, we find that the contents fully justify the statement made. It is the most unique and complete book on cookery we have yet seen; unique in its conception, because a separate *menu* is provided, not only for each day of the year, but for every meal for each day; complete in its directions which not only give ordinary, and many extraordinary receipts; but even include in the proper time

and place, such directions as: "Put a cupful of hominy in soak in cold water ready for to-morrow morning." A remarkable feature is the daily paragraph of things that must not be forgotten. Careful attention to these paragraphs, day by day, would cause a considerable reduction in the expenses of many households, where a large proportion of the food now cooked, or supposed to be cooked, is simply wasted. American cereals and tinned goods are judiciously referred to, and included in many of the dishes, and the novel receipts are not only numerous, but as far as we have yet tried them, generally good.

NOTES OF THE MONTH.

Two cases have been decided during the month on the subject of cream of tartar, and it has been held that the commercial salt, containing tartrate of lime, is a legal tender under that name. Modern *argol* certainly always contains a much larger proportion of lime than was formerly the case, owing to the almost universal custom of "plastering" the grape juice; but it is a question how far purification by recrystallization should be carried, before the crude *argol* can be sold as cream of tartar. There is no standard for this apparently, because that of the British Pharmacopœia is taken only when it suits the defence, and when it does not it is promptly repudiated. It is unfortunate, therefore, that some analysts should continue to take that standard without first making themselves acquainted with all the details of the manufacture and contents of commercial articles, as it only leads to action tending to discredit the general body. What an analyst ought to do in the case of his getting any article with the commonly recognised composition of which he is not experimentally familiar, was well stated by Dr. Dupré at our last meeting, when he said that, under such circumstances, the analyst should apply to our Secretaries to furnish him with the names of one or two of the members who had made a specialty of the subject, and then seek the advice of the gentlemen named before certifying. Had this been done in the cases in point the analyst would have doubtless been referred to one of our Vice-presidents, who is well-known for the depth of his information on everything relating to wine, and to our President, who is daily engaged in the study of all relating to drugs, and between them we are satisfied such advice would have been tendered as would have induced the insertion of some special remarks in the certificate, tending to prevent prosecution if possible. We trust that all our country friends will in future take this course, as all our specialists have expressed their perfect willingness to give such advice in every case. Members should not forget that the very object of our Society is mutual self-help, and no scruples of false delicacy should prevent their applying, as no man can hope to unite in himself a perfect practical familiarity with all the articles embraced in our very wide field of research, and it is no slur on his general knowledge that he requires now and then special enlightenment.

Of course the trade journals have their fling as usual when any prosecutions break down. The *Chemist and Druggist* comments on the cases in an article headed "Angellic Pharmacy," but as in this case it fairly confines its strictures to a particular analyst's evidence, and does not make it a handle to denounce the whole body of Public Analysts, we must leave the gentleman affected to take whatever remedy he may be advised to adopt, if he feels desirous of doing so. The *Pharmaceutical Journal*, on the other hand, talks loudly of our general incompetence, and suggests that *their* society should move so as to obtain a more rigid scrutiny of the knowledge of analysts before appointment. To the latter desire we have nothing to say, and *our* Society would cordially second any true effort to raise the standard of analysts; but to the cry of general incompetence we return a most unqualified denial, and, in support of that, we can point to the fact, referred to in our President's address, that England, as represented by our members, is at present the leading source of improvements in all processes used by Public Analysts, as evidenced by the 41 papers read before our Society or published in our columns during the past year.

While on this subject, we would ask the learned doctor who presides over the *Pharmaceutical Journal* what remedy he proposes in the matter? His own society has examinations continually increasing in stringency, and would he dare to say that, even then, every man who obtains the power to legally write himself pharmaceutical chemist is perfectly competent to deal with every prescription which may be submitted to him? If so, where the necessity for the "dispensing memoranda" for mutual self-help, which is so prominent a feature in his journal. Again, take the medical and legal professions, both of which guard their doors with the utmost jealousy, and do we there find each man universally cognisant of all diseases or points of law? If so, why the skin, ear, eye, and brain specialists, and why the conveyancer and special pleader? Hedge any scientific pursuit with as many barriers as you please, you cannot ensure universally competent men to deal with every special matter which may arise. Why then should Public Analysts be expected to be superhuman? If the same blaze of publicity was necessarily entailed on pharmacists as on Public Analysts we should soon see which body would come out most slightly scathed. There are no journals interested in holding up to public scorn every pharmacist who, when engaged in counter prescribing, mistakes the symptoms of his customer, and gives him a purge when he ought to have let him alone or referred him to a medical man; but woe betide the analyst who makes the slightest slip, for all his previous work goes for nothing! Let the Pharmaceutical Society render all its members perfectly free from even a chance of mistaken opinion before it undertakes to do the same to others.

Another disputed case has been heard on the subject of alum in baking powder, and it has been held that the use of that article, as a constituent in such mixtures, is not dangerous to health when combined with sodium carbonate. It is doubtless a great victory for the manufacturers, but we have yet to see its ultimate effect for public good. In this case, at all events, no blame can be laid to the door of the analyst, even by the most rabid detractor, seeing that it commenced by the prosecution of a baker for alum in buns, and on his stating that he used this powder, the magistrate directed an examination of the article, and prosecution of the manufacturers. All through the case Mr. Knights (ably seconded by Mr. Muir) acted with skill, and made a series of interesting experiments in support of the contention that alum rendered bread indigestible. The matter was forced upon the analyst, so the failure of the case can in no way be attributed to him. The result of the case does not interfere with the prohibition of the use of alum in bread, because even the defence witnesses (brought up at great cost it was stated) said that, in giving their opinion as to the innocence of this particular powder, they were not to be held to say that the addition of alum to bread was, in their opinion, allowable. There is no need to fight the question of danger to health, when the fact remains that the use of alum enables the baker to defraud the public by using inferior flour, and getting his loaves to hold more water, and it is on this view that certificates had better be drawn in future.

BOOKS, *&c.*, RECEIVED.

The Art of Perfumery, by G. Septimus Piesse; The Chemist and Druggist; The Brewers' Guardian; The British Medical Journal; The Medical Press; The Pharmaceutical Journal; The Sanitary Record; The Miller; Journal of Applied Science; The Boston Journal of Chemistry; The Provisioner; The Practitioner; American New Remedies; Proceedings of the American Chemical Society; Le Praticien; The Inventors' Record; New York Public Health; Philadelphia Printers' Circular; The Scientific American; The American Traveller; Society of Arts Journal.

*** Owing to the pressure on our space this month, we are compelled to hold over several papers and other interesting matter already in type, especially a paper by Mr. West Knights, on his experiments in the Norfolk Baking Powder Case.

THE ANALYST.

MARCH, 1880.

SOCIETY OF PUBLIC ANALYSTS.

A GENERAL MEETING of this Society was held at Burlington House, on Wednesday, the 18th February, the President, Dr. Muter, in the chair.

The Scrutineers appointed to examine the voting papers reported that Mr. T. P. Bruce Warren, Analytical Chemist and Telegraph Engineer, had been elected as a Member, and Mr. Lionel Stansell, Assistant to Mr. C. H. Piesse, as an Associate.

The following were proposed for election as Members :—

J. G. Tatters, Analytical Chemist, South Shields.

F. P. Perkins, Public Analyst for Exeter.

Elwyn Waller, Ph.D., F.A.C.S., School of Mines, Columbia College, New York.

H. A. Mott, Ph.D., F.A.C.S., 117, Wall Street, New York.

H. Lancaster Hobbs, Analytical Chemist, Holborn Viaduct.

The following papers were read and discussed :—

"Remarks on the Estimation of Milk Sugar," and "A Process for the Estimation of Cane Sugar in Milk," by J. Muter, Ph.D., M.A.

"On a New Method of Taking the Specific Gravity of Solid Fats at Ordinary Temperatures," by A. Wynter Blyth, M.R.C.S.

"On the Action of Alum in Bread-Making," by J. West-Knights, F.C.S.

"On Blowpipe Assays of Silver Lead," by F. Maxwell Lyte, F.C.S.

"On the Persistent Occurrence of Starch," by F. P. Perkins, Public Analyst for Exeter.

"A Series of Analyses of Air," by H. Macagno, Director of Agricultural Station, Palermo.

The next Meeting of the Society will be held at Burlington House, on Wednesday, March 17th.

REMARKS ON THE ESTIMATION OF MILK SUGAR.

BY JOHN MUTER, PH.D., M.A., F.C.S.

Read before the Society of Public Analysts, on 18th February, 1880.

I HAVE been for some time studying the behaviour of milk sugar with Fehling's solution, and now propose to lay a summary of my results before the Society, so as to give, if possible, an answer to the oft-repeated questions: (1) What is the best method for an analyst to follow? and (2) Given such method, what is the true equivalent for calculation of results? I do not propose to go at tedious length into all the numerous experiments on which I have based my conclusions; suffice it to say, that I have definitely formed the following opinions: (*a*) that the best process for general use is the gravimetric; (*b*) that it should be carried out according to strict rules so as to

ensure a constant equivalent; (*c*) that the precipitate may be directly weighed as cuprous oxide (Cu_2O). I am aware that, at first sight, the propositions (*a*) and (*c*) will be at once mentally disputed by persons prejudiced by former training, because they would naturally consider the volumetric method to be more rapid, and at once declare that cuprous oxide is not stable, and ought to be first converted into cupric oxide before weighing. In answer to the first objection, I may say that when dealing with lactose, the volumetric method, in which the sugar must be brought into contact a little at a time with strong alkali, never gives really accurate results except by accident, and that a really constant equivalent cannot be ensured unless *the whole can be diluted to such a point as will render the alkali harmless, while the Fehling's solution is at once added in sufficient quantity to instantaneously perform the whole reaction, and both the sugar solution and the Fehling are actually boiling when mixed*, points only to be attained by the gravimetric process. In reply to the second prejudice, I say that cuprous oxide precipitated from boiling solutions, washed with boiling water so that it is never unduly exposed, and at once transferred to a good close drying chamber, in the air of which there is a little petroleum vapour, is really a more convenient and accurate article for weighing than the very hygroscopic cupric oxide. This I have proved again and again, and have definitely abandoned the conversion into CuO. With regard to the equivalent of milk sugar in copper, I have practically proved that the results of Herrn. Rodewald and Tollens *(Deut. Chem. Ges. Ber. II. 2076-84)* are accurate as to the alterations obtainable under various circumstances, but I say in addition that an extreme point of dilution may be obtained at which the alkali ceases to affect the process, provided the "Fehling" be added boiling, and at once in very slight excess, and the precipitate be not allowed to stand in contact with the re-agent for any length of time. At this point we obtain a constant equivalent of 146·3 parts cuprous oxide for every 100 of lactose, (or in other words, 7·0 atoms of metallic copper for each molecule of anhydrous milk sugar) and so avoid dealing with fractions of atoms, which are on their very face most probably inaccurate, and the mere result of special accidental circumstances.

The exact details of the process by which this equivalent can be attained within a very small fraction are as follows:—

A 3½-inch Swedish filter is well dried at 212°, weighed rapidly between watch glasses, placed in a funnel, moistened, and the folded part well pressed to the funnel. The sugar solution is diluted with boiling water, until it does not contain more than ·1 per cent., and brought to brisk ebullition in a large beaker. A very slight excess of *boiling* "Fehling" is then added, and the whole kept boiling for three minutes and set to settle. In a very few minutes the precipitate will have subsided sufficiently to enable the slightly blue liquid to be poured off *quite close* into another beaker. 50 c.c. of boiling water are then poured on the precipitate, and it is kept warm over a low gas flame while the poured off liquid (which should also be kept nearly boiling) is passed through the filter if necessary, but generally this is not required, and always to be avoided if possible. As soon as this is done, the filter is washed with boiling water until all blue colour is washed out, and the main precipitate is then transferred to the filter, taking care that the latter is never more than half full, as the cuprous oxide creeps up very much. When all is on, it is rapidly washed with boiling water, until what passes through ceases to give a pink with a drop of spirituous solution of phenol-

phthalein, and when perfectly drained, two drops of petroleum spirit are dropped on to the precipitate, and the filter is removed from the funnel and placed in a close drying oven at 212° on several folds of hot and dry blotting paper. In about half an hour it will be dry, and the whole is then rapidly weighed in the same watch glasses as were originally used, put back into the bath for a short time longer, and again weighed. If the weight be no less, then deduct the filter tare and say, as 146·3 : 100 : : weight of precipitate, which gives the amount of milk sugar in the original solution. The process can be completed in about two hours, and since I worked in this way I have rarely failed to get my equivalent. Departing even in the least, however, from these exact details, the equivalent may range from 145 to 150, and be quite a matter of accident. In fact, the whole estimation wants practice and rapidity, but that once attained, it is good.

A PROCESS FOR THE ESTIMATION OF THE AMOUNT OF CANE SUGAR ADDED TO MILK, TOGETHER WITH THE WATER THEREBY CONCEALED.

By John Muter, Ph.D., M.A., F.C.S.

Read before the Society of Public Analysts, on 18th February, 1880.

The very extensive use of "Milk Improvers," and other similar nostrums, nearly all of which have for their object the defeat of ordinary methods of milk analysis, as well as the constantly increasing practice of making up a short supply by using condensed milk and water, renders it imperative that Public Analysts should be on their guard as to the presence of cane sugar. Happily the qualitative test is very simple, being that of taste, and it is only necessary to practise for some days the tasting of pure and sugared milk to render oneself perfectly proficient in detecting as little as 10 per cent. of sugar-water of 9·3 per cent. which has a gravity corresponding nearly to that of milk, and the addition of which will not reduce the "solids not fat." The presence of sugar being thus suspected, the question of amount has to be settled, and I have thought it would be of general interest to our members that I should detail the process we have now for some time used at the South London Central Public Laboratory for this purpose, by which, as will be seen, the total sugar is *directly weighed*, and the estimated milk sugar having been deducted the difference expresses added sugar. It is as follows:—

Ten grammes of the milk are poured upon 4 grammes of hydrated calcium sulphate in a basin, and evaporated to perfect dryness, with frequent stirring, so that nothing sticks to the basin. The dry residue is powdered, macerated with ether, thrown on a *dried* filter over a tared beaker and percolated with ether till free from fat. The ether is then evaporated off, and the beaker *plus* fat is weighed, by which the percentage of fat is ascertained. The contents of the filter are then transferred to a beaker, together with the filter itself, and 20 c.c. of hot (but not actually boiling) water are added, and the whole well stirred. 30 c.c. of rectified spirit (60° o.p.) are then added, and the mixture is allowed to cool, stirring occasionally. When cool it is thrown on a filter placed over a long graduated measure, and washed with proof spirit (2 parts by volume of water, and 3 of 60 o.p. spirit) until the filtrate measures 120 c.c., at which point

extraction is usually complete. The filtrate is then divided into two equal parts, and one portion is evaporated in a platinum dish and then placed in the drying oven at 212° till constant in weight. The weight is noted and the dish and contents are ignited for some time at a dull red heat and again weighed, when the total weight, less that of the dish *plus* ash, gives total sugar, which is multiplied by 20 to get percentage. The other portion of the filtrate has meanwhile been evaporated on the water-bath until the smell of spirit has passed off, and it is then washed into a large beaker, diluted with boiling water to 200 c.c., treated with boiling "Fehling," and the milk sugar is estimated exactly as described in my previous paper on that subject. The weight of the cuprous oxide obtained is multiplied by 20, and the calculated from 146 to 100. (The fraction of ·3 on the equivalent may be disregarded, as the process is not accurate within that amount.) The weight of milk sugar thus found is then deducted from the total sugar, and the difference (if over ·5) is put down as cane sugar. If over ·5 and under 1·0, a rebate of ·2 per cent., and if over 1 but under 1·5, an allowance of ·1 is to be made; but if the sugar reaches over 2 per cent., it may be taken as it stands, for the following reasons. Dealing with pure milk in a series of trials we got the following differences, due to the presence of bodies unestimated by "Fehling," or to natural inherent error.

Total sugar..	5·02	
Milk sugar	4·94	lowest.
Difference	·08	
Total sugar..	5·10	
Milk sugar	4·77	highest (probably loss in Cu_2O and carbon left in ash).
Difference	·33	
Total sugar..	5·00	
Milk sugar	4·80	fair average milk.
Difference	·20	

It is therefore evident that by allowing the extreme limit of ·5 before condemning a milk, we guard entirely against risk of error.

As the amount of cane sugar increases, and consequently also the water it conceals, the amount of natural error due to unestimable bodies sinks, as will be seen from the following experiments taken at random from our books, as being fair average ones to indicate the possible accuracy of the process.

1. A Milk containing 10 per cent. sugar water of 9·3 per cent. strength—

Total sugar	5·56
Milk sugar	4·45
Cane sugar found	1·11
„ „ by theory	·93
Difference	·18

2. A Milk with 20 per cent. of sugar water—

Total sugar	5·77
Milk sugar	3·80
Cane sugar found	1·97
„ „ by theory	1·86
Difference	·11

8. A Milk with 30 per cent. of sugar water—

Total sugar	6·18
Milk sugar	3·35
Cane sugar found	2·83
„ „ by theory	2·79
Difference	·04

The process is therefore reliable within an extreme of ·3 per cent., which is really, I believe, due to the difficulty of getting a perfect ash without either on the one hand leaving some charcoal, or on the other volatilizing some chlorides.

The analysis of the milk is completed by taking a total residue and ash in the usual way. As an example of how nearly the added water may be calculated, let us take Milk No. 1, which showed—

Total solids	12·39
Fat	2·90
Solids not fat	9·39
Ash	·71

And correct it as follows:—

Apparent solids, not fat	9·39
Cane sugar found	1·11
True solids not fat	8·28

then

$$\frac{8{\cdot}28 \times 100}{9} = 92 \text{ per cent. milk by the Society's limit.}$$

or

$$\frac{8{\cdot}28 \times 100}{9{\cdot}3} = 89 \text{ per cent. milk by Wanklyn's standard.}$$

Whereas it was as we have seen, actually 90 per cent. of pure milk, and would have passed as unadulterated if not examined by this process. I have used the process several times in actual practice, and in every case the use of condensed milk has been afterwards admitted in court, so I consider that it is one which may be safely recommended for general use, always remembering that *if after proper training of the palate you cannot taste sugar in a sample, there is no use seeking for it*, and, indeed, to do so is to invite chances of error.

I may mention that I am now experimenting on an inversion process, having, I believe, substantiated the fact that lactose does not invert into galactose by the ordinary method used with the sugar polariscope, viz.:—heating 50 c.c. sugar solution to 68° C. with 5 c.c. of fuming HCl, but my results are not sufficiently advanced to warrant any change in our process, and I doubt if the double determination of sugar will prove any advantage over the evaporation method as detailed in this paper, seeing that we cannot use the Fehling volumetrically with any real degree of certainty.

In the discussion which ensued, Mr. Wynter Blyth said he thought Dr. Muter was the first to establish in a court of law that cane sugar really is used in milk, and pointed

out that analysts must look after that particular thing. As to extracting the sugar with solvents in the way indicated, he himself generally preferred to precipitate the caseine in the manner mentioned in his paper published last year in the *Journal of the Chemical Society*. By using that process fairly pure milk sugar crystals could be obtained, and sometimes he had got almost perfectly white crystals. He mentioned that the Tartars separated the sugar from milk by freezing the milk when a kind of white flour is formed on the ice. This flour they scrape off and make into cakes, which they eat.

Mr. Hehner said that one objection which had been urged against filtering the alkaline copper solution was that the solution acted very strongly upon some kinds of filter papers, and dissolved the cellulose in them, but

Dr. Muter said that in nine cases out of ten the solution did not act on the filter.

ON THE COMPOSITION OF UNFERMENTED WINES OF COMMERCE.

By J. Carter Bell.

Read before the Society of Public Analysts, on 14th Jan., 1880.

Lately I have had some of these so-called wines to examine, which were alleged to be manufactured from the pure juice of the grape. My opinion is, and I think it will be shared by those who study the following analyses, that the juice of the grape is totally absent. These samples of wine have been made the subject of legal proceedings, and the defendants on cross-examination stated that they were made from sugar, crystallised tartaric acid, salycylic acid, and one-sixth of grape juice.

No. 1 bottle was labelled: "Unfermented Port Wine, manufactured from the juice of the grape, for family and sacramental purposes."

Specific gravity 1100.

	100 volumes contain
Volatile acid, calculated as acetic	·006
Tartaric acid	·502
Sugar (invert)	21·2
Ash	·0395
Insoluble ash in water	·0185; or 46·8 per cent.
Soluble ash in water	·0210; or 53·1 „
Residue, dried at 230° F.	24·50
Salycylic acid	·02

The ash contained traces of chlorine, sulphuric acid, phosphoric acid and potash.

No. 2 bottle was labelled: "Unfermented Wine, Sherry, manufactured from the juice of the grape, for family and sacramental purposes."

Specific gravity 1098.

Volatile acids, calculated as acetic	·006
Tartaric acid	·581
Sugar (invert)	22·900
Ash	·019
Insoluble ash in water	·009; or 47·3 per cent.
Soluble ash in water	·010; or 52·6
Residue, dried at 230° F.	25·421
Salycylic acid	0·100

This ash also contained traces of sulphuric acid, phosphoric acid, potash and soda.

No. 3 bottle was labelled: "Unfermented Juice of the Vine, pure uncoloured virgin fruit of the vine, nutriment of the grape without the irritant, for sacramental and dietetic purposes, and in all cases where wine is generally used. This alone should be used where any wine is required."

Specific gravity 1120.

Volatile acids, calculated as acetic	·005
Sugar (invert)	28·502
Tartaric acid	·616
Ash	·026
Insoluble ash in water	·012; or 46·1 per cent.
Soluble ash in water	·014; or 53·8 ,,
Residue, dried at 230°	29·821
Salycylic acid	·123

The price charged for these liquors was 2s. 6d. a bottle. I reported that they were merely solutions of sugar and tartaric acid, flavoured and coloured, and kept from fermenting by the addition of a little salycylic acid. I have made a partial analysis of the juice from black and white grapes to compare with the above.

Juice of Black English Grapes:—

Specific gravity 10835.

Residue at 212° F.	22·902
Residue at 230° F.	18·615
Sugar	13·210
Total free acid, calculated as tartaric	·700
Ash	·356
Insoluble in water	·0336; or 9·43 per cent.
Soluble in water	·3224; or 90·56 ,,

Juice of White Almeria Grapes:—

Specific gravity 1071.

Residue at 212° F.	20·282
Residue at 230° F.	15·960
Sugar	12·60
Total free acid, calculated as tartaric	·60
Ash	·331
Insoluble ash in water	·035; or 10·57 per cent.
Soluble ash in water	·296; or 89·42 ,,

I think it is very evident that one-sixth of grape juice is not in the so-called wines, for it would have raised the percentage of ash, and also have increased the percentage of solubility.

Mr. Heisch expressed his surprise that the case was taken into court. He could not understand what the nature and quality of an unfermented wine should be. In ancient time the juice of the grape was certainly looked upon as wine, but its keeping qualities were doubtful.

Mr. Allen thought it was clearly the purchaser's duty to take the matter into court. There was always some confusion in the English language between wine and vine, but if they called it unfermented wine it certainly represented that it was made from the vine.

Dr. Dupré regretted that such a case should have been brought into court. He himself was consulted by someone who wanted to institute a prosecution; he examined

some wine, and substantially agreed with Mr. Bell's analysis. His sample was almost free from potash, he could not detect any with the spectroscope, consequently it was not juice of the grape; but then came the question—Was it manufactured from the juice of the grape? Was it cane sugar inverted by the use of tartaric acid? It was impossible to say whether invert sugar was cane sugar inverted, or whether it was grape. In the second place, the tartaric acid was undoubtedly derived from the grape. The chemist cannot say that it is not a sugar of the grape; he has to admit that tartaric acid comes from the grape, and for that reason he (Dr. Dupré) declined to have anything to do with the case. He could not possibly prove that it was not the juice of the grape, although it was obviously an imposture.

ALCOHOL TABLES,*

By Otto Hehner, F.C.S.

Every chemist who has to make alcohol determinations, must have felt the want of *complete* Alcohol Tables, such as would give for all possible specific gravities from pure water to absolute alcohol, the percentages of alcohol by weight, by volume, and of proof spirit. A great number of elaborate tables are in existence, and are to be found in every comprehensive work on chemistry, but there is none, as far as I am aware, which answers the requirements, giving at a glance the data above mentioned, without entailing the trouble of a calculation.

To meet that want, the following tables have been compiled and calculated.

The excellent tables of Fownes—giving the percentages by weight, of Gay Lussac—giving volumina, and of Drinkwater, are all at present in use, but unfortunately they do not agree absolutely with each other: thus, for instance, absolute alcohol according to Fownes and Kopp has a specific gravity at 15·5° C. of 0·7938, and according to Gay Lussac of 0·7946. All later investigators having confirmed the general accuracy of Fownes' table (which gives whole percentages only), this has been taken as the basis of calculation. But it became necessary to include in the table the specific gravity of proof spirit, which according to Drinkwater is 0·9198, corresponding to 49·24 per cent of alcohol by weight, in the tables, since all excise calculations are based upon proof spirit. According to Fownes, however, a specific gravity of 0·9198 does *not* correspond to 49·24 per cent. of alcohol, but to 49·37 per cent. This figure was consequently dove-tailed into the tables with as low gradients as possible.

The following rules were followed in the calculations.

To convert—

$$\text{Weight into volume} = \frac{\text{Specific gravity} \times \text{per cent. weight.}}{0{\cdot}7938}$$

$$\text{Volume into weight} = \frac{0{\cdot}7938 \times \text{per cent. volume.}}{\text{Specific gravity.}}$$

Volume into proof spirit = per cent. volume × 1·7525.

Weight into proof spirit = per cent. weight × specific gravity × 2·20771.

Degrees under proof are obtained by subtracting percentages of proof spirit lower than 100 from that figure, and degrees over proof by the subtraction of 100 from percentages of proof spirit lying between proof and absolute alcohol.

* These Tables, of which we print four pages this month, will be comprised in four or five numbers of The Analyst, and the paging has been so arranged that when the volume is bound the whole of the Tables may be placed together.

All figures were calculated to the third decimal, and then abbreviated to the second.

The greatest possible care has been taken to exclude mistakes, and although it can hardly be hoped that such be entirely absent—considering that the table includes thousands of figures—they will, it is hoped, in no case be found serious.

No originality whatever is claimed for these tables, and if they be but found to save some trouble and calculation, the large amount of work which they embody will not have been expended in vain.

Sp. Gravity at 60° F. = 15·5° C.	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit; per cent.	Sp. Gravity at 60° F. = 15·5° C.	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit; per cent.
1·0000	0·00	0·00	0·00				
·9999	0·05	0·07	0·12	·9959	2·33	2·93	5·13
8	0·11	0·13	0·23	8	2·39	3·00	5·25
7	0·16	0·20	0·35	7	2·44	3·07	5·37
6	0·21	0·26	0·46	6	2·50	3·14	5·49
5	0·26	0·33	0·58	5	2·56	3·21	5·61
4	0·32	0·40	0·70	4	2·61	3·28	5·74
3	0·37	0·46	0·81	3	2·67	3·35	5·86
2	0·42	0·53	0·93	2	2·72	3·42	5·98
1	0·47	0·60	1·04	1	2·78	3·49	6·10
0	0·53	0·66	1·16	0	2·83	3·55	6·22
·9989	0·58	0·73	1·28	·9949	2·89	3·62	6·34
8	0·63	0·79	1·39	8	2·94	3·69	6·47
7	0·68	0·86	1·51	7	3·00	3·76	6·58
6	0·74	0·93	1·62	6	3·06	3·83	6·72
5	0·79	0·99	1·74	5	3·12	3·90	6·84
4	0·84	1·06	1·86	4	3·18	3·98	6·97
3	0·89	1·13	1·97	3	3·24	4·05	7·10
2	0·95	1·19	2·09	2	3·29	4·12	7·23
1	1·00	1·26	2·20	1	3·35	4·20	7·36
0	1·06	1·34	2·34	0	3·41	4·27	7·49
·9979	1·12	1·42	2·48	·9939	3·47	4·34	7·61
8	1·19	1·49	2·61	8	3·53	4·42	7·74
7	1·25	1·57	2·75	7	3·59	4·49	7·87
6	1·31	1·65	2·89	6	3·65	4·56	8·00
5	1·37	1·73	3·03	5	3·71	4·63	8·13
4	1·44	1·81	3·16	4	3·76	4·71	8·26
3	1·50	1·88	3·30	3	3·82	4·78	8·38
2	1·56	1·96	3·44	2	3·88	4·85	8·51
1	1·62	2·04	3·58	1	3·94	4·93	8·64
0	1·69	2·12	3·71	0	4·00	5·00	8·77
·9969	1·75	2·20	3·85	·9929	4·06	5·08	8·90
8	1·81	2·27	3·99	8	4·12	5·16	9·04
7	1·87	2·35	4·12	7	4·19	5·24	9·18
6	1·94	2·43	4·26	6	4·25	5·32	9·31
5	2·00	2·51	4·40	5	4·31	5·39	9·45
4	2·06	2·58	4·52	4	4·37	5·47	9·58
3	2·11	2·62	4·64	3	4·44	5·55	9·72
2	2·17	2·72	4·76	2	4·50	5·63	9·86
1	2·22	2·79	4·89	1	4·56	5·71	9·99
0	2·28	2·86	5·01	0	4·62	5·78	10·13

Sp. Gravity at 60° F. = 15·5° C.	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit; per cent.	Sp. Gravity at 60° F. = 15·5° C.	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit; per cent.
·9919	4·69	5·86	10·26	·9869	8·00	9·95	17·43
8	4·75	5·94	10·40	8	8·07	10·03	17·58
7	4·81	6·02	10·54	7	8·14	10·12	17·74
6	4·87	6·10	10·67	6	8·21	10·21	17·89
5	4·94	6·17	10·81	5	8·29	10·30	18·04
4	5·00	6·24	10·94	4	8·36	10·38	18·20
3	5·06	6·32	11·08	3	8·43	10·47	18·35
2	5·12	6·40	11·21	2	8·50	10·56	18·50
1	5·19	6·48	11·35	1	8·57	10·65	18·65
0	5·25	6·55	11·49	0	8·64	10·73	18·81
·9909	5·31	6·63	11·62	·9859	8·71	10·82	18·96
8	5·37	6·71	11·76	8	8·79	10·91	19·11
7	5·44	6·78	11·89	7	8·86	11·00	19·27
6	5·50	6·86	12·03	6	8·93	11·08	19·42
5	5·56	6·94	12·16	5	9·00	11·17	19·58
4	5·62	7·01	12·30	4	9·07	11·26	19·73
3	5·69	7·09	12·43	3	9·14	11·35	19·89
2	5·75	7·17	12·57	2	9·21	11·44	20·04
1	5·81	7·25	12·70	1	9·29	11·52	20·19
0	5·87	7·32	12·84	0	9·36	11·61	20·35
·9899	5·94	7·40	12·97	·9849	9·43	11·70	20·50
8	6·00	7·48	13·11	8	9·50	11·79	20·65
7	6·07	7·57	13·27	7	9·57	11·87	20·81
6	6·14	7·66	13·42	6	9·64	11·96	20·96
5	6·21	7·74	13·57	5	9·71	12·05	21·11
4	6·28	7·83	13·73	4	9·79	12·13	21·27
3	6·36	7·92	13·88	3	9·86	12·22	21·42
2	6·43	8·01	14·04	2	9·93	12·31	21·57
1	6·50	8·10	14·19	1	10·00	12·40	21·73
0	6·57	8·18	14·35	0	10·08	12·49	21·89
·9889	6·64	8·27	14·50	·9839	10·15	12·58	22·06
8	6·71	8·36	14·66	8	10·23	12·68	22·22
7	6·78	8·45	14·81	7	10·31	12·77	22·38
6	6·86	8·54	14·96	6	10·38	12·87	22·55
5	6·93	8·63	15·12	5	10·46	12·96	22·71
4	7·00	8·72	15·27	4	10·54	13·05	22·88
3	7·07	8·80	15·42	3	10·62	13·15	23·04
2	7·13	8·88	15·56	2	10·69	13·24	23·21
1	7·20	8·96	15·70	1	10·77	13·34	23·37
0	7·27	9·04	15·85	0	10·85	13·43	23·54
·9879	7·33	9·13	15·99	·9829	10·92	13·52	23·70
8	7·40	9·21	16·14	8	11·00	13·62	23·86
7	7·47	9·29	16·28	7	11·08	13·71	24·03
6	7·53	9·37	16·42	6	11·15	13·81	24·19
5	7·60	9·45	16·57	5	11·23	13·90	24·36
4	7·67	9·54	16·71	4	11·31	13·99	24·52
3	7·73	9·62	16·86	3	11·38	14·09	24·69
2	7·80	9·70	17·00	2	11·46	14·18	24·85
1	7·87	9·78	17·14	1	11·54	14·27	25·01
0	7·93	9·86	17·29	0	11·62	14·37	25·18

Sp. Gravity at 60° F. = 15·5° C.	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit; per cent.	Sp. Gravity at 60° F. = 15·5° C.	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit; per cent.
·9819	.. 11·69 ..	.. 14·46 ..	.. 25·34 ..	·9769	.. 15·75 ..	.. 19·39 ..	.. 33·96 ..
8	.. 11·77 ..	.. 14·56 ..	.. 25·51 ..	8	.. 15·83 ..	.. 19·49 ..	.. 34·14 ..
7	.. 11·85 ..	.. 14·65 ..	.. 25·67 ..	7	.. 15·92 ..	.. 19·59 ..	.. 34·32 ..
6	.. 11·92 ..	.. 14·74 ..	.. 25·83 ..	6	.. 16·00 ..	.. 19·68 ..	.. 34·50 ..
5	.. 12·00 ..	.. 14·84 ..	.. 26·00 ..	5	.. 16·08 ..	.. 19·78 ..	.. 34·66 ..
4	.. 12·08 ..	.. 14·93 ..	.. 26·17 ..	4	.. 16·15 ..	.. 19·87 ..	.. 34·82 ..
3	.. 12·15 ..	.. 15·02 ..	.. 26·33 ..	3	.. 16·23 ..	.. 19·96 ..	.. 34·98 ..
2	.. 12·23 ..	.. 15·12 ..	.. 26·49 ..	2	.. 16·31 ..	.. 20·06 ..	.. 35·14 ..
1	.. 12·31 ..	.. 15·21 ..	.. 26·66 ..	1	.. 16·38 ..	.. 20·15 ..	.. 35·31 ..
0	.. 12·38 ..	.. 15·30 ..	.. 26·82 ..	0	.. 16·46 ..	.. 20·24 ..	.. 35·47 ..
·9809	.. 12·46 ..	.. 15·40 ..	.. 26·99 ..	·9759	.. 16·54 ..	.. 20·33 ..	.. 35·63 ..
8	.. 12·54 ..	.. 15·49 ..	.. 27·15 ..	8	.. 16·62 ..	.. 20·43 ..	.. 35·79 ..
7	.. 12·62 ..	.. 15·58 ..	.. 27·31 ..	7	.. 16·69 ..	.. 20·52 ..	.. 35·95 ..
6	.. 12·69 ..	.. 15·68 ..	.. 27·48 ..	6	.. 16·77 ..	.. 20·61 ..	.. 36·12 ..
5	.. 12·77 ..	.. 15·77 ..	.. 27·64 ..	5	.. 16·85 ..	.. 20·71 ..	.. 36·28 ..
4	.. 12·85 ..	.. 15·86 ..	.. 27·81 ..	4	.. 16·92 ..	.. 20·80 ..	.. 36·44 ..
3	.. 12·92 ..	.. 15·96 ..	.. 27·97 ..	3	.. 17·00 ..	.. 20·89 ..	.. 36·60 ..
2	.. 13·00 ..	.. 16·05 ..	.. 28·13 ..	2	.. 17·08 ..	.. 20·99 ..	.. 36·78 ..
1	.. 13·08 ..	.. 16·15 ..	.. 28·29 ..	1	.. 17·17 ..	.. 21·09 ..	.. 36·95 ..
0	.. 13·15 ..	.. 16·24 ..	.. 28·46 ..	0	.. 17·25 ..	.. 21·19 ..	.. 37·13 ..
·9799	.. 13·23 ..	.. 16·33 ..	.. 28·62 ..	·9749	.. 17·33 ..	.. 21·29 ..	.. 37·30 ..
8	.. 13·31 ..	.. 16·43 ..	.. 28·78 ..	8	.. 17·42 ..	.. 21·39 ..	.. 37·48 ..
7	.. 13·38 ..	.. 16·52 ..	.. 28·95 ..	7	.. 17·50 ..	.. 21·49 ..	.. 37·65 ..
6	.. 13·46 ..	.. 16·61 ..	.. 29·11 ..	6	.. 17·58 ..	.. 21·59 ..	.. 37·83 ..
5	.. 13·54 ..	.. 16·70 ..	.. 29·27 ..	5	.. 17·67 ..	.. 21·69 ..	.. 38·00 ..
4	.. 13·62 ..	.. 16·80 ..	.. 29·43 ..	4	.. 17·75 ..	.. 21·79 ..	.. 38·18 ..
3	.. 13·69 ..	.. 16·89 ..	.. 29·60 ..	3	.. 17·83 ..	.. 21·89 ..	.. 38·35 ..
2	.. 13·77 ..	.. 16·98 ..	.. 29·76 ..	2	.. 17·92 ..	.. 21·99 ..	.. 38·53 ..
1	.. 13·85 ..	.. 17·08 ..	.. 29·92 ..	1	.. 18·00 ..	.. 22·09 ..	.. 38·71 ..
0	.. 13·92 ..	.. 17·17 ..	.. 30·09 ..	0	.. 18·08 ..	.. 22·18 ..	.. 38·87 ..
·9789	.. 14·00 ..	.. 17·26 ..	.. 30·26 ..	·9739	.. 18·15 ..	.. 22·27 ..	.. 39·03 ..
8	.. 14·09 ..	.. 17·37 ..	.. 30·45 ..	8	.. 18·23 ..	.. 22·36 ..	.. 39·13 ..
7	.. 14·18 ..	.. 17·48 ..	.. 30·64 ..	7	.. 18·31 ..	.. 22·46 ..	.. 39·35 ..
6	.. 14·27 ..	.. 17·59 ..	.. 30·83 ..	6	.. 18·38 ..	.. 22·55 ..	.. 39·51 ..
5	.. 14·36 ..	.. 17·70 ..	.. 31·03 ..	5	.. 18·46 ..	.. 22·64 ..	.. 39·68 ..
4	.. 14·45 ..	.. 17·81 ..	.. 31·22 ..	4	.. 18·54 ..	.. 22·73 ..	.. 39·84 ..
3	.. 14·55 ..	.. 17·92 ..	.. 31·41 ..	3	.. 18·62 ..	.. 22·82 ..	.. 40·00 ..
2	.. 14·64 ..	.. 18·03 ..	.. 31·61 ..	2	.. 18·69 ..	.. 22·92 ..	.. 40·16 ..
1	.. 14·73 ..	.. 18·14 ..	.. 31·80 ..	1	.. 18·77 ..	.. 23·01 ..	.. 40·32 ..
0	.. 14·82 ..	.. 18·25 ..	.. 31·99 ..	0	.. 18·85 ..	.. 23·10 ..	.. 40·48 ..
·9779	.. 14·91 ..	.. 18·36 ..	.. 32·19 ..	·9729	.. 18·92 ..	.. 23·19 ..	.. 40·64 ..
8	.. 15·00 ..	.. 18·48 ..	.. 32·38 ..	8	.. 19·00 ..	.. 23·28 ..	.. 40·80 ..
7	.. 15·08 ..	.. 18·58 ..	.. 32·56 ..	7	.. 19·08 ..	.. 23·38 ..	.. 40·98 ..
6	.. 15·17 ..	.. 18·68 ..	.. 32·73 ..	6	.. 19·17 ..	.. 23·48 ..	.. 41·15 ..
5	.. 15·25 ..	.. 18·78 ..	.. 32·91 ..	5	.. 19·25 ..	.. 23·58 ..	.. 41·33 ..
4	.. 15·33 ..	.. 18·88 ..	.. 33·08 ..	4	.. 19·33 ..	.. 23·68 ..	.. 41·50 ..
3	.. 15·42 ..	.. 18·98 ..	.. 33·26 ..	3	.. 19·42 ..	.. 23·78 ..	.. 41·68 ..
2	.. 15·50 ..	.. 19·08 ..	.. 33·44 ..	2	.. 19·50 ..	.. 23·88 ..	.. 41·85 ..
1	.. 15·58 ..	.. 19·18 ..	.. 33·61 ..	1	.. 19·58 ..	.. 23·98 ..	.. 42·03 ..
0	.. 15·67 ..	.. 19·28 ..	.. 33·79 ..	0	.. 19·67 ..	.. 24·08 ..	.. 42·20 ..

Sp. Gravity at 60° F. = 15·5° C.	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit; per cent.	Sp. Gravity at 60° F. = 15·5° C.	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit; per cent.
·9719	19·75	24·18	42·38	·9669	23·69	28·86	50·57
8	19·83	24·28	42·55	8	23·77	28·95	50·73
7	19·92	24·38	42·73	7	23·85	29·04	50·89
6	20·00	24·48	42·90	6	23·92	29·13	51·05
5	20·08	24·58	43·07	5	24·00	29·22	51·21
4	20·17	24·68	43·25	4	24·08	29·31	51·37
3	20·25	24·78	43·42	3	24·15	29·40	51·53
2	20·33	24·88	43·60	2	24·23	29·49	51·69
1	20·42	24·98	43·77	1	24·31	29·58	51·84
0	20·50	25·07	43·94	0	24·38	29·67	52·00
·9709	20·58	25·17	44·12	·9659	24·46	29·76	52·16
8	20·67	25·27	44·29	8	24·54	29·86	52·32
7	20·75	25·37	44·47	7	24·62	29·95	52·48
6	20·83	25·47	44.64	6	24·69	30·04	52·64
5	20·92	25·57	44·81	5	24·77	30·13	52·80
4	21·00	25·67	44·99	4	24·85	30·22	52·95
3	21·08	25·76	45·15	3	24·92	30·31	53·11
2	21·15	25·86	45·31	2	25·00	30·40	53·27
1	21·23	25·95	45·47	1	25·07	30·48	53·42
0	21·31	26·04	45·63	0	25·14	30·57	53·56
·9699	21·38	26·13	45·79	·9649	25·21	30·65	53·71
8	21·46	26·22	45·95	8	25·29	30·73	53·86
7	21·54	26·31	46·11	7	25·36	30·82	54·00
6	21·62	26·40	46·27	6	25·43	30·90	54·15
5	21·69	26·49	46·43	5	23·50	30·98	54·30
4	21·77	26·58	46·59	4	25·57	31·07	54·44
3	21·85	26·67	46·75	3	25·64	31·15	54·59
2	21·92	26·77	46·91	2	25·71	31·23	54·74
1	22·00	26·86	47·07	1	25·79	31·32	54·88
0	22·08	26·95	47·23	0	25·86	31·40	55·03
·9689	22·15	27·04	47·39	·9639	25·93	31·48	55·18
8	22·23	27·13	47·55	8	26·00	31·57	55·32
7	22·31	27·22	47·70	7	26·07	31·65	55·46
6	22·38	27·31	47·86	6	26·13	31·72	55·59
5	22·46	27·40	48·02	5	26·20	31·80	55·73
4	22·54	27·49	48·18	4	26·27	31·88	55·87
3	22·62	27·59	48·34	3	26·33	31·96	56·00
2	22·69	27·68	48·50	2	26·40	32·03	56·14
1	22·77	27·77	48·66	1	26·47	32·11	56·27
0	22·85	27·86	48·82	0	26·53	32·19	56·41
·9679	22·92	27·95	48·98	·9629	26·60	32·27	56·55
8	23·00	28·04	49·14	8	26·67	32·34	56·68
7	23·08	28·13	49·30	7	26·73	32·42	56·82
6	23·15	28·22	49·46	6	26·80	32·50	56·95
5	23·23	28·31	49·62	5	26·87	32·58	57·09
4	23·31	28·41	49·78	4	26·93	32·65	57·23
3	23·38	28·50	49·94	3	27·00	32·73	57·36
2	23·46	28·59	50·10	2	27·07	32·81	57·51
1	23·54	28·68	50·25	1	27·14	32·90	57·65
0	23·62	28·77	50·41	0	27·21	32·98	57·80

Sp. Gravity at 60° F. = 15·5° C.	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit; per cent.	Sp. Gravity at 60° F. = 15·5° C.	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit; per cent.
·9619	.. 27·29 ..	.. 33·06 ..	.. 57·94 ..	·9569	.. 30·50 ..	.. 36·76 ..	.. 64·43 ..
8	.. 27·36 ..	.. 33·15 ..	.. 58·09 ..	8	.. 30·56 ..	.. 36·83 ..	.. 64·54 ..
7	.. 27·43 ..	.. 33·23 ..	.. 58·24 ..	7	.. 30·61 ..	.. 36·89 ..	.. 64·65 ..
6	.. 27·50 ..	.. 33·31 ..	.. 58·38 ..	6	.. 30·67 ..	.. 36·95 ..	.. 64·76 ..
5	.. 27·57 ..	.. 33·39 ..	.. 58·53 ..	5	.. 30·72 ..	.. 37·02 ..	.. 64·87 ..
4	.. 27·64 ..	.. 33·48 ..	.. 58·67 ..	4	.. 30·78 ..	.. 37·08 ..	.. 64·98 ..
3	.. 27·71 ..	.. 33·56 ..	.. 58·82 ..	3	.. 30·83 ..	.. 37·14 ..	.. 65·10 ..
2	.. 27·79 ..	.. 33·64 ..	.. 58·97 ..	2	.. 30·89 ..	.. 37·20 ..	.. 65·21 ..
1	.. 27·86 ..	.. 33·73 ..	.. 59·11 ..	1	.. 30·94 ..	.. 37·27 ..	.. 65·32 ..
0	.. 27·93 ..	.. 33·81 ..	.. 59·26 ..	0	.. 31·00 ..	.. 37·34 ..	.. 65·43 ..
·9609	.. 28·00 ..	.. 33·89 ..	.. 59·40 ..	·9559	.. 31·06 ..	.. 37·41 ..	.. 65·55 ..
8	.. 28·06 ..	.. 33·97 ..	.. 59·53 ..	8	.. 31·12 ..	.. 37·48 ..	.. 65·68 ..
7	.. 28·12 ..	.. 34·04 ..	.. 59·65 ..	7	.. 31·19 ..	.. 37·55 ..	.. 65·80 ..
6	.. 28·19 ..	.. 34·11 ..	.. 59·78 ..	6	.. 31·25 ..	.. 37·62 ..	.. 65·93 ..
5	.. 28·25 ..	.. 34·18 ..	.. 59·90 ..	5	.. 31·31 ..	.. 37·69 ..	.. 66·05 ..
4	.. 28·31 ..	.. 34·25 ..	.. 60·03 ..	4	.. 31·37 ..	.. 37·76 ..	.. 66·18 ..
3	.. 28·37 ..	.. 34·33 ..	.. 60·16 ..	3	.. 31·44 ..	.. 37·83 ..	.. 66·30 ..
2	.. 28·44 ..	.. 34·40 ..	.. 60·28 ..	2	.. 31·50 ..	.. 37·90 ..	.. 66·43 ..
1	.. 28·50 ..	.. 34·47 ..	.. 60·41 ..	1	.. 31·56 ..	.. 37·97 ..	.. 66·55 ..
0	.. 28·56 ..	.. 34·54 ..	.. 60·53 ..	0	.. 31·62 ..	.. 38·04 ..	.. 66·68 ..
·9599	.. 28·62 ..	.. 34·61 ..	.. 60·66 ..	·9549	.. 31·69 ..	.. 38·11 ..	.. 66·80 ..
8	.. 28·69 ..	.. 34·69 ..	.. 60·79 ..	8	.. 31·75 ..	.. 38·18 ..	.. 66·93 ..
7	.. 28·75 ..	.. 34·76 ..	.. 60·91 ..	7	.. 31·81 ..	.. 38·25 ..	.. 67·05 ..
6	.. 28·81 ..	.. 34·83 ..	.. 61·04 ..	6	.. 31·87 ..	.. 38·33 ..	.. 67·17 ..
5	.. 28·87 ..	.. 34·90 ..	.. 61·16 ..	5	.. 31·94 ..	.. 38·40 ..	.. 67·30 ..
4	.. 28·94 ..	.. 34·97 ..	.. 61·29 ..	4	.. 32·00 ..	.. 38·47 ..	.. 67·42 ..
3	.. 29·00 ..	.. 35·05 ..	.. 61·42 ..	3	.. 32·06 ..	.. 38·53 ..	.. 67·55 ..
2	.. 29·07 ..	.. 35·12 ..	.. 61·55 ..	2	.. 32·12 ..	.. 38·60 ..	.. 67·67 ..
1	.. 29·13 ..	.. 35·20 ..	.. 61·69 ..	1	.. 32·19 ..	.. 38·68 ..	.. 67·80 ..
0	.. 29·20 ..	.. 35·28 ..	.. 61·82 ..	0	.. 32·25 ..	.. 38·75 ..	.. 67·92 ..
·9589	.. 29·27 ..	.. 35·35 ..	.. 61·95 ..	·9539	.. 32·31 ..	.. 38·82 ..	.. 68·04 ..
8	.. 29·33 ..	.. 35·43 ..	.. 62·09 ..	8	.. 32·37 ..	.. 38·89 ..	.. 68·17 ..
7	.. 29·40 ..	.. 35·51 ..	.. 62·22 ..	7	.. 32·44 ..	.. 38·96 ..	.. 68·29 ..
6	.. 29·47 ..	.. 35·58 ..	.. 62·36 ..	6	.. 32·50 ..	.. 39·04 ..	.. 68·42 ..
5	.. 29·53 ..	.. 35·66 ..	.. 62·49 ..	5	.. 32·56 ..	.. 39·11 ..	.. 68·54 ..
4	.. 29·60 ..	.. 35·74 ..	.. 62·63 ..	4	.. 32·62 ..	.. 39·18 ..	.. 68·67 ..
3	.. 29·67 ..	.. 35·81 ..	.. 62·76 ..	3	.. 32·69 ..	.. 39·25 ..	.. 68·79 ..
2	.. 29·73 ..	.. 35·89 ..	.. 62·90 ..	2	.. 32·75 ..	.. 39·32 ..	.. 68·92 ..
1	.. 29·80 ..	.. 35·97 ..	.. 63·03 ..	1	.. 32·81 ..	.. 39·40 ..	.. 69·04 ..
0	.. 29·87 ..	.. 36·04 ..	.. 63·17 ..	0	.. 32·87 ..	.. 39·47 ..	.. 69·16 ..
·9579	.. 29·93 ..	.. 36·12 ..	.. 63·30 ..	·9529	.. 32·94 ..	.. 39·54 ..	.. 69·29 ..
8	.. 30·00 ..	.. 36·20 ..	.. 63·43 ..	8	.. 33·00 ..	.. 39·61 ..	.. 69·41 ..
7	.. 30·06 ..	.. 36·26 ..	.. 63·55 ..	7	.. 33·06 ..	.. 39·68 ..	.. 69·53 ..
6	.. 30·11 ..	.. 36·32 ..	.. 63·66 ..	6	.. 33·12 ..	.. 39·74 ..	.. 69·65 ..
5	.. 30·17 ..	.. 36·39 ..	.. 63·77 ..	5	.. 33·18 ..	.. 39·81 ..	.. 69·76 ..
4	.. 30·22 ..	.. 36·45 ..	.. 63·88 ..	4	.. 33·24 ..	.. 39·87 ..	.. 69·88 ..
3	.. 30·28 ..	.. 36·51 ..	.. 63·99 ..	3	.. 33·29 ..	.. 39·94 ..	.. 69·99 ..
2	.. 30·33 ..	.. 36·57 ..	.. 64·10 ..	2	.. 33·35 ..	.. 40·01 ..	.. 70·11 ..
1	.. 30·39 ..	.. 36·64 ..	.. 64·21 ..	1	.. 33·41 ..	.. 40·07 ..	.. 70·23 ..
0	.. 30·44 ..	.. 36·70 ..	.. 64·32 ..	0	.. 33·47 ..	.. 40·14 ..	.. 70·34 ..

Sp. Gravity at 60° F. = 15·5° C.	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit; per cent.	Sp. Gravity at 60° F. = 15·5° C.	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit; per cent.
·9519	33·53	40·20	70·46	·9469	36·06	43·01	75·37
8	33·59	40·27	70·57	8	36·11	43·07	75·48
7	33·65	40·34	70·69	7	36·17	43·13	75·59
6	33·71	40·40	70·81	6	36·22	43·19	75·70
5	33·76	40·47	70·92	5	36·28	43·26	75·80
4	33·82	40·53	71·04	4	36·33	43·32	75·91
3	33·88	40·60	71·15	3	36·39	43·38	76·02
2	33·94	40·67	71·27	2	36·44	43·44	76·13
1	34·00	40·74	71·39	1	36·50	43·50	76·24
0	34·05	40·79	71·48	0	36·56	43·56	76·34
·9509	34·10	40·84	71·58	·9459	36·61	43·63	76·45
8	34·14	40·90	71·67	8	36·67	43·69	76·56
7	34·19	40·95	71·76	7	36·72	43·75	76·67
6	34·24	41·00	71·85	6	36·78	43·81	76·78
5	34·29	41·05	71·94	5	36·83	43·87	76·88
4	34·33	41·11	72·04	4	36·89	43·93	76·99
3	34·38	41·16	72·13	3	36·94	44·00	77·10
2	34·43	41·21	72·22	2	37·00	44·06	77·21
1	34·48	41·26	72·31	1	37·06	44·12	77·32
0	34·52	41·32	72·41	0	37·11	44·18	77·42
·9499	34·57	41·37	72·50	·9449	37·17	44·24	77·53
8	34·62	41·42	72·59	8	37·22	44·30	77·64
7	34·67	41·48	72·68	7	37·28	44·36	77·75
6	34·71	41·53	72·78	6	37·33	44.43	77·85
5	34·76	41·58	72·87	5	37·39	44·49	77·96
4	34·81	41·63	72·96	4	37·44	44·55	78·07
3	34·86	41·69	73·05	3	37·50	44·61	78·18
2	34·90	41·74	73·14	2	37·56	44·67	78·28
1	34·95	41·79	73·24	1	37·61	44·73	78·39
0	35·00	41·84	73·33	0	37·67	44·79	78·50
·9489	35·05	41·90	73·43	·9439	37·72	44·86	78·61
8	35·10	41·95	73·52	8	37·78	44·92	78·71
7	35·15	42·01	73·62	7	37·83	44·98	78·82
6	35·20	42·06	73·72	6	37·89	45·04	78·93
5	35·25	42·12	73·81	5	37·94	45·10	79·04
4	35·30	42·17	73·91	4	38·00	45·16	79·14
3	35·35	42·23	74·01	3	38·06	45·22	79·25
2	35·40	42·29	74·10	2	38·11	45·28	79·36
1	35·45	42·34	74·20	1	38·17	45·34	79·46
0	35·50	42·40	74·30	0	38·22	45·41	79·57
·9479	35·55	42·45	74·39	·9429	38·28	45·47	79·68
8	35·60	42·51	74·49	8	38·33	45·53	79·79
7	35·65	42·56	74·59	7	38·39	45·59	79·89
6	35·70	42·62	74·68	6	38·44	45·65	80·00
5	35·75	42·67	74·78	5	38·50	45·71	80·11
4	35·80	42·73	74·88	4	38·56	45·77	80·21
3	35·85	42·78	74·97	3	38·61	45·83	80·32
2	35·90	42·84	75·07	2	38·67	45·89	80·43
1	35·95	42·89	75·17	1	38·72	45·95	80·53
0	36·00	42·95	75·26	0	38·78	46·02	80·64

Sp. Gravity at 60° F. = 15·5° C.	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit; per cent.	Sp. Gravity at 60° F. = 15·5° C.	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit; per cent.
·9419	38·83	46·08	80·75	·9369	41·35	48·80	85·53
8	38·89	46·14	80·86	8	41·40	48·86	85·62
7	38·94	46·20	80·96	7	41·45	48·91	85·71
6	39·00	46·26	81·07	6	41·50	48·97	85·81
5	39·05	46·32	81·17	5	41·55	49·02	85·90
4	39·10	46·37	81·26	4	41·60	49·07	86·00
3	39·15	46·42	81·36	3	41·65	49·13	86·09
2	39·20	46·48	81·45	2	41·70	49·18	86·18
1	39·25	46·53	81·55	1	41·75	49·23	86·28
0	39·30	46·59	81·64	0	41·80	49·29	86·37
·9409	39·35	46·64	81·74	·9359	41·85	49·34	86·47
8	39·40	46·70	81·83	8	41·90	49·40	86·56
7	39·45	46·75	81·93	7	41·95	49·45	86·65
6	39·50	46·80	82·02	6	42·00	49·50	86·75
5	39·55	46·86	82·12	5	42·05	49·55	86·84
4	39·60	46·91	82·21	4	42·10	49·61	86·93
3	39·65	46·97	82·31	3	42·14	49·66	87·02
2	39·70	47·02	82·40	2	42·19	49·71	87·11
1	39·75	47·08	82·50	1	42·24	49·76	87·20
0	39·80	47·13	82·59	0	42·29	49·81	87·29
·9399	39·85	47·18	82·69	·9349	42·33	49·86	87·37
8	39·90	47·24	82·78	8	42·38	49·91	87·46
7	39·95	47·29	82·88	7	42·43	49·96	87·55
6	40·00	47·35	82·97	6	42·48	50·01	87·64
5	40·05	47·40	83·07	5	42·52	50·06	87·73
4	40·10	47·45	83·16	4	42·57	50·11	87·82
3	40·15	47·51	83·26	3	42·62	50·16	87·91
2	40·20	47·56	83·35	2	42·67	50·21	88·00
1	40·25	47·62	83·45	1	42·71	50·26	88·09
0	40·30	47·67	83·54	0	42·76	50·31	88·18
·9389	40·35	47·72	83·64	·9339	42·81	50·37	88·26
8	40·40	47·78	83·73	8	42·86	50·42	88·35
7	40·45	47·83	83·83	7	42·90	50·47	88·44
6	40·50	47·89	83·92	6	42·95	50·52	88·53
5	40·55	47·94	84·02	5	43·00	50·57	88·62
4	40·60	47·99	84·11	4	43·05	50·62	88·71
3	40·65	48·05	84·21	3	43·10	50·67	88·79
2	40·70	48·10	84·30	2	43·14	50·72	88·88
1	40·75	48·16	84·39	1	43·19	50·77	88·97
0	40·80	48·21	84·49	0	43·24	50·82	89·06
·9379	40·85	48·26	84·58	·9329	43·29	50·87	89·15
8	40·90	48·32	84·68	8	43·33	50·92	89·24
7	40·95	48·37	84·77	7	43·39	50·97	89·33
6	41·00	48·43	84·87	6	43·43	51·02	89·41
5	41·05	48·48	84·96	5	43·48	51·07	89·50
4	41·10	48·54	85·06	4	43·52	51·12	89·59
3	41·15	48·59	85·15	3	43·57	51·17	89·68
2	41·20	48·64	85·24	2	43·62	51·22	89·77
1	41·25	48·70	85·34	1	43·67	51·27	89·86
0	41·30	48·75	85·43	0	43·71	51·32	89·95

Sp. Gravity at 60° F. = 15·5° C.	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit; per cent.	Sp. Gravity at 60° F. = 15·5° C.	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit; per cent.
·9319	43·76	51·38	90·03	·9269	46·05	53·77	94·22
8	43·81	51·43	90·12	8	46·09	53·81	94·31
7	43·86	51·48	90·21	7	46·14	53·86	94·39
6	43·90	51·53	90·30	6	46·18	53·91	94·47
5	43·95	51·58	90·39	5	46·23	53·95	94·55
4	44·00	51·63	90·48	4	46·27	54·00	94·64
3	44·05	51·68	90·56	3	46·32	54·05	94·72
2	44·09	51·72	90·64	2	46·36	54·10	94·80
1	44·14	51·77	90·73	1	46·41	54·14	94·89
0	44·18	51·82	90·81	0	46·46	54·19	94·97
·9309	44·23	51·87	90·89	·9259	46·50	54·24	95·05
8	44·27	51·91	90·98	8	46·55	54·29	95·13
7	44·32	51·96	91·06	7	46·59	54·33	95·22
6	44·36	52·01	91·14	6	46·64	54·38	95·30
5	44·41	52·06	91·23	5	46·68	54·43	95·38
4	44·46	52·10	91·31	4	46·73	54·47	95·46
3	44·50	52·15	91·39	3	46·77	54·52	95·55
2	44·55	52·20	91·48	2	46·82	54·57	95·63
1	44·59	52·25	91·56	1	46·86	54·62	95·71
0	44·64	52·29	91·64	0	46·91	54·66	95·79
·9299	44·68	52·34	91·73	·9249	46·96	54·71	95·88
8	44·73	52·39	91·81	8	47·00	54·76	95·96
7	44·77	52·44	91·90	7	47·05	54·80	96·04
6	44·82	52·48	91·98	6	47·09	54·85	96·12
5	44·86	52·53	92·06	5	47·14	54·90	96·21
4	44·91	52·58	92·15	4	47·18	54·95	96·29
3	44·96	52·63	92·23	3	47·23	54·99	96·37
2	45·00	52·68	92·31	2	47·27	55·04	96·45
1	45·05	52·72	92·40	1	47·32	55·09	96·53
0	45·09	52·77	92·48	0	47·36	55·13	96·62
·9289	45·14	52·82	92·56	·9239	47·41	55·18	96·70
8	45·18	52·87	92·64	8	47·46	55·23	96·78
7	45·23	52·91	92·73	7	47·50	55·27	96·86
6	45·27	52·96	92·81	6	47·55	55·32	96·95
5	45·32	53·01	92·89	5	47·59	55·37	97·03
4	45·36	53·06	92·98	4	47·64	55·41	97·11
3	45·41	53·10	93·06	3	47·68	55·46	97·19
2	45·46	53·15	93·14	2	47·73	55·51	97·27
1	45·50	53·20	93·23	1	47·77	55·55	97·36
0	45·55	53·24	93·31	0	47·82	55·60	97·44
·9279	45·59	53·29	93·39	·9229	47·86	55·65	97·52
8	45·64	53·34	93·48	8	47·91	55·69	97·60
7	45·68	53·39	93·56	7	47·96	55·74	97·68
6	45·73	53·43	93·64	6	48·00	55·79	97·77
5	45·77	53·48	93·73	5	48·05	55·83	97·85
4	45·82	53·53	93·81	4	48·09	55·88	97·93
3	45·86	53·58	93·89	3	48·14	55·93	98·01
2	45·91	53·62	93·98	2	48·18	55·97	98·09
1	45·96	53·67	94·06	1	48·23	56·02	98·18
0	46·00	53·72	94·14	0	48·27	56·07	98·26

Sp. Gravity at 60° F. = 15·5° C.	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit; per cent.	Sp. Gravity at 60° F. = 15·5° C.	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit; per cent.
·9219	48·32	56·11	98·34	·9169	50·57	58·41	102·35
8	48·36	56·16	98·42	8	50·61	58·45	102·43
7	48·41	56·21	98·50	7	50·65	58·50	102·51
6	48·46	56·25	98·59	6	50·70	58·54	102·59
5	48·50	56·30	98·67	5	50·74	58·58	102·66
4	48·55	56·35	98·75	4	50·78	58·63	102·74
3	48·59	56·40	98·83	3	50·83	58·67	102·82
2	48·64	56·44	98·91	2	50·87	58·72	102·89
1	48·68	56·49	99·00	1	50·91	58·76	102·97
0	48·73	56·54	99·08	0	50·96	58·80	103·05
·9209	48·77	56·58	99·16	·9159	51·00	58·85	103·12
8	48·82	56·63	99·24	8	51·04	58·89	103·20
7	48·86	56·68	99·32	7	51·08	58·93	103·27
6	48·91	56·72	99·41	6	51·13	58·97	103·34
5	48·96	56·77	99·49	5	51·17	59·01	103·41
4	49·00	56·82	99·57	4	51·21	59·05	103·49
3	49·04	56·86	99·64	3	51·25	59·09	103·56
2	49·08	56·90	99·71	2	51·29	59·14	103·63
1	49·12	56·94	99·78	1	51·33	59·18	103·71
0	49·16	56·98	99·86	0	51·38	59·22	103·78
·9199	49·20	57·02	99·93	·9149	51·42	59·26	103·85
PROOF. 8	49·24	57·06	100·00	8	51·46	59·30	103·92
7	49·29	57·10	100·08	7	51·50	59·34	104·00
6	49·34	57·15	100·17	6	51·54	59·39	104·07
5	49·39	57·20	100·25	5	51·58	59·43	104·14
4	49·44	57·25	100·34	4	51·63	59·47	104·21
3	49·49	57·30	100·42	3	51·67	59·51	104·29
2	49·54	57·35	100·51	2	51·71	59·55	104·36
1	49·59	57·40	100·59	1	51·75	59·59	104·43
0	49·64	57·45	100·68	0	51·79	59·63	104·50
·9189	49·68	57·49	100·76	·9139	51·83	59·68	104·58
8	49·73	57·54	100·85	8	51·88	59·72	104·65
7	49·77	57·59	100·93	7	51·92	59·76	104·72
6	49·82	57·64	101·02	6	51·96	59·80	104·80
5	49·86	57·69	101·10	5	52·00	59·84	104·87
4	49·91	57·74	101·19	4	52·05	59·89	104·95
3	49·95	57·79	101·27	3	52·09	59·93	105·03
2	50·00	57·84	101·36	2	52·14	59·98	105·11
1	50·04	57·88	101·43	1	52·18	60·02	105·19
0	50·09	58·92	101·51	0	52·23	60·07	105·27
·9179	50·13	57·97	101·59	·9129	52·27	60·12	105·35
8	50·17	58·01	101·66	8	52·32	60·16	105·43
7	50·22	58·06	101·74	7	52·36	60·21	105·51
6	50·26	58·10	101·82	6	52·41	60·25	105·59
5	50·30	58·14	101·89	5	52·45	60·30	105·67
4	50·35	58·19	101·97	4	52·50	60·34	105·75
3	50·39	58·23	102·05	3	52·55	60·39	105·83
2	50·43	58·28	102·12	2	52·59	60·44	105·91
1	50·48	58·32	102·20	1	52·64	60·47	105·99
0	50·52	58·36	102·28	0	52·68	60·52	106·07

Sp. Gravity at 60° F. = 15·5° C.	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit; per cent.	Sp. Gravity at 60° F. = 15·5° C.	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit; per cent.
·9119	52·73	60·56	106·15	·9069	55·00	62·84	110·12
8	52·77	60·61	106·23	8	55·05	62·88	110·20
7	52·82	60·65	106·31	7	55·09	62·93	110·28
6	52·86	60·70	106·39	6	55·14	62·97	110·36
5	52·91	60·74	106·47	5	55·18	63·02	110·44
4	52·95	60·79	106·55	4	55·23	63·06	110·52
3	53·00	60·85	106·63	3	55·27	63·11	110·60
2	53·04	60·89	106·71	2	55·32	63·15	110·68
1	53·09	60·93	106·78	1	55·36	63·20	110·76
0	53·13	60·97	106·86	0	55·41	63·24	110·84
·9109	53·17	61·02	106·93	·9059	55·45	63·28	110·92
8	53·22	61·06	107·01	8	55·50	63·33	111·00
7	53·26	61·10	107·08	7	55·55	63·37	111·08
6	53·30	61·15	107·16	6	55·59	63·42	111·16
5	53·35	61·19	107·23	5	55·64	63·46	111·24
4	53·39	61·23	107·31	4	55·68	63·51	111·32
3	53·43	61·28	107·38	3	55·73	63·55	111·40
2	53·48	61·32	107·46	2	55·77	63·60	111·48
1	53·52	61·36	107·54	1	55·82	63·64	111·56
0	53·57	61·40	107·61	0	55·86	63·69	111·64
·9099	53·61	61·45	107·69	·9049	55·91	63·73	111·71
8	53·65	61·49	107·76	8	55·95	63·78	111·79
7	53·70	61·53	107·84	7	56·00	63·82	111·87
6	53·74	61·58	107·91	6	56·05	63·87	111·95
5	53·78	61·62	107·99	5	56·09	63·91	112·03
4	53·83	61·66	108·06	4	56·14	63·96	112·10
3	53·87	61·71	108·14	3	56·18	64·00	112·18
2	53·91	61·75	108·21	2	56·23	64·05	112·26
1	53·96	61·79	108·29	1	56·27	64·09	112·34
0	54·00	61·84	108·36	0	56·32	64·14	112·41
·9089	54·05	61·88	108·45	·9039	56·36	64·18	112·49
	54·10	61·93	108·53	8	56·41	64·22	112·57
	54·14	61·98	108·62	7	56·45	64·27	112·64
6	54·19	62·03	108·70	6	56·50	64·31	112·72
5	54·24	62·07	108·78	5	56·55	64·36	112·80
4	54·29	62·12	108·87	4	56·59	64·40	112·87
3	54·33	62·17	108·95	3	56·64	64·45	112·95
2	54·38	62·22	109·03	2	56·68	64·49	113·03
1	54·43	62·26	109·12	1	56·73	64·54	113·11
0	54·48	62·31	109·20	0	56·77	64·58	113·18
·9079	54·52	62·36	109·28	·9029	56·82	64·63	113·26
8	54·57	62·41	109·37	8	56·86	64·67	113·34
7	54·62	62·45	109·45	7	56·91	64·71	113·41
6	54·67	62·50	109·53	6	56·95	64·76	113·49
5	54·71	62·55	109·62	5	57·00	64·80	113·57
4	54·76	62·60	109·70	4	57·04	64·85	113·64
3	54·81	62·65	109·78	3	57·08	64·89	113·71
2	54·86	62·69	109·87	2	57·13	64·93	113·78
1	54·90	62·74	109·95	1	57·17	64·97	113·85
0	54·95	62·79	110·03	0	57·21	65·01	113·92

Sp. Gravity at 60° F. = 15·5° C.	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit; per cent.	Sp. Gravity at 60° F. = 15·5° C.	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit; per cent.
·9019	57·25	65·05	113·99	·8969	59·43	67·15	117·68
8	57·29	65·09	114·06	8	59·48	67·19	117·76
7	57·33	65·13	114·13	7	59·52	67·24	117·83
6	57·38	65·17	114·20	6	59·57	67·28	117·90
5	57·42	65·21	114·27	5	59·61	67·32	117·98
4	57·46	65·25	114·34	4	59·65	67·36	118·05
3	57·50	65·29	114·41	3	59·70	67·40	118·12
2	57·54	65·33	114·48	2	59·74	67·44	118·20
1	57·58	65·37	114·55	1	59·78	67·49	118·27
0	57·63	65·41	114·62	0	59·83	67·53	118·34
·9009	57·67	65·45	114·69	·8959	59·87	67·57	118·41
8	57·71	65·49	114·76	8	59·91	67·61	118·49
7	57·75	65·53	114·83	7	59·96	67·65	118·56
6	57·79	65·57	114·90	6	60·00	67·69	118·63
5	57·83	65·61	114·97	5	60·04	67·73	118·70
4	57·88	65·65	115·04	4	60·08	67·77	118·77
3	57·92	65·69	115·11	3	60·13	67·81	118·84
2	57·96	65·73	115·18	2	60·17	67·85	118·91
1	58·00	65·77	115·26	1	60·21	67·89	118·98
0	58·05	65·81	115·33	0	60·26	67·93	119·05
·8999	58·09	65·85	115·41	·8949	60·29	67·97	119·12
8	58·14	65·90	115·49	8	60·33	68·01	119·18
7	58·18	65·94	115·57	7	60·38	68·05	119·25
6	58·23	65·99	115·64	6	60·42	68·09	119·32
5	58·27	66·03	115·72	5	60·46	68·13	119·39
4	58·32	66·07	115·80	4	60·50	68·17	119·46
3	58·36	66·12	115·87	3	60·54	68·21	119·53
2	58·41	66·16	115·95	2	60·58	68·25	119·60
1	58·45	66·21	116·03	1	60·63	68·29	119·67
0	58·50	66·25	116·11	0	60·67	68·33	119·74
·8989	58·55	66·29	116·18	·8939	60·71	68·36	119·80
8	58·59	66·34	116·26	8	60·76	68·40	119·87
7	58·64	66·38	116·34	7	60·79	68·44	119·94
6	58·68	66·43	116·42	6	60·83	68·48	120·01
5	58·73	66·47	116·49	5	60·88	68·52	120·08
4	58·77	66·51	116·57	4	60·92	68·56	120·15
3	58·82	66·56	116·65	3	60·96	68·60	120·22
2	58·86	66·60	116·72	2	61·00	68·64	120·29
1	58·91	66·65	116·80	1	61·04	68·68	120·35
0	58·95	66·69	116·88	0	61·08	68·72	120·42
·8979	59·00	66·74	116·96	·8929	61·13	68·76	120·49
8	59·04	66·78	117·03	8	61·17	68·80	120·56
7	59·09	66·82	117·11	7	61·21	68·83	120·63
6	59·13	66·86	117·17	6	61·25	68·87	120·70
5	59·17	66·90	117·25	5	61·29	68·91	120·77
4	59·22	66·94	117·32	4	61·33	68·95	120·83
3	59·26	66·99	117·39	3	61·38	68·99	120·90
2	59·30	67·03	117·47	2	61·42	69·03	120·97
1	59·35	67·07	117·54	1	61·46	69·07	121·04
0	59·39	67·11	117·61	0	61·50	69·11	121·11

Sp. Gravity at 60° F. = 15·5° C.	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit; per cent.	Sp. Gravity at 60° F. = 15·5° C.	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit; per cent.
·8919	61·54	69·15	121·18	·8869	63·74	71·22	124·80
8	61·58	69·19	121·24	8	63·78	71·26	124·87
7	61·63	69·22	121·31	7	63·83	71·30	124·94
6	61·67	69·26	121·38	6	63·87	71·34	125·02
5	61·71	69·30	121·45	5	63·91	71·38	125·09
4	61·75	69·34	121·52	4	63·96	71·42	125·16
3	61·79	69·38	121·59	3	64·00	71·46	125·23
2	61·83	69.42	121·66	2	64·04	71·50	125·30
1	61·88	69·46	121·72	1	64·09	71·54	125·38
0	61·92	69·50	121·79	0	64·13	71·58	125·44
·8909	61·96	69·54	121·86	·8859	64·17	71·62	125·51
8	62·00	69·58	121·93	8	64·22	71·66	125·58
7	62·05	69·62	122·01	7	64·26	71·70	125·65
6	62·09	69·66	122·08	6	64·30	71·74	125·72
5	62·14	69·71	122·16	5	64·35	71·78	125·79
4	62·18	69·75	122·23	4	64·39	71·82	125·86
3	62·23	69·79	122·31	3	64·43	71·86	125·93
2	62·27	69·84	122·38	2	64·48	71·90	126·01
1	62·32	69·88	122·46	1	64·52	71·94	126·08
0	62·36	69·92	122·53	0	64·57	71·98	126·15
·8899	62·41	69·96	122·61	·8849	64·61	72·02	126·22
8	62·45	70·01	122·68	8	64·65	72·06	126·29
7	62·50	70·05	122·76	7	64·70	72·10	126·36
6	62·55	70·09	122·84	6	64·74	72·14	126·43
5	62·59	70·14	122·91	5	64·78	72·18	126·50
4	62·64	70·18	122·99	4	64·83	72·22	126·57
3	62·68	70·22	123·06	3	64·87	72·26	126·64
2	62·73	70·27	123·14	2	64·91	72·30	126·71
1	62·77	70·31	123·21	1	64·96	72·34	126·78
0	62·82	70·35	123·29	0	65·00	72·38	126·85
·8889	62·86	70·40	123·36	·8839	65·04	72·42	126·92
8	62·91	70·44	123·44	8	65·08	72·46	126·99
7	62·95	70·48	123·52	7	65·13	72·50	127·05
6	63·00	70·52	123·59	6	65·17	72·54	127·12
5	63·04	70·57	123·66	5	65·21	72·58	127·19
4	63·09	70·61	123·73	4	65·25	72·61	127·25
3	63·13	70·65	123·80	3	65·29	72·65	127·32
2	63·17	70·69	123·88	2	65·33	72·69	127·39
1	63·22	70·73	123·95	1	65·38	72·73	127·45
0	63·26	70·77	124·02	0	65·42	72·77	127·52
·8879	63·30	70·81	124·09	·8829	65·46	72·80	127·59
8	63·35	70·85	124·16	8	65·50	72·84	127·65
7	63·39	70·89	124·23	7	65·54	72·88	127·72
6	63·43	70·93	124·30	6	65·58	72·92	127·79
5	63·48	70·97	124·37	5	65·63	72·96	127·85
4	63·52	71·01	124·44	4	65·67	72·99	127·92
3	63·57	71·05	124·52	3	65·71	73·03	127·99
2	63·61	71·09	124·59	2	65·75	73·07	128·05
1	63·65	71·13	124·66	1	65·79	73·11	128·12
0	63·70	71·17	124·73	0	65·83	73·15	128·19

Sp. Gravity at 60° F. = 15·5° C.	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit; per cent.	Sp. Gravity at 60° F. = 15·5° C.	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit; per cent.
·8819	.. 65·88 ..	.. 73·19 ..	128·25 ..	·8769	.. 68·00 ..	.. 75·12 ..	131·64 ..
8	.. 65·92 ..	.. 73·22 ..	.. 128·32 ..	8	.. 68·04 ..	.. 75·16 ..	.. 131·71 ..
7	.. 65·96 ..	.. 73·26 ..	.. 128·39 ..	7	.. 68·08 ..	.. 75·19 ..	.. 131·77 ..
6	.. 66·00 ..	.. 73·30 ..	.. 128·45 ..	6	.. 68·13 ..	.. 75·23 ..	.. 131·84 ..
5	.. 66·04 ..	.. 73·34 ..	.. 128·52 ..	5	.. 68·17 ..	.. 75·27 ..	.. 131·90 ..
4	.. 66·09 ..	.. 73·38 ..	.. 128·59 ..	4	.. 68·21 ..	.. 75·30 ..	.. 131·97 ..
3	.. 66·13 ..	.. 73·42 ..	.. 128·66 ..	3	.. 68·25 ..	.. 75·34 ..	.. 132·04 ..
2	.. 66·17 ..	.. 73·46 ..	.. 128·73 ..	2	.. 68·29 ..	.. 75·38 ..	.. 132·10 ..
1	.. 66·22 ..	.. 73·50 ..	.. 128·80 ..	1	.. 68·33 ..	.. 75·42 ..	.. 132·17 ..
0	.. 66·26 ..	.. 73·54 ..	.. 128·87 ..	0	.. 68·38 ..	.. 75·45 ..	.. 132·23 ..
·8809	.. 66·30 ..	.. 73·57 ..	128·94 ..	·8759	.. 68·42 ..	.. 75·49 ..	132·30 ..
8	.. 66·35 ..	.. 73·61 ..	.. 129·01 ..	8	.. 68·46 ..	.. 75·53 ..	.. 132·36 ..
7	.. 66·39 ..	.. 73·65 ..	.. 129·08 ..	7	.. 68·50 ..	.. 75·57 ..	.. 132·43 ..
6	.. 66·43 ..	.. 73·69 ..	.. 129·15 ..	6	.. 68·54 ..	.. 75·60 ..	.. 132·49 ..
5	.. 66·48 ..	.. 73·73 ..	.. 129·22 ..	5	.. 68·58 ..	.. 75·64 ..	.. 132·56 ..
4	.. 66·52 ..	.. 73·77 ..	.. 129·29 ..	4	.. 68·63 ..	.. 75·68 ..	.. 132·63 ..
3	.. 66·57 ..	.. 73·81 ..	.. 129·36 ..	3	.. 68·67 ..	.. 75·72 ..	.. 132·69 ..
2	.. 66·61 ..	.. 73·85 ..	.. 129·43 ..	2	.. 68·71 ..	.. 75·75 ..	.. 132·76 ..
1	.. 66·65 ..	.. 73·89 ..	.. 129·50 ..	1	.. 68·75 ..	.. 75·79 ..	.. 132·82 ..
0	.. 66·70 ..	.. 73·93 ..	.. 129·57 ..	0	.. 68·79 ..	.. 75·83 ..	.. 132·89 ..
·8799	.. 66·74 ..	.. 73·97 ..	129·64 ..	·8749	.. 68·83 ..	.. 75·87 ..	132·95 ..
8	.. 66·78 ..	.. 74·01 ..	.. 129·71 ..	8	.. 68·88 ..	.. 75·90 ..	.. 133·02 ..
7	.. 66·83 ..	.. 74·05 ..	.. 129·78 ..	7	.. 68·92 ..	.. 75·94 ..	.. 133·08 ..
6	.. 66·87 ..	.. 74·09 ..	.. 129·85 ..	6	.. 68·96 ..	.. 75·98 ..	.. 133·16 ..
5	.. 66·91 ..	.. 74·13 ..	.. 129·92 ..	5	.. 69·00 ..	.. 76·01 ..	.. 133·21 ..
4	.. 66·96 ..	.. 74·17 ..	.. 129·99 ..	4	.. 69·04 ..	.. 76·05 ..	.. 133·28 ..
3	.. 67·00 ..	.. 74·22 ..	.. 130·06 ..	3	.. 69·08 ..	.. 76·09 ..	.. 133·34 ..
2	.. 67·04 ..	.. 74·25 ..	.. 130·13 ..	2	.. 69·13 ..	.. 76·13 ..	.. 133·41 ..
1	.. 67·08 ..	.. 74·29 ..	.. 130·19 ..	1	.. 69·17 ..	.. 76·16 ..	.. 133·47 ..
0	.. 67·13 ..	.. 74·33 ..	.. 130·26 ..	0	.. 69·21 ..	.. 76·20 ..	.. 133·54 ..
·8789	.. 67·17 ..	.. 74·37 ..	130·33 ..	·8739	.. 69·25 ..	.. 76·24 ..	133·60 ..
8	.. 67·21 ..	.. 74·40 ..	.. 130·39 ..	8	.. 69·29 ..	.. 76·27 ..	.. 133·67 ..
7	.. 67·25 ..	.. 74·44 ..	.. 130·46 ..	7	.. 69·33 ..	.. 76·31 ..	.. 133·73 ..
6	.. 67·29 ..	.. 74·48 ..	.. 130·52 ..	6	.. 69·38 ..	.. 76·35 ..	.. 133·80 ..
5	.. 67·33 ..	.. 74·52 ..	.. 130·59 ..	5	.. 69·42 ..	.. 76·39 ..	.. 133·86 ..
4	.. 67·38 ..	.. 74·55 ..	.. 130·66 ..	4	.. 69·46 ..	.. 76·42 ..	.. 133·93 ..
3	.. 67·42 ..	.. 74·59 ..	.. 130·72 ..	3	.. 69·50 ..	.. 76·46 ..	.. 133·99 ..
2	.. 67·46 ..	.. 74·63 ..	.. 130·79 ..	2	.. 69·54 ..	.. 76·50 ..	.. 134·06 ..
1	.. 67·50 ..	.. 74·67 ..	.. 130·85 ..	1	.. 69·58 ..	.. 76·53 ..	.. 134·12 ..
0	.. 67·54 ..	.. 74·70 ..	.. 130·92 ..	0	.. 69·63 ..	.. 76·57 ..	.. 134·19 ..
·8779	.. 67·58 ..	.. 74·74 ..	130·98 ..	·8729	.. 69·67 ..	.. 76·61 ..	134·25 ..
8	.. 67·63 ..	.. 74·78 ..	.. 131·05 ..	8	.. 69·71 ..	.. 76·65 ..	.. 134·32 ..
7	.. 67·67 ..	.. 74·82 ..	.. 131·12 ..	7	.. 69·75 ..	.. 76·68 ..	.. 134·38 ..
6	.. 67·71 ..	.. 74·86 ..	.. 131·18 ..	6	.. 69·79 ..	.. 76·72 ..	.. 134·45 ..
5	.. 67·75 ..	.. 74·89 ..	.. 131·25 ..	5	.. 69·83 ..	.. 76·76 ..	.. 134·51 ..
4	.. 67·79 ..	.. 74·93 ..	.. 131·31 ..	4	.. 69·88 ..	.. 76·80 ..	.. 134·58 ..
3	.. 67·83 ..	.. 74·97 ..	.. 131·38 ..	3	.. 69·92 ..	.. 76·83 ..	.. 134·64 ..
2	.. 67·88 ..	.. 75·01 ..	.. 131·45 ..	2	.. 69·96 ..	.. 76·87 ..	.. 134·71 ..
1	.. 67·92 ..	.. 75·04 ..	.. 131·51 ..	1	.. 70·00 ..	.. 76·91 ..	.. 134·77 ..
0	.. 67·96 ..	.. 75·08 ..	.. 131·58 ..	0	.. 70·04 ..	.. 76·94 ..	.. 134·84 ..

Sp. Gravity at 60° F. = 15·5° C.	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit; per cent.	Sp. Gravity at 60° F. = 15·5° C.	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit; per cent.
·8719	.. 70·08 ..	.. 76·98 ..	134·90 ..	·8669	.. 72·13 ..	.. 78·77 ..	..138·05..
8	.. 70·12 ..	.. 77·01 ..	.. 134·96 ..	8	.. 72·17 ..	.. 78·81 ..	.. 138·11 ..
7	.. 70·16 ..	.. 77·05 ..	.. 135·02 ..	7	.. 72·22 ..	.. 78·85 ..	.. 138·18 ..
6	.. 70·20 ..	.. 77·08 ..	.. 135·08 ..	6	.. 72·26 ..	.. 78·89 ..	.. 138·25 ..
5	.. 70·24 ..	.. 77·12 ..	.. 135·14 ..	5	.. 72·30 ..	.. 78·93 ..	.. 138·32 ..
4	.. 70·28 ..	.. 77·15 ..	.. 135·21 ..	4	.. 72·35 ..	.. 78·96 ..	.. 138·38 ..
3	.. 70·32 ..	.. 77·19 ..	.. 135·27 ..	3	.. 72·39 ..	.. 79·00 ..	.. 138·45 ..
2	.. 70·36 ..	.. 77·22 ..	.. 135·33 ..	2	.. 72·43 ..	.. 79·04 ..	.. 138·52 ..
1	.. 70·40 ..	.. 77·25 ..	.. 135·39 ..	1	.. 72·48 ..	.. 79·08 ..	.. 138·58 ..
0	.. 70·44 ..	.. 77·29 ..	.. 135·45 ..	0	.. 72·52 ..	.. 79·12 ..	.. 138·65 ..
·8709	.. 70·48 ..	.. 77·32 ..	135·51 ..	·8659	.. 72·57 ..	.. 79·16 ..	138·72 ..
8	.. 70·52 ..	.. 77·36 ..	.. 135·57 ..	8	.. 72·61 ..	.. 79·19 ..	.. 138·79 ..
7	.. 70·56 ..	.. 77·39 ..	.. 135·64 ..	7	.. 72·65 ..	.. 79·23 ..	.. 138·85 ..
6	.. 70·60 ..	.. 77·43 ..	.. 135·70 ..	6	.. 72·70 ..	.. 79·27 ..	.. 138·92 ..
5	.. 70·64 ..	.. 77·46 ..	.. 135·76 ..	5	.. 72·74 ..	.. 79·31 ..	.. 138·99 ..
4	.. 70·68 ..	.. 77·50 ..	.. 135·82 ..	4	.. 72·78 ..	.. 79·35 ..	.. 139·05 ..
3	.. 70·72 ..	.. 77·53 ..	.. 135·88 ..	3	.. 72·83 ..	.. 79·39 ..	.. 139·12 ..
2	.. 70·76 ..	.. 77·57 ..	.. 135·94 ..	2	.. 72·87 ..	.. 79·42 ..	.. 139·19 ..
1	.. 70·80 ..	.. 77·60 ..	.. 136·00 ..	1	.. 72·91 ..	.. 79·46 ..	.. 139·26 ..
0	.. 70·84 ..	.. 77·64 ..	.. 136·07 ..	0	.. 72·96 ..	.. 79·50 ..	.. 139·32 ..
·8699	.. 70·88 ..	.. 77·67 ..	136·13 ..	·8649	.. 73·00 ..	.. 79·54 ..	..139·39 ..
8	.. 70·92 ..	.. 77·71 ..	.. 136·19 ..	8	.. 73·04 ..	.. 79·57 ..	.. 139·45 ..
7	.. 70·96 ..	.. 77·74 ..	.. 136·25 ..	7	.. 73·08 ..	.. 79·61 ..	.. 139·52 ..
6	.. 71·00 ..	.. 77·78 ..	.. 136·31 ..	6	.. 73·13 ..	.. 79·65 ..	.. 139·58 ..
5	.. 71·04 ..	.. 77·82 ..	.. 136·37 ..	5	.. 73·17 ..	.. 79·68 ..	.. 139·64 ..
4	.. 71·08 ..	.. 77·85 ..	.. 136·44 ..	4	.. 73·21 ..	.. 79·72 ..	.. 139·71 ..
3	.. 71·13 ..	.. 77·89 ..	.. 136·50 ..	3	.. 73·25 ..	.. 79·75 ..	.. 139·77 ..
2	.. 71·17 ..	.. 77·93 ..	.. 136·56 ..	2	.. 73·29 ..	.. 79·79 ..	.. 139·83 ..
1	.. 71·21 ..	.. 77·96 ..	.. 136·63 ..	1	.. 73·33 ..	.. 79·83 ..	.. 139·90 ..
0	.. 71·25 ..	.. 78·00 ..	.. 136·69 ..	0	.. 73·38 ..	.. 79·86 ..	.. 139·96 ..
·8689	.. 71·29 ..	.. 78.04 ..	136·76 ..	·8639	.. 73·42 ..	.. 79·90 ..	..140·02..
8	.. 71·33 ..	.. 78·07 ..	.. 136·82 ..	8	.. 73·46 ..	.. 79·94 ..	.. 140·09 ..
7	.. 71·38 ..	.. 78·11 ..	.. 136·88 ..	7	.. 73·50 ..	.. 79·97 ..	.. 140·15 ..
6	.. 71·42 ..	.. 78·14 ..	.. 136·95 ..	6	.. 73·54 ..	.. 80·01 ..	.. 140·21 ..
5	.. 71·46 ..	.. 78·18 ..	.. 137·01 ..	5	.. 73·58 ..	.. 80·04 ..	.. 140·27 ..
4	.. 71·50 ..	.. 78·22 ..	.. 137·08 ..	4	.. 73·63 ..	.. 80·08 ..	.. 140·34 ..
3	.. 71·54 ..	.. 78·25 ..	.. 137·14 ..	3	.. 73·67 ..	.. 80·12 ..	.. 140·40 ..
2	.. 71·58 ..	.. 78·29 ..	.. 137·20 ..	2	.. 73·71 ..	.. 80·15 ..	.. 140·46 ..
1	.. 71·63 ..	.. 78·33 ..	.. 137·27 ..	1	.. 73·75 ..	.. 80·19 ..	.. 140·53 ..
0	.. 71·67 ..	.. 78·36 ..	.. 137·33 ..	0	.. 73·79 ..	.. 80·22 ..	.. 140·59 ..
.8679	.. 71·71 ..	.. 78·40 ..	137·40 ..	·8629	.. 73·83 ..	.. 80·26 ..	..140·65..
8	.. 71·75 ..	.. 78·44 ..	.. 137·46 ..	8	.. 73·88 ..	.. 80·30 ..	.. 140·72 ..
7	.. 71·79 ..	.. 78·47 ..	.. 137·52 ..	7	.. 73·92 ..	.. 80·33 ..	.. 140·78 ..
6	.. 71·83 ..	.. 78·51 ..	.. 137·59 ..	6	.. 73·96 ..	.. 80·37 ..	.. 140·84 ..
5	.. 71·88 ..	.. 78·55 ..	.. 137·65 ..	5	.. 74·00 ..	.. 80·40 ..	.. 140·91 ..
4	.. 71·92 ..	.. 78·58 ..	.. 137·72 ..	4	.. 74·05 ..	.. 80·44 ..	.. 140·98 ..
3	.. 71·96 ..	.. 78·62 ..	.. 137·78 ..	3	.. 74·09 ..	.. 80·48 ..	.. 141·05 ..
2	.. 72·00 ..	.. 78·66 ..	.. 137·85 ..	2	.. 74·14 ..	.. 80·52 ..	.. 141·12 ..
1	.. 72·04 ..	.. 78·70 ..	.. 137·91 ..	1	.. 74·18 ..	.. 80·56 ..	.. 141·19 ..
0	.. 72·09 ..	.. 78·73 ..	.. 137·98 ..	0	.. 74·23 ..	.. 80·60 ..	.. 141·26 ..

Sp. Gravity at 60° F. = 15·5° C.	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit; per cent.	Sp. Gravity at 60° F. = 15·5° C.	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit; per cent.
·8619	74·27	80·64	141·33	·8569	76·50	82·58	144·72
8	74·32	80·68	141·40	8	76·54	82·61	144·78
7	74·36	80·72	141·47	7	76·58	82·65	144·84
6	74·41	80·76	141·54	6	76·63	82·69	144·91
5	74·45	80·80	141·61	5	76·67	82·72	144·97
4	74·50	80·84	141·68	4	76·71	82·76	145·03
3	74·55	80·88	141·75	3	76·75	82·79	145·09
2	74·59	80·92	141·82	2	76·79	82·83	145·15
1	74·64	80·96	141·89	1	76·83	82·86	145·22
0	74·68	81·00	141·96	0	76·88	82·90	145·28
·8609	74·73	81·04	142·03	·8559	76·92	82·93	145·34
8	74·77	81·08	142·10	8	76·96	82·97	145·40
7	74·82	81·12	142·17	7	77·00	83·00	145·46
6	74·86	81·16	142·24	6	77·04	83·04	145·52
5	74·91	81·20	142·31	5	77·08	83·07	145·59
4	74·95	81·24	142·38	4	77·13	83·11	145·65
3	75·00	81·28	142·45	3	77·17	83·14	145·71
2	75·05	81·32	142·52	2	77·21	83·18	145·77
1	75·09	81·36	142·59	1	77·25	83·21	145·83
0	75·14	81·40	142·66	0	77·29	83·25	145·89
·8599	75·18	81·44	142·73	·8549	77·33	83·28	145·96
8	75·23	81·48	142·79	8	77·38	83·32	146·02
7	75·27	81·52	142·86	7	77·42	83·36	146·08
6	75·32	81·56	142·93	6	77·46	83·39	146·14
5	75·36	81·60	143·00	5	77·50	83·43	146·20
4	75·41	81·64	143·07	4	77·54	83·46	146·26
3	75·45	81·68	143·14	3	77·58	83·50	146·32
2	75·50	81·72	143·21	2	77.63	83·53	146·39
1	75·55	81·76	143·28	1	77·67	83·57	146·45
0	75·59	81·80	143·35	0	77·71	83·60	146·51
·8589	75·64	81·84	143·42	·8539	77·75	83·64	146·57
8	75·68	81·88	143·49	8	77·79	83·67	146·63
7	75·73	81·92	143·56	7	77·83	83·71	146·69
6	75·77	81·96	143·63	6	77·88	83·74	146·75
5	75·82	82·00	143·70	5	77·92	83·78	146·82
4	75·86	82·04	143·77	4	77·96	83·81	146·88
3	75·91	82·08	143·84	3	78·00	83·85	146·94
2	75·95	82·12	143·91	2	78·04	83·88	147·00
1	76·00	82·16	143·98	1	78·08	83·91	147·05
0	76·04	82·19	144·04	0	78·12	83·94	147·11
·8579	76·08	82·23	144·10	·8529	78·16	83·98	147·17
8	76·13	82·26	144·16	8	78·20	84·01	147·23
7	76·17	82·30	144·23	7	78·24	84·04	147·29
6	76·21	82·33	144·29	6	78·28	84·08	147·31
5	76·25	82·37	144·35	5	78·32	84·11	147·40
4	76·29	82·40	144·41	4	78·36	84·14	147·46
3	76·33	82·44	144·47	3	78·40	84·18	147·52
2	76·38	82·47	144·54	2	78·44	84·21	147·57
1	76·42	82·51	144·60	1	78·48	84·24	147·63
0	76·46	82·54	144·66	0	78·52	84·27	147·69

Sp. Gravity at 60° F. = 15·5° C.	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit; per cent.	Sp. Gravity at 60° F. = 15·5° C.	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit; per cent.
·8519	78·56	84·31	147·75	·8469	80·58	85·97	150·67
8	78·60	84·34	147·80	8	80·63	86·01	150·73
7	78·64	84·37	147·86	7	80·67	86·04	150·79
6	78·68	84·41	147·92	6	80·71	86·08	150·85
5	78·72	84·44	147·98	5	80·75	86·11	150·91
4	78·76	84·47	148·03	4	80·79	86·15	150·97
3	78·80	84·51	148·09	3	80·83	86·18	151·03
2	78·84	84·54	148·15	2	80·88	86·22	151·09
1	78·88	84·57	148·21	1	80·92	86·25	151·15
0	78·92	84·60	148·27	0	80·96	86·28	151·21
·8509	78·96	84·64	148·32	·8459	81·00	86·32	151·27
8	79·00	84·67	148·38	8	81·04	86·35	151·33
7	79·04	84·70	148·44	7	81·08	86·38	151·38
6	79·08	84·74	148·50	6	81·12	86·42	151·44
5	79·12	84·77	148·56	5	81·16	86·45	151·49
4	79·16	84·80	148·61	4	81·20	86·48	151·55
3	79·20	84·83	148·67	3	81·24	86·51	151·61
2	79·24	84·87	148·73	2	81·28	86·54	151·66
1	79·28	84·90	148·79	1	81·32	86·58	151·72
0	79·32	84·93	148·84	0	81·36	86·61	151·78
·8499	79·36	84·97	148·90	·8449	81·40	86·64	151·83
8	79·40	85·00	148·96	8	81·44	86·67	151·89
7	79·44	85·03	149·02	7	81·48	86·71	151·95
6	79·48	85·06	149·07	6	81·52	86·74	152·00
5	79·52	85·10	149·13	5	81·56	86·77	152·06
4	79·56	85·13	149·19	4	81·60	86·80	152·11
3	79·60	85·16	149·25	3	81·64	86·83	152·17
2	79·64	85·19	149·27	2	81·68	86·87	152·23
1	79·68	85·23	149·32	1	81·72	86·90	152·28
0	79·72	85·26	149·38	0	81·76	86·93	152·34
·8489	79·76	85·29	149·44	·8439	81·80	86·96	152·40
8	79·80	85·33	149·50	8	81·84	86·99	152·45
7	79·84	85·36	149·56	7	81·88	87·03	152·51
6	79·88	85·39	149·61	6	81·92	87·06	152·57
5	79·92	85·42	149·67	5	81·96	87·09	152·62
4	79·96	85·46	149·73	4	82·00	87·12	152·68
3	80·00	85·49	149·82	3	82·04	87·15	152·73
2	80·04	85·53	149·88	2	82·08	87·18	152·79
1	80·08	85·56	149·94	1	82·12	87·21	152·84
0	80·13	85·59	150·00	0	82·15	87·24	152·89
·8479	80·17	85·63	150·06	·8429	82.19	87·27	152·95
8	80·21	85·66	150·12	8	82·23	87·30	153·00
7	80·25	85·70	150·19	7	82·27	87·34	153·05
6	80·29	85·73	150·25	6	82·31	87·37	153·11
5	80·33	85·77	150·31	5	82·35	87·40	153·16
4	80·38	85·80	150·37	4	82·38	87·43	153·21
3	80·42	85·84	150·43	3	82·42	87·46	153·27
2	80·46	85·87	150·49	2	82·46	87·49	153·32
1	80·50	85·90	150·55	1	82·50	87·52	153·37
0	80·54	85·94	150·61	0	82·54	87·55	153·43

Sp. Gravity at 60° F. = 15·5° C.	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit; per cent.	Sp. Gravity at 60° F. = 15·5° C.	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit; per cent.
·8419	82·58	87·58	153·48	·8369	84·52	89·11	156·16
8	82·62	87·61	153·53	8	84·56	89·14	156·21
7	82·65	87·64	153·59	7	84·60	89·17	156·27
6	82·69	87·67	153·64	6	84·64	89·20	156·33
5	82·73	87·70	153·69	5	84·68	89·24	156·38
4	82·77	87·73	153·75	4	84·72	89·27	156·44
3	82·81	87·76	153·80	3	84·76	89·30	156·49
2	82·85	87·79	153·85	2	84·80	89·33	156·55
1	82·88	87·82	153·91	1	84·84	89·36	156·60
0	82·92	87·85	153·96	0	84·88	89·39	156·66
·8409	82·96	87·88	154·01	·8359	84·92	89·42	156·71
8	83·00	87·91	154·07	8	84·96	89·46	156·77
7	83·04	87·94	154·12	7	85·00	89·49	156·82
6	83·08	87·97	154·17	6	85·04	89·52	156·87
5	83·12	88·00	154·23	5	85·08	89·55	156·93
4	83·15	88·03	154·28	4	85·12	89·58	156·98
3	83·19	88·06	154·33	3	85·15	89·61	157·03
2	83·23	88·09	154·38	2	85·19	89·64	157·08
1	83·27	88·13	154·44	1	85·23	89·67	157·13
0	83·31	88·16	154·49	0	85·27	89·70	157·19
·8399	83·35	88·19	154·54	·8349	85·31	89·72	157·24
8	83·38	88·22	154·60	8	85·35	89·75	157·29
7	83·42	88·25	154·65	7	85·38	89·78	157·34
6	83·46	88·28	154·70	6	85·42	89·81	157·39
5	83·50	88·31	154·75	5	85·46	89·84	157·45
4	83·54	88·34	154·81	4	85·50	89·87	157·50
3	83·58	88·37	154·86	3	85·54	89·90	157·55
2	83·62	88·40	154·91	2	85·58	89·93	157·60
1	83·65	88·43	154·97	1	85·62	89·96	157·65
0	83·69	88·46	155·02	0	85·65	89·99	157·71
·8389	83·73	88·49	155·07	·8339	85·69	90·02	157·76
8	83·77	88·52	155·13	8	85·73	90·05	157·81
7	83·81	88·55	155·18	7	85·77	90·08	157·86
6	83·85	88·58	155·23	6	85·81	90·11	157·91
5	83·88	88·61	155·28	5	85·85	90·14	157·97
4	83·92	88·64	155·34	4	85·88	90·17	158·02
3	83·96	88·67	155·39	3	85·92	90·20	158·07
2	84·00	88·70	155·44	2	85·96	90·23	158·12
1	84·04	88·73	155·50	1	86·00	90·26	158·17
0	84·08	88·76	155·55	0	86·04	90·29	158·23
·8379	84·12	88·79	155·61	·8329	86·08	90·32	158·28
8	84·16	88·83	155·66	8	86·12	90·35	158·33
7	84·20	88·86	155·72	7	86·15	90·38	158·38
6	84·24	88·89	155·77	6	86·19	90·40	158·43
5	84·28	88·92	155·83	5	86·23	90·43	158·48
4	84·32	88·95	155·88	4	86·27	90·46	158·53
3	84·36	88·98	155·94	3	86·31	90·49	158·59
2	84·40	89·01	155·99	2	86·35	90·52	158·64
1	84·44	89·05	156·05	1	86·38	90·55	158·69
0	84·48	89·08	156·10	0	86·42	90·58	158·74

Sp. Gravity at 60° F. = 15·5° C.	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit; per cent.	Sp. Gravity at 60° F. = 15·5° C.	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit; per cent.
·8319	.. 86·46 ..	.. 90·61 ..	158·79 ..	·8269	.. 88·40 ..	.. 92·08 ..	.. 161·37 ..
8	.. 86·50 ..	.. 90·64 ..	.. 158·84 ..	8	.. 88·44 ..	.. 92·12 ..	.. 161·43 ..
7	.. 86·54 ..	.. 90·67 ..	.. 158·90 ..	7	.. 88·48 ..	.. 92·15 ..	.. 161·48 ..
6	.. 86·58 ..	.. 90·70 ..	.. 158·95 ..	6	.. 88·52 ..	.. 92·18 ..	.. 161·53 ..
5	.. 86·62 ..	.. 90·73 ..	.. 159·00 ..	5	.. 88·56 ..	.. 92·21 ..	.. 161·59 ..
4	.. 86·65 ..	.. 90·76 ..	.. 159·05 ..	4	.. 88·60 ..	.. 92·24 ..	.. 161·64 ..
3	.. 86·69 ..	.. 90·79 ..	.. 159·10 ..	3	.. 88·64 ..	.. 92·27 ..	.. 161·70 ..
2	.. 86·73 ..	.. 90·82 ..	.. 159·15 ..	2	.. 88·68 ..	.. 92·30 ..	.. 161·75 ..
1	.. 86·77 ..	.. 90·85 ..	.. 159·20 ..	1	.. 88·72 ..	.. 92·33 ..	.. 161·80 ..
0	.. 86·81 ..	.. 90·88 ..	.. 159·26 ..	0	.. 88·76 ..	.. 92·36 ..	.. 161·86 ..
·8309	.. 86·85 ..	.. 90·90 ..	159·31 ..	·8259	.. 88·80 ..	.. 92·39 ..	161·91 ..
8	.. 86·88 ..	.. 90·93 ..	.. 159·36 ..	8	.. 88·84 ..	.. 92·42 ..	.. 161·96 ..
7	.. 86·92 ..	.. 90·96 ..	.. 159·41 ..	7	.. 88·88 ..	.. 93·45 ..	.. 162·02 ..
6	.. 86·96 ..	.. 90·99 ..	.. 159·46 ..	6	.. 88·92 ..	.. 92·48 ..	.. 162·07 ..
5	.. 87·00 ..	.. 91·02 ..	.. 159·51 ..	5	.. 88·96 ..	.. 92·51 ..	.. 162·12 ..
4	.. 87·04 ..	.. 91·05 ..	.. 159·57 ..	4	.. 89·00 ..	.. 92·54 ..	.. 162·18 ..
3	.. 87·08 ..	.. 91·08 ..	.. 159·62 ..	3	.. 89·04 ..	.. 92·57 ..	.. 162·23 ..
2	.. 87·12 ..	.. 91·11 ..	.. 159·67 ..	2	.. 89·08 ..	.. 92·60 ..	.. 162·28 ..
1	.. 87·15 ..	.. 91·14 ..	.. 159·72 ..	1	.. 89·12 ..	.. 92·63 ..	.. 162·33 ..
0	.. 87·19 ..	.. 91·17 ..	.. 159·77 ..	0	.. 89·16 ..	.. 92·66 ..	.. 162·38 ..
·8299	.. 87·23 ..	.. 91·20 ..	159·82 ..	·8249	.. 89·19 ..	.. 92·68 ..	.. 162·43 ..
8	.. 87·27 ..	.. 91·23 ..	.. 159·87 ..	8	.. 89·23 ..	.. 92·71 ..	.. 162·48 ..
7	.. 87·31 ..	.. 91·25 ..	.. 159·92 ..	7	.. 89·27 ..	.. 92·74 ..	.. 162·53 ..
6	.. 87·35 ..	.. 91·28 ..	.. 159·97 ..	6	.. 89·31 ..	.. 92·77 ..	.. 162·58 ..
5	.. 87·38 ..	.. 91·31 ..	.. 160·02 ..	5	.. 89·35 ..	.. 92·80 ..	.. 162·63 ..
4	.. 87·42 ..	.. 91·34 ..	.. 160·08 ..	4	.. 89·38 ..	.. 92·83 ..	.. 162·68 ..
3	.. 87·46 ..	.. 91·37 ..	.. 160·13 ..	3	.. 89·42 ..	.. 92·86 ..	.. 162·73 ..
2	.. 87·50 ..	.. 91·40 ..	.. 160·18 ..	2	.. 89·46 ..	.. 92·89 ..	.. 162·78 ..
1	.. 87·54 ..	.. 91·43 ..	.. 160·23 ..	1	.. 89·50 ..	.. 92·91 ..	.. 162·83 ..
0	.. 87·58 ..	.. 91·46 ..	.. 160·28 ..	0	.. 89·54 ..	.. 92·94 ..	.. 162·88 ..
·8289	.. 87·62 ..	.. 91·49 ..	160·33 ..	·8239	.. 89·58 ..	.. 92·97 ..	.. 162·93 ..
8	.. 87·65 ..	.. 91·52 ..	.. 160·38 ..	8	.. 89·62 ..	.. 93·00 ..	.. 162·98 ..
7	.. 87·69 ..	.. 91·55 ..	.. 160·43 ..	7	.. 89·65 ..	.. 93·03 ..	.. 163·03 ..
6	.. 87·73 ..	.. 91·57 ..	.. 160·48 ..	6	.. 89·69 ..	.. 93·06 ..	.. 163·08 ..
5	.. 87·77 ..	.. 91·60 ..	.. 160·53 ..	5	.. 89·73 ..	.. 93·09 ..	.. 163·13 ..
4	.. 87·81 ..	.. 91·63 ..	.. 160·59 ..	4	.. 89·77 ..	.. 93·11 ..	.. 163·18 ..
3	.. 87·85 ..	.. 91·66 ..	.. 160·64 ..	3	.. 89·81 ..	.. 93·14 ..	.. 163·23 ..
2	.. 87·88 ..	.. 91·69 ..	.. 160·69 ..	2	.. 89·85 ..	.. 93·17 ..	.. 163·28 ..
1	.. 87·92 ..	.. 91·72 ..	.. 160·74 ..	1	.. 89·88 ..	.. 93·20 ..	.. 163·33 ..
0	.. 87·96 ..	.. 91·75 ..	.. 160·79 ..	0	.. 89·92 ..	.. 93·23 ..	.. 163·38 ..
·8279	.. 88·00 ..	.. 91·78 ..	160·84 ..	·8229	.. 89·96 ..	.. 93·26 ..	.. 163·43 ..
8	.. 88·04 ..	.. 91·81 ..	.. 160·89 ..	8	.. 90·00 ..	.. 93·29 ..	.. 163·48 ..
7	.. 88·08 ..	.. 91·84 ..	.. 160·95 ..	7	.. 90·04 ..	.. 93·31 ..	.. 163·53 ..
6	.. 88·12 ..	.. 91·87 ..	.. 161·00 ..	6	.. 90·07 ..	.. 93·34 ..	.. 163·57 ..
5	.. 88·16 ..	.. 91·90 ..	.. 161·05 ..	5	.. 90·11 ..	.. 93·36 ..	.. 163·62 ..
4	.. 88·20 ..	.. 91·93 ..	.. 161·11 ..	4	.. 90·14 ..	.. 93·39 ..	.. 163·66 ..
3	.. 88·24 ..	.. 91·96 ..	.. 161·16 ..	3	.. 90·18 ..	.. 93·41 ..	.. 163·70 ..
2	.. 88·28 ..	.. 91·99 ..	.. 161·21 ..	2	.. 90·21 ..	.. 93·44 ..	.. 163·75 ..
1	.. 88·32 ..	.. 92·02 ..	.. 161·27 ..	1	.. 90·25 ..	.. 93·47 ..	.. 163·79 ..
0	.. 88·36 ..	.. 92·05 ..	.. 161·32 ..	0	.. 90·29 ..	.. 93·49 ..	.. 163·84 ..

Sp. Gravity at 60° F. = 15·5° C.	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit; per cent.	Sp. Gravity at 60° F. = 15·5° C.	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit; per cent.
·8219	90·32	93·52	163·88	·8169	92·11	94·79	166·12
8	90·36	93·54	163·93	8	92·15	94·82	166·17
7	90·39	93·57	163·97	7	92·18	94·84	166·21
6	90·43	93·59	164·02	6	92·22	94·87	166·26
5	90·46	93·62	164·06	5	92·26	94·90	166·30
4	90·50	93·64	164·11	4	92·30	94·92	166·35
3	90·54	93·67	164·15	3	92·33	94·95	166·40
2	90·57	93·70	164·20	2	92·37	94·98	166·44
1	90·61	93·72	164·24	1	92·41	95·00	166·49
0	90·64	93·75	164·29	0	92·44	95·03	166·53
·8209	90·68	93·77	164·33	·8159	92·48	95·06	166·58
8	90·71	93·80	164·38	8	92·52	95·08	166·63
7	90·75	93·82	164·42	7	92·55	95·11	166·67
6	90·79	93·85	164·47	6	92·59	95·13	166·72
5	90·82	93·87	164·51	5	92·63	95·16	166·76
4	90·86	93·90	164·56	4	92·67	95·19	166·81
3	90·89	93·93	164·60	3	92·70	95·21	166·86
2	90·93	93·95	164·65	2	92·74	95·24	166·90
1	90·96	93·98	164·69	1	92·78	95·27	166·95
0	91·00	94·00	164·74	0	92·81	95·29	167·00
·8199	91·04	94·03	164·78	·8149	92·85	95·32	167·04
8	91·07	94·05	164·83	8	92·89	95·35	167·09
7	91·11	94·08	164·87	7	92·92	95·37	167·13
6	91·14	94·10	164·91	6	92·96	95·40	167·18
5	91·18	94·13	164·96	5	93·00	95·42	167·23
4	81·21	94·15	165·00	4	93·04	95·45	167·27
3	91·25	94·18	165·05	3	93·07	95·48	167·32
2	91·29	94·21	165·09	2	93·11	95·50	167·36
1	91·32	94·23	165·14	1	93·15	95·53	167·41
0	91·36	94·26	165·18	0	93·18	95·55	167·46
·8189	91·39	94·28	165·23	·8139	93·22	95·58	167·50
8	91·43	94·31	165·27	8	93·26	95·61	167·55
7	91·46	94·33	165·31	7	93·30	95·63	167·59
6	91·50	94·36	165·36	6	93·33	95·66	167·64
5	91·54	94·38	165·40	5	93·37	95·69	167·69
4	91·57	94·41	165·45	4	93·41	95·71	167·73
3	91·61	94·43	165·49	3	93·44	95·74	167·78
2	91·64	94·46	165·54	2	93·48	95·76	167·82
1	91·68	94·48	165·58	1	93·52	95·79	167·87
0	91·71	94·51	165·62	0	93·55	95·82	167·92
·8179	91·75	94·53	165·67	·8129	93·59	95·84	167·96
8	91·79	94·56	165·71	8	93·63	95·87	168·01
7	91·82	94·59	165·76	7	93·67	95·90	168·05
6	91·86	94·61	165·80	6	93·70	95·92	168·10
5	91·89	94·64	165·85	5	93·74	95·95	168·15
4	91·93	94·66	165·89	4	93·78	95·97	168·19
3	91·96	94·69	165·94	3	93·81	96·00	168·24
2	92·00	94·71	165·98	2	93·85	96·03	168·28
1	92·04	94·74	166·03	1	93·89	96·05	168·33
0	92·07	94·76	166·07	0	93·92	96·08	168·38

Sp. Gravity at 60° F. = 15·5° C.	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit; per cent.	Sp. Gravity at 60° F. = 15·5° C.	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit per cent.
·8119	.. 93·96 ..	.. 96·11 ..	..168·42..	·8069	.. 95·71 ..	.. 97·29 ..	170·50 ..
8	.. 94·00 ..	.. 96·13 ..	.. 168·47 ..	8	.. 95·75 ..	.. 97·32 ..	.. 170·54 ..
7	.. 94·03 ..	.. 96·16 ..	.. 168·51 ..	7	.. 95·79 ..	.. 97·34 ..	.. 170·59 ..
6	.. 94·07 ..	.. 96·18 ..	.. 168·55 ..	6	.. 95·82 ..	.. 97·37 ..	.. 170·63 ..
5	.. 94·10 ..	.. 96·20 ..	.. 168·59 ..	5	.. 95·86 ..	.. 97·39 ..	.. 170·67 ..
4	.. 94·14 ..	.. 96·22 ..	.. 168·63 ..	4	.. 95·89 ..	.. 97·41 ..	.. 170·72 ..
3	.. 94·17 ..	.. 96·25 ..	.. 168·67 ..	3	.. 95·93 ..	.. 97·44 ..	.. 170·76 ..
2	.. 94·21 ..	.. 96·27 ..	.. 168·71 ..	2	.. 95·96 ..	.. 97·46 ..	.. 170·80 ..
1	.. 94·24 ..	.. 96·29 ..	.. 168·75 ..	1	.. 96·00 ..	.. 97·49 ..	.. 170·84 ..
0	.. 94·28 ..	.. 96·32 ..	.. 168·79 ..	0	.. 96·03 ..	.. 97·51 ..	.. 170·88 ..
·8109	.. 94·31 ..	.. 96·34 ..	..168·84..	·8059	..96·07 ..	.. 97·53 ..	..170·92..
8	.. 94·34 ..	.. 96·36 ..	.. 168·88 ..	8	.. 96·10 ..	.. 97·55 ..	.. 170·96 ..
7	.. 94·38 ..	.. 96·39 ..	.. 168·92 ..	7	.. 96·13 ..	.. 97·57 ..	.. 171·00 ..
6	.. 94·41 ..	.. 96·41 ..	.. 168·96 ..	6	.. 96·16 ..	.. 97·60 ..	.. 171·03 ..
5	.. 94·45 ..	.. 96·43 ..	.. 169·00 ..	5	.. 96·20 ..	.. 97·62 ..	.. 171·07 ..
4	.. 94·48 ..	.. 96·46 ..	.. 169·04 ..	4	.. 96·23 ..	.. 97·64 ..	.. 171·11 ..
3	.. 94·52 ..	.. 96·48 ..	.. 169·08 ..	3	.. 96·26 ..	.. 97·66 ..	.. 171·15 ..
2	.. 94·55 ..	.. 96·50 ..	.. 169·12 ..	2	.. 96·30 ..	.. 97·68 ..	.. 171·19 ..
1	.. 94·59 ..	.. 96·53 ..	.. 169·16 ..	1	.. 96·33 ..	.. 97·70 ..	.. 171·22 ..
0	.. 94·62 ..	.. 96·55 ..	.. 169·20 ..	0	.. 96·37 ..	.. 97·73 ..	.. 171·26 ..
·8099	.. 94·66 ..	.. 96·57 ..	..169·24..	·8049	.. 96·40 ..	.. 97·75 ..	171·30 ..
8	.. 94·69 ..	.. 96·60 ..	.. 169·28 ..	8	.. 96·43 ..	.. 97·77 ..	.. 171·34 ..
7	.. 94·73 ..	.. 96·62 ..	.. 169·32 ..	7	.. 96·46 ..	.. 97·79 ..	.. 171·37 ..
6	.. 94·76 ..	.. 96·64 ..	.. 169·36 ..	6	.. 96·50 ..	.. 97·81 ..	.. 171·41 ..
5	.. 94·80 ..	.. 96·67 ..	.. 169·40 ..	5	.. 96·53 ..	.. 97·83 ..	.. 171·45 ..
4	.. 94·83 ..	.. 96·69 ..	.. 169·44 ..	4	.. 96·57 ..	.. 97·86 ..	.. 171·49 ..
3	.. 94·86 ..	.. 96·71 ..	.. 169·48 ..	3	.. 96·60 ..	.. 97·88 ..	.. 171·53 ..
2	.. 94·90 ..	.. 96·74 ..	.. 169·52 ..	2	.. 96·63 ..	.. 97·90 ..	.. 171·56 ..
1	.. 94·93 ..	.. 96·76 ..	.. 169·57 ..	1	.. 96·66 ..	.. 97·92 ..	.. 171·60 ..
0	.. 94·97 ..	.. 96·78 ..	.. 169·61 ..	0	.. 96·70 ..	.. 97·94 ..	.. 171·64 ..
·8089	.. 95·00 ..	.. 96·80 ..	169·65 ..	·8039	.. 96·73 ..	.. 97·96 ..	171·68 ..
8	.. 95·04 ..	.. 96·83 ..	.. 169·69 ..	8	.. 96·76 ..	.. 97·98 ..	.. 171·72 ..
7	.. 95·07 ..	.. 96·85 ..	.. 169·73 ..	7	.. 96·80 ..	.. 98·01 ..	.. 171·75 ..
6	.. 95·11 ..	.. 96·88 ..	.. 169·78 ..	6	.. 96·83 ..	.. 98·03 ..	.. 171·79 ..
5	.. 95·14 ..	.. 96·90 ..	.. 169·82 ..	5	.. 96·87 ..	.. 98·05 ..	.. 171·83 ..
4	.. 95·18 ..	.. 96·93 ..	.. 169·86 ..	4	.. 96·90 ..	.. 98·07 ..	.. 171·87 ..
3	.. 95·21 ..	.. 96·95 ..	.. 169·90 ..	3	.. 96·93 ..	.. 98·09 ..	.. 171·91 ..
2	.. 95·25 ..	.. 96·98 ..	.. 169·95 ..	2	.. 96·96 ..	.. 98·11 ..	.. 171·94 ..
1	.. 95·29 ..	.. 97·00 ..	.. 169·99 ..	1	.. 97·00 ..	.. 98·14 ..	.. 171·98 ..
0	.. 95·32 ..	.. 97·02 ..	.. 170·03 ..	0	.. 97·03 ..	.. 98·16 ..	.. 172·02 ..
·8079	.. 95·36 ..	.. 97·05 ..	170·07 ..	·8029	.. 97·07 ..	.. 98·18 ..	172·05 ..
8	.. 95·39 ..	.. 97·07 ..	.. 170·12 ..	8	.. 97·10 ..	.. 98·20 ..	.. 172·09 ..
7	.. 95·43 ..	.. 97·10 ..	.. 170·16 ..	7	.. 97·13 ..	.. 98·22 ..	.. 172·13 ..
6	.. 95·46 ..	.. 97·12 ..	.. 170·20 ..	6	.. 97·16 ..	.. 98·24 ..	.. 172·17 ..
5	.. 95·50 ..	.. 97·15 ..	.. 170·25 ..	5	.. 97·20 ..	.. 98·27 ..	.. 172·20 ..
4	.. 95·54 ..	.. 97·17 ..	.. 170·29 ..	4	.. 97·23 ..	.. 98·29 ..	.. 172·24 ..
3	.. 95·57 ..	.. 97·20 ..	.. 170·33 ..	3	.. 97·26 ..	.. 98·31 ..	.. 172·28 ..
2	.. 95·61 ..	.. 97·22 ..	.. 170·37 ..	2	.. 97·30 ..	.. 98·33 ..	.. 172·32 ..
1	.. 95·64 ..	.. 97·24 ..	.. 170·42 ..	1	.. 97·33 ..	.. 98·35 ..	.. 172·35 ..
0	.. 95·68 ..	.. 97·27 ..	.. 170·46 ..	0	.. 97·37 ..	.. 98·37 ..	.. 172·39 ..

Sp. Gravity at 60° F. = 15·5° C.	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit; per cent.	Sp. Gravity at 60° F. = 15·5° C.	Absolute Alcohol by weight; per cent.	Absolute Alcohol by volume; per cent.	Proof Spirit; per cent.
·8019	97·40	98·39	172·43	·7969	99·00	99·37	174·17
8	97·43	98·42	172·47	8	99·03	99·39	174·21
7	97·46	98·44	172·50	7	99·06	99·41	174·24
6	97·50	98·46	172·54	6	99·10	99·43	174·28
5	97·53	98·48	172·58	5	99·13	99·45	174·31
4	97·57	98·50	172·62	4	99·16	99·47	174·35
3	97·60	98·52	172·65	3	99·19	99·49	174·38
2	97·63	98·54	172·69	2	99·23	99·51	174·42
1	97·66	98·56	172·73	1	99·26	99·53	174·45
0	97·70	98·59	172·77	0	99·29	99·55	174·49
·8009	97·73	98·61	172·80	·7959	99·32	99·57	174·52
8	97·76	98·63	172·84	8	99·36	99·59	174·55
7	97·80	98·65	172·88	7	99·39	99·61	174·59
6	97·83	98·67	172·92	6	99·42	99·63	174·62
5	97·87	98·69	172·95	5	99·45	99·65	174·66
4	97·90	98·71	172·99	4	99·48	99·67	174·69
3	97·93	98·74	173·03	3	99·52	99·69	174·73
2	97·96	98·76	173·07	2	99·55	99·71	174·76
1	98·00	98·78	173·10	1	99·58	99·73	174·80
0	98·03	98·80	173·14	0	99·61	99·75	174·83
·7999	98·06	98·82	173·17	·7949	99·65	99·77	174·87
8	98·09	98·83	173·20	8	99·68	99·80	174·90
7	98·12	98·85	173·24	7	99·71	99·82	174·94
6	98·16	98·87	173·27	6	99·74	99·84	174·97
5	98·19	98·89	173·30	5	99·78	99·86	175·01
4	98·22	98·91	173·34	4	99·81	99·88	175·04
3	98·25	98·93	173·37	3	99·84	99·90	175·08
2	98·28	98·94	173·40	2	99·87	99·92	175·11
1	98·31	98·96	173·44	1	99·90	99·94	175·15
0	98·34	98·98	173·47	0	99·94	99·96	175·18
·7989	98·37	99·00	173·50	·7939	99·97	99·98	175·22
8	98·41	99·02	173·54		Absolute	Alcohol.	
7	98·44	99·04	173·57	·7938	100·00	100·00	175·25
6	98·47	99·05	173·60				
5	98·50	99·07	173·64				
4	98·53	99·09	173·67				
3	98·56	99·11	173·71				
2	98·59	99·13	173·74				
1	98·62	99·15	173·77				
0	98·66	99·16	173·81				
·7979	98·69	99·18	173·84				
8	98·72	99·20	173·87				
7	98·75	99·22	173·91				
6	98·78	99·24	173·94				
5	98·81	99·26	173·97				
4	98·84	99·27	174·01				
3	98·87	99·29	174·04				
2	98·91	99·31	174·07				
1	98·94	99·33	174·11				
0	98·97	99·35	174·14				

MANUFACTURE OF CITRIC ACID.

By J. Carter Bell, F.C.S.

Read before the Society of Public Analysts, on 14th April, 1880.

The following paper is written, not from theoretical but practical knowledge. For some time I have been engaged with experiments upon citric acid, with the view of lessening the great loss which occurs during the process of manufacture—a manufacture which I have been obliged to abandon, owing to the great care which is required in the work, and not having had the time which is requisite for such a delicate chemical process. It is not often that authors record their failures in print; I do so now as a warning to those who may feel inclined to embark in similar enterprises. After finding my workmen had destroyed and wasted many gallons of liquor, I thought it was time to hand over the works to one who could give his sole attention to them.

Buying the Lemon Juice. A novice in the trade may lose a large sum at starting by not knowing how to buy the juice, for it seems the custom is to buy the juice by the old English gallon, and three pipes which were sent to the works were described in the invoice as containing 130 gallons in each pipe, whereas, when they were measured the quantity was found to be only 108 imperial gallons. Some Liverpool merchants very much wished to sell me 10 pipes of juice, each gallon to contain 64 ounces of crystallised citric acid. I agreed to take them if each pipe contained 130 English imperial gallons, and each gallon to contain 64 ounces of crystallised citric acid, English weight; they declined to execute the order, saying that the juice was sold according to the old English measure. The juice, which is generally concentrated before it arrives in this country, contains about four pounds of citric acid in each gallon; I have had it as high as six pounds to the gallon. The appearance of the juice is like thin black treacle, and on dilution with water a considerable quantity of organic matter is precipitated.

The following description is for working up two pipes of juice at the same time, for the labour is nearly the same as for one:—

A cistern must be provided capable of holding twelve hundred gallons: into this two pipes of juice are put, diluted with eight pipes of water, the colder the water is for this purpose the better, because the flocculent matter, which separates on dilution, is partially redissolved on warming. To allow this to settle, the solution must be allowed to stand for a day or two. Weak liquor should never be kept too long as it has a tendency to decompose. When the solution is clear it can be drawn off and allowed to flow through a sugar-bag or filter. These bags are made in Manchester, without seam, specially for the sugar makers; they are about six feet long and one in diameter. When the liquor has all passed through the bag, the solution may now be boiled up by means of steam blown into it at about 10 pounds pressure; when the liquor boils, fine whitening, which must be practically free from alumina, iron, and magnesia, is thrown in by small quantities at a time. Great care must be exercised that no lumps are introduced into the liquor, for they will fall to the bottom and thus a large excess of chalk may be used; it is advisable to mix the chalk with water, to the consistence of cream, or rather thicker, and pour the mixture in very gradually, taking great care that the contents of the vat do not overflow. The lime carbonate must be most accurately weighed, as the quantity of sulphuric acid necessary to decompose the citrate of lime can then be calculated. My practice was to estimate the amount of citric

acid in the juice, and then, after analysing the chalk, calculate the amount which was required; when all the chalk has been added, the mixture must be boiled for half an hour, agitating the whole time. The citrate of lime is now allowed to settle; the supernatant liquor, if found free from citric acid, is run off; and for this purpose two holes may be made in the vat, one just above the citrate of lime deposit, and another six inches above. Notice must be taken where the citrate of lime rises to, as this will be the same in all cases if the same quantity and strength of juice be used; these holes may have gun-metal taps in them, or tubes with india-rubber and a clip. If taps are not convenient, have a large syphon; anything so that it will run the water off quickly. The object to be gained is to wash the citrate of lime as speedily as possible. Near this vat must be placed a citrate of lime washer, which consists of a frame made of wood, about six to eight inches deep, having a wooden bottom perforated with holes a quarter of an inch in diameter, and it is rather important that there should be no corners to this frame, therefore they must be curved off; if there are corners the citrate of lime is apt to lodge in them and decompose.

The citrate of lime washer must be made large enough to hold the one charge of citrate of lime: the size necessary can easily be calculated by noticing the depth of citrate of lime in the washing vat. The depth of the citrate of lime upon this washer should not exceed four inches. A piece of unbleached calico, rather larger than the bed of the washer, must now be spread smoothly over the bottom, and just allowed to overhang the sides. The supernatant liquor of the citrate of lime is now run upon the calico filter, in order to arrest any particles of citrate of lime. About one hundred gallons of hot water is poured upon the citrate of lime, well agitated, then allowed to settle and run off as before, while hot, because the citrate of lime is more soluble in cold water than hot. Repeat this two or three times, then run the citrate of lime on to the washer with sufficient water to make it flow easily. When all the liquor has drained away, the surface of the citrate of lime must be beaten all over with a little wooden pallet to prevent any cracks forming. When this is done give the citrate of lime a final wash with cold water about an inch in depth. The time required for washing this citrate of lime may vary almost in every case, as it depends very much upon the state of the citrate of lime; if it has a crystalline appearance, the easier it will be to wash; thus the time may vary from one to three days. Three days is a very extreme case. In summer it will require more time than winter, and also decomposes sooner. The citrate of lime in draining is very liable to form cracks upon the surface, and when water is poured, it would easily run through, without properly washing the citrate of lime, therefore the surface must be broken up.

There is no doubt that the tediousness of this washing would be much shortened by using a filter press.

When the citrate of lime has been well washed it must be taken out of the drainer and put into about one hundred and fifty gallons of cold water, this water must be in a tub with an agitator. When all the citrate of lime has been added, then put in brown oil of vitriol about 140° Twaddle, one per cent. in excess of the equivalent of carbonate of lime, but not more than one and a half per cent. Great care must be used in adding this acid; it must be weighed. When all the sulphuric acid has been added, agitate for an hour. The mixture will not require warming, as the heat generated by the addition of the sulphuric acid will be sufficient for the decomposition of the citrate of lime. When the agitation is finished, let the contents of the tub run on at once to the washer previously described.

The washing of the sulphate of lime requires great care. You must continue washing till the filtrates are no longer acid to the taste, or only slightly so. No certain rule can be laid

down, as the number of washings may vary in each case. The last two or three washes may be used for the dilution of the crude juice. At each wash let the surface be covered with one inch of water, and before the new waters go on the sulphate of lime must be well drained each time, and between each wash the surface of the sulphate of lime must be well agitated, or cracks may be formed in the partially dry mass, which will allow the water to run through without percolating the whole of it. The cake of sulphate of lime should not be thicker than from four to five inches, and a similar filter may be used as in the washing of the citrate of lime. The free sulphuric acid in the juice will very soon rot the calico filters; therefore, perhaps, it would be more advisable to use a flannel for filtering. In washing the sulphate of lime it is better to use a small quantity of water each time, and a greater number of washes. The weak solution of citric acid is now run into a leaden evaporator. This may consist of a wooden box lined with lead. Into this must be put square tiles, and the best to use for this purpose are the tiles used in kilns for malt drying: they are perforated with very small holes. These must be put into the leaden tray, so as to present a perfectly flat surface. These are to be covered with water, and then a leaden evaporator will rest upon these tiles, being about one inch higher all round than the water-bath, as this will prevent the condensed water finding its way into the citric acid. On each side of the evaporator a steam pipe must be placed, capable of blowing steam into the water, and heating it to a certain temperature; also an overflow pipe, to carry away the condensed water. This evaporator should be nine inches deep, and it is better to make the sides square, and not sloping. The size of this evaporator must be in proportion to the quantity of liquor there is to evaporate down. When the weak acid is in the evaporator it must be evaporated down as quickly as possible at a temperature of 150° F., but not exceeding 160° F. When the acid is evaporated down to between 50° and 60° Twaddle, most of the sulphate of lime will have been precipitated. At this point it is better to syphon it off into another evaporator which stands at a lower level, and complete the evaporation in the second vessel. The evaporation must be carried on till a very slight film is observed upon the surface. The liquor must now be syphoned off into the crystallising trays. These vessels should be about six feet long, two feet wide, and six inches deep; these must be lined with nine pound lead. These solutions should stand about two days, and be covered to prevent dust falling in. At the end of two days good brown crystals should be obtained. The mother liquors must be evaporated, and a distinct pellicle must be formed before the steam is turned off. This liquor can now be run into the crystallisers.

It is very important that the mother liquors should never be mixed with original liquors, as the crystals from the mother liquors will be of a darker colour than from the original liquors.

Take the brown crystals—say four to five pounds of crystals to one gallon of water, dissolve, and boil with animal charcoal, which has been deprived of its lime salts by hydrochloric acid (about one pound of charcoal to one hundredweight of crystals) in a leaden-lined tub with steam blowing in; stir with a paddle the whole time, and boil for about twenty minutes. This solution must be filtered into leaden perforated cones, the top being about 18 inches square; calico is put into the leaden filters, and the filtrate is allowed to fall into a leaden vessel. This filtered solution must go into an evaporator kept solely for the purpose for white liquor, and evaporate at the same temperature as before. Now run off into the same crystallising vessels, and cover them with wooden covers. These crystallisers should not be in a cold place, say about 60° F. Let these stand from two to four days. The mother liquor might go back into the white evaporator. Let the market crystals drain; dig them out with a copper spud, and take them to a butterman's table, break them up slightly, and water them with a watering can. Take them to a stove and dry at about 80° F., on shallow trays, one inch deep, and about two feet square.

ON THE ACTION OF ALUM IN BREAD-MAKING.

By J. West-Knights, F.C.S.

Read before the Society of Public Analysts, on 18th February, 1880.

To satisfy myself of the injurious action of alum in bread-making, I undertook the following experiments, the objects of which were chiefly to compare the digestibility of gluten—with and without alum—in an artificially prepared gastric juice. The results of my experiments, I think, will not be altogether uninteresting to Public Analysts at large.

The object of the baker in using alum seems to be a question upon which there are many opinions. It is frequently stated that it enables the bread to hold a larger quantity of water; this I undoubtedly consider a mistake, as I have estimated the moisture in all samples of bread that have passed through my hands, and have found on the average, no difference in moisture whatever, between pure and alumed bread; but I am inclined to think that it may cause bread, when first drawn from the oven, to have more water, as it is well known amongst bakers that alumed bread can be drawn 10 or 12 minutes sooner than pure bread; but this excess of moisture the bread does not retain.

The supposition has, no doubt, arisen from the fact, that gluten prepared (by washing) from alumed flour, retains, after working up in the hand and squeezing, considerably more moisture than that from pure flour, which excess of water separates shortly afterwards on standing. Alum is also said to save labour in the kneading of the dough, and so be an inducement for the workman to use it against the knowledge and consent of his master; how far this is correct I am unable to say. It seems certain, however, that the action of alum on flour that has become unsound, by fermentation that has been induced by dampness or heat, is to arrest the change, by destroying or arresting the action of the ferment, so that an apparently sound loaf can be produced from unsound flour. But if alum arrests the fermentation, and there can be little doubt that it does so, will it not act in the same way with the ferments of the saliva and gastric juice?

To test this question, I prepared some gluten with pure wheat flour, and weighed four portions of two grammes each, which were treated as follows:—

I. was boiled ten minutes in pure distilled water.

II. was boiled ten minutes in a weak solution of alum.

III. was boiled ten minutes in weak alum and carbonate of soda solutions, with the resulting precipitate of hydrate of alumina.

IV. was boiled ten minutes in weak alum and phosphate of soda solutions, and the resulting precipitate of phosphate of alumina.

Each sample, after washing with water, was digested in 50 c.c. of an artificial gastric juice (consisting of pepsin and 0·2 per cent. hydrochloric acid), at a temperature of from 90° to 96° F.; after five hours digestion, the residues that remained were removed, gently washed with distilled water, dried and weighed.

I. had entirely disappeared.

II. A tough spongy residue remained, which weighed 1·05 grammes.

III. A similar residue remained, which weighed 0·90 grammes.

IV. A similar residue, weighing 0·80 grammes.

These experiments have been repeated, using lactic acid instead of hydrochloric, with similar results.

I think the inference can fairly be drawn from these results, that gluten, after treatment with alum, or insoluble salts of alumina, is less soluble than ordinary gluten, in the gastric juice, by about one-half. Whether the alumina is in a soluble or insoluble form seems to have no great influence on its effects upon the gluten.

I next compared the digestibility of pure and alumed bread. The samples employed were:—

V. Pure bread made with yeast.

VI. Bread made with same flour as above, and "Alum Baking Powder" (containing about 30 per cent. of alum), in the proportion of a teaspoonful of baking powder to a pound of flour.

Two grammes of crumb in each case were taken, in its natural state of moisture.

After six hours digestion in 50 c.c. of gastric juice at 90° to 96° F., the residues in each case were collected, washed, dried and weighed, with the following results:—

V. Residue weighed 0·40 grammes.

VI. Residue weighed 0·66 grammes.

If 40 be taken as the average percentage of moisture in bread, and that percentage deducted from the two grammes originally taken, it leaves 1·2 grammes of dry bread operated upon, of which, in the pure sample, 0·80 grammes, corresponding to 66 per cent. was dissolved; and in the alumed bread 0·54 grammes, or 45 per cent. only.

Or, in other words, the pure bread was one-third more soluble in the gastric juice than the bread containing the "Alum Baking Powder."

I next tried the action of alum upon diastase.

Two separate grammes of crushed malt were weighed, and to one was added 0·1 grammes of crystallized alum; both samples were then digested with 20 c.c. of water at a temperature of 160° F., and maintained at that temperature half-an-hour, then filtered, and the residues washed with cold distilled water.

The pure sample gave 0·70 grammes of extract.

The sample containing alum gave 0·185 grammes only of extract, including the alum added, or that portion of it that was not retained in the residue. A considerable portion of the alum was in the extract, and no doubt a very much smaller quantity would have had the same effect.

This experiment shows that alum exerts a very marked influence on the conversion of starch by diastase; as diastase is similar in its action to, and supposed to be identical with, ptyalin, the ferment of the saliva, I think this has a direct bearing upon the indigestibility of alumed bread; for not only is the gluten of the bread but also the starch rendered much more indigestible by the presence of alnm.

This powerful action of mere traces of alum or salts of alumina upon soluble gluten and diastase is, I think, sufficient foundation upon which to assert that alum, either in a soluble form or mixed with carbonate of soda, is injurious to health when introduced into bread: the extent of the injury may or may not be small.

THE WORK DONE BY PUBLIC ANALYSTS DURING 1879 UNDER THE SALE OF FOOD AND DRUGS ACT.

We are now preparing our Annual Tabulated Statement, which has always been received with so much interest, not only by the profession, but by Members of Parliament and the public at large. In order to obtain the necessary particulars, we have prepared a short and concise form of Return, copies of which have been sent to nearly every Public Analyst in the kingdom. To any Public Analyst who has not received one we shall be pleased to send a copy on having a post card from him. As the tabulating the returns involves a considerable expenditure of time, and it is desired to publish the table in our April number, we should be glad to receive the forms filled up by the 17th inst.

ANALYSTS' REPORTS.

Mr. W. W. Stoddart, Analyst for Somersetshire, in his report, states that he had during the quarter examined 177 samples of food, &c., of which 174 were brought by the police and three by the general public. Of these 13 were adulterated. During the past year he had made 802 analyses, many of them of great intricacy, and 54 of the samples were adulterated.

Mr. J. Carter Bell, Public Analyst for Cheshire, reports that during the quarter ended December 31st, 1879, he had examined 232 samples. Of these 29 were adulterated—namely, six whiskies, five gins, one brandy, seven coffees, two paregoric, five milks, and two mustards. 38 samples came from Hyde, 34 from Middlewich, 29 Broxton, 19 Eddisbury, 17 Wirral, 15 Altrincham, 14 Nantwich, 13 Runcorn, 12 Stockport, and nine Macclesfield. Owing to the energetic measures taken by Captain Arrowsmith, who had caused samples of milk to be taken from every division of the county, the quality of the milk supply has been excellent. By dividing the milk into three classes they obtained a ready means of comparison. First-class includes all milks whose numbers range from 93 to 100, and which milk could only be procured from cows which are in health, and properly fed and cared for. Second-class includes milk from cows which are not so well fed, and therefore cannot be in such good condition as the first. Third-class includes all adulterated samples, and milk from half-starved cows. There were some farmers who prided themselves on the fine condition in which they kept their cows, for their stock was well fed with the best food, and the shippons were kept in a clean state. The milk obtained from such a farm would rise above the first standard, and he proposed to call such milk extra first-class. There had been this quarter 48 milks extra first-class, 28 first-class, 10 second-class, and 13 third-class. The Analyst thought it would be wise now that in each division a record is kept of the number of milk dealers, to register the class to which the dealer belongs, and any farmer could then know how his milk was classed, and it would be an incentive to him to try and improve the quality, which could easily be done by ordinary care and attention. He would again press upon the notice of the Court the urgent necessity of having all water used for domestic purposes carefully examined, for upon several occasions he had found such water to be nearly diluted sewage, and highly dangerous. This remark applied not only to the poorer classes, but also to the wealthier, as one of the worst samples he had received came from a Cheshire mansion. The total number of samples analysed in the year 1879 had been 687; of these 134 had been adulterated.

Mr. Carter Bell, Analyst for Salford, reports that during the quarter ended December 31st, 1879, 124 samples had been analysed. The total number analysed for the year 1879 was 527. Of these 73 were adulterated, namely: 49 milks, eight breads, one port wine, four unfermented wines, two coffees, two sweet spirits of nitre,' five butters, one whisky, and one cocoa. The greater number of the milks were adulterated with water from 10 to 20 per cent. One reached the high number of 35 per cent. It will be interesting to show how the quality of the milk has improved since the appointment of a Public Analyst. In the year 1874, 96 per cent. of the samples were adulterated; in 1875, 52 per cent; in 1876, 45 per cent.; in 1877, 38 per cent.; in 1878, 27 per cent.; and in 1879, 16 per cent. The samples of unfermented wines call for some attention. These were bought supposing them to be pure juice of the grape. Two shillings and sixpence a bottle was charged. The analysis of these so-called wines proved them to consist of nothing else but sugar, water, tartaric acid, and a little flavouring and colouring matter; and, in his opinion, worth as many pence as shillings were paid for them. One of the samples of unfermented wine bought from another maker was really what it professed to be—pure juice of the grape, mixed with a small quantity of sugar.

LAW REPORTS.

Potato Starch in Yeast held to be no Adulteration:—

At York, W. Appleton was summoned for having sold half-a-pound of German yeast, not of the nature, substance, and quality demanded. Inspector Farrah deposed to visiting defendant's shop and asking for half-a-pound of Dutch yeast. He was informed that there were only French and German yeasts in stock. He purchased half-a-pound of the latter, and declared that his purpose was to have it analysed. Dividing it into three parts, he gave one part to the defendant, kept one part himself, and sent the third to Mr. Baynes, the East Riding Analyst, for examination. The certificate of the latter gentleman declared the yeast to be adulterated with 35 per cent. of potato starch. Defendant pleaded that he had bought the yeast for pure, and that he had neither the means nor the intention of adulterating it. Major Bower, chief constable, suggested that the defendant should get a warranty from the wholesale dealer, but Mr. Holtby (magistrates' clerk) doubted the necessity of this. Between the magistrates and their clerk some discussion took place, the latter observing that the yeast was made from the refuse of gin, and so prepared that it could be imported into this country in bulk. One of the magistrates said that, to his mind, the potato starch had been added in order that the yeast might be brought over in a solid state. The Clerk thought it was unfair to say that the yeast had been adulterated by the use of potato starch. If anything deleterious had been found in the yeast it would have been an offence. A magistrate: It says "adulterated." The Clerk: I don't think potato starch is an adulteration. The Bench considered that no adulteration had taken place, and dismissed the case.

Unfermented Wine.—No standard of what Grape Juice it should contain:—

At the Salford Borough Police Court, before the stipendiary magistrate (Mr. J. Makinson), William Pilling, chemist and druggist, New Bailey Street, was summoned for having sold "to the prejudice of the purchaser, one bottle of unfermented port wine, which was not of the nature, substance, and quality of the article demanded." Another summons charged the defendant with selling similarly a bottle of unfermented sherry. Mr. J. C. Walker, assistant town clerk, appeared on behalf of the prosecution, and Mr. W. S. Sebright Green, solicitor, of Liverpool, represented the manufacturers, Messrs. Bell and Company, Liverpool. It appeared that on the 22nd of November, the inspector obtained at the defendant's shop a bottle of liquid labelled "unfermented port wine, manufactured from the juice of the grape, for sacramental and other purposes." He also obtained a bottle labelled "sherry," together with the rest of the above description. For these bottles he paid half-a-crown each. He left a sample of each bottle with the defendant, and submitted some of each to the Borough Analyst. Mr. J. Carter Bell, the analyst for the borough, was called, and stated that he received the samples in question on the 23rd November, and analysed them. He found in them no trace of the juice of the grape. The pure juice of the grape contained in a thousand parts three parts of ash, and that ash should consist mainly of potash, phosphoric acid, and other elements. About 90 per cent. of this ash should be soluble in water. With reference to the "unfermented sherry wine" which he had analysed, he only found ·190 of ash, which was considerably less than one-tenth of what ought to be found in pure grape juice. This ash contained a trace of potash and a trace of phosphoric acid. It consisted chiefly of sulphate of sodium, and calcium, with a few other mineral ingredients. 52 per cent. of it was only soluble in water. This was no more ash than could be got from ordinary drinking-water. In answer to the Bench, the witness said the sherry wine contained about 6-10ths per cent. of tartaric acid and about 22 per cent. of sugar. He considered that this so-called sherry wine was nothing more than a solution of sugar and tartaric acid, flavoured and coloured, and contained in a little salycylic acid. The port wine was very similar to the sherry. He was prepared to say that the wine was not manufactured as stated on the label from the pure juice of the grape. Cross-examined: He would not take his oath there was not some percentage of the juice of the grape in the compound, but he should think there was not 10 per cent. of grape juice in it. He would not swear that. He could not distinguish any grape sugar in it. For the defence it was contended that what was sold to the inspector as unfermented wine was sold without the slightest deception. It was not sold as pure juice of the grape. It was sold as manufactured from the pure juice of the grape. Pure juice of the grape would not keep without being mixed with other substances. The inspector did not ask for pure grape juice, and did not get it, but asked for unfermented wine manufactured from the juice of the grape, and got it. There were other materials used, but it was manufactured mainly from the juice of the grape. Mr. Green called attention to the fact that orange wine had not a particle of orange juice in it. He did not say this unfermented wine was proper for sacramental purposes, but he would show that it was produced from the juice of the grape. William Pilling, the defendant, was called. He said he had some customers for the wine, though not very many. His assistant, Jos. Littlewood, said he remembered supplying the inspector with the wine. He had sold

it to a number of persons. G. B. Bell, one of the firm manufacturing the wine, stated that it was manufactured in large quantities. It was made from grapes, both black and white. The principal ingredient was grape juice. They had 3,284 wholesale customers at the present time. Cross-examined: They had dealt in the wine for about eight years, and they had had customers in Bradford for four or five years. Mr. J. Houston, manager for Messrs. Bell, said it was his business to manufacture the wine in question. With some reluctance, the witness stated that the process of manufacture was to preserve the grape juice with salycylic acid. To five parts of water he generally put one part of grape juice. To six gallons of this liquid was added two pounds of sugar. Mr. Louis Siebold, F.C.S., &c., said he had examined one of the samples of the wine in question. The predominant constituent of it was sugar, precisely the same as was contained in grapes. He also found tartaric acid exactly the same as was found in grapes. He found the constituents of grape juice present, but whether grapes or separate materials had been used he could not say, chemistry could not decide. His personal opinion was that something like ten per cent. of grape juice was used in the wine. Mr. Makinson, in dismissing the summons, said that there was no standard of what grape juice the wine should contain, and it could not be said that the manufacturers had fraudulently made this wine from water, for there was evidence that some proportion of grape juice was used. The defendant was allowed costs.

Decomposed Vinegar.—Vinegar Eels not Injurious:—

At the Droxford (Hants) Petty Sessions, Mr. Benjamin Boghurst was summoned for selling adulterated vinegar. A constable went to the defendant's shop and asked for a pint of vinegar. Mrs. Boghurst said she did not think she could draw so much, but managed to do so, and the payment of 3d. concluded the purchase. Mr. Arthur Angell, the County Analyst, said the vinegar was found to contain 3·9 per cent. of acetic acid, dead insects, organic matter, and vinegar eels. It was turbid and filthy, and swarmed with microscopic organisms. In his opinion it was not fit for food. In reply to Mr. Bullen, barrister-at-law, who defended, Mr. Angell said the liquid was of the substance of vinegar, but he could not swear that it was malt vinegar. There was no difference between the acetic acid of either malt vinegar or wood vinegar. He could not say that the vinegar eels were injurious to health. In defence, Mr. Bullen said his client had purchased the vinegar from a well-known firm at Winchester, who had received it from Messrs. Grimble & Co., of London. Both the defendant and Mr. Aylward, of Winchester, were called to give evidence, and both denied that the vinegar had been adulterated, and the head of the firm of Grimble & Co. said they occasionally obtained the assistance of Dr. Graham to analyse the vinegar. Professor Vöelcker proved on oath that the vinegar contained 4·22 per cent. of acetic acid. He did not find it in any microscopic organisms, only vinegar eels. It was of pleasant taste and odour, and was not decomposed. The vinegar eels were not injurious, as they were generated and nourished in brown vinegar. Although the sample was not so bright as he should like to use, it was free from adulteration. Professor Graham also proved that the vinegar was fit for food, and the bench dismissed the case.

Alum in Bread.—Can Alum be detected by the Taste or the Microscope?—

On February 16th, at Eckington Sessions, an important case was heard. George Widdowson, miller, Eckington, was summoned under the Act, for selling flour, not of the nature and substance and quality of the article demanded by the purchaser. Mr. Binney appeared for the prosecution, and Mr. Barker was for the defence. Mr. A. H. Allen, analyst for the Northern Division of Derbyshire, deposed to having analysed the flour, and finding it adulterated with alum in the proportion of twenty-four grains to four pounds of flour, or, roughly speaking, about a quarter of a pound of alum to a sack of flour. Alum was used, particularly in bad seasons, to improve inferior flour. Cross-examined by Mr. Barker: He found alum in the flour. There were two kinds of alum, one composed of sulphate of alumina and potash, and the other of sulphate of alumina and ammonia—hence the names potash and ammonia alum. He obtained alum in the form of crystals from the flour. The way in which he arrived at the result was as follows:—He shook the flour with chloroform, which was a heavy liquid. The flour floated, and the alum sank to the bottom. It was from what sank that he obtained crystals in the characteristic form of alum. He tasted it, and it had the astringent taste of alum. It gave the logwood reaction such as alum gives. He placed about thirty grains of flour in the chloroform, and the precipitate was probably about one-eighth of a grain. He let the chloroform evaporate and so obtained the crystals. Alum crystallized in octohedra of the cubical system. The alum was in a fragmentary form until water was added to the deposit from the chloroform, and the liquid filtered and evaporated. Silica crystallized in hexagonal prisms and could not be mistaken for alum. Besides, it was insoluble in water. He had made an analsyis for the purpose of estimating the quantity of alumina present, and he found it was in the proportion corresponding to thirty grains of alum to four pounds of flour. He made an allowance of

six grains, equal to the amount of silica found in the sample. The allowance was made in accordance with the researches of Mr. J. Carter Bell, who had analysed upwards of 100 samples of flour. Mr. Carter Bell found the alumina natural to flour, if calculated to alum, was on an average equal in amount to the silica of the flour. He based his opinion upon the quantity of alumina present, after the deduction of six grains, which he believed to be naturally present. Alum was present, because he saw it under the microscope and tasted it in the deposit from the chloroform. Thirty grains was a very small quantity to work on, and he should not have used so little had not the quantity received from Colonel Shortt been very small. The alum in 30 grains was distinctly astringent in taste. The flour also imparted a blue colour to a solution of logwood. He was positive alum was present, but he would not say whether it was ammonia alum or potash alum. Re-examined by Mr. Binney: Clay and dirt might be present in the form of a silicate of alumina, but it would not be soluble in water, and would give no reaction with logwood. Further examined by Mr. Barker: It was not an unusual practice for millers to mend their stones with a preparation of alum. He was not aware that they washed them with a solution of it. Mr. Barker, in defence, said that he did not wish to say anything against Mr. Allen, but the question to be decided was whether the Bench were satisfied that Mr. Allen could not be mistaken. He believed that Mr. Allen had innocently—he would say innocently—drawn upon his imagination, when he said he had tasted the alum extracted from 30 grains. A simple calculation would shew that the alum present in 30 grains of the flour was about the three-hundredth of a grain. From the cross-examination which he thought it his duty to submit Mr. Allen to, it was perfectly clear that the question of calculating alum in flour was one which exercised the minds of analytical chemists all over the country. There were cases where chemists could at once come forward and state positively that alum did exist in the flour, but in the present case it was really a matter of opinion and nothing more, and Mr. Allen had given reasons why he had formed that opinion, which was so hostile to his client. He should call an analyst, Mr. Bell, brother to Mr. Carter Bell, and after that evidence they might come to the conclusion that although it might be a case of suspicion, that amount of proof was wanting which alone would justify them in convicting the defendant. There was nothing astonishing in finding alumina twenty-four grains of alum in wheat which was perfectly pure and unadulterated. This he believed was especially the case with wheats of foreign growth. He was instructed that the English wheats had been so bad for some time that the defendant had been obliged to make his flour from foreign grain. Thomas Ford, foreman at Mr. Widdowson's mill, spoke to Colonel Shortt purchasing the flour. No alum had been put into the flour, nor was there any about the place at the time. They had used alum sometimes. They used it for filling up the cracks in the millstones. The flour was made from foreign wheat. Mr. H. S. Bell, analytical chemist, Sheffield, said he received a packet of flour from Mr. Widdowson. He analysed it for the purpose of detecting alum. He first tried the logwood test, which gave a slight blue reaction, which alone was not absolutely conclusive of the presence of alum. No chemist would be perfectly satisfied with that test alone—it was not infallible. He then proceeded to analyse the flour in order to discover the quantity of alumina. He found it in the proportion of 17·2 grains of alum to three pounds of flour, which was nearly what Mr. Allen found it. That was a quantity of alumina which was sometimes found in pure and unadulterated flour. He thought it was practically impossible to find the other constituents of alum in flour. He found 8·5 grains of silica. It was consistent with known experiments to find 17·2 grains of alumina with 8·5 grains of silica in flour. With regard to the chloroform test applied by Mr. Allen, he thought that the three-hundredth part of a grain of alum would be deposited from thirty grains of flour. Having regard to the quantity of alum which would be precipitated from the thirty grains, he did not think it possible for Mr. Allen to come to any positive conclusion. He also thought it impossible to distinguish alum in such a small amount by the taste or by the microscope. He should be sorry to swear there was alum in the flour, though he was of opinion that the case was one of great suspicion. Cross-examined by Mr. Binney: He had had some experience in analysing bread for alum. He had analysed several samples. He had never tried the chloroform process. He had forgotten that it was published in THE ANALYST for January, 1879. He tried the logwood test, and he got a faint blue colour. Magnesia, or iron, or alumina in solution would give it. He, however, did not find either iron or magnesia present in the sample. He could not account for the blue colour with logwood unless there was alum present. He ignored the results of the chloroform test. Mr. Barker, acting on a suggestion from the Bench, asked that the third packet of flour which was in the possession of Colonel Shortt might be sent to Somerset House for analysis, as was provided in the Act in case of difficulty. His client courted investigation, and would pay the expenses if the decision was against him. Mr. Rodgers, the magistrate, said there was a difficulty in deciding between the two analysts, and it would be better to have another opinion as to whether alum was contained in the flour. Mr. Binney said he thought he had given sufficient proof in the case, and he had confidence in leaving the case in the hands of the

Bench. Mr. Rodgers said they were satisfied with the evidence up to a certain point but the question which remained was whether they should believe Mr. Allen or Mr. Bell. Mr. Allen said he saw and tasted the alum, and Mr. Bell said he did not believe it was possible to do so. Mr. Binney remarked that he had no objection to another analysis being made. After some further discussion it was agreed to forward the third sample to Somerset House for analysis, and the case was adjourned for a month.

NOTES OF THE MONTH.

Verily some people are hard to please! We have frequently been obliged to point out, in reply to the *Pharmaceutical Journal's* articles abusing analysts as alone responsible for prosecutions which turn out to be questionable in their propriety, that the analyst can only give the facts of the case, and has no power either to suggest or arrest prosecution. Judge then our astonishment when this distinguished weather-cock suddenly turns round and blames an analyst for actually interfering to stop a questionable prosecution. It seems that Mr. Allen, of Sheffield, being present at a dinner of the Sheffield Druggists, and feeling somewhat hurt at the idea spread abroad amongst them by such articles as those referred to, as to the analyst being alone to blame for all prosecutions, made some remarks characterised by after dinner freedom, and showed how, when on one occasion he had attempted to point out that although his analysis of a drug exhibited a departure from exact purity, it was not in his opinion a case for prosecution, he had been told to mind his own business and leave such points to the local authority. Surely here was an analyst exercising the very wisdom which the *Pharmaceutical Journal* roundly charged some time ago as being wanting in Mr. Arthur Angell, but yet out comes an article taking our very words, and insisting that the analyst should never interfere, and blaming Mr. Allen for his speech. If Mr. Angell was wrong, surely Mr. Allen was right; and if both were wrong, will the *Pharmaceutical Journal* kindly show the remedy? If it cannot, we are clearly entitled to demand that in all cases of doubtful prosecutions depending not on results, but on their interpretation, no blame shall be by inference attached to the analyst after this admission of his powerlessness to interfere. It is no wonder that in a business where standards are so much wanted, that members even squabble over the very titles they can legally write over their shop doors, there should now and then occur doubtful points, and that the intellect of their great apostle should occasionally be so "obfuscated" as to induce self-contradiction such as that above alluded to.

According to the Hull magistrates, the addition of 25 per cent. of potato starch to compressed yeast is not an adulteration, but the bench evidently decided on their clerk's *dictum* without any scientific or practical evidence. Anyone who has had occasion to examine many samples of such yeast knows very well that it never ought to contain any notable proportion of starch, and if it was known to do so, no person in the trade would give a price for it. Indeed, it is a fact, that several of the larger consumers think it worth their while, every now and then, to send their yeast to a microscopic expert with the view of preventing their suffering from this very imposture, and find the cost well repays itself.

With reference to some communications as to the non-publication of certain papers which, although read before the Society, have not appeared in our pages, we may state that we are *in this respect* entirely under the orders of the Publication Committee of the Council, who alone have the right of arranging the order of publication of the Society's transactions, and who, if they see fit, may even altogether decline to permit us to print a particular paper.

Local authorities should remember that the Sale of Food and Drugs Act simply applies to the sale of an article not of the nature and substance required, and that articles bad from decomposition should be dealt with under the Public Health Act. This point should also be kept in view by analysts, and if they get a sample of an article which is genuine, but in their opinion decomposed, they should simply return it as genuine in their certificate, and request the inspector to call the attention of the medical officer to the article. Had Mr. Angell and his authority both remembered these points we should have heard nothing of the vinegar case containing microscopic organisms, which was rightly dismissed at Droxford when brought under the Sale of Food and Drugs Act, but with the sale of which the medical officer might have seen fit to interfere had he been notified of it.

RECENT CHEMICAL PATENTS.

The following specifications have been recently published, and can be obtained from the Great Seal Office, Cursitor Street, Chancery Lane, London.

1879 No.	Name of Patentee.	Title of Patent.	Price.
1481	W. Muller	Manufacture of Ammonia	6d.
1959	J. Hopkinson	Electric Lamps	4d.
1969	A. Longsdon	Electric Light Apparatus or Lamps	6d.
1971	A. M. Clark	Lighting by Electricity	8d.
2000	J. Congnet	Electric Lamps	2d.
2006	J. B. Spence	Treatment of Metallic Sulphides	4d.
2706	Ditto	Combining Metallic Sulphides with Sulphur	4d.
2060	A. F. Blandy	Apparatus for Electric Lighting	6d.
2101	W. P. Thompson	Manufacture of Aluminium Soduim, &c.	2d.
2110	C. W. Siemens	Producing Light and Heat by Electricity	10d.
2111	W. R. Lake	Electric Lighting Apparatus	6d.
2137	G. Bischof	Apparatus for Purification of Sewage, &c.	4d.
2290	Ditto	Preserving Butter	4d.
2199	I. Furstenhagen	Lighting by Electricity	2d.
2204	J. Pattinson	Manufacture of Soluble Phosphates	2d.
2267	G. Grout	Illuminating by Electricity	2d.
2293	L. McIntyre	Manufacture of Manure	6d.
2301	R. Werdermann	Apparatus for Electric Lighting	6d.
2322	C. D. Abel	Electric Lamps	2d.
2828	Ditto	Production of Sulpho-Acids of Rosaniline	2d.
2321	J. D. Andrews	Production of Electrity for Illumination	6d.
2339	A. M. Clark	Obtaining Light by Electricity	6d.
2340	Ditto	Electrodes for Electric Lights	2d.
2386	W. E. Hartmann	Manufacture of Sulphuretted Hydrogen Gas	6d.
2387	E. Solvay	Manufacture of Soda	8d.
2402	T. A. Edison	Electric Light	10d.
2414	S. G. Thomas	Phosphates	2d.
2502	F. E. Beanes	Glucose	2d.
2511	H. Lake	Manufacture of a Sulpho-Acid or its Salts	4d.
2539	L. Thiercelin	Extracting Iodine from Sea Weed	2d.
2543	F. J. De Hamel	Manufacture of Carbon Candles for Electric Lighting	4d.
2599	H. Chamberlain	Treating Sewage	2d.
2645	J. H. Valentine	Volatilizing Cresylic Acid	6d.
2745	G. W. Von Nawrocki	Production of Hydrofluosilicic Acid	2d.
2769	H. E. Newton	Electric Lighting	2d.
2860	S. Pitt	Production of Hydrocarbons	4d.

BOOKS, &c., RECEIVED.

The Chemist and Druggist; The Brewers' Guardian; The British Medical Journal; The Medical Press; The Pharmaceutical Journal; The Sanitary Record; The Miller; Journal of Applied Science; The Boston Journal of Chemistry; The Provisioner; The Practitioner; American New Remedies; Proceedings of the American Chemical Society; Le Praticien; The Inventors' Record; New York Public Health; Philadelphia Printers' Circular; The Scientific American; The American Traveller; Society of Arts Journal.

THE ANALYST.

APRIL, 1880.

SOCIETY OF PUBLIC ANALYSTS.

A General Meeting of this Society was held on Wednesday, the 17th instant, at Burlington House, Piccadilly, the President, Dr. Muter, in the chair.

The Scrutineers having examined the voting papers reported that the following gentlemen had been duly elected as Members:—

J. G. Tatters, Chemist to the Jarrow Chemical Works, South Shields.

F. P. Perkins, Public Analyst for Exeter.

Elwyn Waller, Ph.D., F.A.C.S., School of Mines, Columbia College, New York.

H. A. Mott, Ph.D., F.A.C.S., 117, Wall Street, New York.

H. Lancaster Hobbs, Analytical Chemist, Holborn Viaduct.

The following gentlemen were proposed for election as Members, and will be balloted for at the next Meeting:—

F. A. Bond, M.B., &c., Brincklow, Coventry.

J. Napier, Public Analyst for West Suffolk, &c.

H. S. Carpenter, Analytical Chemist, Holborn Viaduct.

The following papers were then read and discussed:—

"On a Peculiar Water," by Dr. W. Wallace.

"On the Estimation of Phosphoric Acid in Phosphatic Materials," by A. Smetham, F.C.S., and Mr. Dyer, Mr. Hehner, Dr. Bartlett and others took part in the discussion which ensued, and Mr. Smetham replied.

"On the Work Done during 1879 under the Sale of Food and Drugs Acts," by G. W. Wigner, F.C.S., when Dr. Dupré, Mr. Hehner, and others made some important remarks on the recently issued Report of the Inland Revenue Commissioners.

"The Effect of Light upon some Reagents and Chemical Compounds," by T. P. Blunt, F.C.S.

The President called attention to an abstract in the *Journal of the Chemical Society* of a paper by Mr. Allen "On the Analytical Examination of Tinctures," which had been read before the Society of Public Analysts and published in THE ANALYST last year. This paper had been reprinted by the *Pharmaceutical Journal* and of course acknowledged, but the abstractor of the Chemical Society described the paper as being from the *Pharmaceutical Journal*, thus ignoring both the Society of Public Analysts and THE ANALYST. The President thought the Committee of Publication of the Chemical Society's *Journal* should have their attention directed to the matter, as this was said to be not the first time such a thing had occurred.

The next Meeting of the Society will take place on April the 14th, at Burlington House.

ON THE WORK DONE DURING 1879 UNDER THE SALE OF FOOD AND DRUGS ACT.

Owing to several of the returns from Public Analysts having been sent in within the past few days, we regret to state that we are compelled to hold over this interesting tabular statement, together with the paper written on the subject until next month; but we may mention that it comprises returns from as many as 200 districts, which is a much larger number than we have been able to include in any previous statement. We are also obliged to postpone until our next number the observations made by members of the Society on the recently issued Inland Revenue Commissioners' Report.

ON THE DETERMINATION OF THE SPECIFIC GRAVITY OF BUTTER FAT AND OTHER SOLIDS AT ORDINARY TEMPERATURES.

By A. Wynter Blyth, M.R.C.S., F.C.S., &c.

Read before the Society of Public Analysts, on 18th February, 1880.

I consider it far more convenient to take the specific gravity of solid butter fat at 15° than at higher temperatures. My procedure, which has no claim to originality, is as follows:—A short wide test tube is taken, and a little mercury is placed at the bottom, or, which is perhaps more convenient, a lead weight is attached by means of a little wire cage. This is now suspended to the scale-hook by a fine thread of glass and weighed in water, the height of the water in the beaker being noted and kept constant in any subsequent operation.

The same tube is now filled with a weighed portion of the filtered butter fat under examination, and the whole weighed in water. From the data thus obtained the usual calculations are made.

Thus, as an example:—

	Grms.
Weighted test tube in water	18·224
Weight of butter fat in air	22·223
Loss of weight in water	1·722

then

$$\frac{22{\cdot}223}{1{\cdot}722 \times 22{\cdot}223} = 9280 \text{ sp. gr.}$$

I find that the average specific gravity of Devon butters taken in this way is ·9275, whilst butterine is ·8467. This method is also excellent for the purpose of determining the specific gravity of a variety of organic solids, whether they be lighter or heavier than water.

If, for example, it is necessary for the purpose of the pathologist to take the specific gravity of kidney or muscle, the tube with mercury is weighed as before, a section of the tissue cut by means of a cork-cutter so that it exactly fits, and, indeed moves rather tightly into the tube, and the surface of the section covered with the mercury and then weighed in water. Should a solid be full of pores, as—for example—bread, it may be placed in a tube, stoppered with a caoutchouc doubly perforated cork, one perforation carrying a thistle head funnel tube, the other a tube for connection with a sprengel. In the throat of the funnel a solid rod is ground airtight, and the mercury

is poured into the funnel. On now completely exhausting the tube of air, the solid stopper is gently loosened and a thin stream of mercury allowed to pour in; thus the solid is completely injected and all errors from air avoided.

ON BLOWPIPE ASSAYS OF SILVER LEAD.

By F. Maxwell Lyte, F.C.S.

Read before the Society of Public Analysts, on 18th February, 1880.

In making blowpipe assays of lead ore, one considerable disadvantage and cause of inaccuracy has always been the extreme minuteness of the button of silver usually obtainable. By the following simple method the whole of the silver may be collected from a comparatively large quantity of ore, so as to be able to obtain a really ponderable button, even before the blowpipe. From one to five grammes of the lead ore to be examined are reduced to fine powder, and treated with strong HCl., and boiled till the whole of the lead has become converted into $Pb.Cl_2$. This usually takes place rapidly. The solution, together with the gangue, is evaporated to dryness on a water-bath, and for each gramme of lead ore which has been employed 50 or 60 c.c. of saturated solution of chloride of sodium is to be added. This being heated to boiling, with the residue of the evaporation of the acid solution of the ore takes up all the $Pb.Cl_2$ and the Ag.Cl. The solution is filtered, as hot as possible, into a beaker, or capsule, and the precipitate washed on the filter with a little boiling brine, the washings being added to the rest of the filtrate. Meanwhile a little spongy lead is prepared by reducing a solution of lead acetate with a rod of metallic zinc, and four or five bits of this spongy lead, about the size of peas, are to be added to the hot brine solution and digested with it on a water-bath for a few hours. Such bits of spongy lead will not really weigh altogether more than ·04 to ·05 grammes, and these will collect all the silver from the solution. The spongy lead should not be compressed when put into the brine, and will float in it, and while they are digested together they should be frequently stirred and agitated with a glass rod. The lead, as soon as placed in the brine, will be seen to change from its blue grey tint to a dull silver grey, and this reaction also affords a delicate test to see when the extraction of the silver is complete. It is only necessary to drop into the solution a fresh morsel of spongy lead, and observe whether it changes colour or not. As soon as the reaction is complete, and all the silver has been withdrawn from solution the argentiferous lead may be collected and fused with Na_2CO_3 on a charcoal support, and finally cupelled; and if properly manipulated, a lead button may be obtained containing all the silver from several grammes of ore, and yet able to be cupelled before the blowpipe. With a little practice the operator will soon find out how to apportion the quantity of spongy lead he employs to the quantity of ore worked on, so as to obtain a button of treatable size, and yet containing ponderable quantities of silver.

ON THE PERSISTENT OCCURRENCE OF STARCH.

By Frank P. Perkins, Public Analyst for Exeter.

Read before the Society of Public Analysts, on 18th February, 1880.

Things trivial in themselves occasionally assume a high degree of importance, and in the daily whirl we are too apt to overlook it. There is a substance used extensively by everyone, everywhere, constituting a great portion of our daily food, and yet its very

commonness makes us forget how widespread it is. This substance is starch. Until it is brought home to us in some direct manner we do not bestow a thought on the fact that it is always present with us, and that the dust of our houses, and the air we breathe must contain starch. My attention was first called to what may be named the "Persistent Occurrence of Starch," in rather a notable way. Not many months since I was engaged on a case in which a woman was charged with the murder and mutilation of a child, a case horrible in all its details, the end of which was that the murderess paid the full penalty of her crime on the scaffold. Many articles were submitted to me for examination; among them a chopper, on which was a stain that proved to be not blood, but starch discoloured by iron rust. Another thing was a razor, on which was found blood and *starch*. I spent some time in endeavouring to solve the problem, How did it come there? Supposing the child had been fed with farinaceous food, and this instrument used in severing the head from the body, would any starch have been likely to adhere to it, and was there any connection between the razor and the chopper? A piece of floorcloth turned up. It had been taken from the mill-stream, and was said to have been the piece in which the child's head was wrapped when it was thrown into the water. It was thoroughly soaked with water and rotten; it had evidently been in the water for a long while, water insects had taken up their abode on it, and were clinging to it. It was minutely examined, but—as might be expected—no blood stains were discovered, but starch again made its appearance—not a few grains here and there, but every part was crowded with granules. It was thickly coated in some places with a black incrustation; this appeared to be nearly made up of starch. I began to open my eyes. This starch had evidently not come from the body. Could the floorcloth have formerly been placed beneath some table on which culinary operations were performed. Full of these thoughts I went to my own kitchen, and transferring a little of the inevitable dust from the matting placed under the table to a glass slide, I submitted it to microscopical inspection; there were the granules of starch plain enough. I was now fully awake. I went to the lobby, and in the dust of the floor starch was present; I went to the stairs, starch was again found. Evidently then, the occurrence of starch in this investigation was but of little value, although that in the child's food bottle afterwards examined was found to be similar in character, and although the woman stated in her confession that the chopper had been used in the way at first suggested, after which she washed it. But what these observations lead to is this, viz: the way in which starch granules are carried or wafted everywhere. I have since examined dust from the floor, and the ledges of the door of my laboratory; freshly deposited dust from a sideboard; dust from high up on papered walls; dust that had settled on new woodwork in a room, dust from the mouldings of the street door, and in every instance starch granules have been identified. The granules have in all cases been confirmed by means of the polariscope, much in the same way as suggested by Dr. Tripe, in his interesting paper in the December number of THE ANALYST;* and probably starch may be frequently overlooked or species confounded without the aid of this beautiful and useful apparatus. I have thought it worth while to bring these thoughts before you, because I believe the consideration may be applied, and be helpful in discriminating between wilful and accidental adulteration of certain articles of food.

* Vol. iv., p. 221.

ON A PECULIAR WATER.

By Dr. Wallace.

Read before the Society of Public Analysts, on 17th March, 1880.

The following analysis of a peculiar water may be interesting to some of the members of the Society of Public Analysts. It was obtained from a very deep bore, the strata penetrated consisting entirely of sedimentary rocks of the lower coal formation, but volcanic rocks are found at no great distance. The distinguishing feature of the composition of the water is the occurrence of a barium compound, the entire absence of sulphates, and the presence of a large quantity of chlorides. An immediate precipitate is obtained by adding the solution of a sulphate (even calcic sulphate) to the water. The free ammonia is somewhat large, and the amount of oxygen required to oxydize the organic matter is considerable. A second sample taken after the interval of a month, during which a large quantity of water had been taken from the bore, still gave an immediate precipitate, with solution of sulphate of lime, and contained almost exactly the same quantity of chlorine.

	Parts per million.
Barium Carbonate	54·1
Calcium ,, ...	262·6
Magnesium ,, ...	23·0
Calcium Chloride	92·4
Magnesium ,, ...	78·0
Potassium ,, ...	24·0
Sodium ,, ...	1783·0
Alumina, &c...	8·0
Silica	7·0
Organic and Volatile	85·0
Total Solids....	2417·1
Hardness, degrees per million	537
Oxygen required to oxydise organic matter	1·67
Ammonia, free, per million	·95
Do. organic	·07

THE EFFECT OF LIGHT UPON SOME REAGENTS AND CHEMICAL COMPOUNDS.

By T. P. Blunt, M.A. Oxon., F.C.S.

Read before the Society of Public Analysts, on 17th March, 1880.

The following remarks are for the most part of a practical character, and intended to point out the importance to the chemist of a consideration of the effects of exposure to light upon some of the ordinary reagents of the laboratory, which have not been usually regarded as subject to its influence. My attention was first drawn in this direction in the course of an investigation into the action of light on certain organisms, upon which Dr. A. H. Downes and I have been engaged for more than two years. Nearly all our results have been embodied in a series of papers read before the Royal Society, but it may not be considered impertinent to reproduce here such of them as have a bearing upon the practical question of the preservation of reagents. I do not pretend that all the facts detailed below are new, but some of them have certainly not received the attention they deserve. Oxalic acid forms a most useful basis for a standard solution, owing to the ease

with which it is obtained in a pure state by crystallization, and subsequently weighed, but it has fallen into disrepute on account of the instability of the normal solutions prepared with it; now it has been clearly proved by us that this instability is solely due to the action of light, and that normal volumetric oxalic solution (6·3 per cent.) may be preserved unchanged for any period in the dark. The same remark applies even to the decinormal (0·63 per cent.) solution, if the precaution be taken of first boiling to destroy germs or organisms, otherwise it may become turbid and lose strength in the dark. In the light decinormal oxalic solution is rapidly destroyed by oxidation. In one of our experiments, made in test tubes, partially filled and plugged with cotton wool, six months' insolation, between Jan. 21st and June 15th, sufficed to destroy both acid taste and reaction, apparently leaving nothing behind but pure water—the carbonic acid formed having of course escaped. I have already, in the columns of THE ANALYST, called attention to the fact that a weak permanganate solution, such as that used by Tidy in water analysis, is perfectly permanent for one month when kept in the dark. My experience extends now over a longer period, and I find that such a solution may be preserved unchanged in the dark for many months, in spite of variations of temperature. Potassium iodide and ferrous iodide are a pair of compounds whose conduct under light is mutually anomalous; solid potassium iodide in presence of light and moisture soon becomes tinged with yellow through the liberation of iodine, while it is a fact well known to pharmacists that in order to preserve the syrup of iodide of iron (ferrous iodide) from discolouration it should be placed in white glass bottles in the strongest available light. We once half filled a test tube with the syrup and exposed it in a window, in the summer. Each morning a brown layer appeared on its surface, the accumulation of the past night. This gradually disappeared in the sunlight, so that before evening the contents of the tube had once more become completely colourless, and this phenomenon occurred as long as the experiment was under observation. It was satisfactorily proved that the only effect of the sugar was to render the solution more stable, for aqueous solutions of ferrous iodode were found to become discoloured much more rapidly in the dark than when exposed to sunlight. Solutions of potassium iodide behave in an exactly opposite manner to those of ferrous iodide in all the respects mentioned above; they become discoloured under sunlight, but can be preserved indefinitely in the dark, and if a dilute solution which has turned yellow in the light be afterwards screened from it, the colour very gradually disappears.

The cause of the discolouration of potassium iodide by light having been much discussed of late years, it may perhaps be worth while to give a somewhat detailed account of our own attempts at the solution of the problem. Four tubes containing a weak solution of the salt, which filled them to about one-third of their capacity, were exhausted at the sprengel pump; air which had been freed from carbonic and all other acids by long contact and frequent agitation with caustic potash was then admitted by a special arrangement, and the tubes were sealed off; two were insolated and two encased. At the same time some more of the solution was placed in four ordinary test tubes, which were simply plugged with cotton wool, and exposed to sunlight and darkened respectively in a similar manner to the previous pairs. All the insolated tubes rapidly became coloured, no difference being noticeable between the rates of colouration in the tubes containing ordinary and purified air, those kept in the dark being perfectly preserved. A pair of tubes was now charged with solution, exhausted and sealed off. No change took place on insolation, and thus the

somewhat improbable alternative of mere dissociation was disposed of, and the conclusion remained that the effect of light was due to direct oxidation, without the intervention of any acid.

There can be little doubt that solution of potassium iodide of any strength could be perfectly preserved in a well-stoppered bottle in the dark, and would be much more convenient than the fragments of solid salt we are most of us in the habit of using. A similar reaction to that observed in the case of potassium iodide under light occurrs with dilute solutions of all the alkaline oxalates, which are gradually oxidized, with the formation of carbonates, but much less rapidly than a solution of oxalic acid of corresponding strength. In operating on solutions containing the same proportion of acid radical it was found that the decomposition was nearly equal in the case of the oxalates of sodium, potassium, and lithium, but somewhat greater in that of the ammonium salt; hence it would appear to be desirable to keep solutions of ammonium oxalate in the dark when they are required to be preserved of uniform strength—as for instance, where they are employed in the volumetric estimation of lime.

In the course of one of our experiments two tubes were partially filled over mercury with a mixture of atmospheric air and ammoniacal gas, one was then exposed to light and the other darkened. On examining the tubes after many months the mercury had risen in the encased tube. The surface of the metal was blackened and its convexity lost, these appearances being evidently due to oxidation. In the tube in the light, on the other hand, the level of the mercury remained unchanged, and its surface was clean, bright and convex.

These results afford strong presumptive evidence against the formation of ozone in sunlight, and consequently against the views of those writers who have ascribed some of the phenomena of oxidation under light to its intervention, for it is well known that a trace of ozone in air is capable of destroying the convexity and lustre of the mercurial surface.

Dr. Dupré said he heard a similar paper read some time ago, and he went the next day and examined his decinormal oxalic acid which had been made about 14 months, and standing in a place never struck by sunlight. He had some of the exact acid with which it was made and could certainly find no difference between the two.

Dr. Muter said that had it been in the light it might have been affected. He thought it was probably through germs if any change took place. If no germs could get in it a solution might remain correct for a number of years.

Mr. Hehner pointed out that some germs were not fond of light as they flourished much better in the dark. If fungus were exposed to the sunlight it would very quickly die.

Dr. Bartlett said that he had some potassium iodide which had been for about 20 years in the dark in his laboratory, and it had become of a deep yellow colour.

ON THE PRESENCE OF ARSENIC IN THE ATMOSPHERE.

By H. C. Bartlett, Ph.D., &c.

Having been very anxious to ascertain if arsenic in any form can be detected in the atmosphere of a room papered with arsenical wall paper, I have made a series of preliminary experiments which appear to prove that this highly important object can be satisfactorily accomplished.

I. I first took a large glass jar, in which I placed three square yards of wall paper,

known to be free from arsenic and antimony. I then passed a gentle stream of pure hydrogen, obtained from the gradual decomposition of sodium amalgam, through the jar, directing the jet of gas upon a filter paper moistened with very slightly acid silver nitrate. When this experiment was conducted in complete darkness, or with the assistance of completely non-actinic light, no reaction took place during an exposure of twelve hours.

II. Repeated this experiment, after passing a small quantity of ammoniacal gas through the jar, with the same result as before.

III. This time I varied the experiment by producing the hydrogen by the decomposition of zinc in dilute sulphuric acid. After twelve hours a slight stain on the filter paper induced me to continue, greatly increasing the quantity of hydrogen passing through the jar. A deep brown mark then resulted. This was very unsatisfactory, as both the zinc and the acid appeared to be free from arsenic and antimony when tested by Marsh's process.

IV. My next attempt was to substitute aluminium and pure potassic hydrate for the acid, and afterwards magnesium for the zinc, and when no actinic light fell upon the nitrate of silver paper no discolouration took place. I therefore assume that my samples of zinc, or sulphuric acid, contained a trace of arsenic too minute to be detected by Marsh's test, but sufficient to give a strong reaction with ammoniacal silver nitrate.

V. Taking the same quantity of wall paper as in the previous experiments, but selecting one coloured with a large quantity of arsenical pigment, I moistened the back of the paper slightly, and then passed a little ammoniacal gas through the jar. The hydrogen from sodium amalgam being the purest and most easily available, I chose this, and I am happy to say that in each of the three experiments so carried out there has been a characteristic reaction, proving to my mind conclusively that arsenic in a gaseous or pulverulent form, emanating from wall paper, can be detected.

I am now about to try a long continuous experiment of passing pure hydrogen with a trace of ammonia over the surface of 20 square yards of paper in the hope of being able to collect the resulting arsenious compounds of silver salt (arsenite of silver).

Milk of Ruminants.—In all probability there has not been sufficient attention, thinks Dr. Brush, drawn to the differences existing between the milk of animals who ruminate, as the cow, and those who do not chew the cud, as the ass and the horse; and he would divide milk into two classes—that which is the product of cud-chewing, and that which is the product of non-cud-chewing animals. The milk of the cud-chewers contains a variety of caseine, which, under the action of the digestive process, coagulates into a hard mass. Contrary to the often-expressed belief, he declares that this coagulation takes place in the ordinary process of digestion in the calf. He had one tied up, out of the reach of any food, and had it fed with freshly-drawn cow's milk. Half an hour after its meal, he always found it busily chewing the cud. After many inquiries, he has ascertained that the same takes place with the sheep and the goat; and from these facts, he is inclined to explain the difficulty often experienced by the human stomach in properly digesting the milk of ruminating animals. The other variety of milk, to which human, equine, and asses' milk belong, does not under the action of acids in the same way coagulate into the hard mass that is found in cows' milk, but coagulates rather into small granular or flocculent masses, which are easily diffusible. This would explain why Kumyss prepared from cows' milk is found to agree better with children than cows' milk itself; the Kumyss has been, so to speak, already chewed. In the milk of the cud-chewers there is but a small amount of sugar and a large amount of caseine, while exactly the reverse of this is the case with the milk of the non-cud-chewers; and in this fact there is again a reason why the milk of the latter, at least in the case of children who cannot get their natural supply, is to be preferred. It will be remembered that Kumyss is a beverage prepared by the people of Yakutz from mares' milk, and found to be highly nutritious, but that the beverage referred to by Dr. Brush is a product artificially prepared from cows' milk.

CORRESPONDENCE.

[The Editors are not responsible for the opinions of their Correspondents.]

To the Editor of "The Analyst."

Sir,—With regard to the vinegar case at Droxford, reported in the last number of your journal, may I say a word?

I do not desire passionately to defend the action taken, but your editorial remarks have raised a curious point—one I think worthy of ventilation in your columns; namely, What is to be understood by the phrase "*nature, substance and quality?*" Does, or does not an article which has undergone decomposition meet the spirit, or even the letter of the demand?

I have never said that the acetic acid of the sample in question was decomposed. I found 0·22 per cent. less $C_2H_4O_2$ than Professors Voelcker and Graham. My portion was weighed, and perhaps theirs was measured.

In evidence it was shown that the pint served to the inspector was the dregs obtained by the tilting on end of a large cask, and doubtless most of the dirt, *matter out of place, and therefore foreign matter*, fell to the bottom of the collecting vessel, and thence into one of the three portions. I believe that I happened to have that portion, for my sample was so filthy as to be almost gelatinous—certainly mucous—in its consistency; the "eels" formed a translucent mass, plainly visible across my writing table, and to my mind it was totally unfit for food, and it needs a stretch of imagination and a miscarriage of our mother tongue to consider such dirty dregs, notwithstanding the percentage of acetic acid, as an article of the *nature, substance and quality* demanded, and worth the money spent upon it.

Undoubtedly it should have been thrown away, and not sold for good honest English coin.

The learned professors gave it in evidence that vinegar eels are not injurious. How do they know that? I don't venture to say they are, but they should be looked upon with suspicion as members of the order *Nematoidea*, some of which "infest abundantly the human body," * and most of which are exceedingly tenacious of life, and will survive after almost complete dessication. He is a bold man who will venture to tell us which of the low forms of life are injurious to health, and which are not, and will dare to declare that the most innocent organisms may not sometimes set up foreign fermentation in the human body. These are matters as yet absolutely in the dark, and certainly much too remote and ill defined to be lightly sworn to in courts of justice as known conditions.

Can an article be at once genuine and decomposed? Are the following articles of the nature, substance, and quality demanded?

Drugs which have lost their essential properties by evaporation, precipitation, fermentation, and other so-called spontaneous changes; milk containing colostrum; whiskey which has been reduced by evaporation to 30° u.p.; trichinized pork sausages; a pepper whose percentage of acrid resin is not materially affected, but which is dirty and contains an excess of ash. These are a few of the questions which are opened up by a consideration of the late vinegar and other cases, and which may be summed up in one: Where does the Public Analyst's duty leave off, and the Medical Officer's commence? Is there a distinct line of demarcation between them, or do they not fuse at the margins?

The question whether or not a dirty sample of food, drink, or drugs is adulterated in the meaning of the Act, is to my mind dependent upon how much dirt there is present, and I am still of opinion that the vinegar in question was most certainly not of the nature, substance, and quality of the article demanded. And seeing that both of the learned professors in cross-examination admitted that they should not like such stuff upon their tables, and that the magistrates retired for something like twenty minutes before they could arrive at a decision, and that they would not grant costs, and that the defendant was warned not to sell such rubbish again, I maintain that the prosecution was neither frivolous, careless, nor improper.

Yours faithfully,

ARTHUR ANGELL.

REVIEWS.

Annals of Chemical Medicine.

By J. L. W. Thudichum, M.D. London: Longmans, Green & Co.

This first volume of a new periodical possesses very marked originality. Of chemistry, pure and simple, it contains but little; but of that chemistry which forms the boundary line between that science and physiology, it is full.

* *Cobbold's Entozoa*, Chap. IV., page 53.

To take the most unfavourable feature first, some parts of the volume are of a very personal character. Dr. Thudichum feels himself aggrieved by unauthorised and unacknowledged use of his work. We can hardly wonder even if we regret that he takes the first really suitable opportunity to publish his grievances. He is by no means alone in this respect, for every chemical reader knows how frequently personal matters are forced on his attention, because in no other way can the rightful claims of a discoverer or inventor be brought to notice.

Entirely apart from this we have a large amount of interesting biographical information, put before the reader with a peculiar and marked style, and with little facts, of much interest which would escape the notice of an ordinary writer. This is specially noticeable in some curious anecdotes of Meyer's life, which we do not remember to have seen anywhere else.

Infection and contagion are carefully and completely treated, *i.e.*, as completely as the space allows, and in this case certainly the author summarises the views of others so justly that he cannot be considered to give undue predominance to his own.

The chapters on the Organic Acids of the Brain, and on the Chemical Decomposition of the Bile will both be read with interest.

Blowpipe Analysis.

By J. Landauer. Translated by J. Taylor and W. E. Kay, 1879.

London: Macmillan & Co.

Until recently chemical literature has been very deficient in works upon this subject; and generally the only information the student could obtain on blowpipe analysis was from the few experiments given—in tables on qualitative analysis—for "the preliminary examination." We are sure this book will be favourably received: not only does it give most of the latest foreign improvements, but also those that have been added by England to this important method of analysis. In the first chapter is contained a very good account of the "apparatus and reagents" required, followed by one on the "Operations of Blowpipe Analysis," giving the reactions on the "Aluminium Plate"—Ross's—"Bunsen's Flame Reactions," &c. Chapters three and four are devoted to the reactions of the elements in combination, and the systematic examination for them. At the end of the work are a series of tables arranged as simply as it is possible: it is obvious that they cannot be so easily and systematically drawn up as tables for the examination of substances by the wet method. As usual, this work is prefaced by a coloured diagram of the spectra of the elements. We begin to doubt the possibility of the publication of any work on chemistry without this pretty coloured preface.

LAW REPORTS.

How Alum is Mixed with Flour:—

On February 21st, at the Retford County Police Court, Charles Loweth, miller, of Haughton Mills, was charged with having in his possession a quantity of alum, to be used for the adulteration of flour or meal. This case excited a great amount of interest, many millers and farmers being present. Mr. A. Lane, inspector, prosecuted, and Mr. Bescoby defended. Mr. Lane stated that from information he received he obtained a search warrant, and went to Haughton. Defendant and he went to the top of the stairs into an attic, where he found a bag full of alum (produced). He asked "What's this, Mr. Loweth?" and defendant replied "It's alum, which I use for the accommodation of my customers." He searched about in the other rooms but found nothing more. Defendant told him he used the alum

for filling up the crevices in the stones. He had since weighed the alum and found there were 5st. 4lbs. Albert Rinch (who had just preferred a charge against his master, and obtained an order for the cancelling of his indentures) said he had been an apprentice to Loweth. He had seen and used the alum by order of his master (the defendant) and the miller (foreman). He had put some into the stones to fill up the holes. He had also put it into the flour to strengthen it. By his master's orders he had put two or three handfuls at a time into a sack of flour. By Mr. Bescoby: He had not mentioned about it to a soul. He did not give information. Joseph Johnson (a miller, who had been discharged by Loweth the week before) said by Loweth's orders he had put three handfuls of the alum into every sack of flour. During the grinding process he put in a handful when the bags were "a stone high." That would have the effect of mixing it with the flour. By Mr. Bescoby: He knew it was wrong. He had never done it in the service of any other miller, but had seen it done. He had been four months with Mr. Loweth, who discharged him in a hurry last Saturday. Mr. Bescoby: Then you gave the information? Witness: Well, don't be too sure. I did not give the information. Mr. Bescoby then addressed the Bench for the defence, dwelling on the fact that alum, properly used, was an improvement, especially in such seasons as the last. He asked for the leniency of the Bench. This would be a serious thing for Mr. Loweth, and there were samples of flour before the County Analyst. This was not an offence committed only by Mr Loweth. Many millers were fond of using alum to strengthen unsound flour. Mr. Huntsman: But the object is also to make of bad flour what is called good flour. The Clerk remarked the lowest fine was 40s. and the highest £10. The Bench ordered the defendant to pay the full penalty of £10, including costs.

Purchaser must inform Vendor that Sample is to be Analysed by Public Analyst:—

Recently, at the Jarrow Police Court, Andrew Scott, White Mare Pool, was charged with selling adulterated milk in Jarrow. Mr. Bush, of Newcastle, defended. The certificate of the County Analyst, Mr. Edger, was put in, which showed 14 per cent. of added water. After the witnesses had been heard, Mr. Bush showed that the inspector (Mr. Edward Baty) had omitted his duty. He had told the parties that he was going to have the sample analysed, but, according to the Act, he should have told them that he was going to send it to a "Public Analyst." The Bench dismissed the case on the point raised. Defendant had been fined several times before for selling adulterated milk.

Milk Adulteration.—Severe Fines:—

Mrs. B. Sheldrich, No. 114, Henry Street, St. John's Wood, was summoned by the Vestry of Marylebone, for selling milk that was found on analysis to be adulterated with 36 per cent. of added water. Chapman & Co., of 108, High Street, Edward Blewin, of 54, Henry Street, William Jenkins, of 68, Bevington Road, George Nash and Jane Sangleir, of 4, Paradise Street, and John Sinfield, of 37, Hereford Street, appeared to answer like complaints. Mr. W. E. Greenwell, solicitor to the Marylebone Vestry, prosecuted; and all the defendants said they sold the milk as they had bought it. Mr. De Rutzen said he was sorry there appeared to be such a prevalence of adulteration. The excuse set up that the people sold the milk as they bought it was no excuse at all. If they did not like to avail themselves of the protection given them by the Act of Parliament they rendered themselves liable. They could buy the milk with a warranty, and if they took the trouble to do that it would soon put a stop to adulteration. But no one cared to do it, and they were thus liable for selling adulterated articles. In these cases the degree of adulteration varied from 38 to 14 per cent.; but to him the figures made little difference. The thing to be stopped was the fraud, and the fraud was the same in all the cases. He would make no difference in the cases at all, nor between the large and small dealers. There would be a fine of £5, and 4s. costs in each case.

Alum in Bread.—Public Analyst's Certificate confirmed by Somerset House Chemists:—

At the Eckington Petty Sessions, the adjourned hearing of the case reported in our last number was resumed. Mr. Binney, instructed by Col. Shortt, prosecuted. He said their Worships would recollect that in that case, at Mr. Barker's request, the third portion of the sample obtained by Colonel Shortt at the defendant's mill, was referred to the analysts at Somerset House for their analysis, and the following certificate had been received with reference to it:—"The sample of flour marked D 91, referred to in the annexed letter, was duly received on the 18th ult., and was securely sealed. We hereby certify that we have analysed the same, and declare it to contain not less than 18 grains of alum per 4lbs. of flour. As witness our hands this 5th day of March, 1880, J. Bell, R. Bannister, H. J. Helm." Mr. Binney (continuing) said it would be seen from the certificate that the analysis made at Somerset House fully bore out Mr. Allen's results, so it was a case in which their Worships would have no difficulty in making a conviction. He (Mr. Binney) was sorry, however, to say that he had received an intimation from the solicitor for the defendant that the defendant had died a week ago, consequently

the case could not be proceeded with. The Bench said they had fully determined on the last occasion to convict, but as the defendant had died the case was terminated.

Mr. Binney said that informations had been laid against four other persons for selling adulterated flour and bread, and in each of the cases the flour had been purchased from Mr. Widdowson, and made into bread in the same state as it had been received from the mill. He pointed out, however, that the simple fact of their having purchased flour from Mr. Widdowson was not sufficient evidence to entitle them to an acquittal, because the Act of Parliament required, in addition to the proof, that a written warranty as to the purity of the flour should be given at the same time.

The first case was that of James and W. G. Pearson, grocers, Eckington. On the 29th November last Colonel Shortt, the inspector under the Adulteration Act, visited the defendants' premises, and purchased a loaf of bread. It was divided into three parts, one of which was submitted to Mr. A. H. Allen, of Sheffield, for analysis. Mr. Allen's certificate as to the result of the analysis showed that the sample was adulterated with alum in the proportion of 36 grains to 4 lbs. of bread. The defendants said that they had the assurance of Mr. Widdowson that the flour was pure, but they had not a written warranty. Oliver Ashmore, confectioner, Eckington, was the next defendant. A loaf of bread had been purchased by Colonel Shortt at the defendant's shop, and on a third part being analysed by Mr. A. H. Allen it was found to be adulterated with alum to the extent of 50 grains to 4 lbs. Defendant produced an Eckington newspaper, which contained an advertisement to the effect that the flour from which the bread was made was warranted perfectly pure. The flour was purchased from Mr. Widdowson. George Marsden, shopkeeper, Eckington, was summoned for a similar offence. A loaf of bread which was purchased at the defendant's shop was found, on a portion being analysed by Mr. A. H. Allen, to be adulterated with alum in the proportion of 28 grains to 4 lbs. Defendant said he was under the impression that the flour was pure. Joseph Dolby, grocer, Eckington, was charged with selling flour not of the nature and quality demanded. A sample had been purchased by Colonel Shortt, and on its being subjected to analysis by Mr. Allen was found to contain alum in the proportion of 70 grains to 4 lbs of flour. Defendant said he had used the flour just as he had received it from Mr. Widdowson's mill. He was not aware that it contained alum, but on the contrary believed it to be perfectly pure. The Bench said they had power to inflict a penalty of £20, but they did not wish to deal hardly with the defendants. It was nevertheless a serious offence for respectable men to be connected with cases of that description. The magistrates did not wish to look at the cases in any vindictive way, and under the circumstances they should only impose a fine of 5s. each and the costs, as they believed that the defendants had only made a mistake in buying the flour without obtaining a written warranty as to its purity, as required by the Act of Parliament.

Adulterated Butter.—A Servant's Mistake :—

At the Bishop Auckland Police Court, John Armstrong, of the firm of Armstrong & Co., pleaded guilty to a charge preferred under the above Act by Supt. Banks. It appeared that Mr. Banks went to defendant's shop and asked for a pound of butter. He was supplied with a pound, for which he paid a shilling. He submitted it to the County Analyst, Mr. Edger, from whose certificate it appeared there was no butter in it, but it was simply fat other than butter. Mr. Armstrong said that the article sold was butterine and that he had bought it as such. He was not at home and an apprentice had broken into a cask of butterine and thought it was butter, as it was the first they had had in, or it would not have been sold as such. The Bench were of opinion that it had been purely a mistake and not done to defraud, the lad having charged the same price as the butter. As the costs were £1 9s. 6d. the Bench made the fine as low as possible, 6d. and costs.

Sample not to be divided by purchaser unless desired by vendor :—

At Portsmouth, Charles Arthur, grocer, of Commercial Road, was summoned for having sold as coffee an article not of the nature, substance, and quality demanded by the purchaser. Inspector Redward said he went to the defendant's shop on November 28th, and asked what the price of coffee was. He was told that it was 1s. 4d., 1s. 6d., and 1s. 8d. per lb., and he asked for half a pound of that at 1s. 4d. He was served, and on the parcel was a label to the effect that it was a mixture of chicory and coffee. The inspector told the defendant that he had asked for coffee, and said he should divide the sample into three parts, giving one to the defendant, keeping one himself, and forwarding the other to the Borough Analyst. The Clerk asked the inspector whether he said he should divide the sample, or whether he gave the vendor the option of having it divided, and he replied, that having been served with the article he told the defendant that he should divide it. The Clerk observed that the case therefore fell through. The Act said that the purchaser should give the vendor the opportunity of having the sample divided, and if he did not desire this, then the whole had to be forwarded to the analyst, who would himself divide it. The Act of Parliament in question was very stringent, and in one case where the purchaser

said he should send the sample to the analyst, instead of saying the Borough Analyst, the case was dismissed. The magistrates also dismissed this case on account of the technicality in question.

Adulterated Coffee.—Another Mistake :—

At the Southwark Police Court, Thomas Smith, grocer, 110, Russell-street, Bermondsey, was summoned for selling as pure coffee a mixture of 30 per cent. coffee and 70 per cent. chicory. Mr. Thomas said he caused to be purchased half a pound of coffee at the defendant's shop. On the same day he sent a portion of it to Dr. Muter, and his certificate showed that it contained 70 per cent. of chicory. Defendant said it was a mistake, as he was out of printed wrappers at the time, and should have written on the paper "Mixture of coffee and chicory." Mr. Slade fined him 40s. and 12s. 6d. costs.—Misses Milde and Sanger, 10, Snow's Fields, were also charged with selling coffee mixed with 50 per cent. of chicory, and butter containing 77 per cent. of added fat. Mr. Thomas said that the defendants were females in a small way of business. He, however, had cautioned them before. Mr. Slade, after hearing the evidence, fined them 40s. and 12s. 6d. costs.

Adulterated Coffee.—Notice of Mixture after Sale :—

At the Southampton Police Court, Charles Baker, grocer, 8, Upper East Street, was summoned for having sold coffee, adulterated 50 per cent. with chicory, to the prejudice of G. H. Collis, inspector, for whom the Town Clerk (Mr. R. S. Pearce) appeared. Mr. Bell appeared for the defendant. A lad named William Harvey stated that, acting under the directions of Mr. Collis, he went to the defendant's shop and purchased a pound of sugar at 4d. and a quarter of a pound of coffee at 1s. 4d. per pound from the assistant in the shop. He paid for the goods and got change, and asked the assistant, "What did you sell this for?" The assistant said "chicory and coffee." Mr. Baker then remarked to Mr. Collis, "Pure coffee is 1s. 6d." The coffee was weighed up in witness's presence. Cross-examined: He knew if there was anything wrong with the goods he purchased that it would be a case before the magistrates, but he did not read what was on the paper covering the coffee. The coffee was placed in paper folded in the shape of a funnel. Mr. Baker came in the shop after Mr. Collis had placed the coffee he had received on the counter, and, placing his hand on it, said, "This is a mixture of chicory and coffee." Witness did not hear Mr. Collis say, "It is too late." When he first went into the shop he asked for half a pound of coffee and one pound of sugar, and had not enough money to pay for it. He afterwards asked for a quarter of a pound of coffee for 4d. In reply to the Bench, witness could not say if the half-pound of pure coffee was in the same sort of paper as the coffee he afterwards received, nor could he say if both coffees were taken from the same canister. Mr. Bell said it was obvious if the boy had asked in the first place for 1s. 4d. coffee he had put down money enough. Mr. Collis deposed to sending the last witness into the defendant's shop for some sugar and coffee, and to the latter being in a square and not funnel-shaped packet. He divided the packet into three parts, and gave one to Mr. Baker, the other to the Public Analyst, and the third portion he produced. The assistant said, in the presence of the defendant, that he charged 3½d. for the sugar and 4½d. for the coffee. Mr. Baker then said he always sold pure coffee for 1s. 6d. Pure coffee is generally sold for 1s. 4d., 1s. 6d., and 1s. 8d., and chicory 5d., 6d., and 7d. In reply to Mr. Bell, the witness said he would not swear that he said to the assistant, "It is a good job we have not got you to deal with in this case to swear falsely." Witness wished to explain that the assistant said something to him which induced him to give the answer. Mr. Bell: Then he does admit it. The Bench asked the witness if he did make use of the words, as he had denied his recollection of using them. Witness said he would not swear that he said them. Continuing, he said he was not aware there were three compartments in the canister the assistant took the coffee from. He was paid by the Corporation. Mr. J. Brierly, the Borough Analyst, was called, and his analysis showed that the sample sent was 50 parts coffee and 50 chicory. In reply to the Bench, the witness said it was difficult to tell the precise amount of chicory in coffee beyond a certain point. On behalf of the defendant, Mr. Bell raised the question as to whether the sale was completed at the time the defendant said the contents of the packet were chicory and coffee. The Bench, desiring to hear the case further, Mr. Bell said it was obvious from the evidence of the first witness that the purest quality coffee was given at first, but that he, not having enough money to pay for it, was served with the mixture, and the paper covering showed what were the contents. Further, before the purchaser had the change, Mr. Baker put his hand down on the packet and said the contents were the mixture. Mr. Bell therefore contended that there was no fraud against the purchaser. He called the defendant, who deposed that the canister that had been referred to had three compartments, containing two different priced mixtures and pure coffee. At the time he entered the shop the coffee was on the counter, and he put his hands on it and on the change while he said to his man, "What did you sell this for?" The man replied, "Chicory and coffee, in printed paper." Witness asked the boy whom the goods were for, and Mr. Collis shouted, "It is mine." He (witness),

however, said, "You have not the change; the purchase is not complete." Collis then said, "It is too late." Witness afterwards let the purchaser have the goods, as he had explained that it was mixture, and Mr. Collis began to divide the coffee. John James Brown, assistant to the defendant, corroborated his employer's evidence. The Mayor stated that the Bench had given this case great consideration, and they thought that coffee very considerably adulterated with chicory was sold for pure coffee. He would be fined 40s. and costs, or, in default, fourteen days. Mr. Bell begged to give notice of appeal, and the Bench bound over the defendant in the sum of £100 and two securities of £50 each to prosecute the appeal at the sessions. The money was afterwards paid.

Mr. Edward Thomas Wise, grocer and provision dealer, East Street, was summoned for selling coffee to G. H. Collis, which was not of the nature, substance, and quality demanded. The Town Clerk again prosecuted, and Mr. Bell defended. William Harvey said that on February 3rd he went to defendant's shop, and purchased of the assistant one pound of sugar and a quarter of a pound of coffee, the former for 3½d. and the latter for 4d. The sugar and coffee were ready in packets, and handed to witness, and he paid for them with 1s., receiving 4½d. in change. Witness told the assistant the goods were for Mr. Collis, and then the latter said (alluding to the packet of coffee), "This is chicory and coffee," and attempted to take it up, but witness forestalled him. Mr. Collis came in, and witness put the sugar and coffee on the counter for him to divide. The assistant neither called his attention to the paper covering the coffee, nor did he say that the contents were chicory and coffee. In answer to Mr. Collis, the assistant said Mr. Wise was not on the premises. Cross-examined: It was not until Mr. Collis had commenced to open the packet of coffee to distribute it that the assistant called his attention to the words on the paper-covering, "This is a mixture of chicory and coffee." Mr. Collis proved receiving the articles purchased from the last witness. He was proceeding to divide the coffee, when the assistant said "I have sold it all right; I have sold it as chicory and coffee," and he called witness's attention to the label. The analysis made by Mr. Brierly was put in, and showed that the sample analysed was sixty parts coffee and forty parts chicory. Mr. Bell submitted, for the defence, that the boy was the purchaser, and it was the actual purchaser who must make the statement to the seller, "I have bought this to be analysed." He should submit evidence to prove that the assistant stated in distinct terms that the article he was selling was chicory and coffee, and that would be an oath against that of the boy Harvey. As the burden of proof was on the complainant, he therefore claimed that the case should be dismissed. Albert Kirby proved serving the boy Harvey with some sugar and coffee, telling him that the prices of the mixture were 1s. and 1s. 4d. per pound, and the pure coffee 1s. 8d. The lad then asked for the fourpenny. After serving the lad, and before giving him the change, witness told him that if he wanted pure coffee he would change it, but Harvey immediately picked the packet up. Cross-examined by the Town Clerk: The 1s. mixture consisted of 65 per cent. of chicory, and the 1s. 4d. mixture contained more coffee—about 75 per cent. This concluded the evidence, and the Mayor said the case appeared similar to the last, and the defendant would be fined 40s. and costs, or fourteen days' imprisonment in default.

NOTES OF THE MONTH.

In our last number appeared a report of a case of flour adulteration which was heard at Eckington, in North Derbyshire. In this case the certificate was worded as follows: "The sample was adulterated with alum. I estimate the proportion of alum added at about 24 grains to the four pounds of flour. This is a somewhat smaller proportion than that commonly employed. Alum is added to flour of inferior nutritive value to cause the bread made from it to simulate in whiteness and apparent quality that made from the best flour." It will be observed that while Mr. Allen certifies positively to the presence of alum, he clearly shows that the amount found is based on an "*estimate*," which may not be strictly accurate.

It will be in the memory of our readers that, in consequence of the evidence given by the chemist called by the defence, the third portion of the sample was sent to Somerset House. Thence a certificate has been received, signed by Messrs. Bell, Bannister & Helm, stating that "we have analysed the same, and declare it to contain not less than 18 grains of alum per four pounds of flour." This is a substantial

confirmation of Mr. Allen's certificate; but we think it would have been more satisfactory if the Somerset House chemists had stated how much alum they believed to be present, instead of giving the absolute *minimum amount*, without mention of the maximum.

Our versatile contemporary, the *Grocer*, having completed its review of the German reproduction of the researches of English Public Analysts on the Analysis of Tea has been treating its readers to their periodical dose of diluted science. That our contemporary should take a special and fatherly interest in, and do its best to circulate, productions remarkable for being largely diluted, is only natural; but the article entitled "Ridiculous Adulteration," which appears in the number for March 6th, is unapproached in absurdity even by the numerous attempts in that direction with which our contemporary's pages have rendered us so familiar. In the article in question, the *Grocer* takes Mr. Allen to task for asserting that alum is used to improve the quality of flour, especially in bad seasons. "When they tell us openly, deliberately, and under oath that the $\frac{1}{1100}$th part of alum is added by millers or flour merchants for the purpose of improving inferior flour, and enabling them to palm it upon their customers as a superior article, what must be the mental condition of analysts?" "We should like to know how it operates on the buyer, in order to deceive him, when he examines the sample." "If Mr. Allen had found 4 or 5 per cent., or anything like a commercial quantity, of alum or alumina in the flour, it would be mere hair-splitting and special pleading to talk about dust at all." "We are bound to protest, in the name of common sense, against the assumption that vendors of flour defraud their customers by mixing with the genuine article such a quantity as $\frac{1}{33\frac{1}{3}}$rd part of its bulk of alum crystals, the which crystals alter the quality, or apparent quality, of the flour, and deceive the purchaser by merely lying amidst the particles of flour, without undergoing any chemical change whatever."

"In the name of common sense," why did not the *Grocer* have a talk with a miller before publishing such a tissue of false arguments. Any miller would have told the writer that the addition of a quarter of a pound of alum to the sack of flour would raise the selling value of that flour by about 1d. per stone, and hence there is ample inducement to adulterate. ¼ lb. of alum to the sack is 28 grains to 4 lbs., $\frac{1}{100}$th part by weight, or $\frac{1}{200}$th part by measure. This quantity is therefore but slightly in excess of the amount found by Mr. Allen in the Eckington flour. In the Retford case, reported on another page, the miller was in the habit of using "three handfuls of alum in every sack of flour." Here we have a larger, but still very small, proportion of alum. Four or 5 per cent.—the "commercial quantity" suggested by the article in the *Grocer*—would be 10 or 12 lbs. to the sack! Seeing, therefore, that the quantity found was stated in the certificate to be somewhat less than the proportion usually employed, and was clearly "anything like a commercial quantity," common justice ought to cause the insertion in the *Grocer* of an apology for having, in ignorance of the subject, created an erroneous impression.

A somewhat amusing scene is reported in a paper which has been sent to us, as having occurred between Dr. Tidy (who, it will be remembered, was one of the defence witnesses in the Alum in Baking Powder case) and the West Ham Local Board. The

learned doctor, it seems, had received a number of samples, but had not thought proper to give certificates until too late to prosecute. In excuse for this, he alleged, *inter alia*, that there were many things a man in large practice had to do, and that he was not aware of the 28 days' limitation in the Act, but at the same time he offered to resign. It is, we think, a great pity that he did not resign and have done with it, because a man in such large general practice as to forbid his even making himself master of the requirements of the Act, to work which he is appointed, is surely wrong in continuing to pretend to carry out the duties of his office. The retaining of the post of Public Analyst by anyone who does not give his immediate and careful attention to every sample he receives, and who neglects to report thereon "with all reasonable speed" is a farce, which had better cease, both in the interests of the analyst himself and the public.

During the discussion, Dr. Tidy is also reported to have said, "It is not my wish to be troublesome; but there is one thing I shall set myself against, and that is, mere prosecutions for the sake of prosecution. I abominate the thing, and if ever I was thought to pass over samples, it was because I saw that action would be merely harassing to trade." To this, Mr. Helmore, a member of the Board, very neatly and appropriately replied that "the Board expected to receive a correct analysis from him, leaving it to the Board to judge as to whether it is a case to prosecute or not." We commend Mr. Helmore's advice to the learned doctor, and advise him in future to do what a good cobbler should, viz., stick to his last, and not invite articles in trade journals, discrediting the whole body of Public Analysts by arrogating functions which the Act does not give him.

We have received letters complaining of the conduct of one of the members of our Society, who calls himself a "Public Analyst," although he holds at the moment no appointment. Such a course is clearly wrong, and the gentleman in question will doubtless see this, and substitute "Member of the Society of Public Analysts" for the bare words "Public Analyst" on his printed headings until he obtains office.

Mr. W. Johnstone, F.C.S., has been appointed Public Analyst for King's Lynn, *vice* Mr. W. M. Hamlet, resigned.

RECENT CHEMICAL PATENTS.

The following specifications have been recently published, and can be obtained from the Great Seal Office, Cursitor Street, Chancery Lane, London.

1879 No.	Name of Patentee.	Title of Patent.	Price
2809	J. Hargreaves	Manufacture of Sulphates of Soda and Potassa ..	6d.
2839	W. E. Hartmann	Manufacture of Sulphuric Acid	6d.
2939	E. Carey and H. Gaskell	Purification of Alkaline Solutions	6d.
2983	F. Wirth	Manufacturing White Lead	6d.
3003	W. L. Wise	Treating Sugar Cane	6d.
3077	E. De Pass	Application of Bisulphite of Lime for Manufacturing Sugar	4d.
3125	W. McDonnell	Abstracting Colour from Annatto or Arnatto	2d.
3194	W. Weldon	Obtaining Sulphur from a Lye-product of the Manufacture of Alkali	4d.
3195	W. L. Wise..	Producing Caustic Alkalis and Preparations of Alumina	6d.
3196	S. T. Thomas	Manufacture of Phosphates	4d.
3200	G. H. Ogston	Softening Water and obtaining Fertilizing Compounds	2d.

BOOKS, &c., RECEIVED.

The Chemist and Druggist; The Brewers' Guardian; The British Medical Journal; The Medical Press; The Pharmaceutical Journal; The Sanitary Record; The Miller; Journal of Applied Science; The Boston Journal of Chemistry; The Provisioner; The Practitioner; New Remedies; Proceedings of the American Chemical Society; Le Practioner; The Inventors' Record; New York Public Health; Philadelphia Printers' Circular; The Scientific American; The American Traveller; Society of Arts Journal.

THE ANALYST.

MAY, 1880.

SOCIETY OF PUBLIC ANALYSTS.

An Ordinary Meeting of this Society was held on Wednesday evening, the 14th April, at Burlington House, Piccadilly. In the absence of the President, Dr. Dupré, F.R.S., took the chair.

The Scrutineers having examined the voting papers, reported that the following gentlemen had been duly elected as Members :—

F. A. Bond, M.B., &c., Brincklow, Coventry.

J. Napier, Public Analyst for West Suffolk, &c.

H. S. Carpenter, Analytical Chemist, Holborn Viaduct.

Mr. J. J. Eastick, Analyst to Fieldgate Sugar Refinery was proposed as a Member, and will be balloted for at the next Meeting.

The following papers were then read and discussed :—

"Some Results of the Analysis of various Tinned Food Products," by G. W. Wigner, F.C.S., and Mr. Wigner also gave some further particulars as to the "Work Done during 1879 under the Sale of Food and Drugs' Act."

"Note on a Fibrous Substance found in the Intestine of a Sheep," by Bernard Dyer, F.C.S.

"Notes on Cream of Tartar," by A. H. Allen, F.C.S.

"On the Manufacture of Citric Acid," by J. Carter Bell, F.C.S.

The next Meeting will be held at Burlington House, on Wednesday, 2nd June next.

ON THE WORK DONE BY PUBLIC ANALYSTS DURING 1879 UNDER THE SALE OF FOOD AND DRUGS' ACT.

By G. W. Wigner, F.C.S.

Read before the Society of Public Analysts, on 17th March, 1880.

The returns which have been furnished, in response to the application of the Proprietors of The Analyst, by Members of our Society and by a few other Public Analysts who are not members, but who take an interest in this annual statement, enable me this year to lay before you much fuller statistics as to the amount of work which has been done under the Sale of Food and Drugs' Act during 1879, than has been possible in any previous year. These detailed results are shown in the annexed table.

In 1877 we received returns from 127 districts; in 1878 from 168 districts; while this year we have returns from 212 districts. There is an apparent increase in the number of samples analysed during 1879 of about 2,500 samples, but this is, probably, mainly due to the fact that there are so many more returns.

It is rather unsatisfactory to note that the general average shows a slight increase in the proportion of adulterated samples, the percentages shown by the returns of various years being as follows :—

In 1872	26·0 per cent.
1875 & 6	18·10 ,,
1877	17·70 ,,
1878	16·58 ,,
1879	17·25 ,,

I cannot trace out any special cause for this increase, and it will, therefore, be well to consider it first in reference to the different classes of samples. The total number of samples examined in these 212 districts has been 17,574. Omitting Somersetshire, as to which we have received no details, these samples have been divided as follows :—

Milk	6036 =	36·1 per cent.
Butter..	969 =	5·7 ,,
Groceries	4197 =	25·0 ,,
Drugs	615 =	3·6 ,,
Wine	1615 =	9·7 ,,
Bread	1471 =	8·7 ,,
Water	1240 =	7·5 ,,
Sundries	629 =	3·7 ,,
	16,772	100·0 per cent.

The next point of interest, is to notice how the various classes stand as regards the percentages of adulteration, as compared with those which were shown by the same classes of goods in the previous years, the percentage in each class being calculated on its own class total, and not on the general total of samples analysed.

	1877	1878	1879
Milk	26·07	18·38	22·06
Butter	12·48	13·23	13·93
Groceries	13·00	12·89	11·73
Drugs	23·82	35·77	26·66
Wine, &c.	47·00	29·31	28·30
Bread	6·84	2·97	4·62
Water.. Sundries	21·63	14·98	21·45 / 10·17

From these figures it will be seen that wines and spirits, which occupied the worst place in 1877, with 47 per cent., and fell in 1878 to 29·3 per cent, now shows the worst place of all, 28·3 per cent. being adulterated. Of course this includes, as before, those samples of spirits which were returned as watered, but as a limit has been laid down by The Sale of Food and Drugs' Amendment Act, which is lower than had been previously customary in many districts, I think we must come to the conclusion that the degree to which the spirits were adulterated was probably considerably greater during 1879 than in 1878.

Next on the list come drugs, showing 26·66 per cent. adulterated, as against 35·77 in the previous year. The difference is very great, but it must be borne in mind that this year comparatively few samples of violet powder are included, and the result is, therefore, probably a more near approach to a fair average. Of course by this I do not mean a fair average of all the drugs sold, because the inspectors naturally purchase most frequently those kinds which are more likely to be inferior or impure. The most noticeable remark in the returns, as to drugs, is one relating to so-called quinine wine, which contained no quinine at all. This was in the County of Antrim.

Milk shows a considerably increased percentage of adulteration—3·68 per cent.

more than in 1878. It is difficult to trace this increase to any other cause than the extremely low fines which are generally thought sufficient in cases of milk adulteration. It really is a serious matter that more than 22 per cent. of the samples of milk purchased by inspectors, who are in almost every case well known and recognised, should turn out to be adulterated, even when judged by the low limit adopted by the Society. Two cases which have been reported appear of some special interest here. In one case at Margate, Mr. Harvey tells us that the defendant pleaded that the milk was taken from a particularly poor cow, and the case was adjourned in order that the inspector might procure a sample from this cow. This was done and the sample was analysed, with the result of solids not fat 9·46 ; fat 2·75, and the defendant was, in consequence, heavily fined, as he deserved.

In another case, Mr. Carter Bell refers to a defendant pleading that, owing to the deficiency of grass, &c., his cow had been fed entirely upon hay, and the plea was so far successful that the magistrates acquitted him; whereupon the next defendant, determined not to be outdone, pleaded that his cows had been fed entirely upon *straw*, and, in consequence, he also was acquitted. Mr. Bell thinks this case suitable for investigation by the Society for Prevention of Cruelty to Animals.

Butter appears to show a continued increase of adulteration, the percentages for 1877, 1878, and 1879, respectively being 12·48, 13·23, 13·93, or an increase of almost exactly ·7 per cent. per year. It is, perhaps, hardly fair to attribute this to greater accuracy in butter analysis, because even in 1877 the methods were sufficiently well understood to make it certain that few adulterated samples would be passed as genuine; while on the other hand, it is a notorious fact that the make of butterine has greatly increased during the past two years, and the figures point to the opinion that the sale of butterine under the name of butter has become more common. The number of samples examined during 1879—nearly 1,000, is sufficient to prevent any idea of an unfair average being drawn.

Groceries show a decided improvement on the two previous years, the reduction in the amounts of adulteration being 1·16 per cent., but still the present figure is far too high. Doubtless a large proportion is due to the sale of chicory and coffee under the name of coffee, and other similar practices, but even shutting out those samples, which are probably from this cause returned as adulterated, the remaining percentage is much greater than it should be.

Bread and flour again show a change for the worse; in this particular case the increase may be more apparent than real, and is due partly to the improved method of analysis devised by Dr. Dupré, which, although it has unquestionably proved some samples to be genuine, in reference to which considerable doubt would otherwise have been felt, yet has on the other hand enabled the presence of alum in flour to be detected in some cases with absolute certainty where, without this process, suspicion only could have been entertained.

This year our correspondents have, at some trouble to themselves, separated the samples of water from the sundries. As we have so often pointed out before, water does not really belong to the work done under the Act by the Public Analyst, and should in no case be undertaken by him except for a separate and special fee or a larger salary than would otherwise be accepted, nor should he even then issue certificates on the forms provided for in the Schedule to the Act. It is, of course, quite right that the water analyses of the district for sanitary purposes should be done by the Public Analyst, but it is

undesirable that in any case he should view it as part of his official duty. In consequence of this separation of the waters, the sundries show the very considerable reduction in the percentage of adulteration of 4·81 per cent.

Considering next the proportion of adulterated samples of each class calculated on the total number found to be adulterated, we find that altogether there were 2978 samples adulterated, the description of which has been particularly reported to us, and these were divided as follows:—

The Milk Samples adulterated were	.. ..	1332 or 44·72 per cent.	
,, Butter ,,	,, ...	135 ,, 4·53	,,
,, Groceries ,,	,, ...	492 ,, 16·52	,,
,, Drugs ,,	,, ...	164 ,, 5·52	,,
,, Wines, &c. ,,	,, ...	457 ,, 15·36	,,
,, Bread ,,	,, ...	68 ,, 2·28	,,
,, Waters ,,	,, ...	266 ,, 8·93	,,
,, Sundries ,,	,, ...	64 ,, 2·14	,,
		2978 or 100·00 per cent.	

Viewed in this way the table shows, as the table for the previous year did, that milk, butter and bread show a larger percentage of adulteration this year than they did before, the increase in the case of milk being 2·57 per cent.

The percentage of adulteration in different districts is of much interest. Norfolk nominally heads the list, but as the majority of the samples are waters, I will not take account of that here, but pass on to Margate, which really heads the list with 72 per cent. of adulterated samples—entirely milks. At this rate we may certainly commiserate the children who are fed on Margate milk. Southampton and Glasgow follow pretty closely with 60 per cent. adulterated, and South Shields shows more than 50 per cent. of adulteration, Derbyshire having 44 per cent. Bermondsey and St. George's, Southwark, each show 34 per cent., while in the adjoining district of Wandsworth, with the same analyst, the rate is only 8·25 per cent. Hampstead shows 6 per cent. and Lewisham 22 per cent., both of these places again having the same analyst. The City of London shows 30 per cent., although on the very small total of 49 samples, while the remaining Metropolitan districts which have been reported show an average of about 14 per cent., a figure which is pretty closely adhered to in Cheshire, Dublin County, Limerick County, Sligo County, Manchester, Cumberland, Brighton, Northumberland and Yorkshire generally, while in Staffordshire, Isle of Wight, Sussex, and Somersetshire, the percentage of adulteration is still less, averaging rather under 10 per cent.

From these we pass to the counties and towns in which very few samples have been analysed, so few, in fact, as to render the Act nugatory. There are fourteen counties, towns, and districts, having a gross population of very nearly one million, in which only 66 samples were submitted for analysis, or an average of less than 5 per place. These are Chesterfield, Montgomery, Carlow County, Cavan, Waterford County, Macclesfield, Ramsgate, St. Martin's, Carmarthen Borough, Chichester, Newington, Bury St. Edmund's, Ipswich, and Radnor County. In this respect the returns seem worse than last year.

Referring to another feature in the table, it appears that in Andover, Barnsley, Stalybridge, Wenlock, Lancaster, Helmsburgh, Falmouth, Launceston, Penzance, Truro, Ashton-under Lyne, Pontefract, Richmond, Ripon, Wakefield, Deal, Faversham, Sandwich,

Ryde, Stratford-on-Avon, Warwick, Gloucester, Hereford, Falkirk, Stirling, Airdrie, Stewarton, Brecon Borough, Cardigan, Neath, Pembroke, Tenby, Tenterden, Suffolk, Penryn, Berwick, Durham, Tynemouth, Maidenhead, Monmouth, Droitwich, New Radnor, Birkenhead, Kilmarnock, Rutherglen and Sutherlandshire, or altogether 2 counties and 44 towns, with a population of about 1,000,000, no samples whatever have been analysed. In the table for 1878 there were 37 places in this condition; therefore the number has apparently increased by 9 during the year, and this notwithstanding the action which the Local Government Board have been taking to compel authorities to enforce the Act. It is well to point out here that it is the duty of every Public Analyst in accordance with the Act to make a quarterly report to the authority appointing him, even when he has received no samples for analysis, and this authority or their clerk are bound to forward copies of each year's quarterly reports to the Local Government Board. By this means the central authorities are kept informed year by year, and unfortunately not oftener, of the neglect of the officials in those districts who have so far complied with the Act as to appoint an analyst, but do not seem inclined, unless pressure is put upon them from higher quarters, to do anything more.

After the President had thanked Mr. Wigner for the trouble he had taken in compiling the returns,

Dr. Dupré said that, as Public Analysts were aware, the Inland Revenue Report for the year ending March, 1879, had recently been published. It included the Report of the Principal of the Somerset House Laboratory, who stated that 21 samples were referred to that department by magistrates under the Sale of Food Act. In 8 of these cases he came to a conclusion different from that of the Public Analysts, and he gave two instances which he thought of sufficient interest to describe. One was a sample of flour which had been stated to be adulterated with alum, and although he agreed with the Public Analyst as to the amount of alumina present, he could find no evidence of its existence as alum, but "on the contrary, the results of the experiments conclusively pointed to the absence of alum, and the unusual amount of silica found indicated that the alumina was present as an impurity in the form of clay." He (Dr. Dupré) would like to point out in regard to this that at the time the Inland Revenue certificate said nothing whatever about silica; and still less about its relation to the amount of clay present. Indeed, up to the present he (the speaker) had believed that the relation between silica and clay in flours, and its bearing on the estimation of alum in flour and bread, was first pointed out by himself some time afterwards. The next was a whisky case, where some Public Analyst reported it to have consisted of diluted alcohol coloured with burnt sugar. They did not agree with this, and stated that "we found that the sample was what is known as neutral spirit, or patent still whisky, which had been coloured and flavoured with wine. This is a kind of whisky which is almost entirely free from fusel oil, and consequently, while more deficient in character than some whiskies, is yet less dangerous to the health of the consumer." He (Dr. Dupré) said it was absolutely impossible for any chemist when dealing with a weak spirit free from fusel oil, to state positively that he was not dealing with alcohol which had been diluted and flavoured. The Inland Revenue chemists could therefore have had no chemical reasons for upsetting the analyst's certificate. The utmost they could have said was that it might be diluted alcohol flavoured, as stated, but that it also might be weak spirit free from fusel

oil flavoured with wine. How, even in this latter case, it could be called whisky, he failed to see. In a subsequent part of the Report relating to beer, the Principal referred to a case where a brewer was prosecuted for having added sugar to the wort. One of the members of the Society appeared against the Inland Revenue chemists, and had examined a sample of the wort which was several months old, and although it had altered very slightly or not at all, still there was that objection to it. This analyst stated that there was no cane sugar in it, and the Inland Revenue Chemists remarked: "In this the chemist who analysed it was no doubt right as the sample was then three months old, but he added the very remarkable statement that the sample was as fresh and undecomposed as when first brewed, and that if cane sugar had ever been used, it must have been found by him. In this evidence there must have been a serious mistake, as all who know anything of the composition of malt wort are aware that when it is bottled and kept under ordinary circumstances, it will only remain for a very short time without undergoing decomposition, the first effect of which is to invert the cane sugar, if any be present." If this sentence has any meaning, it implied that after the cane sugar had been inverted it could not be found out whether cane sugar had ever been added to the malt wort or not, whereas that was an entire mistake. Cane sugar, after it has been inverted, turns to the *left*, about one-sixth as strongly as maltose turns to the *right*. Maltose reduces Fehling's solution about two-thirds as much as invert sugar. A combined optical and chemical test would therefore readily show the presence or absence of invert sugar. But chemical test alone would suffice. If when dealing with pure maltose it was estimated chemically, and then converted into dextrose by heating with an acid, 100 parts became 150.

When dealing with maltose, plus a certain quantity of cane sugar, the 100 became rather more than 150 after heating with acid, because the maltose which gave 100 was alone measured in the first instance, and that was made into 150, in addition to which the cane sugar, not estimated at first, became invert sugar, which of course reduced a certain proportion of copper solution. Therefore, in the presence of cane sugar, 100 of maltose will make more than 150 of dextrose.

If dealing with maltose, plus a certain amount of invert sugar, the 100 measured chemically was made into less than 150, because the 100 measured chemically consisted of a certain quantity of maltose and a certain proportion of invert sugar, and only the maltose was converted, which is assumed to be less than 100, into its proportion as to 150.

If, then, in a wort which had been kept the sugar on conversion into dextrose increased in the proportion of 100 to 150, they were perfectly justified in stating that that wort did not then contain, and could never have contained, any appreciable amount of cane sugar.

Dr. Bartlett pointed out that it was unusual to have a considerable amount of inverted dextrine where the solids of beer were entirely composed of malt, but this was not always the case. There was now a large sale of other saccharine matters, and he was acquainted with brewers who used cane sugar or invert sugar, and that takes the place of malt extract; how then would come out the calculation laid down by Dr. Dupré? He meant that, if in the first instance that the solids were composed of malt extract one-third, and cane sugar two-thirds, there he thought the ground laid down for calculation by Dr. Dupré disappeared. He thought the matter was of considerable importance, and one very likely to crop up before the members of that Society.

TABULATED STATEMENT SHOWING THE WORK DONE BY PUBLIC ANALYSTS, UNDER THE SALE OF FOOD AND DRUGS' ACT, DURING THE YEAR 1879.

Compiled specially for THE ANALYST.

	Analyst for	Milk, Butter-milk and Cream.		Butter.		Groceries.		Drugs, &c.		Wines, Spirits, and Beer.		Bread and Flour.		Waters.		Sundries.		Total.		Remarks.
		No. Analysed.	No. Adulterated.	No. Analysed.	No. Adulterated.	No. Analysed.	No. Adulterated.	No. Analysed.	No. Adulterated.	No. Analysed.	No. Adulterated.	No. Analysed.	No. Adulterated.	No. Analysed.	No. Adulterated.	No. Analysed.	No. Adulterated.	No. Analysed.	No. Adulterated.	
M. A. Adams	Kent	38	5	70	8	146	41	1	..	84	31	4	..	..	..	12	..	355	85	
A. H. Allen	Barnsley	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
,,	Chesterfield	..	..	1	..	4	..	..	..	..	..	2	1	..	..	..	..	7	1	
,,	Derbyshire (N.)	13	8	..	..	6	..	4	4	2	..	28	12	..	..	1	..	54	24	
,,	Sheffield	23	8	12	1	..	..	6	1	..	..	26	..	..	..	1	..	68	10	
,,	Yorkshire (W.R.)	34	14	38	8	108	38	53	24	27	4	16	..	..	..	3	..	279	88	
A. Angell	Andover	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
,,	Guildford	..	..	9	2	36	1	..	..	14	2	..	..	..	..	..	..	59	5	
,,	Hants	56	5	35	1	68	4	14	7	21	2	12	..	..	..	15	5	221	24	
,,	Newport, I. W.	2	..	1	..	4	1	2	..	6	1	1	..	..	..	2	..	18	2	
A. Ashby	Grantham	4	..	..	..	3	..	1	..	..	..	9	..	..	..	..	..	17	..	
J. J. Bancroft	Denbigh (County)	4	1	..	..	..	..	..	..	..	..	..	..	7	..	..	..	11	1	
A. W. Barclay	Chelsea	23	5	27	1	189	16	10	1	16	3	36	..	13	..	6	..	320	26	
J. Baynes	Boston	..	..	..	..	..	..	..	..	..	..	11	3	..	..	..	..	11	3	Act only in operation last three months. Nearly all the milks were ordered to be examined because of the prevalence of scarlet fever and cattle disease.
,,	Hanley	27	4	1	..	2	..	2	..	..	..	6	..	..	..	6	4	44	8	
,,	Hull	22	..	1	..	..	..	..	..	..	..	..	..	13	3	..	..	36	3	
,,	Scarborough	11	..	..	..	4	..	2	2	2	1	3	..	3	..	..	..	25	3	
,,	York (E.R.)	16	5	7	1	88	15	15	8	4	..	..	..	..	..	3	2	133	31	
J. Carter Bell	Cheshire	247	33	11	1	141	28	20	3	116	55	62	..	75	..	19	14	691	134	
,,	Congleton	1	1	..	..	..	..	..	..	..	..	3	..	..	..	..	..	4	1	
,,	Glossop	1	1	1	..	..	..	..	..	..	..	..	..	..	..	..	..	2	1	
,,	Salford	281	78	19	4	28	3	12	..	52	12	133	7	2	..	15	2	542	106	
,,	Stalybridge	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
A. J. Bernays	St. Giles', Camberwell	99	26	12	..	26	1	27	8	7	..	29	..	..	..	13	..	213	34	
,,	St. Saviour's, Southwark	51	11	..	..	25	1	4	..	18	..	5	..	..	..	..	..	103	12	
J. W. Biggart	Greenock	14	4	4	1	12	..	..	..	..	..	2	..	..	..	1	..	33	5	
,,	Port Glasgow	11	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	11	1	
T. P. Blunt	Montgomery (County)	..	..	..	..	1	..	..	..	..	..	..	..	5	..	..	..	6	..	Appointment made at end of 1879.
,,	Shropshire	6	..	..	..	..	..	..	..	1	..	..	..	11	..	..	..	18	..	
,,	Wenlock	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
A. Wynter Blyth	Devon	16	2	3	..	24	3	12	5	4	1	4	..	..	..	2	..	65	11	
J. Brierley	Southampton	50	27	23	13	3	2	..	..	22	17	..	..	..	..	..	..	98	59	
J. Campbell Brown	Blackburn	25	3	8	..	..	..	2	..	..	..	18	..	1	1	..	..	54	4	
,,	Lancaster (Borough)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
,,	,, (County)	302	42	30	1	163	24	18	3	163	50	55	2	67	40	51	..	849	162	
,,	Liverpool	161	32	7	2	60	30	21	..	..	..	..	..	60	..	..	..	309	64	
,,	Preston	8	4	9	3	29	10	..	..	..	..	..	..	..	..	..	..	46	17	
C. Cameron	Carlow (County)	..	..	..	..	..	..	..	..	1	..	..	..	3	..	..	..	4	..	
,,	Cavan ,,	5	5	..	..	..	..	..	..	..	..	..	..	4	..	..	..	9	5	
,,	Clare ,,	1	1	..	..	80	1	..	..	20	5	..	..	8	..	..	..	109	7	
,,	Down ,,	42	23	..	..	97	12	..	..	15	..	8	..	6	..	34	2	202	37	
,,	Dublin (City)	405	85	1	..	158	6	..	..	..	..	..	..	8	..	31	..	603	91	
,,	,, (County)	421	33	..	..	..	..	..	..	..	..	..	..	42	..	..	..	463	33	
,,	Galway ,,	11	8	..	..	7	..	..	..	1	..	..	..	9	..	..	..	28	8	
,,	Kerry ,,	29	11	..	..	21	5	..	..	5	..	6	..	17	..	..	..	78	16	
,,	Kildare ,,	21	2	..	..	7	..	..	..	5	2	..	..	9	..	..	..	42	4	
,,	Kilkenny ,,	11	3	..	..	..	..	..	..	3	..	1	..	3	..	..	..	18	3	
,,	Leitrim ,,	6	6	..	..	..	..	..	..	..	..	..	..	7	..	..	..	13	6	
,,	Limerick (City)	..	..	..	..	..	..	..	..	..	..	..	..	12	..	..	..	12	..	
,,	,, (County)	41	5	..	..	3	1	7	5	5	..	..	..	28	..	..	..	84	11	
,,	Mayo ,,	34	27	..	..	1	1	..	..	1	1	1	1	20	..	..	..	56	30	
,,	Meath ,,	6	5	..	..	3	1	..	..	7	4	4	..	17	..	..	..	37	10	
,,	Monaghan ,,	4	3	..	..	..	..	..	..	1	1	..	..	..	..	..	..	5	4	
,,	Queen's ,,	5	1	..	..	..	..	..	..	6	..	..	..	25	..	..	..	36	1	
,,	Roscommon ,,	24	19	..	..	5	..	..	..	4	..	..	..	13	..	..	..	46	19	
,,	Sligo ,,	29	6	..	..	39	14	..	..	54	7	22	..	13	..	..	..	157	27	
,,	Tipperary ,,	12	3	..	..	..	..	1	1	4	..	..	..	23	..	..	..	40	4	
,,	Waterford (City)	1	..	..	..	..	..	..	..	..	..	..	..	16	..	..	..	17	..	
,,	,, (County)	..	..	..	..	..	..	..	..	..	..	1	..	5	..	..	..	6	..	
,,	Westmeath ,,	7	5	..	..	..	..	..	..	1	1	..	..	20	..	..	..	28	6	
,,	Wexford ,,	14	4	..	..	..	..	..	..	..	..	1	..	8	..	..	..	23	4	
,,	Wicklow ,,	5	1	..	..	..	..	..	..	3	2	..	..	18	..	..	..	26	3	
J. Clark	Dumbarton	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
,,	Helmsburg	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
,,	Paisley	1	..	..	..	..	..	1	..	..	..	..	..	..	..	1	1	3	1	
J. H. Collins	Cornwall	..	..	1	..	3	1	..	..	4	2	2	2	2	..	..	..	12	5	
,,	Falmouth	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
,,	Helston	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
,,	Launceston	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
,,	Penzance	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
,,	Truro	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
M. Corner	Mild End Old Town	4	1	..	..	16	2	..	..	..	..	6	..	..	..	2	..	28	3	
W. G. Crook	Norwich	4	2	..	..	..	..	..	..	..	..	..	..	41	35	2	1	47	38	
A. Dupré	Westminster	96	12	12	1	..	..	..	..	6	..	18	1	..	..	6	..	138	14	
A. J. Edger	Durham (County)	233	68	19	1	79	4	70	42	122	54	18	..	..	..	26	1	567	170	
,,	Gateshead	14	2	..	..	..	..	..	..	..	..	..	..	25	2	..	..	39	4	
,,	Hartlepool	25	6	6	..	3	..	..	..	8	8	..	..	..	..	3	..	45	14	Appointed August, 1879.
C. Estcourt	Ashton-under-Lyne	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
,,	Macclesfield	..	..	..	..	..	..	..	..	..	..	2	..	..	..	..	..	2	..	
,,	Manchester	50	18	4	2	27	..	..	..	26	..	38	2	..	..	..	..	145	22	
,,	Oldham	54	14	..	..	8	4	..	..	3	..	12	..	..	..	..	..	77	18	
T. Fairley	Leeds	34	2	2	..	23	10	10	4	..	..	2	..	..	..	3	..	74	16	
,,	Pontefract	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
,,	Richmond	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
,,	Ripon	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
,,	Wakefield	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
,,	Yorkshire	11	1	4	..	49	4	8	2	16	6	7	..	..	..	12	..	107	13	
J. W. Gatehouse	Bath	80	5	15	..	8	..	2	..	17	..	11	..	..	..	2	2	135	7	
J. H. Gramshaw	Gravesend	1	1	3	..	..	..	..	..	..	..	..	..	6	6	..	..	10	7	
W. M. Hamlet	King's Lynn	25	3	2	..	..	..	2	..	10	4	2	..	27	..	..	..	68	7	
C. Harrison	Lincoln	18	2	..	..	..	..	8	3	..	..	10	1	..	..	..	..	36	6	
S. Harvey	Canterbury	2	..	..	..	1	1	..	..	..	..	1	..	22	11	..	..	26	12	
,,	Deal	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
,,	Faversham	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
,,	Folkestone	3	1	..	..	..	..	..	..	..	..	..	..	35	12	..	..	38	13	
,,	Margate	25	18	..	..	..	..	..	..	..	..	..	..	..	..	..	..	25	18	
,,	Ramsgate	..	..	..	..	..	..	..	..	..	..	..	..	2	..	..	..	2	..	
,,	Sandwich	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
C. W. Heaton	St. Martin's-in-the-Fields	3	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	4	..	
O. Hehner	Ryde	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
,,	Isle of Wight	11	..	2	..	16	4	5	1	3	..	2	..	..	..	4	..	43	5	
C. Heisch	Hampstead	10	1	8	2	16	..	..	..	..	..	14	..	..	..	4	..	52	3	
,,	Lewisham	45	14	11	1	..	..	..	..	..	..	5	..	..	..	..	..	61	15	
Alfred Hill	Birmingham	62	38	7	..	84	5	..	..	6	1	6	..	..	..	3	..	168	44	
A. Bostock Hill	Leamington	4	1	..	..	..	..	..	..	..	..	..	..	8	..	..	..	12	1	
,,	Stratford-on-Avon	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
,,	Warwick (Borough)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
,,	,, (County)	18	8	3	..	70	9	..	..	2	1	2	..	..	..	2	2	97	20	
J. F. Hodges	Antrim (County)	25	8	..	..	50	8	16	3	20	..	27	..	..	..	9	..	147	19	
,,	Belfast	187	52	..	..	10	..	52	13	5	..	39	3	..	..	..	..	293	68	
J. Horsley	Gloucester (City)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
,,	,, (County)	90	1	15	..	271	5	2	..	63	..	54	..	..	..	..	..	495	6	
,,	Hereford ,,	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
G. Jarmain	Huddersfield	70	21	9	3	8	4	6	..	1	..	1	..	54	31	2	1	151	60	
E. W. T. Jones	Kidderminster	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
,,	Lichfield	8	1	..	..	6	1	..	..	..	..	..	..	..	..	..	..	14	2	
,,	Staffordshire	222	29	42	4	532	67	4	3	18	1	45	..	..	..	20	7	883	111	
,,	Walsall	4	..	..	..	..	..	3	..	..	..	2	1	..	..	..	..	9	1	
,,	Wolverhampton	33	9	9	1	46	3	..	..	9	2	26	..	..	..	1	1	124	16	
J. Falconer King	Edinburgh and Leith	5	2	2	1	4	3	..	..	..	..	2	..	6	..	2	..	21	6	
J. West-Knights	Cambridge (Borough and County)	6	2	..	..	6	3	4	..	..	..	4	1	..	..	..	..	20	6	
,,	Isle of Ely and Wisbeach	4	..	1	..	..	..	..	..	..	..	47	13	..	..	..	..	52	13	
,,	Huntingdon (County)	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	1	..	No instructions ever given for collection of samples.
,,	Saffron Walden	9	2	..	..	..	..	..	..	..	..	13	3	1	..	..	..	23	5	
J. R. Leebody	Londonderry (City)	15	..	..	..	..	..	5	..	4	2	3	..	14	..	8	3	49	5	
,,	,, (County)	2	1	..	..	..	..	..	..	1	..	..	..	18	8	..	..	21	9	
W. F. Lowe	Flintshire	6	2	..	..	7	..	..	..	12	5	2	..	17	..	8	..	52	7	
R. McAlley	Falkirk	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
,,	Stirling	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
J. M. Milne	Fife (County)	27	13	..	..	..	..	..	..	..	..	..	..	11	..	..	..	38	13	
,,	Airdrie	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
,,	Stewarton	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
J. W. Montgomery	Cumberland	34	10	3	..	41	1	1	..	12	4	20	..	..	..	..	..	111	15	
E. H. Moore	Brighton	56	14	18	3	38	1	24	1	28	3	28	..	14	..	..	..	192	22	
,,	Chichester	9	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	9	1	
,,	Sussex (E. and W.)	88	16	18	2	22	1	12	..	24	2	14	..	126	..	10	..	323	22	
W. Morgan	Brecon (Borough)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
,,	,, (County)	7	..	..	..	..	..	..	..	52	39	..	..	..	..	..	..	59	39	
,,	Cardigan ,,	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
,,	Carmarthen (Borough)	4	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	4	1	
,,	,, (County)	7	1	1	..	5	..	..	..	16	4	2	..	..	..	..	..	31	5	
,,	Neath	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
,,	Pembroke	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
,,	Swansea	184	8	..	..	75	3	..	..	25	5	37	2	..	..	12	..	333	18	
,,	Tenby	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
J. Muter	Bermondsey	13	5	10	3	15	8	3	..	12	5	9	1	..	..	2	..	64	22	
,,	Lambeth	61	18	17	2	70	12	3	..	20	4	63	2	26	..	20	..	280	38	
,,	Newington	2	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2	2	Condensed milk unfit for food.
,,	Rotherhithe	13	1	21	16	2	..	..	..	2	..	..	..	..	..	..	..	38	17	
,,	St. George's, Southwark	16	11	11	4	3	1	..	..	8	1	11	..	..	..	1	..	50	17	
,,	Tenterden	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
,,	Wandsworth	104	19	51	9	103	1	2	..	26	2	73	..	1	..	40	2	400	33	
J. Napier	Bury St. Edmunds	..	..	..	..	1	..	..	..	..	..	..	..	2	2	..	..	3	2	
,,	Ipswich	..	..	..	..	..	..	..	..	..	..	..	..	4	1	..	..	4	1	
,,	Suffolk (E. and W.)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
C. O'Keeffe	Cork (City and County)	169	11	5	3	5	5	..	..	1	..	11	..	34	10	6	6	231	35	
J. Parry	Penryn	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
J. Pattinson	Berwick-on-Tweed	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
,,	Durham (City)	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
,,	Newcastle-on-Tyne	42	6	14	..	6	1	..	..	12	5	29	..	..	..	15	..	118	12	
,,	Northumberland	7	..	3	..	5	..	4	..	18	9	10	..	..	..	2	..	49	9	
,,	S. Shields	15	9	..	..	..	..	..	..	..	..	..	..	..	..	3	1	18	10	
,,	Tynemouth	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
W. Pearce	Maidenhead	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	No instructions for collection of samples.
F. P. Perkins	Exeter	7	5	..	..	4	3	..	..	..	..	..	..	21	11	..	..	32	19	
C. H. Piesse	Strand	35	12	24	3	215	1	4	..	13	..	18	..	1	..	6	..	316	16	
R. H. Ridout	Monmouth	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
F. M. Rimmington	Bradford and Dewsbury	109	11	25	3	39	3	..	..	..	..	4	..	..	..	..	..	177	17	
W. S. Saunders	City of London	29	10	9	..	2	..	..	..	..	..	6	3	2	2	1	..	49	15	This included some "bosh" butters.
E. Sergeant	Bolton	18	7	6	2	3	2	..	..	..	..	9	..	..	..	11	..	47	11	
J. Shea	Reading	23	2	3	..	18	3	3	1	11	..	3	..	..	..	2	..	63	6	
T. Stevenson	Bedfordshire	11	2	38	5	54	8	34	4	30	6	50	1	..	..	41	..	258	26	
,,	Reigate	..	..	..	..	..	..	..	..	..	..	..	..	..	..	4	..	4	..	
,,	St. Leonard, Shoreditch	8	4	8	1	3	..	..	..	6	3	17	..	..	..	..	..	42	8	
,,	St. Pancras, Middlesex	86	33	11	1	24	1	1	..	18	6	18	..	..	..	16	..	174	41	
,,	Surrey	62	13	37	..	158	16	69	12	98	42	4	..	..	..	20	4	448	87	
A. W. Stokes	Paddington	66	16	9	3	20	2	1	..	17	..	..	..	..	..	..	..	113	21	
W. W. Stoddart	Somerset	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	802	54	
F. Sutton	Norfolk	11	8	..	..	..	..	..	..	..	..	..	..	26	26	..	..	37	34	
H. Swete	Bewdley	..	..	..	..	..	..	..	..	..	..	..	..	2	2	..	..	2	2	
,,	Coventry	..	..	..	..	..	..	..	..	..	..	..	..	9	5	..	..	9	5	
,,	Droitwich	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
,,	New Radnor	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
,,	Northampton	..	..	..	..	..	..	..	..	..	..	11	3	4	3	..	..	20	6	
,,	Radnor (County)	2	..	..	..	..	..	..	..	2	..	..	..	..	..	..	..	4	..	
,,	Worcester (City)	6	1	3	..	19	4	..	..	7	3	1	..	9	3	..	..	45	11	
,,	,, (County)	43	7	1	..	42	1	..	..	32	7	12	..	56	42	15	..	201	57	
J. W. Thomas	Cardiff	58	6	6	..	38	1	6	1	15	7	9	..	..	..	13	..	145	15	
,,	Newport	33	6	1	1	8	1	..	..	..	..	4	..	..	..	19	3	65	11	
,,	Monmouth (Couuty)	51	18	..	..	..	..	..	..	..	..	..	..	2	..	..	..	53	18	
C. R. Tichborne	Longford ,,	4	4	..	..	1	..	..	..	14	4	..	..	..	..	..	..	19	8	
J. W. Tripe	Hackney	46	19	..	..	41	4	8	1	2	..	15	3	1	1	7	..	120	28	
G. Turner	Portsmouth	75	11	..	..	30	5	1	..	..	..	26	..	5	5	..	..	137	21	
F. Vacher	Birkenhead	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	No instructions for collection of samples.
T. Walker	Carlisle	..	..	..	..	..	..	..	..	..	..	..	..	6	4	..	..	6	4	
W. Wallace	Ayr	1	1	..	..	..	..	..	..	..	..	4	..	..	..	..	..	5	1	
Wallace, Tatlock, and Clarke	Glasgow	24	19	1	..	1	..	2	1	4	..	..	..	..	..	2	..	34	20	
,,	Johnstone	2	1	1	..	..	..	..	..	..	..	..	..	..	..	..	..	3	1	
,,	Kilmarnock	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
,,	Lanark	10	5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	10	5	
,,	Renfrewshire	18	4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	18	4	
,,	Rutherglen	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
,,	Sutherlandshire	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
J. Whitmore	Marylebone	63	9	21	4	60	3	..	..	19	7	1	..	..	..	..	..	164	23	
G. W. Wigner	Greenwich	12	6	26	4	38	2	1	..	14	1	10	..	..	..	16	..	117	13	
,,	Plumstead	44	10	51	1	23	1	..	..	..	..	6	..	..	..	2	..	126	12	
,,	Woolwich	21	11	9	2	30	..	4	..	6	..	4	..	..	..	6	..	80	13	
T. Woods	King's (County)	1	1	..	..	..	..	..	..	..	..	..	..	8	..	2	..	11	1	
	Totals	6036	1332	969	135	4197	492	615	164	1615	457	1471	68	1240	266	629	64	17574	3032	

Mr. Hehner said he was not ashamed to own that he was the chemist alluded to in the malt wort case, and would first like to say that it was not, as might perhaps be supposed, a Public Analyst case, but one in which he was engaged privately. With regard to the case itself, there was certainly a doubt about the identity of the sample, but that must be attributed to the Excise officers themselves, who bottled the samples without securing the cork by any seal. His sample was taken by the inspectors whilst it was very hot, and it therefore had a chance of keeping some length of time. It possessed the same specific gravity, the same acidity, and so on, as the Inland Revenue chemists' sample, and he believed, that as far as the chemical evidence went, the samples were identical. It would have been practically impossible for the brewer to substitute for the original sample, had it been sugared, another genuine one, showing practically the same gravity, acidity, &c. The difference was chiefly in the interpretation of the results. The Inland Revenue chemists, as far as he could learn, simply took a measured quantity of the wort and boiled it for a few minutes with a drop or two of acid, any increase in the copper reducing power being taken to represent cane sugar, the dextrine and maltose not being supposed to undergo any change. From a large number of experiments made by him upon pure malt worts of different strength, and obtained under widely different conditions, Mr. Hehner could, however, state most positively that some inversion invariably took place even after a very short time of heating and with very little acid, and in exceptionally strong worts, such as the one forming the foundation of the case, this inversion might amount to several percentages calculated as cane sugar. At the same time he would admit that cane sugar was inverted with extreme facility, whilst the total inversion of malt worts was a very difficult matter, even when 10 per cent. of strong hydrochloric acid were employed. He still believed that the sample was perfectly genuine, and that, anyhow, the presence of cane sugar had by no means been conclusively proved. The Excise Chemists ridiculed the proposition that the cane sugar should have been separated from the wort in the crystallised state and produced as *corpus delicti*, and said this was quite impossible. Mr. Hehner, however, said it had been done in other cases, and he himself was ready to do it. What grounds the Inland Revenue Chemists had for saying in their Report that he had made a serious mistake he could not understand, especially as at the hearing of the case they disputed the identity of the sample. He still adhered to the opinion he expressed at the time—though then, perhaps, too strongly—that the brewer had been subjected to a grievous wrong.

THE PROPOSED AMERICAN PHARMACOPŒIA STANDARDS.

By John Muter, Ph.D., F.C.S.

A report has been just issued on the revision of the *U.S. Pharmacopœia*, preliminary to the Convention of 1880, being a rough draft of the general principles, titles, and working formulæ proposed for the next *Pharmacopœia*, prepared and compiled by Charles Rice, chairman of the committee of revision. This interesting document (which is not for sale, but of which a copy can be had by any interested professional man on application to George Ross, Lebanon Pa., U.S.A.) is a most gratifying instance of the able efforts of our American cousins to advance and perfect their official standards. The many evidences of painstaking research contained in the voluminous report, extending in all to 200 closely printed pages, reflects the greatest credit on Dr. Rice and his coadjutors. Into the pure

pharmacy of the report it is scarcely my province to enter, although I may say broadly that it will well repay deep study and careful criticism at the hands of those responsible for the next edition of the *British Pharmacopœia*. The point which to us, as analysts, is the most interesting, is the careful way in which the tests for valuation of alkaloids and their preparations have been worked out. Compare, for example, our crude official method of single precipitation with ammonia and drying, with the following test for quinine in the *ferri et quinæ citras* scale :—Dissolve four grams of the scales by heat in sufficient water, and when cool transfer the solution to a glass separator, rinsing the dish; add a solution of half a gram of tartaric acid, and then solution of soda in decided excess, and extract the alkaloid by well shaking with three or four portions of water-washed chloroform of 15 c.c. each. Evaporate the chloroform in a weighed dish and dry the residue at 100° C. Lastly, extract the residue with forty times its weight of pure ether, when it should dissolve practically without residuum. The addition of the tartaric acid is to prevent separation of ferric hydrate on shaking up with the soda. The process adopted for the valuation of the barks is that of De Vrij, but the estimation of quinine by mere extraction of the total mixed alkaloids with ether is very properly objected to as entirely fallacious, and the crystallization process as sulphate is given, which is undoubtedly the true one for a real valuation of the bark for commercial purposes. It is no uncommon thing for a manufacturer, who trusts to the analysis of persons who use the simple ether abstraction of the mixed alkaloids, to find in practice that he has bought an article which contains a quantity of amorphous quinine weighed by the analyst as actual quinine. Not only is the present system of weighing the whole ether residue and calling it quinine bad, but there really ought to be some recognised allowance off the crystallizable quinine, just as in sugar analysis an allowance off the crystallizable sugar is made according to the amount of uncrystallizable sugar present. If this were done, manufacturers could really get from the bark the amount shown by the analysis. It is a matter of some wonder that the method of extraction by percolation with ·735 methylated ether, after treating with dilute spirit and lime and drying, has not been noticed by the reporter, Professor Prescott, because, although De Vrij's extraction is undoubtedly the best for red and pale Indian barks, the value of which depends on the other alkaloids as well as quinine, yet in the case of a *yellow* or an *officinalis* bark, where quinine only is required, the direct process with ether leaves nothing to be desired. The only difficulty is the recovery of the large bulk of ether necessarily used, but that is now rendered most simple by Mr. Wynter Blyth's ingenious apparatus, and the process is not only easily completed in 24 hours, but requires a minimum of attention. Another point in the estimation as sulphate has been looked over, which is of great importance in issuing instructions such as are supposed never to fail even in inexperienced hands, and that is the use of a definite amount of weak volumetric sulphuric acid to dissolve the quinine, so regulated that although a certain portion be first used and then so many other portions be afterwards employed to wash the animal charcoal, yet on neutralizing with ammonia and evaporating to a given low bulk, no crystals of ammonium sulphate can ever separate at a temperature of 15° C. These suggestions are, it appears to me, worthy of note by revisers of the *Pharmacopœia*.

The process recommended for the estimation of opium is that of preliminary percolation of 6½ grams of dried opium with benzol, heating in a weighed flask with a definite weight of water and 3 grams of freshly slaked lime, and restoring the original weight of the

whole with water. The whole is then thrown upon a filter and a definite weight of the filtrate is taken representing 5 grams of the original opium agitated with 8 drops of benzol and 3 c.c. of pure ether and the morphia caused to crystallize by the addition of 4½ grams of powdered ammonium chloride. Lastly, the crystals are washed with pure ether and dried at 50 °C. As to this process some objections have been lately raised, mainly that the benzol is not perfectly without action on the other alkaloids besides narcotine, and therefore it is good to observe that Professor Flückiger's process, given originally in the *German Pharmacopœia Report*, is also referred to. In my own experience this latter is really the most desirable, and as now finally modified by the author it is in every respect a useful one. As many of the readers of THE ANALYST may not have yet used it, I give it in full, and I think that exactly followed they will find it easy to work, and giving always concordant results. Eight grams of *dried* opium are repeatedly extracted with *absolute* ether, and the residue allowed to once more dry by exposure to the air. The residue is then treated in a closed flask with 80 grams of water for 12 hours with frequent agitation, and the whole is thrown on a ribbed filter of 5 inches diameter, and 42·5 grams of the filtrate weighed off for analysis in a small previously weighed flask of 100 c.c. capacity. To this 12 grams of ·815 alcohol and 10 grams of ether are added, together with 1·5 gram of liquor ammonia ·960 sp. gr. The flask is closed, shaken, and set aside for 24 hours. After agitating so as to detach the crystals from the flask, the whole is thrown on a 4-inch ribbed filter and washed out, first with 10 grams of alcohol-ether mixture, and then with 10 grams pure ether. Lastly, the crystals are transferred back to the flask in which they are dried and weighed. The weight multiplied by 2 and then by 20 gives the percentage of $C_{17}H_{19}NO_3.H_2O$ in the original opium.

A very wise precaution on the part of the committee is the suggestion that all opium shall be considered to contain exactly 10 per cent. of morphia in the dried state, and if it contain more a proportionate dilution in strength shall be directed according to a definite method before any preparation of it be made. Having thus shortly glanced at some points of interest to analysts in the report, I heartily recommend it to the perusal of persons interested.

SOME RESULTS OF THE ANALYSIS OF VARIOUS TINNED FOOD PRODUCTS.

BY G. W. WIGNER, F.C.S.

Read before the Society of Public Analysts, on 14th April, 1880.

THE use of American and Australian tinned goods and other food products has extended greatly during the last year or two. The high price in this country of many articles of food, as compared with their value abroad and in the colonies, has been gradually forcing them forward into more general consumption, but in addition to this it is evident that more care and skill have been brought to bear on the preparation and packing of the goods, and that they have consequently been offered for sale in better condition and in more attractive form.

At present little has been done except in the form of advertisements to familiarize the English consumer with the value and advantages or disadvantages possessed by these foreign goods. In one or two cases, and notably in *A Year's Cookery*, which was reviewed in THE ANALYST a short time since, and in a series of articles by Mr. Ernest Hart, which

have appeared in the *British Medical Journal*, the practicability of making palatable and nutritious dishes from these products has been considered, but I have never met with any careful examination of them which gave any information as to their food value.

I propose to lay certain results of this character before the Society to-night.

The cooked foods which I have analysed have been selected by their general indications of care in packing and the good and sound appearance of the tins. Those brands which were in tins of bad colour, and which appeared therefore more likely to contain much lead alloy in the tin plate, were not chosen, and I have not considered it worth while to examine those which were of obviously inferior character in any other respect. Every article mentioned has been tested as a dish served at the table, either cooked or not as may be necessary, as well as by analysis. The prices are only approximately correct, for the profit which the retailer requires appears to vary much.

1. Roast beef.* In cylindrical tins, containing 1½-lb. net weight, inclusive of a small amount of strong gravy boiled to a jelly, with which the tin is perfectly filled. The analysis gave the following results :—

Moisture	60·73 per cent.
Albuminoid substances	18·93
Containing nitrogen 2·99	
Fat	17·77
Ash	1·68

Comparing this with the analysis of an average sample of raw beef free from bone it will be seen that the moisture is about 15 per cent. less than in raw beef and within 5 per cent. of that found in cooked lean mutton chop, and that a large proportion of the fat has been removed ; that is, instead of nearly 30 per cent. of fat there is less than 18 per cent. The true albuminoids are nearly 17·8 per cent. against about 15 per cent. found in raw beef free from fat. The ash is nearly 1·7, or as nearly as may be identical with raw beef. This roast beef, therefore, is, as regards dietetic value, as shown by analysis, some 10 to 20 per cent. more valuable than uncooked lean beef, quite free from bone, and only slightly less valuable than cooked steak. The tins should retail at about 1/0 each. This would be equal to 8d. per lb. for cooked, boneless meat; or say, 6½d. per lb. for raw meat, without bone. If the tin is cut open the meat comes out in a solid of the shape of the tin, and if served as a cold dish, it is of excellent flavour, and firm enough to cut well. It does not do equally well when warmed up, because the stock with which the tin has been filled up melts to gravy. For hashes, stews, or pies it answers well, but as it is already sufficiently cooked, it obviously needs care to avoid overcooking before sending to table.

2. Boiled Beef. This article is sent out in tins which are slightly conical in shape, so as to facilitate emptying the contents in a compressed form. The fat is low, 8·5 per cent.; water 50·6 per cent.; while the nitrogen is increased to 3·80 per cent., corresponding to 24·07 per cent. of albuminoid substances. This article is therefore shown by the analysis to be a good sample of cooked meat, fully 20 per cent. more valuable as a food than raw lean meat; it certainly serves up well at the table. It is sold in several sized tins, and the net retail price comes to about 7d. per lb. on the cooked meat, or a fraction over 5d. per lb. on raw beef, free from bone.

* As the quality of tinned beef varies considerably, I may mention that this sample was marked "Thurbers."

3. Boiled chicken. In cylindrical tins, almost free from bone, weighing about 1¼ lb. net, including a small proportion of stock put in to fill the tin. The larger bones are entirely absent, and there is a smaller proportion of the dark coloured flesh of the legs than in the entire fowl. The results obtained were—

Moisture	53·00 per cent.
Albuminoids	24·00 ,,

The average water in the flesh of chicken free from bone is variously quoted at from 73 to 77 per cent., and the different analyses show albuminoids varying from 17 to 21 per cent. The cooking in this case also has therefore been satisfactory, and it is fair to estimate the food value as about 25 per cent. higher than the flesh of raw fowls. The flavour of this article was good; it was in the opinion of several who tried it even more palatable than ordinary cold roast chicken. The retail price is about 1s. 3d. per tin, or say 10d. per lb.

4. Mackerel. My experience with these has at present been unsatisfactory. For some reason this fish appears to take up the metal from the tins more readily than any other I have yet examined; so much so, that a slight metallic flavour has in one or two cases been found. The results of the analysis, except in this respect, have been satisfactory, showing—

Moisture	70·85 per cent.
Albuminoids	18·86 ,,
Ash	2·79 ,,

These figures included the whole of the liquor in the tin, and they correspond very closely with Payen's analysis of the flesh of the mackerel freed from bone. The tins might perhaps be improved in quality so as to make this a palatable article.

5. Lobster. In tins. The contents consist mainly of the harder parts of the flesh, *i.e.*, the claws, &c. The tins contained about 1½ lb. net weight, including the liquor, which was, of course, also included in the sample analysed. The results were :—

Moisture	77·16 per cent.
Albuminoids	18·42 ,,
Ash	1·90 ,,

I have not been able to find any previous analysis of the flesh of the lobster; but judging by the analysis of other shell fish there does not appear to have been any increase in water or loss of albuminoids. The sample was quite satisfactory in flavour, and at retail price costs about 6d. per lb. This certainly must be of value for food, and in flavour it was excellent, both for salad and when potted.

6. Baked Beans. These are a species of haricot bean cooked in the tin, with the addition of a slice of fat bacon. The cooking has apparently been steaming rather than baking, or at any rate the tins had been filled up with water so as to exclude the air. The entire sample, liquor included, contained

Water	68·80 per cent.

Ripe haricots by Church's analysis contain 14 per cent. of water. Therefore about 50 per cent. of this water has been introduced for cooking purposes. This proportion does not appear to be at all in excess of what is necessary for cooking beans in the ordinary way, but it has to be borne in mind that, contrary to the case of the meats, we get less raw material as the result of the cooking. Each tin contains about 2½ lbs., this would equal about 1¼ lb. of ripe haricots not cooked. Calculating on this basis, I find that the

albuminoids in the beans containing 18 per cent. of water were 17·21 per cent., a figure which is rather lower than Church found in the fresh beans. It is, however, high enough to make them class as a good and nutritious vegetable food. There is sound judgment shown in cooking a piece of bacon with them, as haricots are naturally deficient in fat, and the bacon supplies this and also improves the flavour. I have used these much, and they have almost always been liked. The retail price is about 1s. per tin.

7. Peas. These are tinned in a similar way to the beans, and they consequently contain more water than ripe peas. I took a large sample, and after filtering them, evaporated the filtrate. The residue left, *i.e.*, the proportion dissolved by the water, was 1·11 per cent. This, of course, represents the proportion of the sample which would in ordinary course be wasted, because it would not be served at table. The total water was 58·3 per cent., so that as ripe peas contain about 14 per cent., about 45 per cent. had been added for cooking purposes. The albuminoids calculated on to the sample, with 14 per cent. of water, were 21 per cent., so that the loss of flesh-forming matter has certainly not exceeded 1 per cent. They are, therefore, probably quite as good for food as freshly cooked peas. The retail price is about 10d. per tin, containing about 1½ lb.

I am carrying out these experiments on other products of the same class, and shall hope to bring the results forward at a future time.

NOTE ON A FIBROUS SUBSTANCE FOUND IN THE INTESTINE OF A SHEEP.

By Bernard Dyer, F.C.S.

Read before the Society of Public Analysts, on 14th April, 1880.

On two occasions—once two or three years ago, and once recently—I have been consulted with reference to fibrous masses found, during *post-mortem* examinations, in sheep that had died from obstruction of the bowels. In each case an accusation was made against the vendors of oil-cake on which the sheep had been fed, to the effect that the cake must have been the cause of the mischief—the cake being cotton-cake, and the supposition on the part of the owners of the sheep being that the cake must have contained sufficient cotton-fibre adhering to the crushed kernels to have caused the fatal accumulation. On microscopic examination, however, of the substance, I found that the fibre—which was brown, and coated of course with fœcal matter—contained no cotton-fibre, but consisted mainly of wool, the probability being that the sheep had been nibbling their fleeces in the endeavour to allay cutaneous irritation.

CORRESPONDENCE.

[The Editors are not responsible for the opinions of their Correspondents.]

THE EFFECT OF LIGHT UPON REAGENTS.

To the Editor of "The Analyst."

Sir,—In connection with my friend Mr. Blunt's paper on this subject, reported in the April number of The Analyst, it may be of interest to state that the oxidation of oxalic acid solution in sunlight may, under favourable conditions, be much more rapid than would appear from our experiment there quoted. For example, I have for some time past been endeavouring to turn this reaction to practical account as a means of measuring the oxidising power of sunlight from week to week; and, in the week ending April 22nd, I found that 4 c.c. of decinormal oxalic solution were entirely oxidised in sunlight. An important condition determining the rate of oxidation is the surface-area of the solution exposed. The tube in which the 4 c.c. referred to were contained was more than an inch in diameter. The same quantity in tubes of ½-inch diameter had, during the same time, taken up only ·001 gramme of oxygen.

Faithfully yours, ARTHUR DOWNES, M.D.

REVIEW.

The Art of Perfumery.

By G. W. Septimus Piesse, Ph.D., F.C.S. London: Longmans, Green & Co.

This is the fourth edition of Dr. Piesse's Book, a fact in itself giving high testimony to its excellence. The author has taken care to deal with his subject in a full and comprehensive manner. Even snuff which "we repudiate" is considered in its proper place and under the same class as smelling salts, because its odour is mainly due to the liberation of ammonia.

The collection of formulæ in this volume is very extensive, and it will prove of much service as a book of reference to any analyst who is consulted on such matters.

The appendix on preparing artificial fruit essences contains more plain and useful information on the subject than we have seen collected in any other book. The volume is singularly free from printers' errors.

ANALYSTS' REPORTS.

Mr. J. Carter-Bell, Analyst to the Borough of Salford, in his report, states that during the quarter ended March 31st, 1880, he had analysed 138 samples. Of these, 43 were adulterated, namely, 38 milks, 1 unfermented wine, 1 oatcake, 1 whisky, and 2 beers. The sample of unfermented wine contained a considerable amount of copper, which might be seriously detrimental to health, for in warm weather a person might feel inclined to drink a large quantity of this acid sugary compound, containing a very dangerous dose of a copper salt. The presence of copper in the liquid is a proof of the careless and ignorant manner by which it had been prepared. There is little doubt that the mixture of tartaric acid and sugar has been boiled in copper vessels, and the acid has dissolved the metal. The quality of the milk supply this quarter has been much below the average. Some of the samples contained more than 30 per cent. of water. Several samples of beer have been analysed to ascertain the amount of salt, but only in two cases did the salt exceed 50 grains to the gallon. One of the samples of oatcake was adulterated with a large amount of chalk.

Mr. J. Carter-Bell, Public Analyst for the County of Chester, in his report, states that during the quarter ended March 31st, 1880, he had examined 288 samples. Of these 71 were adulterated—viz., 32 milks, six whiskies, six rums, six gins, one cocoa, six mustards, 13 coffees, and one butter. The report adds that it is remarkable how the quality of the milk varies in different divisions of the county; for instance, from the Hyde division 31 samples of milk were received, and 19 of them were adulterated, or 61 per cent.; whereas from the Eddisbury division, out of 20 samples only two were adulterated, or 10 per cent.; Nantwich, four samples of milk, and one adulterated; Altrincham, six samples, three adulterated; Wirral, eight samples, four adulterated; Stockport, 15 samples, three adulterated; Macclesfield, three samples, but all pure. In the Hyde division, where there is a large factory population, it is more than necessary that the milk should be pure, and of better quality than is to be found elsewhere.

LAW REPORTS.

Inspectors cannot take Samples from Milk sent by train before delivery to Consignee, and without authority from him. Railway Porter not Contractor's Agent to receive portion of sample :—

At Marylebone, Mrs. Thame, having a farm at Swanburne, near Bletchley, was summoned before Mr. De Rutzen for selling milk which had been diluted by water. Mr. Ricketts, solicitor, prosecuted on behalf of the Vestry of St. Pancras. The defendant was in the habit of consigning milk by the London and North Western Railway to a dairyman named Sims at Kentish Town. On the 18th ult., on the arrival of a churn of milk sent by the defendant to Euston, a sample of it was taken by William Roach, one of the sanitary inspectors of the parish, which on analysis was found to contain 11 per cent. of added water. John Hall, farmer, of Pinley, Coventry, Warwickshire, was summoned for a similar offence. The defendant in this case also sent milk to Mr. Sims. A sample of some that arrived at Euston on the 18th ult. was submitted for analysis and was found to have 10 per cent. of added water

in it. The inspector had not been authorized to take samples of the milk by Mr. Sims in either case, but had done so as several complaints had been made to the Vestry. Mr. De Rutzen observed that he thought there was great objection to this mode of procedure, and he saw several difficulties that would arise from it. He did not think that the Act of Parliament contemplated such a thing. The milk had left the hands of the seller and had not arrived in those of the purchaser, and the inspector goes behind Mr. Sims's back to the station and lays violent hands on the milk and takes a sample from it. Where was the prejudice to the purchaser? Mr. Ricketts said that the power was given to the inspector, under the new Statute of 1879, to make seizure at the place of delivery. Mr. De Rutzen said that it was admitted the contract was to supply milk and that it was mixed with water. The only question was whether the proper proceedings had been taken to secure a conviction under the Act of last year, which amended the Sale of Food Act of 1875. By Section 14 of the latter Act it was enacted that the person purchasing with the intention of analysis after the purchase was completed should forthwith notify to the seller or his agent selling the article his intention, and should offer to divide the article sold into three parts, giving one of the parts to the seller or his agent. In these cases the samples were procured at the railway station, in the course of the milk being delivered to the purchaser, and one part was given to the porter at the station who was in charge of the milk, treating him as the agent of the seller. Although the porter might have been a person intrusted by the seller for the time being with the charge of such milk so as to render him liable to a penalty under Section 4 if he refused to allow the inspector to take a sample, in his opinion the porter was in no sense contemplated by the Act the agent of the seller to receive the sample. The inspector, therefore, having failed to comply with the provisions of the Act, the summonses must be dismissed. Mr. Ricketts asked for a case for the decision of a Superior Court to be given on the question. Mr. De Rutzen said that he would grant one. The Vestry, he thought, had taken a right course in endeavouring to defend the retail dealers of London, and they had only broken down in the way they had sought to carry it out.

Spirits may be Reduced below Strength fixed by Law if Notice thereof be given:—

Thomas Henry Cooke, grocer, of 94, High Street, Camden Town, was summoned for selling a bottle of Irish whisky which was adulterated by water so as to reduce the spirit more than 25 degrees under proof—namely, 31½ degrees under proof. Mr. Ricketts prosecuted for the St. Pancras Vestry; Mr. Townshend, from the office of Messrs. Linklater & Co., defended. Mr. De Rutzen said that he had already decided a case which was on all fours with this one in favour of the defendant. The Vestry of St. Pancras, however, thought it desirable in the interests of the public, and in consequence of some decisions supposed to be contrary to his, to raise the question again. Many people were under the impression that spirits could not be sold below a certain strength, and that idea had arisen, no doubt, owing to the marginal note of the 6th section of the Act passed last year, which says, "Reduction allowed to the extent of 25 degrees under proof for brandy, whisky, or rum, and 35 degrees for gin," and from that people had inferred that it could not be reduced to a greater extent. By that section the Legislature had merely fixed for the purposes of this Act a certain standard for the strength of spirits, and had enacted that it should be a good defence to a charge of adulterating spirits if it was proved that such admixture had not reduced the spirits to a greater extent than that which had been quoted. There was nothing in the Act to prevent people from selling spirits mixed with any greater quantity of water if at the time of sale and delivery they supplied to the person receiving the same a notice by a label that the same was so mixed, and if the magistrate was of opinion that it was not intended fraudulently to increase its bulk. There was a label on the bottle correctly describing, or rather understating, the strength of the spirit, from which he inferred that there was no intention of concealing the quality of the whisky. He was therefore of opinion that no offence had been committed, and the summons must be dismissed.

A Magistrate in a New Position:—

Robert Wilson, dairyman, Acton, was summoned at the Hammersmith Police Court for selling to James Gregg, inspector, milk which was not of the quality demanded. A certificate from Professor Redwood, the Public Analyst, stated that the sample contained milk which had been adulterated by the removal of part of the cream and the addition of 8 per cent. of water. Professor Redwood stated the grounds on which he concluded that the cream had been removed; but Mr. Paget, the magistrate, said it was all guesswork, and dismissed the summons, but gave the inspector leave to withdraw it. The summons was withdrawn.—*Telegraph.*

A New Defence for Water in Milk:—

At Marylebone, William Webb, farmer, of Church Farm, Hurst, Twyford, Berkshire, was summoned by the Metropolitan Dairymen's Society, for selling milk diluted with water. Samples taken from two churns of the defendant's milk consigned to Mr. E. Tisdall, of Kensington, on their arrival at Paddington showed that there was 10 per cent. of added water in one of the samples. Mr. Ricketts prosecuted for the Society, and Mr. Parish, the Society's Inspector, gave the usual evidence. It was contended that if there was any water in the milk it had found its way there by leakage in the refrigerator by which the milk was cooled before it was sent away. Mr. de Rutzen imposed a fine of £5 and costs.

NOTES OF THE MONTH.

Our readers will remember that last month an unfortunate difference of opinion occurred at Portsmouth as to a sample of coffee. We have received the following copy of a letter which has been subsequently addressed to the Town Clerk of that borough, by an enterprising gentleman. The letter speaks for itself as a specimen of professional ethics as understood by the writer—

School of Science, * * * * * * * * *March 8th, 1880.*

Sir,—Seeing the report of the coffee adulteration case in the papers, I write to ask the favour of an intimation in the event of the resignation of your Public Analyst now or at a future time, as I should in that case wish to make an application for the appointment. It would be found that I have good qualifications. Apologizing for troubling you, I am, Sir, your obedient Servant,

* * ******* F.C.S.,

Analytical Chemist.

We are informed that Dr. Turner has no intention of resigning, considering, as he does, that he has a perfect explanation of the difference of opinion, without throwing any doubt either on his own analysis, or that of Somerset House; but, meantime, we are glad to give the writer of the above letter this notice in our columns of his good qualifications and excellent business habits, of taking time by the forelock. Perhaps some of our members may know of another appointment which would suit him.

The Vestry of St. Pancras has been following the lead of the Vestry of Lambeth, in attacking milk adulteration at its possible source, by taking samples of milk at the railway stations, but unfortunately without the precautions adopted by the latter authority, and consequently a difficulty has arisen, as will be seen from our law reports. The remedy for the apparent stoppage is very simple, if the Lambeth plan be followed: the Inspector obtains the co-operation of the consignee, who attends at the station, receives the milk, and formally requests the Inspector to take the sample. In this way, the Lambeth Authorities have obtained something like 40 samples of milk, six of which have proved to be either watered or skimmed, and the farmers duly punished, to the great gratification of the local milk dealers.

A dispute is going on in America, *re* Oleo-margarine, which Mr. John Michels, a well-known New York microscopist, declares to be very dangerous. He states that the heat used is not sufficient to kill the embryos of living parasites, which are thereby transferred to the body of the consumer, and that this is rendered more likely to occur by the fact that, the refuse fat of at least one pork packing establishment in New York is worked up daily into "butterine," and exported both to England direct, and also to Holland. It is made up in tubs and even in pats, and stamped like genuine butter. On the other hand, Dr. Mott declares it to be perfectly wholeseme, but it is to be noted that he is chemist to one of the large grease factories. We would suggest to our members the advisability of carefully

examining every sample microscopically, to see if they can discover any encysted parasites, and thus put at rest what is certainly a most serious question of public health. Personally, we have never as yet met with any such appearances, and would welcome communications on the subject.

On the "butterine" question, an eminent trade firm writes as follows:—"That oleo-margarine as presented in the form of butter, is an adulteration, a counterfeit, is clearly established; that it is injurious to health, we think can be scientifically proven; that it is working ruin to one of the most important industries of the country, is beyond question." It is somewhat unfortunate in the face of such opinions even from traders, that the low standard adopted for butter at Somerset House practically prevents the prosecution of any mixture less than about 40 per cent.—one of the specialists in butter having been stopped at 35 per cent.—and in one memorable case the pure "butterine" itself was passed over; but that is not likely to occur again, now that the authorities there have had time to perfect their experiments on the subject. Still the low standard remains so far as we can learn, and no analyst who values his reputation must venture to certify to anything under the percentage mentioned above. We trust, however, that the authorities will soon see their way to permit us to go down, to say, 25 per cent., which is really the ordinary amount added in practice to make up middling Dutch butter in the large factories, at Oos and elsewhere.

ANSWER TO CORRESPONDENT.—INQUIRER.—(1) Marsh's Test, which consists in the formation of arseniuretted hydrogen, is far the best test for the purpose. A small portion of the colouring matter should be detached from the paper, dissolved in hydrochloric acid previously proved to be free from arsenic, and this solution used to test with. If the colouring matter consists, as it most frequently does, of arsenite of copper, it will probably become of a deep blue colour when moistened with strong solution of ammonia. This test is not infallible, because the blue colour is sometimes masked by other colouring matters present.

(2) It certainly is probable that the quantities found in wall paper will prove injurious to health, and many well authenticated instances are on record.

Mr. James Baynes, jun., has been appointed Public Analyst for York, in the room of Dr. Proctor, deceased.

RECENT CHEMICAL PATENTS.

The following specifications have been recently published, and can be obtained from the Great Seal Office, Cursitor Street, Chancery Lane, London.

1879 No.	Name of Patentee.	Title of Patent.	Price.
3060	A. Budenberg	Pyrometers or Thermometers	6d.
3183	W. Cleland	Manufacture of Gas	6d.
3230	A. L. Bruce and W. McCowan	Treatment of Dextrine Maltose	8d.
3355	W. Morgan Brown	Manufacture of Electrodes for the Electric Light	6d.
3393	P. S. Justice	Telephones	6d.
3437	A. H. Hassall and O. Helmer	Preparing Extracts from Tea, Coffee, &c.	2d.
3562	W. R. Lake	Manufacture of Hydrogen Gas	6d.
3579	G. W. Bremner	Treating Phosphates of Alumina to obtain a Gum	4d.
3587	F. J. Cheesbrough	Electric Lamps	6d.
3645	W. C. Barney	Electric Telegraphs	6d.
3661	G. J. Lacombe	Manufacture or Treatment of Potash	2d.
3724	J. P. Rickman and J. B. Thompson	Manufacture of Ammonia and its Compounds	2d.
5149	J. Imray	Telephones	6d.
3844	J. Imray	Manufacture of Hydrocyanic Acid	6d.

BOOKS, &c., RECEIVED.

The Chemist and Druggist; The Brewers' Guardian; The British Medical Journal; The Medical Press; The Pharmaceutical Journal; The Sanitary Record; The Miller; Journal of Applied Science; The Boston Journal of Chemistry; The Provisioner; The Practitioner; New Remedies; Proceedings of the American Chemical Society; Le Practicien; The Inventors' Record; New York Public Health; Philadelphia Printers' Circular; The Scientific American; The American Traveller; Society of Arts Journal; **Sewage Disposal, by Robinson; Potable Water, by Ekin; Nature's Hygiene, by Kingzett.**

THE ANALYST.

JUNE, 1880.

THE ESTIMATION OF PHOSPHORIC ACID.

By Alfred Smetham, F.C.S., &c.

*Read before the Society of Public Analysts, on 17th March, 1880.**

The experiments which I propose to bring before your notice this evening resulted from a statement made by Messrs. Teschemacher and Smith, in a pamphlet which they issued during the past year on the Estimation of Phosphoric Acid, wherein they gave in detail the process which they at present use in their laboratory, and also an account of some experiments which they had conducted on the solubility of ammonio-magnesic phosphate in ammonia water. By these experiments they came to the conclusion, which had previously been arrived at by other chemists, that this salt is totally insoluble in water containing $\frac{1}{8}$th of its bulk of ·880 ammonia. In striking contrast with this conclusion is the high solubility which was found by Fresenius; which, however, I believe he has since found occasion to modify. As the conclusion of Teschemacher and Smith seemed to me at variance with what we should expect, and as, moreover, their experiments were conducted in a very crude manner, viz., by dissolving and reprecipitating ammonio-magnesic phosphate a great number of times, whereby they found that the resulting magnesic pyrophosphate weighed more than the precipitate obtained in the usual course from the same quantity of phosphate, I started the following set of experiments in the hope of setting the matter at rest.

A solution of phosphate was prepared by dissolving 50 grammes of pure phosphate of soda in a litre of water, which solution was used throughout the experiments.

Experiment I.—40 c.c. phosphate solution were mixed with 95 c.c. water, 40 c.c. of ·880 ammonia were added, and the phosphoric acid precipitated with 25 c.c. magnesia mixture, which allowed a good excess of magnesia. The solution was allowed to stand for 66 hours in a covered beaker in the laboratory when the resulting precipitate was filtered through a close Swedish filter, washed clean with ammonia water (1 in 4), dried, ignited and weighed. This yielded ·6385 grammes of $Mg_2P_2O_7$.

The filtrate was evaporated to a small bulk in a water-bath, and the phosphoric acid contained in solution determined by precipitation with ammonia, care being taken to ascertain the purity of the precipitate. On ignition it yielded $Mg_2P_2O_7$ ·0020 grammes.

The yield of pyrophosphate is ·0064 grammes in excess of the theoretical quantity, due probably to the fact that the phosphate had effloresced. This, however, is immaterial.

Experiment II. was conducted in a precisely similar manner, but with the following quantities.

40	c.c. phosphate solution.
25	c.c. magnesia mixture.
114	c.c. ·880 ammonia.
321	c.c. water.
500	c.c.

* We regret that the publication of this interesting Paper should have been postponed so long.

This yielded a precipitate of $Mg_2P_2O_7$ weighing ·6350 grammes.

The filtrate on evaporation gave $Mg_2P_2O_7$ ·0060 grammes.

Experiment III.—In this experiment the quantities taken were:—

40 c.c. phosphate solution.
25 c.c. magnesia mixture.
120 c.c. ·880 ammonia.
815 c.c. water.

1000 c.c.

The pyrophosphate obtained from the experiment was ·6250 grammes. And on evaporating the filtrate a further quantity weighing ·0160 grammes was obtained.

From these experiments it is evident that ammonio-magnesic phosphate is perceptibly soluble in ammonia water, but not to the extent originally stated by Fresenius. Instead of an addition of one millegramme of pyrophosphate for every 54 c.c. of solution it would be necessary to add only one millegramme for every 100 c.c. by the first experiment, and by the second one millegramme for every 84 c.c. for ammonia water 1 in 4, and by the third experiment 1 millegramme for every 62 c.c. of 1 in 8 ammonia water. It is possible that the excess of magnesium may have slightly diminished the solubility, but as in practice the excess is always present, this is, as far as the present experiments are concerned, immaterial.

But even supposing that the solubility of ammonio-magnesic phosphate in ammonia water was *nil*, it by no means follows that the other substances which are present during the precipitation in the ordinary course by the citric acid process do not increase the solubility and, therefore, Teschemacher and Smith's statement that no allowance should be made for the solubility is far from conclusive. That this is so is proved by the following experiments.

Experiment IV.—To test the influence of citric acid the following quantities were taken and proceeded with as in Experiment I.

40 c.c. phosphate solution.
95 c.c. water.
40 c.c. ·880 ammonia.
25 c.c. magnesia mixture.
5 grammes of citric acid.

200 c.c.

This yielded a precipitate which, when converted into pyrophosphate, weighed ·6315 grammes.

The filtrate from this was evaporated in a platinum dish, ignited, dissolved in HCl, the P_2O_5 precipitated by addition of ammonia in a small bulk. This yielded ·0065 grammes $Mg_2P_2O_7$.

Experiment V.—This was conducted to ascertain the effect of iron in the presence of citric acid in preventing precipitation. The quantities of solution were the same as in Experiment I., but ·35 grammes of ferrous sulphate and 2 grammes citric acid were dissolved in the water previous to precipitation.

The precipitate formed was separated by filtration as before, and the filtrate evaporated, ignited, and the phosphoric acid determined by means of the molybdenum process.

This yielded $Mg_2P_2O_7$ ·0030.

Experiment VI.—The same quantities of the solutions were used in this case, but the ferrous sulphate was increased to ·7 grammes, and the citric acid to 5 grammes.

The filtrate was treated as in Experiment V., and yielded $Mg_2P_2O_7$ ·0065 grammes.

Experiment VII.—This, and the following two experiments were conducted to determine the effect of alumina on the solubility. ·5 grammes potash alum and 2 grammes citric acid were dissolved in 95 c.c. water, and the solution made up to the same strength as in Experiment I.

The direct precipitate weighed ·6425 grammes $Mg_2P_2O_7$. The filtrate was evaporated, ignited, fused with a little sodic carbonate and the phosphoric acid estimated with molybdenum.

This gave $Mg_2P_2O_7$ ·0055 grammes.

Experiment VIII.—A similar experiment to the last, but 1·5 grammes of alum and 5 grammes citric acid were used.

The direct precipitate weighed ·6340 grammes.

The filtrate treated as in Experiment VII. gave $Mg_2P_2O_7$ ·0095.

Experiment IX.—A similar experiment to VII. to VIII., but 5 grammes of alum and 5 grammes citric acid were used.

The direct precipitate weighed ·6300 grammes, and the filtrate yielded, when treated as before, ·0100 grammes.

From these experiments it is evident:—

I. That the presence of citric acid increases slightly the solubility.

II. The presence of iron makes no perceptible difference in this respect, the solubility being determined by the quantity of citric acid present.

III. Alumina increases slightly the solubility, but the quantity dissolved seems to be beyond a certain point determined by the citric acid rather than the alumina present.

IV. That the influence of alumina is not so marked as is generally supposed. The widespread idea that alumina prevents the precipitation is doubtless due to the fact that in the presence of much alumina the precipitate forms very slowly, but the almost complete separation is merely a matter of time.

By subtracting the solubility of ammonio-magnesic phosphate in ammonia water (1 in 4) from the increased solubility due to citric acid and alumina, and dividing by the quantity of citric acid in grammes, we arrive at the quantity of phosphoric acid expressed as $Mg_2P_2O_7$, held in solution by 1 gramme of citric acid.

In making the correction for solubility, I therefore propose to add ·001 grammes $Mg_2P_2O_7$ for every 100 c.c. of solution, and in addition to allow ·0015 for every gramme of citric acid used in the determination. This would, in a determination where 2 grammes of substance were taken, and the liquid amounted to 250 c.c., and where it was necessary to use 2 grammes of citric acid, amount to ·18 per cent. P_2O_5. The allowance is not great, but it is perceptible, and should in all cases be made.

I have had experience with the citric acid process for many years past, and as I have always found it give excellent results, I may, perhaps, be allowed to sketch the method which I pursue. About two grammes of the finely powdered substance are weighed accurately, transferred to a beaker and decomposed with HCl, and where

necessary a drop or two of HNO_3. The solution is then evaporated to dryness in a water-bath, taken up with HCl, and after digestion, the insoluble silicious matter is separated by filtration; a weighed quantity of citric acid is added; the solution heated up nearly to boiling point, and a weighed quantity of oxalate of ammonia added. The quantities used must vary with the substance under examination, the knowledge only being acquired by experience, but it is seldom necessary to add more than two grammes citric acid or 2·5 grammes oxalate of ammonia. The free acid is then just neutralised, with dilute ammonia, and acetic acid added, to decidedly acid reaction. The liquid is kept simmering for a few minutes with constant stirring, and after standing a short time the oxalate of lime filtered. Great care must be observed not to have too large an excess of oxalate of ammonia present, as oxalate of magnesia in an ammoniacal solution is somewhat easily precipitated. To the filtrate ammonia of ·880 sp. gr. is added to about one-fourth of the bulk, and to the liquid, which must remain clear, or only slowly throw down a small precipitate, due to the magnesia present, magnesia mixture is added in moderate excess. The liquid must be set aside with occasional stirring for the precipitate to form—the time required being principally determined by the quantity of alumina present. It is best, however, to allow it to stand overnight, although in cases where the alumina is absent, or small, the precipitation will be found to be complete in two hours. The precipitate is then separated from the liquid by filtration, dissolved in as little HCl as possible, and reprecipitated with one-third of its bulk of ammonia. After allowing to stand for two hours with occasional stirring, it may be filtered, and after drying converted into $Mg_2P_2O_7$.

The oxalate of lime is converted to $CaCO_3$ by gentle ignition, weighed, dissolved in HCl, and tested for P_2O_5, which may be present in small quantities, and which should be determined.

From these data, and by correction for the slight solubility, the percentages may be calculated.

Warrington has made the statement that oxalate of lime is soluble to a perceptible extent in citrate of ammonia, and in order to ascertain the truth of this statement the following experiment was made: One gramme of pure $CaCO_3$ was dissolved in HCl, five grammes citric acid added, then two grammes oxalate of ammonia, the liquid (about 100 c.c.) just neutralised with dilute ammonia, and acidified with acetic acid. The precipitation was conducted in a hot solution, and after allowing to stand for a few minutes the liquid was filtered. The filtrate was evaporated in a platinum dish, ignited, the residue dissolved in HCl, and the lime precipitated as oxalate in a very small bulk. This yielded $CaCO_3$ ·0020 grammes.

It must be remembered that the citric acid used (five grammes) is far in excess of that required in an analysis, and supposing the solubility to be entirely due to the citric acid, we should have only ·0008 grammes of $CaCO_3$ dissolved where two grammes citric acid were used. This, with two grammes of substance taken, would only represent ·02 per cent. CaO, a quantity so small as to be insignificant, and certainly not exceeding the probable error where a large quantity of lime is present.

In accuracy, the process as described—when all precautions are taken—is unsurpassed by any, and gives strictly reliable results.

When the quantity of phosphoric acid present is small, and the iron and alumina large, the molybdenum process must be used; but with a large percentage of phosphoric acid, the citric acid process is all that can be desired.

Mr. Bernard Dyer said that the process described was one which he had used for several years past, and the results were thoroughly reliable. With regard to the time during which the precipitate stands, he might say that in the case of guanos or bone ashes where the proportion of iron and alumina was slight and the quantity of citric acid small, the precipitation was quite complete within one hour or one and a-half hours at the outside. Where much iron or alumina was present, it was certainly desirable to leave the precipitation for the first time standing overnight. He believed the errors which chemists fell into, and the impossibly high results too often obtained, were due to a great extent to the formation of oxalate of magnesia. He always re-dissolved the precipitate—the trouble was next to nothing, and it only extended the duration of the analysis by one and a-half hours. It was quite possible to make six phosphoric acid determinations in a day by that method.

Mr. Hehner said that the question of phosphoric acid determination was one at which he had worked a good deal, and in which he took much interest. He did not wish to insinuate that Mr. Smetham's and Mr. Dyer's results were incorrect, but if correct they were so only by a fortunate balance of the different errors of the method. Thus the great strength of the ammonia used for precipitating and washing (1 to 3 of strong ammonia) caused a loss by imperfect precipitation and solubility, whilst the proper strength was 1 of strong ammonia to 9 of water, or 1 of ammonia of Fresenius' strength (specific gravity 0·96) to 3 of water. It had long been shown (by Kissel) that any correction for solubility of the ammonium magnesium phosphate in such dilute ammonia ought not to be made, the precipitate being practically insoluble in the dilute ammonia; he thought the correction had been completely dropped. Another cause of error was that the magnesia mixture used by Mr. Smetham was sulphate of magnesia mixture. He thought that had been completely given up, and that it was well understood that from such sulphate mixture basic sulphates almost invariably entered into the phosphate precipitates. He did not see how Mr. Smetham's results went at all to show the solubility of the precipitate in dilute ammonia, as in all of Mr. Smetham's experiments magnesia mixture was invariably present, and it was known that in the presence of magnesia mixture the solubility was very different from that when dilute ammonia only was employed. He considered the molybdic method a far better one, and, after all, the easier and cheaper of the two, no re-dissolving and re-precipitating of precipitates and objectionable corrections for solubilities being required. It certainly allowed of the employment of small quantities of manure only, but if the work was done with due regard to all circumstances there was no chance of error. Most of Mr. Smetham's results were too high, and he attributed this to the presence of sulphate of magnesia in the precipitate and to over-correction.

Mr. Smetham, in reply, said that he had many times worked the molybdate and citric acid processes together on samples of mineral phosphate, and only once had they differed more than 0·2 per cent.; in the majority of cases the difference being within ·05 per cent. In the only case in which they differed he found on repeating that the molybdate process was at fault. He differed entirely from Mr. Hehner as to the solubility. Many experiments

had proved that where the quantity of ammonia was lessened, the solubility became greater. He took particular care to prove the purity of the precipitate; he thought it might safely be considered as having been due to the solubility only; the magnesia mixture he used was made with sulphate, but in his ordinary work he always tested the precipitates, and found that they were quite pure, and that was more than could always be said of the molybdate process, by which, when the precipitates were tested, there was a trace of iron carried down. There was more danger of oxalate of magnesia being precipitated than of the basic sulphate, and it was for that reason he put special stress on the necessity of weighing the oxalate of ammonia used. With due care his process gave quite as accurate results as the molybdate process, since it was possible to work with four times the quantity of substance, and errors in weighing, &c., were therefore considerably diminished, and as it was also more expeditious and less expensive, it was to be preferred where many analyses had to be performed.

NOTE ON THE ANALYSIS OF SOME SAMPLES OF CHIAN TURPENTINE.

By G. W. Wigner, F.C.S.

Read before the Society of Public Analysts, on 2nd June, 1880.

Chian turpentine has for many years past been almost unknown in this country, and its use in pharmacy had almost entirely ceased, but special interest has been directed to it of late by the statement of the success with which Professor Clay has been using it in the treatment of cases of cancer. Great difficulty was experienced in obtaining even a small supply of the genuine article, and Professor Clay stated that more than 95 per cent. of the samples which he had seen were spurious. I have examined some samples of undoubted genuineness in order to obtain a standard for future comparison.

The description given in Flückiger and Hanbury's *Pharmacographia* is as follows:—"A soft solid becoming brittle by exposure to the air; viewed in mass it appears opaque, and of a dull brown hue. If pressed, while warm, between two slips of glass, it is seen to be transparent, of a yellowish brown, and much contaminated by various impurities in a state of fine division. It has an agreeable, mild terebinthinous odour and very little taste."

As to its chemical composition, *Pharmacographia* says—that it consists of resin and essential oil; the former, *i.e.* the resin, being probably identical with the alpha resin of mastich.

The first sample which I examined (obtained from Messrs. Allen & Hanburys) was very probably a portion of the sample referred to in *Pharmacographia*, and would, in all probability, be 10 or 15 years old. It was of an opaque yellow brown colour, rather too soft to make a good pill mass alone, very slightly sticky, and covered on the surface with a whitish powder, which appeared to consist of parts of the resin itself, acted on by the atmosphere. A small portion was melted and dropped into cold water so as to form tears, and the sp. gr. of these tears was found to be 1050 at 60° F. If one of these fragments is gradually heated in water to the boiling point, it melts and expands rapidly, becoming lighter than the water, and floating as a film on the surface.

With the exception of a small amount of mineral impurities, consisting chiefly of sand, it dissolves readily in boiling alcohol 60 o.p., which becomes slightly milky when cold. The resin is precipitated as a white powder on dilution with water.

Absolute alcohol dissolves it readily even in the cold; so also do ether, chloroform

and bisulphide of carbon. Petroleum spirit and turpentine dissolve it readily on warming, and wood naptha dissolves it slowly on warming, the solution becoming slightly milky on cooling.

A portion was distilled with water for the volatile oil, which was found to amount to a little over 9 per cent.

A 20 per cent. solution of the turpentine itself was examined in the polariscope, and gave a right-handed rotation of 9° 12′ in a tube 200 m.m. long for the sodium ray.

The essential oil from the same solution gave a rotation of 1° 54′ for the sodium ray, leaving 7° 18′ as the rotation due to the resinous constituents.

The sample contained two different resins, one of which saponifies readily with carbonate of soda, and the other saponifies with somewhat more difficulty, but forms a far less soluble soap. This latter is present in by far the larger quantity, and it appears likely from its appearance and character that it corresponds pretty closely with the alpha resin of mastich.

Dividing these resins as far as possible by solubility, the sample appeared to contain as follows:—

Volatile Oil	9·2 per cent.
Alpha Resin	79·0 ,,
Gamma Resin	4·0 ,,
Benzoic Acid	traces
Impurities, chiefly sand	7·3 ,,
	99·5 ,,

The second sample I examined was a portion of a new supply just received in this country, but coming through almost the same channel as the first one. It was, of course, newer, and probably from that cause somewhat softer; the brittle characteristic of the original sample was, however, strongly marked, and the tears, which had been produced by letting a few drops fall into the water, were sufficiently brittle to break when allowed to fall on to the table.

A 20 per cent. solution, examined in the polariscope with a sodium flame gave a rotation of 7° 46′, of which 1° 54′ was due to the volatile oil, and the difference 5° 52′ to the resin. Apparently, therefore, there was some slight difference in the optical rotatory power of the resin in this sample.

Saponified and treated in the same way, it gave the following results:—

Volatile Oil	9·2 per cent.
Alpha Resin	81.0 ,,
Gamma Resin	6·0 ,,
Benzoic Acid	traces
Impurities—ash	1·4 ,,
Woody fibre	2·0 ,,
	99·6 ,,

The sp. gr. of this sample was 1052, or rather higher than the old one.

A third sample of very similar appearance was procured in London from another source. This was probably old, although perhaps not so old as the first sample above referred to.

The sp. gr. was 1043. The rotation in the polariscope was practically identical with the first sample. The analysis showed, however, a larger percentage of volatile oil, viz.,

12·1 per cent., and it contained a mere trace of ash and a smaller proportion of impurities. This, which was to all appearance a genuine sample, was evidently more carefully collected.

A fourth sample, also purchased from a London wholesale house, was obviously a spurious one, and I record its characteristics here simply to enable such samples to be distinguished. In colour, appearance and smell it closely resembled Canada balsam; it was softer and far more tenacious than genuine Chian Turpentine, so sticky, in fact, that it was with difficulty it could be removed from the fingers. When a portion was rubbed on the hand the smell was extremely pungent and persistent. The sp. gr. was 1000 or exactly identical with water at 60° F. In connection with this, it should be borne in mind that the sp. gr. of Canada balsam is less than water, some samples being as low as 970. Its rotatory power in the polariscope was 6°·15′ for a 20 per cent. solution in a tube 200 m.m. long; that is, it was only about two-thirds of the rotation of the genuine samples. It yielded about 26 per cent. of volatile oil, or more than twice that contained in the genuine samples, and the rotation due to the volatile oil was 3° 36′, leaving only 2° 39′ due to the rotation of the resin, or less than half that of the genuine samples. The solubility in alcohol, ether, chloroform, petroleum spirit, naphtha, bisulphide of carbon, and turpentine showed no difference from the genuine samples which was capable of being used for discrimination. It appeared to contain about 70 per cent. of a resin which corresponded in some respects to the alpha resin found in the genuine samples, but was of a darker colour, and formed a much harder and more brittle soap, while I could not detect the slightest trace of benzoic acid. My opinion is that this sample was mainly a mixture of Colophony and Canada balsam.

It appears most probable that the Chian turpentine, described as Cyprian or Syrian, or Chio, in *Watts' Dictionary*, p. 920, was a sample of this kind, for the description there states, among other things, that it was viscid, and had an aromatic taste like that of mastich, both of which statements correspond exactly with this spurious sample, but are incorrect as regards the genuine samples first referred to.

NOTES ON CREAM OF TARTAR.

By Alfred H. Allen.

Read before the Society of Public Analysts, on 14th April, 1880.

Crude tartar or argol is well-known to be a crystalline crust deposited during the fermentation of grape juice. It consists largely of acid potassium tartrate, but if plaster be used in the manufacture of the wine, the tartar contains a large proportion of calcium tartrate.

Cream of tartar is generally admitted to be a preparation obtained by boiling crude tartar or argol with water, filtering, and crystallising the salt from the clear liquid. The term "cream" of tartar is derived from the fact that during the evaporation of the liquid the salt is deposited in white crystalline crusts on the surface of the solution.

Cream of tartar thus obtained consists chiefly of potassium hydrogen tartrate, $KHC_4H_4O_6$. All commercial samples contain more or less tartrate of calcium, which, though nearly insoluble in pure water, dissolves with moderate facility in a hot solution of acid tartrate of potassium.

According to the *British Pharmacopœia*, cream of tartar is a synonym for the acid tartrate of potosh, but the solution in hydrochloric acid is admitted to be "rendered slightly turbid by oxalic acid" after neutralization by ammonia.

According to Pereira, cream of tartar "contains from two to five per cent." of calcium tartrate. All the specimens which Thomson examined contained "rather more than five per cent." Stillé and Maisch say, "The amount of tartrate of calcium contained in *crude* tartar varies between 5 and 15 per cent."

According to R. Warington—a high authority on this subject—the proportion of tartaric acid existing as neutral tartrates in refined tartars varies from one and a-half to seven per cent. Taking these amounts as calcium tartrate, we may say that the proportion of that salt existing in cream of tartar is, according to Warington, from 2·0 to 8·8 per cent.

In my capacity of Public Analyst, I have recently received from inspectors 14 samples of cream of tartar which have been considered genuine. These were obtained at various small towns and villages in Derbyshire and the West Riding of Yorkshire, and their purchase extended over some ten months. As one of the tests of purity, I am in the habit of igniting a known weight of the sample, boiling the residue with water, filtering, and again igniting the residue. This last product, when moistened with carbonate of ammonium, consists essentially of calcium carbonate. If the original cream of tartar was pure, it should dissolve completely in hydrochloric acid, or leave merely a faint trace of residue. Evidently its weight represents the calcium in the original sample, and if the amount be multiplied by the factor, 1·88, we obtain a very fair estimate of the proportion of calcium tartrate originally existing in the sample. In the fourteen samples referred to, the highest percentage of "insoluble ash" (= $CaCO_3$) found was 6·46 per cent., the next being 6·36, and no other above 4·68. The lowest amount was 2·60, and the mean of the whole fourteen was exactly four per cent. Multiplying these numbers by 1·88 we find that the highest amount of tartrate of lime met with was 12·14 per cent., the lowest 4·89 per cent., and the average 7·52 per cent. In the case of the two samples yielding 6·46 and 6·36 per cent., of insoluble ash, I ascertained the amount of matter left on boiling the original sample with water, and found 3·15 and 3·35 per cent. respectively. These residues, insoluble in water, were soluble in hydrochloric acid, and, as far as my notes go, appear to have consisted of calcium tartrate. Hence, if 3·15 be substracted from 12·14 per cent., we have a remanet of nine per cent. legitimately present as a soluble constituent of the cream of tartar.

The following table shows the proportions of calcium tartrate present in cream of tartar, according to different observers :—

	Neutral Calcium Tartrate. $CaC_4H_4O_6$.
Pereira	.. 2 to 5 per cent.
Thomson	.. 5 to 6 ,,
Warington	.. 2 to 8·8 ,,
Vauquelin	.. 5 to 7 ,,
Paul	.. 1 to 10 or 12 per cent.
Allen	.. 4·9 to 9 per cent.

In contradistinction to the above results, on September 24th, 1879, at Chertsey Petty Sessions, Mr. William Hodgkinson, of Aldersgate Street, when under examination as a witness for the defence of a druggist who had been prosecuted for selling cream of tartar obtained from Messrs. Hodgkinson & Co., is reported to have stated that—

1. "Cream of tartar was sent to this country from Spain and France, and came in a state that was known as argol."

2. "The article sent to Mr. Boyce (the defendant) was the very finest that could be obtained."*

3. "Argol, or cream of tartar, was the natural product of the fermentation of the juice of the grape."

4. "It was impossible to have cream of tartar without tartrate of lime, and he was informed from the best authority that it was generally found in quantities from 10 to 20 per cent., and the lowest he had ever heard of was 7 per cent."*

5. "He could not account for the very small amount of baryta being with the drug, but had seen it with cream of tartar before."

In the course of a correspondence in the *Pharmaceutical Journal*, which arose out of the above evidence, Dr. Redwood wrote:—"The cream of tartar alluded to by Mr. Hodgkinson, was represented by the grinder as having been obtained by the delivery order for 'cream of tartar in its crude state,' which, of course, means the usual roughly crystallised cream of tartar, a very different thing from crude tartar or argol."

Here then we have a general consensus of opinion that cream of tartar contains a *maximum* amount of nine or ten per cent. of calcium tartrate, and is distinct from argol; while, on the other side, Mr. Hodgkinson stands alone with his evidence that cream of tartar and argol are identical, and that the former contains a very considerable proportion of calcium tartrate.

With a view of ascertaining by direct experiment how far calcium tartrate could exist normally in cream of tartar, I have instituted the following experiments:—

Pure calcium tartrate was prepared by precipitating calcium chloride by neutral sodium tartrate prepared from pure tartaric acid and carbonate of sodium. The analysis of the salt showed that it was strictly neutral in composition.

Pure potassium hydrogen tartrate was prepared by dividing a solution of pure tartaric acid into two equal portions, neutralising one with potassium carbonate, and adding the other.

Weighed quantities of the last product were dissolved in known measures of boiling water, an excess of moist tartrate of calcium added, the liquid boiled for a short time, filtered boiling hot, and the crystals of cream of tartar deposited on the cooling of the filtrate were analysed. In this manner, products were obtained which contained as much calcium tartrate as would dissolve in the measure of boiling solution of tartrate of potassium employed. The only variable condition was the proportion of water used.

It was not found practicable to dissolve the acid tartrate of potassium in fifteen times its weight of boiling water. Hence 1 in 25 was the strongest solution employed. The following are the percentages of insoluble ash and anhydrous neutral tartrate of calcium contained in the different products:—

	Proportion of water used.	Insoluble Ash × 1·88 = $CaC_4H_4O_6$.
1.	25 parts	.. 3·10 per cent. .. .. 5·82 per cent.
1A.	25 ,, ...	.. 3·28 ,, ... 6·16 ,,
2.	50 ,, ...	.. 3·40 ,, ... 6·39 ,,
2A.	50 ,, ...	.. 3·30 ,, ... 6·20 ,,
3.	75 ,, ...	.. 4.40 ,, ... 8.27 ,,
3A.	75 ,, ...	.. 4.80 ,, ... 9.02 ,,

* Notwithstanding Mr. Hodgkinson's evidence, it is satisfactory to know that before the above case (selling cream of tartar containing 11·7 per cent. of tartrate of lime, and 0·6 per cent. of $BaSO_4$) was heard, his firm supplied to a Sheffield pharmacist a highly satisfactory article, containing barely seven per cent. of tartrate of calcium, and no trace of barium sulphate.

From these results, obtained in my laboratory by Mr. W. F. Cocker, it appears that the proportion of calcium tartrate contained in cream of tartar is greater the larger the proportion of water used for solution. The proportions of calcium tartrate are not always strictly constant even under apparently similar conditions. An additional experiment was made by evaporating, at a boiling temperature, a solution in 50 parts of water, and skimming off the crystals from the surface as fast as they formed. The product so obtained contained 6·8 per cent. of calcium tartrate.

The above experiments clearly show that, with such a proportion of water as is likely to be used in practice, the product will not contain more than nine or ten per cent. of calcium tartrate, and this conclusion is fully confirmed by the general experience as to the composition of cream of tartar. One or two per cent. in excess of ten may be allowed as a margin, but it may be safely concluded that any sensibly greater proportion of calcium tartrate is not a normal constituent of the sample.

The higher amounts of calcium tartrate occasionally found in cream of tartar are, doubtless, due to adulteration by compounds of calcium. Sophistication by chloride of calcium is said to have occurred, and there are authentic cases of adulteration by chalk and marble. In a cream of tartar sold near Pontefract, I recently found 20 per cent. of sulphate of calcium* (anhydrous), probably added as plaster of Paris, and in a recent instance in America, as much as 75 per cent. of *terra alba* is reported to have been present.

I believe that in many cases in which a high percentage of calcium tartrate has been found, sulphates were also present, and hence the calcium tartrate did not exist wholly in that form in the sample, but was the result of a double decomposition on treating the cream of tartar with water.

In the sample in which I found 20 per cent. of calcium sulphate, there was also 2·3 per cent. of sulphate of barium. In a case at Huddersfield, Mr. Jarmain found the same impurity in the form of crystalline heavy-spar, and in many other cases small proportions of barium sulphate have been met with. Dr. Redwood suggests that the sulphate of barium may arise from the *yeso*, or Spanish earth, used for plastering wine. He appears to ignore the fact that barium sulphate is an insoluble body. Other apologists for its presence have suggested that it has its origin in the stones employed for grinding the drug. On this point I feel I cannot do better than quote an editorial which appeared in the *Pharmaceutical Journal* for November 22nd, 1879 :—

"The weight of cream of tartar ground by one pair of stones will sometimes amount to 15 or 20 tons in a month, and if only one per cent. of sulphate of baryta was introduced into the powder by the abrasion of the stones, they would very soon cease to exist as stones, since they do not weigh more than five or six hundredweight each.† On the contrary, the fact is, that these stones wear down very little, and last a very long time. But there is another point of evidence especially conclusive as to the origin of the sulphate of baryta in cream of tartar, and this is the fact that by shaking a cask of cream of tartar crystals in such a manner as to make all the dust settle down to the bottom, almost all the sulphate of baryta will be found in this dust; in one instance that lately came within our knowledge

* This was calculated from the sulphates. The calcium was considerably in excess of that corresponding to the above amount of calcium sulphate.

† And how much silica would the cream of tartar contain?

the amount was no less than 45 per cent. There is, therefore, reason to believe that the adulteration of cream of tartar with heavy spar is systematically practised, and that it is probably carried out by throwing a handful of the coarse powder here and there into the casks while they are being packed." A very probable origin of the sulphate of barium in ground cream of tartar is the objectionable trade practice of requiring the grinder to return ground material of the full weight of the article sent to him for reduction, thus compelling him to make up the inevitable loss of weight in some way.

LAWS OF WISCONSIN.

The following is an Act passed by the State of Wisconsin.

AN ACT to prevent the adulteration of food and medicine, and provide for analysing the same. The people of the State of Wisconsin, represented in senate and assembly, do enact as follows:—

Section 1. The governor of the state shall appoint one of the professors of the state university of sufficient competence, knowledge, skill and experience, as state analyst, whose duty it shall be to analyse all articles of food or drink, and all drugs and liquors manufactured, sold or used within this state, when submitted to him as hereinafter provided. The term of office of such analyst shall be three years from his appointment, unless sooner removed by the appointing power, and his compensation shall not exceed two hundred dollars in addition to his annual salary as professor, and shall be paid by the board of regents of the state university, from the university fund.

Section 2. The state board of health and vital statistics, medical officers of health, inspectors of weights and measures, boards of supervisors of any town, boards of trustees of any village, alderman or common council of any city in this state, or a majority of said corporate bodies, may, at the cost of their respective corporations, purchase a sample of any food, drugs or liquors offered for sale in any town, village or city in this state, in violation of sections numbers one, two and four of chapter two hundred and forty-eight of laws of A. D. 1879, or if they have good reasons to suspect the same to have been sold or put up for sale contrary to the provisions of said chapter two hundred and forty-eight, may submit the same to the state analyst as hereinafter provided, and the said analyst shall, upon receiving such article duly submitted to him, forthwith analyse the same, and give a certified certificate to such person or officers submitting the same, wherein he shall fully specify the result of the analysis.

Section 3. Any person purchasing any article with the intention of submitting it to an analysis, shall, after the purchase shall have been made and completed, forthwith notify the seller or his agent selling the same, of his or their intention to have the same analysed by the state analyst, and shall offer to accompany the seller or his agent with the article purchased to the town, village or city clerk of the place in which the article was bought, and shall forthwith remove the article purchased to the office of said clerk, and in the presence of the seller or his agent, if present, divide said article into two parts, each to be marked, fastened and sealed up in such a manner as its nature will permit. The said clerk shall forthwith forward one part to the state analyst by mail, express or otherwise, as he shall elect, and shall retain the other part or package subject to the order of any court, in which proceedings shall thereafter be taken. The certificate of the state analyst shall be held in all the courts of this state as *prima facie* evidence of the properties of the article analysed by him.

Section 4. If any person applying to purchase any article of food, drug or liquor exposed for sale or on sale by retail on any premises in any town, village, or city in this state, and shall tender the price of the quantity which he shall want for the purpose of analysing, not being more than shall be reasonably required, and the person exposing the same for sale shall refuse to sell the same, such person so refusing to sell shall be liable to a penalty not exceeding fifty dollars.

Section 5. The state analyst shall report to the state board of health and vital statistics the number of all the articles analysed, and shall specify the results thereof to said board annually, with full statement of all the articles analysed and by whom submitted.

Section 6. The state board of health and vital statistics may submit to the state analyst any samples of food, drugs, or drink for analysis as hereinbefore provided.

Section 7. This act shall take effect and be in force from and after its passage and publication.

Approved March 15, 1880. (Published March 26, 1880.)

REVIEWS.

Sewage Disposal.

By Henry Robinson. Spon & Co., Charing Cross.

It is very uncommon to find an author write a book on Sewage Disposal without expressing some very pronounced opinons in favour of one system or another, but in this case our author appears to think that all systems may be used in certain cases, and says, "Where suitable land is available I advise irrigation, but where such is not the case I employ chemical treatment, either in aid of land where too little is obtainable, or as a substitute for it altogether where it cannot be obtained." The same impartiality is carried through the whole book, for the only instance in which the author shows any preference for one process rather than another, is where he says that on one occasion he held an interest in a patent for the use of proto-sulphate of iron in combination with sulphate of alumina, but that his interest has since been given up. The Rivers Pollution Commission Report, and most of the other publications on the sewage question have been freely drawn on for the information contained in the work, and the sources of the information acknowledged. There is but very little novel matter in the book, but, as a short and convenient compendium of what has been done, and entirely devoid of personal idiosyncrasies, it may fairly be recommended for all who want such a manual at hand.

Potable Water.—How to form a Judgment on the Suitability of Water for Drinking Purposes.

By C. Ekin. Churchills, New Burlington Street.

This little *brochure* of only 25 pages scarcely justifies its title. It is a collection of a fair number of tolerably well-known facts and statistics, combined with a general review of a part, but only a part, of the best processes used by leading analysts for the analysis of potable waters. Comparatively small reference is made to anything except organic matter, and in reference to this the figures quoted are mainly the results of Dr. Frankland's analyses, although the author evidently differs very greatly from Dr. F. in the deductions drawn, since he gives a separate table of some waters classed as unpolluted by the Rivers Pollution Commission, "whereas in reality they are polluted." The book does not give instructions for forming a judgment as to potable water, because it omits all reference to the results of the microscopical examination, and those physical tests which throw so great a light on the previous history of most waters. Still, as far as it goes, it will be a handy book of reference.

ANALYSTS' REPORTS.

Dr. Alfred Hill, Public Analyst for Birmingham, in his quarterly report states that he examined 43 samples during the first quarter of the year, comprising 26 milks, six beers, six teas, four flours, one butter; and that no fewer than 23, or 89 per cent., of the milks had been more or less adulterated, or deprived of some of their cream.

Dr. Hodges, Public Analyst for Belfast, reports that during the past quarter he examined 61 samples, and of these 12 milks were adulterated by the addition of water, and two samples of quinine wine contained merely traces of quinine. Eight parties were fined in the sum of £22 5s. for selling adulterated milk.

Mr. James Baynes has been appointed Public Analyst for the Borough of Beverley, *vice* Dr. Procter, deceased.

LAW REPORTS.

When Sample not divided by Inspector, the portion not used by Analyst should be sealed up in Inspector's presence :—

At Belfast, David McGown, farmer, Ballygowan, was summoned for having sold adulterated buttermilk on the 20th February. Mr. M'Lean, who conducted the prosecution, said the Town Council were very much interested in cases of this kind, as a decision had been given the previous week in that court which was entirely at variance with the decisions given during the past six years. In fact, if the decision referred to stood good, there would be no use whatever in the sanitary officers buying milk and getting it analysed. So strongly did the Council feel on the point, that they intended to have the case tried in a superior court should a similar decision be now given. He then read the different sections of the Act bearing on the case. One of the sections provided that, at the time the milk was purchased, the purchaser should divide the milk into three parts if asked by the seller to do so. One of these parts was to be handed to the seller, another to the analyst, and the third to be kept by the sanitary officer. Should the seller require this not to be done, another section provided that the local analyst was to take one part of the sample for the purposes of analysis, and to seal the remainder up in order that it might be sent to Somerset House for analysis if required. Sanitary Officer Anderson deposed that he purchased a pint of buttermilk from the defendant on the 20th February last. He informed him for what purpose he wanted it, and asked him if he wished to keep part of it. The defendant replied that he did not. Witness then sealed the sample up in a bottle, and afterwards brought it to Dr. Hodges, who took out of the bottle what he required for analysis. He then sealed up the remainder in witness's presence, and handed it back to him when he gave the certificate. The certificate stated that the milk contained 51 per cent. of added water. Mr. O'Donnell (magistrate) said that when the decision was given on the previous occasion, he was not satisfied that the analyst had sealed up a portion of the sample for further analysis by the officers at Somerset House if required. Defendant was fined £5. Mr. M'Lean said the defendant was a poor man, who held six acres of land, and so heavy a penalty might ruin him. The Bench, however, declined to mitigate the penalty. Agnes Steed was summoned for a similar offence. Mr. M'Lean, sen., prosecuted, and Mr. Harper appeared for the defence. It was proved that the defendant had sold sweetmilk containing 31 per cent. of added water, and their Worships imposed a fine of £5. Mary Ann Jamison and James Hughes for similar offences, were each mulcted in a like amount.

Inspectors may Purchase Samples by Deputy.—Queen's Bench.—Judgment :—

The case of Horder *v.* Scott was heard in the Queen's Bench Division, before Justices Lush and Field, on the 4th May. It was an appeal from the decision of the justices in petty sessions at Bushbury, in the county of Staffordshire. The appellant was represented by Mr. Jelf, Q.C., and the respondent was not represented by counsel. Agnes Scott, the respondent, was charged before the magistrates upon a summons taken out by John George Horder, of Lichfield, inspector of weights and measures, and inspector under the Food and Drugs Act for one of the districts in South Staffordshire—that she, in the parish of Bushbury, did sell to one Samuel Toy, coffee that was not in nature, substance, and quality the article demanded by such purchaser. The magistrates dismissed the summons, and in the case stated by them for the opinion of the Queen's Bench they recited the facts to be the following:—Samuel Toy testifies that he is assistant to Mr. J. G. Horder, and on his behalf he went on December 27th last to the shop of the respondent about 10 a.m., and purchased two ounces of coffee. Mrs. Scott asked him if he wanted the best, and he said "Yes." She charged him 2½d. for the commodity. He thereupon told her that he had bought it for the purpose of having it analysed, and she then told him that it was a mixture of coffee and chicory. Mr. Horder was not present, but he delivered the article to him at Wolverhampton, and he had it analysed. The substantial question, said Mr. Jelf, was whether an inspector can act by a deputy; and there was also a question whether, on the information in the form in which it was laid, there could be a conviction. Mr. Justice Field: What do you mean by an assistant? Is it shown what the terms of his employment were? Mr. Jelf: No; we know nothing of that except that he was his assistant. Of course, I am to argue that the inspector may act by an assistant. Mr. Justice Field: You explain. We know what an inspector is, but we do not know what an assistant is. Is it anything more than—"I went by order of Horder to buy"? Mr. Jelf: If he did that, there would be an acting by deputy under this statute. That is a point of very great importance, because the Act in many districts would be unworkable, from the fact that an inspector cannot be everywhere. There is the question whether the form of the information ought to have been taken out by Toy himself, treating him as the purchaser; or whether, if the matter was taken up by the inspector, he ought not to have been named as the purchaser. Mr. Justice Field: If I send my servant to purchase a pound of sugar, do I purchase or my servant? Mr. Jelf: It may be considered as a purchase by either. I have some difficulty in being quite certain about that. Mr. Justice Field: Then a seller is liable to two people? Mr. Jelf: He would not be liable for two offences. Mr. Justice Field: Is that so? If I send half a dozen servants, is the seller answerable for each? Or the servant of ten people,—are all the ten people purchasers within the meaning of the Act? Mr. Jelf thought that the persons who are masters would be within the meaning. Mr. Justice Field: Relative to the seller the servant is the purchaser. Mr. Jelf contended that an official purchaser may act under the statute, by the provisions of Section 13. Section 12 provides that any purchaser of an article of food should be entitled on payment to a Public Analyst of 10s. 6d., or to any other analyst of such sum as may be agreed upon, to have the article purchased analysed, and a certificate of analysis given. Therefore any ordinary individual might put the Act in motion; and, by Section 13, the inspector comes upon the scene. It provides that any inspector "may procure" (he called the attention of their Lordships to this, as being larger than "buy" or "purchase") any sample of food or drugs, and if he suspect the same to have been sold to him

contrary to any provision in the Act, he could submit it for analysis to the analyst of the district. Mr. Justice Lush at this point remarked: I do not think we need trouble you any further, Mr. Jelf. I am of opinion that the magistrates are mistaken in the conclusion to which they have arrived. This question turns upon Sections 13 and 14. Section 13 says any inspector may procure any sample of food and shall submit the same for analysis. Their Lordships conferred a moment, and Mr. Justice Lush stopped delivering judgment, observing: My brother calls my attention to the form of the summons. It is alleged to be a sale to the prejudice of Toy, the purchaser. Mr. Jelf: I said there were two questions, one of which was a question of fact. Mr. Justice Lush: If it had been alleged to be to the prejudice of the inspector I could not have had a moment's doubt. Mr. Jelf: I think I can satisfy your Lordships as to that. Mr. Justice Field: Then go on. Mr. Justice Lush: That is the only question in my mind; but is not that amendable? In order to settle this legal difficulty the further argument was adjourned. In the afternoon Mr. Jelf resumed the discussion, contending that, under Jarvis's Act, the duty of the magistrates with reference to the form of the information and summons is that they are not to allow a variation between the information and the evidence to affect the matter, unless they think that the parties will be in any way injured or prejudiced thereby, and that then they may grant an adjournment. Mr. Justice Lush interrupted the argument by asking when the case came on, and finding that it was at the close of last year he observed that it would come under the statute passed last year, and that that would get over the difficulty. He accordingly proceeded to give judgment. The magistrates were wrong, and the case must go down to them again. It was true that Toy was an agent of the inspector, and bought the coffee as an agent, and not for his own use, but for the purpose of analysis. Before the Act of last session there was a difference of opinion in this country and in Scotland about the meaning of that particular clause; but then the Act of last session took away all the difficulty arising from that construction. It provided that if any prosecutor under the provisions of the principal Act shall obtain any article of food, and have it analysed, it shall be no defence to such prosecution to allege that he having bought it only for analysis is not prejudiced. Toy might be considered therefore as an ordinary purchaser, as a man who went in and ordered the best coffee, and, it being supplied to him as best coffee, it turned out to be, one-half chicory. On the hearing it appeared that he had been sent by the inspector. He gave due notice to the seller. He delivered the coffee to the inspector, and the inspector sent it to the analyst, and the analyst reported upon it, and that was on the evidence in favour of the prosecution. The magistrates, however, considered that as the proceedings were initiated by the inspector in his official capacity, he having laid the information, and having regard to Sections 13, 14, and 17 of the Act, should personally have purchased the article. He thought they were entirely wrong in that. It did not signify whether the inspector purchased by his own hand or purchased by his agent. Then the magistrates held, secondly, that Samuel Toy, being the purchaser and not the inspector, should have submitted the article to the County Analyst. There, again, he thought the magistrates were wrong. He thought they mixed up the procedure under the Act with the substance of the offence itself. Section 13 of the Act says that any purchaser of an article of food may require or may have the services of an analyst to have the article analysed, and receive a certificate of the analysis. The next section says that any inspector who purchases is bound to take cognisance—it is a duty on his part; the ordinary purchaser may or may not, if he pleases; but that is only a mode of ascertaining the genuineness of the article. As between Toy and the seller, Toy was the purchaser. It would have been equally good to have described the inspector as the purchaser. Toy delivered the coffee over to the inspector, and he handed it to the analyst. That is what any person would have a right to do if he had no connexion with an inspector. If the thing was properly analysed, it does not signify through whose hands the article was bought. Therefore, when the magistrates held that Toy, being the purchaser, the information was bad because laid by the inspector, their decision was wrong. Then, thirdly, the magistrates said that the mode in which the article was bought was not in accordance with Sections 12 and 14. Now, Section 12 simply says that the purchaser may take it to the analyst; but what did that matter? It was merely a mode of ascertaining the quality of the article; and Section 14 provides that the purchaser must give notice to the seller. That Toy did. After the article was bought, the seller said, "You have got chicory among it;" but that did not come within the protective clauses of the Act, because the Act says that a person selling an article shall not be guilty of any offence, &c., if he shall at the time of delivery of the article supply to the person receiving the same, notice by a label distinctly written on or printed with the article, to the effect that it is a mixture. It was therefore clear the case must go back to the magistrates, with the intimation from the Bench that their objections were not tenable, and that the case must be decided on its merits. Mr. Justice Field was of the same opinion, and thought it would be inconvenient if the case were decided otherwise, because clearly inspectors cannot be everywhere in their districts, and must require assistance. Order made accordingly but without costs, as the respondent did not appear.

Exact Words of Act must be used by Purchasers:—

At the St. Columb Petty Sessions, E. Henwood, of the Cornish Arms Inn, was summoned for adulterating beer with salt. Mr. J. R. Collins, of Bodmin, defended. It was proved upon the certificate of the County Analyst, Mr. J. H. Collins, of Truro (not related to defendant's solicitor), that the beer contained 74 grains of common salt per gallon, whereas no beer ought to contain more than 25 to 30 grains per gallon. Supt. Marshall, in his evidence, stated that when he asked the defendant's wife for the beer he told her he "intended to have it analysed." Mr. Collins contended that as the superintendent did not say the analysis was to be made "by the Public Analyst"—the words of the section—no conviction could take place. Supt. Marshall replied that he did use those words. Mr. Collins held that the bench must take the evidence as it was given; and the bench taking this view dismissed the case. The chairman, however, said that the decision was against the better judgment of the bench and refused the defendant's costs.

NOTES OF THE MONTH.

The Lewisham Board of Works has been reckoning up the cost of the Adulteration Act, and it finds that since 1873 its expenses have been £718; or, in other words, the enormous sum of £100 per annum spent to secure a pure food supply in the district. Naturally an immense outlay like this startled the board, and they thought it most unsatisfactory, especially because during all the seven years they had only caught 67 offenders, and they forthwith proceeded to propose the cutting down of the salary of their unfortunate analyst, because, apparently he could not make good things bad. We do not know whether the board ever dines at the expense of the rates, but if it does so, then £100 a year would be nothing for that purpose, of course, although £100 a year for the protection of the ratepayers is of course dreadful, and ought to be at once put down!

Had the board stopped here it would not have been much matter, but they proceeded to decide to trouble the other vestries with their nonsense, and spend money in sending copies of this report to all the Metropolitan Boards, asking them each to count up their costs, and have a conference on the subject, so spending more money, although with what object is not clear. Surely no money is better spent than that expended by the sanitary committees of the various vestries, and even if it ends in comparatively few "cases" being obtained, that should be a matter of congratulation, because it shows the food purveyors of the parish to be honest men, desirous of selling an honest article, and that the nuisances and other sources of disease are reduced to a minimum. Money is spent by the vestries—not to obtain the greatest number of convictions—but to act as a deterrent against fraud, and if that end be obtained, the happiest parish is that in which the fewest "cases" can be got, always supposing, of course, that the inspectors of nuisances really do their duty.

A most important decision has been recorded in the High Court of Justice, which our readers will find fully printed elsewhere. We hope that the attention of inspectors, and sanitary committees, under whose direction they act, will be given to this case, because one great difficulty is that the inspector may be watched, and the milk watered while he is safe in another part of the parish. If, however, some temporary deputies be employed, taking care to change them each time, no adulterator could ever say he was safe, even for an hour, and milk businesses would not be found to be so lucrative an investment as they are at present, according to the *Provisioner*, which states that some have been lately fetching the enormous sum of £8,000. We have heard of one district in which an intelligent woman, nicely got up with a neat market basket to hold the bottles, and a jug on her finger, did wonders in one day with the inspector following her, taking the filled bottles and giving her three empty ones after each transaction.

Here is an advertiser hoist on his own petard in an amusing manner: "Sausages that will keep sweet for some days during the hottest weather can be made with the aid of ———'s Food Preserver, at a cost of *not less* than a halfpenny a pound."

As will be seen from the reprint on another page, the State of Wisconsin has passed an Act to prevent adulteration, and it is very pleasing to find that it follows so closely the lines laid down by the English Act.

BOOKS, &c., RECEIVED.

Water Analysis, by Dr. Frankland; Supplement to a Handbook of Chemical Manipulation, by C. Greville Williams; Manual for the Physiological Laboratory, by Harris and Power; The Chemist and Druggist; The Brewers' Guardian; The British Medical Journal; The Medical Press; The Pharmaceutical Journal; The Sanitary Record; The Miller; Journal of Applied Science; The Boston Journal of Chemistry; The Provisioner; The Practitioner; New Remedies; Proceedings of the American Chemical Society; Le Practicien; The Inventors' Record; New York Public Health; The Scientific American; Society of Arts Journal.

Owing to the pressure on our space this month, we are obliged to omit several articles already in type, including one by Mr. Carter Bell, "On the Manufacture of Citric Acid."

THE ANALYST.

JULY, 1880.

SOCIETY OF PUBLIC ANALYSTS.

A GENERAL MEETING of this Society was held at Burlington House, on Wednesday, 2nd June, the President, Dr. Muter, F.C.S., in the chair.

The Scrutineers having examined the voting papers reported that Mr. J. J. Eastick, Analyst to Fieldgate Sugar Refinery, had been elected as a Member.

The following gentlemen were proposed for election as Members:—

S. A. Goldschmidt, Ph.D., F.C.S., Analyst, of New York.

J. Blake White, M.D., Analyst to Health Department, New York.

The following papers were then read and discussed:—

"On Means for Increasing the Certainty of Perception of Colour Change in Various Titrations," by Dr. Dupré.

"On the Determination of Organic Carbon in a Water Residue," by F. P. Perkins.

"Note on the Analysis of some Samples of Chian Turpentine," and "On the Relation of the Scale of Baume's Hydrometer for Liquids Heavier than Water to the Specific Gravity," by G. W. Wigner.

"On Phosphoric Acid in Potable Waters," by O. Hehner.

NOTE ON A SIMPLE MEANS FOR INCREASING CERTAINTY OF PERCEPTION OF COLOUR CHANGE IN VARIOUS TITRATIONS.

By A. DUPRÉ, Ph.D., F.R.S.

Read before the Society of Public Analysts, on 2nd June, 1880.

As is well known, the change from pale yellow to red, in the titration of chlorides by means of nitrate silver with neutral chromate as indicator, is more distinctly perceived by gaslight than by daylight. No doubt eyes differ in regard to their power of perceiving slight variation of colour tint, and in my case I have always found it advisable, in the analysis of potable waters, containing from one to two grains of chlorine per gallon, considerably to concentrate by evaporation previous to titration, or else to perform the tritation by gaslight. The adoption of the following simple plan enables us, however, to perceive the change of colour as sharply and with as great a certainty by daylight as by gaslight.

The water is placed into a white porcelain dish (100 c.c. are a useful quantity), a moderate amount of neutral chromate is added (sufficient to impart a marked yellow colour to the water), but instead of looking at the water directly a flat glass cell containing some of the neutral chromate solution is interposed between the eye and the dish. The effect of this is to neutralize the yellow tint of the water, or, in other words, if the concentration of the solution in the cell is even moderately fairly adjusted to the depth of tint imparted to the water, the appearance of the latter, looked at through the cell, is the same as if the dish

were filled with pure water. If now the standard silver solution is run in, still looking through the cell, the first faint appearance of a red colouration becomes strikingly manifest, and what is more, when once the correct point has been reached the eye is never left in doubt however long we may be looking at the water. A check experiment in which the water with just a slight deficiency of silver, or excess of chloride, is used for comparison is therefore unnecessary. The plan is useful chiefly with very dilute solutions, one or two grains of chlorine per gallon, and since I have adopted it I have entirely given up the concentration of the water prior to titration formerly practised.

A similar plan will, I think, be found useful in other titrations. Thus, in the case of turmeric, the change from yellow to brown is perceived more sharply and with greater certainty when looking through a flat cell containing tincture of turmeric of suitable concentration than with the naked eye. The liquid to be titrated should, as in the former case, be placed into a white porcelain dish. Again, in estimating the amount of carbonate of lime in a water by means of decinormal sulphuric acid and cochineal, the exact point of neutrality can be more sharply fixed by looking through the cell filled with a cochineal solution. In this case, the following is the plan I have found to answer best. The water to be tested—about 250 c.c.—is placed into a flat porcelain evaporating dish, part of which is covered over with a white porcelain plate. The water is now tinted with cochineal as usual, and the sulphuric acid run in, the operator looking at the dish through the cell containing the neutral cochineal solution. At first, the tint of the water and the tint in which the porcelain plate is seen are widely different; as, however, the carbonate becomes gradually neutralized, the two tints approach each other more and more, and when neutrality is reached they appear identical; assuming that the strength of the cochineal solution in the cell, and the amount of this solution added to the water, have been fairly well matched. Working in this manner I have found no difficulty (taking ¼ litre of water) to come within 0·1 c.c. of decinormal acid in two successive experiments, and the difference need never exceed 0·2 c.c. In the cell I employ, the two glass plates are a little less than half-an-inch apart.

A somewhat similar plan may be found useful in other titrations, or in fact in many operations depending on the perceptions of colour change.

ON THE DETERMINATION OF ORGANIC CARBON IN A WATER RESIDUE.

By Frank P. Perkins.

Read before the Society of Public Analysts, on 2nd June, 1880.

In the *Chemical News*, for April 23rd, the second part of a paper by Mr. W. H. Perkin appeared, "On the Analysis of Organic Bodies containing Nitrogen," * and as we read it, it occurred to us that the means there proposed may very readily be applied, and with some advantage, to the determination of organic carbon in a water residue, rendering what is now a somewhat tedious operation less troublesome.

The determination of organic carbon by Dr. Frankland's method, undoubtedly elegant though it be, requires costly and easily deranged apparatus. That devised by Professor Dittmar—an account of which is to be found in the *Chemical News*, for July 20, 1877, and

* For the first part, see *Chemical News*, Dec. 26th, 1879.

also in *Frankland's Water Analysis*—while it does not require a special gas apparatus, has rather a complex arrangement of tubes, and scrupulous attention must be paid to every detail in order to obtain uniform results.

It is to this process we turn and endeavour to lessen the attendant difficulties.

As it now stands, the process is essentially this—the residue is burnt in a current of purified atmospheric air, in a tube containing cupric oxide and a copper or silver coil. Of the gases evolved during combustion those not broken up and absorbed in the tube pass on through—

1. A small V tube, containing chromic and sulphuric acids.
2. A tube filled with calcic chloride.
3. A small weighed soda lime tube, where the carbonic anhydride formed during the combustion of the residue is absorbed.

The preparation of the combustion tube takes some time, from the necessity, if copper be employed, of igniting the coil in hydrogen when first used.

But we now have a mixture which will do double work and enable us to dispense with the copper or silver coil inside the tube, as well as the chromic acid tube outside. The author of the paper referred to has found that a mixture of potassic chromate and dichromate, together with cupric or manganic oxide (precip.), will break up the nitrogen oxides, and at a lower temperature will also absorb sulphurous anhydride. Directions for preparing the mixture are given by Mr. Perkin.

In working, we have used both manganic and cupric oxide, and the cupric oxide has given the best results. Charge then a combustion tube of rather small bore and drawn out at one end, with the mixture, leaving room for the insertion of a platinum boat at its posterior extremity; let this end of the tube be connected with a bulb apparatus or a Woulffe's bottle, containing potash solution, and let its drawn-out portion be attached to the following arrangement:—

1. A U tube filled with calcic chloride, the outlet of which is bent downwards at a right angle.
2. A straight tube filled with calcic chloride, the inlet of which is bent downwards at a right angle.
3. A small U tube filled with soda lime, and made in the following way:—

A piece of glass tubing, about ¼ inch internal diameter, is drawn out at one end to a small neck. A loose plug of recently ignited asbestos is now inserted, pushing it up nearly close to where the tube begins to decrease in diameter. The tube is then bent into the U form, and after filling it with soda lime another asbestos plug is put in, and this end also drawn out. A short piece of caoutchouc tubing is slipped over each termination, and two stoppers of glass rod are fitted into the tubing.

The U tube is now ready to be weighed. The one we use weighs about 16 grammes. The place it is destined to occupy is between the two calcic chloride tubes, but before attaching it the purity of the combustion tube must be proved. This is done by connecting the two calcic chloride tubes by a piece of caoutchouc tubing and the further one with an aspirator, and then drawing a stream of air, purified by passing through the potash solution, through the apparatus, the combustion tube being heated the while. When the air has passed for a time the rubber tubing is taken off, and a U tube, containing a little clear baryta water substituted in its place; if it is not rendered turbid, the tube is ready to receive the residue.

All that now remains to be done is to turn off the gas from the furnace, to replace the tube containing baryta water, by the weighed soda lime tube, to introduce the platinum boat containing the residue into the combustion tube, to connect it again with the vessel containing the potash solution, and conduct the analysis in a stream of air in the usual way, taking care, however, not to heat strongly the front part of the combustion tube. When the combustion is over, the soda lime tube is disconnected, the little glass stoppers are again inserted, and it is weighed; the increase in weight gives the amount of CO_2 in the residue. In a few minutes the combustion tube is ready for another experiment, and may be used many times without further trouble. The following determinations will show the degree of accuracy attainable. A blank experiment gave an increase of 0·0005.

EXETER WATER SUPPLY.

From the Main.	*Experiment 1.*	Organic Carbon	0·218	per 100,000.
	Experiment 2.	Organic Carbon	0·272	
	Experiment 3.	Organic Carbon	0·164	

In 1870, the same water analysed by Dr. Frankland gave, when—

Drawn from the Works		O.C. 0·366	per 100,000.
Drawn from the Main		O.C. 0·202	
Experiment 4.	250 c.c. of water, taken from a well four weeks after it had been pumped out in consequence of a drain having burst into it, were evaporated with the usual precautions; the residue gave	O.C. 0·927	per 100,000.
Experiment 5.	500 c.c. of the same water gave ..	O.C. 1·09	

REPORT ON THE ANALYSIS OF VARIOUS TINNED FOOD PRODUCTS.

Second Paper.

By G. W. Wigner, F.C.S.

The interest taken in my last paper induces me to publish some further results. The subject grows rapidly in importance, for year by year the food producing power of England becomes less as compared with its food consuming power, while the rapid decrease in cost of transport by sea and land enables produce to be brought over distances of thousands of miles at a cost which is but small compared with the value of the commodity.

In my last paper* I reported on one brand of tinned roast beef and one of boiled beef, and five other articles. I will commence again with meat.

8. Corned Beef (St. Louis Beef Canning Company). These tins are of a peculiar truncated pyramidal shape, which seemed at first calculated merely to increase the labour of tin making, but when a tin is opened it is found that the shape is advantageous, as the meat readily leaves the tin as if from a mould. The tins are very full, more so indeed than any other I have opened, and this should assist in keeping the meat.

The results of my analysis were as follows:—

Moisture		52·23 per cent.
Albuminoid substances		25·44 ,,
Containing nitrogen	4·07	,
Fat		6·71 ,,
Ash		4·76 ,,

* Analyst, vol. v., page 99.

The ash contained—

Salt (Chloride of Sodium)	3·00 per cent.
Phosphate of Lime	·85 ,,

It is evident that the meat is only moderately salted; and, considering that it is absolutely free from bone, it contains a very good proportion of phosphates. The moisture is but little more than two-thirds that of raw beef—the fat is less than one-fourth, while the albuminoids are very nearly twice as high. Comparing all the figures, it is a fair estimate to place the dietetic value at nearly twice as high as boneless fresh beef, and about two and one-third times as high as average joints of meat with bone.

The flavour is good. In the smaller tins especially it forms a handy reserve for a cold breakfast or luncheon dish. As to the retail price it appears to vary between 8d. and 10d. per lb. Taking the higher figure, this would correspond to about 4½d. per lb. for good sound meat, a lower price than our poorer classes now pay for the trimmings and refuse of a butcher's shop.

9. Cooked Beef Tongue (St. Louis). This is sold in tins, which are very similar to the corned beef ones. As a breakfast dish it is, I think, one of the best of all these tinned goods that I have recently tried. It is certainly superior in this respect to the rolled and pressed tongues, so common, and is, in addition, much cheaper.

The analysis showed:—

Moisture		51·58 per cent.
Albuminoid substances		12·15 ,,
Containing nitrogen	1·92	,,
Fat		7·28 ,,
Ash		6·24 ,,
Chloride of Sodium in ash	4·94	,,

This is therefore less salted than the average of ordinary dried tongues, and contains more nutritive matter than they do. It is well packed, so that it keeps for some days after the tins are opened.

10. Tomatoes.—This seems a suitable article to consider with the meat and tongue. I have tried two brands, one Thurbers' and one a French make, with no name on. Both are preserved in water. At first it appeared that this was in excessive quantity, but the whole tin, when analyzed, showed 5·52 per cent. of solid matters. Church gives the solid matter of ripe tomatoes at 10·2 per cent., so that the added water was probably not more than was really needed to fill the tin up when it had been closely packed with the tomatoes. The flavour of most of these has proved excellent, and in no case has there been any objectionable taste.

11. Soup should, perhaps, have been treated of before meat, but that I have less to say about it. The difficulty I met with has been to find a sample sufficiently mild in flavour. I have tried some half dozen kinds, but all are too strong for my palate; otherwise, as foods, they are certainly nutritious and fairly concentrated; the best of them forming a stiff jelly when cold.

12. Succotash, a thoroughly American vegetable preparation. It consists of a mixture of Haricot beans, Lima beans, and Maize cooked in the tin, and then soldered up; there is also a little fat added. The tin wants simply heating in water before dishing.

The analysis showed :—

Water	74·58	per cent.
Albuminoid matters	3·60	,,
Containing nitrogen	·576	,,
Cellulose	1·66	,,
Ash	·75	,,

It is, therefore, a very good specimen of a boiled vegetable food, and a palatable change from our winter monotony of potatoes and greens.

There are several more analyses to report yet, but the space at my disposal is too limited for them this month.

RECENT CHEMICAL PATENTS.

The following specifications have been recently published, and can be obtained from the Great Seal Office, Cursitor Street, Chancery Lane, London.

1879	Name of Patentee.	Title of Patent.	Price
3697	A. M. Clark	Electric Lamps or Regulators	1s.
3750	H. J. Haddan	Electric Lamps or Regulators	8d.
3794	A. White	Apparatus Employed with Telephones	6d.
5535	Ditto	Telephones	6d.
3803	G. J. Wells	Manufacture of Caustic Alkalies	6d.
3804	W. J. Menzies	Manufacture of Caustic Soda, and Potash	6d.
3836	W. R. Lake	Production of Power from Bisulphide of Carbon	10d.
3938	Ditto	Manufacture of White Lead	6d.
3875	C. W. Harrison	Electric Lighting	6d.
4078	W. T. & J. Chadwick	Manufacture of Sulphate of Alumina	4d.
4087	J. H. Johnson	Manufacture of Aluminium and Magnesium	2d.
4122	R. Lancaster	Manufacture of Alkalies	2d.
4162	W. Cormack	Utilizing Spent or Acid Liquors	2d.
4221	A. Dupré	Manufacture of Sulphate of Potash	2d.
4253	A. J. Boult	Manufacture of Magnesia	4d.
4338	G. N. Tucker, &c.	Manufacture of Ammonia and its Salts	8d.
4402	W. F. Nast	Extracting Ammoniacal Salts	6d.
4405	A. V. Newton	Electric Lamps	6d.
4440	J. H. Hohnson	Telephones	2d.
4544	B. E. R. Newlands	Manufacture or Refining of Sugar	4d.
4637	W. Morgan Brown	Manufacture of Sulphate of Lime	6d.
4611	W. A. Barlow	Manufacture of Hydro-oxide of Carbon by the direct introduction of Liquid Protoxide of Hydrogen	6d.
4781	F. J. Bolton and J. A. Wanklyn	Manufacture of Artificial Manures and Ammoniacal Products	4d.
1880.			
810	J. Pattinson	Regulating the Explosion of Compounds containing Chlorate of Potash	2d.

HEHNER'S ALCOHOL TABLES.—We print this month the last pages of the Alcohol Tables, calculated by Mr. Otto Hehner, which we have been publishing month by month since March. Our subscribers will note that the paging is so arranged that it will bind with the March Number. The Tables have proved so useful, that Mr. Hehner has decided on publishing them separately in pamphlet form. They may be procured of Messrs. J. & A. Churchill, 11, New Burlington Street, W.

REVIEWS.

Nature's Hygiene—a series of essays on popular scientific subjects, with special reference to the Chemistry and Hygiene of the Eucalyptus and the Pine.

By C. T. Kingzett, F.C.S. London: Baillière, Tindall & Cox.

The author of this book must surely have enjoyed the writing of it as a huge practical joke; and the idea of getting people to buy a "series of essays on popular scientific subjects," and then leaving them to discover that they have purchased an ingenious advertisement for a disinfectant, called *Sanitas*, must have tickled him immensely. Seriously, from a scientific point of view, the book is altogether beneath criticism, unless we are to admit that all the labours of others on ozone were only mere preliminaries to the grand discovery of the author, which is to save mankind from all diseases, and consists in blowing air through turpentine and warm water, and then bottling and selling the product under an attractive name. In the whole book we find plenty of Andrews, Day, Pasteur and other authors, and towards the end we meet a little of Kingzett, but he is comparatively smothered in the sea of quotations necessary to aid the large and open type in turning the materials for a pamphlet into the size of a book. The concluding paragraph but one is delicious, and is as follows:—"It is possible to dwell very largely on this theme, but it is hoped that enough has been said and sufficient evidence brought forward to prove conclusively that among the processes of Nature's hygiene there are few more extensive or important than that by the study of which the author was led to the discovery of the disinfectant named Sanitas."

Alphabetical Manual of Blowpipe Analysis, showing all known methods, both old and new.

By Lieut.-Colonel W. A. Ross, late R.A. London: Trübner & Co.

The rapidly increasing notice which is being taken of this subject by British chemists has encouraged the author of *Pyrology* to publish another manual. The book is of a handy size, and a large mass of information is conveyed in its 145 pages, the whole being arranged under heads placed alphabetically in dictionary form. The work opens with a dedication to Prince Bismark, which perhaps somewhat too strongly exalts the intelligence of foreigners as compared with the author's own countrymen, and states how that, unable to obtain proper training in blowpipe analysis at home, the author had to seek it at Frieburg University. The book proper begins with a condensed scheme for a general course of examination, classified under the respective heads of the articles and re-agents used, and then the various special subjects are treated alphabetically. Among the most useful articles are those on the beautiful re-actions obtainable on the aluminium plate, an excellent table of the constitution of the alloys, and a very full but concise arrangement of the minerals under the head of their chief metallic constituents. The article on pyrochromes is also furnished with a concise, but very complete, table of coloured flames. Every practical point is well treated, and the directions are short, distinct and easily followed. The article directed to show how to distinguish between the true colour of sodium and the false yellow produced by perfectly clean wires, is good, and in it the author claims the superior accuracy of the blowpipe over the spectroscope for this purpose. To save space, certain abbreviations are employed, a table of which is given at the opening of the book: thus, we have H.P. for the reducing flame and O.P. for the oxidising one; but why we should have HS for H_2S is a mystery, and is a step in the art of abbreviation calculated more to confuse than to shorten.

The whole ends with a set of specimen exercises from the Frieburg course, and so that our readers may see whether the enormous advance in blowpipe work claimed for that laboratory over our native ones is altogether so great, we append the steps in order, as here shown, to be applied in an analysis of crystallized apatite:—

1. Agate mortar and boracic acid bead.
2. Potassium carbonate on aluminium plate and boil with water.
3. The dried residue in boracic acid bead (for Ca as chief base).
4. Specks of potassium carbonate to the same bead.
5. Potassium pyrotungstate (for phosphate).
6. Original with crystals of phosphoric acid in a glass tube (for fluorine).
7. Paste of powder on plaintum wire in inner flame and then on copper wire (for chlorine).

Taking the book as a whole, it will be found very useful for reference and a great aid to a chemist in rapidly obtaining a qualitative idea of the contents of any mineral he may receive for full analysis, and thus enabling a speedy decision as to the course of ordinary quantitative analysis it will be best to follow.

Manual for the Physiological Laboratory.

By Vincent Harris, M.D., and D'Arcy Power, B.A., Oxon.

Baillière, Tindall & Cox, King William Street, Strand.

This little book will be found very useful to medical students preparing for examination as an excellent "cram" on histiology and practical physiological chemistry. It is divided into three sections, the first being devoted to practical directions for hardening, staining and mounting tissues; the second to practical histiology of all the tissues and organs of the body; while the third deals with the chemistry and tests for the various albumens, peptones, and all other chemical compounds found in the various secretions of animals. Taking it as a summary, it is certainly very complete and concise, a good deal of information being compressed into the 125 closely printed pages it contains. Here and there we find an omission of something, the presence of which would be desirable; for instance, in the analysis of urinary calculi, where we are simply told that if the stone burns entirely away it is probably uric acid, but no mention is made of the several other organic calculi frequently met with, such as cystine, xanthine and fatty masses which are surely matter not overlooked by examiners. Considering the book as a whole, however, it is to be pronounced an excellent attempt to summarise the extensive subject with which it deals, while the directions for mounting, &c., are most excellent.

Supplement to a Handbook of Chemical Manipulation.

By C. Greville Williams, F.R.S.

Van Voorst, Paternoster Row.

This is a pamphlet of some eighty pages, which we ought to have noticed some time ago. The greater portion consists of very brief notices of new apparatus, or modified forms of apparatus which have been introduced since the author's *Handbook* was published. These notices are condensed, but still quite sufficient to guide those who have not the opportunity of seeing every new device for saving labour, or increasing the accuracy of work where to obtain the fuller information. A few pages are devoted to short notices of processes of comparatively recent date.

Water Analysis for Sanitary Purposes.
By E. FRANKLAND, PH.D., D.C.L., F.R.S.
Van Voorst, Paternoster Row.

THIS volume is a complete description of Dr. Frankland's well known process of water analysis. References to other processes or methods are hardly to be met with in the book, and the controversial matter, which has given so much rancidity to many of the previous publications on organic carbon and nitrogen, is most studiously avoided. We do not notice that any new feature has been introduced into the process, but we suppose the author could scarcely have anything to add, after the papers and discussions to which it has already given rise. The value of the book lies in the fact that, for the first time, the process is published alone, and in a handy form for reference.

LAW REPORTS.

Can a Public Analyst Appoint a Deputy ?—

William Fitz, of Clifton, appeared at the Bristol Police Court, on May 20th, in answer to an adjourned summons, charging him with selling to Joseph Bruce, two quarts of milk, which was not of the nature and quality demanded. Mr. Wansbrough supported the summons, as solicitor of the Bristol and West of England Dairymen's Association. Mr. Clifton appeared for the defence. When the case was first before the court Mr. Wansbrough proposed to put in the certificate of Mr. Gatchouse, the analyst of the city of Bath, to prove that the milk purchased by the complainant was not of proper quality. Mr. Clifton objected to the admissibility of the document, on the ground that Mr. Stoddart, the analyst of Bristol, was the proper person to have made the analysis. On this point the summons was adjourned. At the re-hearing, the court decided to have the arguments gone through again. Mr. Wansbrough proposed to proceed with the facts, but this was objected to by Mr. Clifton, on the ground that the point in dispute was a legal one, and should be first decided. Mr. Wansbrough said since the adjournment he had looked carefully into the matter, and thought that the magistrates would be of opinion, when they heard what he had to advance, that the case came clearly under sec. 12. They were compelled to go to another analyst because Mr. Stoddart was not acting at the time the milk was submitted to Mr. Gatehouse. He (Mr. Wansbrough) was prepared to show that Mr. Stoddart at that time was in such a state of ill-health that he could not be said to be acting. Their Worships had the Act of Parliament before them, and he thought they would agree that it contemplated such an emergency as the analyst being ill, and the complainants were therefore justified in going to the analyst of the nearest place, and by their so doing no injustice was done to any person. Looking at the state of Mr. Stoddart's health, he asked the Bench to say that that gentleman was not acting. Mr. Clifton followed on the other side, and urged that Mr. Wansbrough, in his interpretation of the Act, had overlooked certain inviolable conditions. The person who held the position of analyst could not delegate his duties to another person unless there was express authority given by the body in whose hands the original appointment was vested. If they examined the Act, nothing could be found authorising the appointment of a deputy other than in the way which he had advanced, viz., by the Town Council. Mr. Stoddart had been properly installed by that body, and it must be taken that he was acting as such until from some cause or other the post became vacant. If Mr. Stoddart was the analyst of Bristol—and his contention was that that was so—the certificate of Mr. Gatehouse could not be admitted. The Chairman, addressing Mr. Wansbrough, said the court was of opinion that before they could deal with the certificate evidence should be taken to prove that Mr. Stoddart was not acting at the time. Joseph Bruce was called, and on being sworn he said he was an inspector in the employ of the Association. In the month of April he purchased two quarts of milk of the defendant, and took a sample to the laboratory of the City Analyst, Park Street. He did not see Mr. Stoddart, and was informed by the assistant that that gentleman was ill. The assistant refused to take in the samples. Mr. F. W. Stoddart, son of the City Analyst, was next called, and proved that since April his father had been too ill to attend to the duties of the office, and Mr. Gatehouse had been appointed by his father to act. In answer to the Bench witness said that Mr. Gatehouse had not been appointed to act for general purposes, but only for the Milk Association. Mr. Clifton objected again that such an appointment was a legal one. After further discussion the Magistrates declined to further adjourn the proceedings, and dismissed the summons. It is probable that the case will be taken to a superior court.

Conviction for Selling Adulterated Coffee, although labelled Mixture of Chicory and Coffee:—

At the Wolverhampton Police Court, on June 3rd, John S. Beddow, grocer, of Victoria Street, Wolverhampton, was summoned for selling an article not of the nature and substance demanded by the purchaser. The Town Clerk prosecuted, and Mr. J. Rowland, defended on behalf of the Birmingham and Midland Counties' Grocers' Protection Society. The witness for the prosecution said he went to the defendant's shop, and asked for a half-pound tin of coffee. The tin was afterwards handed to the Borough Analyst, who certified that the contents were an admixture of chicory and coffee, and the proportion of chicory being 47 per cent. It was stated that the tin was covered with a coloured label, on which was printed in large type, "French Coffee." There was a notice in small type that the contents were a mixture of chicory and coffee, but such notice was concealed by a wrapper of yellow paper. Mr. Rowlands, for the defendant, stated that the mixture was bought from Messrs. S. Hanson, Son, Evison, and Barter, wholesale grocers, of Botolph Lane, London, and was largely sold by grocers throughout the country. It was well known that all tinned coffees were mixed with chicory. He called Mr. G. Shelley, of Hockley, and Mr. John Simmons, wholesale grocer, of Birmingham, who both said all tinned coffees were supposed to be mixed. Mr. Evison, a member of the firm who prepared the mixture, said they sold about a ton weekly. The Mayor said the magistrates were of opinion that the contents of the tin was a fraudulent mixture, and that the label, which was printed in so small type as to be scarcely visible, was not sufficiently plain as to the contents of the tin, and they therefore fined the defendant £5 and costs. Mr. Rowlands asked for a case, which the magistrates refused to grant, and notice of appeal was then given.

How Co-operative Societies earn their Dividends:—

At Forfar Sheriff Court, on June 7th, Sheriff Robertson president, David Mollison, salesman to the Forfar Equitable Co-operative Society, was charged with selling as salt butter a substance not of the nature, substance, and quality demanded. The Supt. of Police said he asked for a pound of salt butter, and paid 1s. 4d. for it. It had a beautiful appearance and was sweet and delicious to the taste, but the analyst reported that it was adulterated with fat other than butter to the extent of not under 75 per cent. One of the members of the managing committee of the Society said they had been swindled by the man from whom they purchased this butter. They paid 118s. per cwt. for it, the same price that was charged for the finest Canadian butter. They had previously had butterine, for which they paid 90s., but each keg was marked as the finest Canadian butterine. The Committee had ordered the manager to buy no more butterine, as they intended to sell nothing but first-class butter. The Fiscal: What became of this butter? Witness: It was nearly all sold out before this sample was taken. I fancy it is all away by this time. The customers seemed to be well pleased with it. We have intimated to the seller that we are not to pay for it as butter. The Sheriff: Then you have made a large profit on this. Witness: But we have to give a large dividend. We must put on the profit somehow. The Fiscal: The members of the Society are their own customers, so that they are just cheating themselves. The Sheriff said the Society ought to be more particular in the appointment of their purchasing committee, as he believed that if they had shown reasonable diligence they would have detected that this was not butter. He found the charge proved, and imposed a penalty of £5.

Inspector Testing Samples before Submitting them to Analyst:—

At Poole Petty Sessions, James Cobb, milk seller, of Longfleet, was summoned for selling adulterated milk. Mr. Dickinson, Town Clerk, appeared in support of the information. John Hutchins, the inspector, stated that on the 24th May he purchased half a pint of milk from the defendant. He forwarded a portion to the Public Analyst, Mr. J. Comyns Leach, whose certificate showed that it contained 9 per cent of water. He asked the defendant for new milk, such as he supplied to his customers, and in reply he said he supplied it to them as milk and water. He had nothing to indicate that. Mr. Hutchings, in answer to the Mayor, said he had obtained samples from at least 20 other milk sellers, but on testing them with the lactometer he found there was no necessity to send the samples to the analyst. Mr. Dugdale suggested to the defendant that he should get one of those instruments for his own protection, so that he could see for himself what was the quality of the milk he supplied. The defendant replied that he knew very well, after selling milk for so many years, what was good milk and what was not good. The milk sold to Mr. Hutchings was as pure as could be got, but there was a certain quantity of water in all milk, and he merely told the inspector that it was milk and water for his own protection. The Mayor fined him £1 and costs.

NOTES OF THE MONTH.

In another column we print a decision of the Bristol magistrates to the effect that in the illness of their own analyst it was impossible to prosecute on the certificate of a neighbouring analyst. As usual in such cases much extraneous matter was introduced by the legal gentlemen, and it was argued whether an analyst could or could not appoint a substitute. All this is quite foreign to the question which resolves itself into the right of the public to take a sample to an adjoining analyst in event of there being no analyst appointed for the district. This right is clearly recognised by the Act, and surely in both common sense and law the illness of the appointed analyst causes a state of things on all fours with there being no analyst. We trust that for the public sake this case will be pushed to an appeal, so that an authoritative decision may be obtained, establishing the right in question, as we have no doubt it will be easily if the strict point be adhered to. It is not a matter of the power of an analyst to delegate his functions, but of a right on the part of the public to seek aid elsewhere, if either there be no analyst for the district, or if he be temporarily laid on the shelf by ill-health. Section 12 of the Act surely covers the case.

Our friend the *Grocer* is getting moral. A case, which will be found detailed elsewhere, was decided lately, and was considered worthy of being reported by the *Grocer twice in the same number*; so, of course, it must be very important, considering the great value of that organ's space. In this trial it has been held that to sell coffee and chicory as French coffee, with a notice of admixture in very small type, and covered by an outer wrapper is illegal, and the party whose ingenuity suggested the expedient has been fined. The case being under appeal, any comments of ours must, of course, be reserved, but our readers will, we think, be amused by the grand opening of the lawyer for the defence who appeared for the trade society. He stated that he had not come to defend a fraudulent transaction. *The association, which he had the honour of representing, was formed to prevent fraud amongst its members, and, as far as possible, to protect the public.* Fancy that now, when no protection societies existed before the passing of the Act, and so it is only when the legislature steps in to protect the public, that the grocers magnanimously assist it by employing their funds to defend a firm who label an article a mixture, and then cover up the label with yellow paper!

Another case has occurred in Forfar, in which the salesman at a co-operative store was fined for selling "butterine." A member of the managing committee said that "They had to pay large dividends and so had to get the profit somehow," and the Fiscal then exclaimed with great dryness that "The members of the society are their own customers, so they are just cheating themselves!" How can we wonder at traders being tempted when immaculate co-operators go in for mutual cheating.

In Dorsetshire they have an analyst, but the inspectors also act as analysts, and take care that he shall make no mistake, by testing all the milk they take by a lactometer, and only sending the analyst those samples which they deem necessary. How beautifully skim

milk must pass in Dorset for the finest new article, and what must be the awful conflict of authority when the inspector gets a milk with excess of cream and forthwith finding it show adulteration, sends it on to the analyst, who thereupon returns it good. In this case who is to be believed by the local authority—the inspector or the analyst? Seriously, this is an innovation which is at once illegal and unjust to both traders and the public.

We take the following two paragraphs from the *Cowkeeper and Dairyman's Journal*, a new periodical devoted to the interest of the milk trade:—

To unprejudiced minds it appears somewhat inconsistent to appoint a dairyman (in an outer suburb of London) as inspector under the Sale of Food and Drugs' Act. This arrangement does not appear to give satisfaction to other members of the trade in the locality who, perhaps not unnaturally, object to their samples being continually taken by one of themselves, and the natural inference that concocted samples of the Inspector's milk are submitted for analysation is generally believed.

There is no analyst in Bristol, and the underselling milk and water dealers are having a good time of it, as milk is being sold at any price—from 2d. a quart—and great injury is being done to the trade generally. Bristol wants a new analyst at once, or some of the interlopers will by their abominable adulterations be the cause of grievous results to the public.

NEW TEST FOR ALOES.

HUGO BORNTRAEGER has recently described* a test for the detection of aloes, which we have no doubt will prove extremely useful. The liquid, or the cold alcoholic extract of the suspected solid, is shaken up with about twice its bulk of benzol. The benzol, which in the presence of aloes assumes a yellowish green colour, is taken off with a pipette, and agitated with a little strong ammonia. The ammonia will now assume a fine violet red colour, even if not more than one part of aloes had been present in 5,000 parts of the liquid. The red colour is destroyed by acids but restored again by alkalies. Other caustic alkalies may be employed, but none yield such good results as ammonia. In the use of beer the presence of aloes can be demonstrated, without any previous preparation, provided about 14 grains of aloes had been added to the gallon.

DEATH OF MR. W. W. STODDART.—It is with much regret we record the death of this gentleman, which took place at his residence, Sneyd Park, on 30th May last, from disease of the heart. Mr. Stoddart carried on the business of chemist and druggist in North Street for a considerable time before he took the public appointment of City Analyst, on the passing of the Act against adulteration. The deceased gentleman was analyst for the county of Somerset as well as for the city and county of Bristol. Mr. Stoddart was a F.I.C. and a F.G.S. He was in the 57th year of his age.

BOOKS, &c., RECEIVED.

The Chemist and Druggist; The Brewers' Guardian; The British Medical Journal; The Medical Press; The Pharmaceutical Journal; The Sanitary Record; The Miller; Journal of Applied Science; The Boston Journal of Chemistry; The Provisioner; The Practitioner; New Remedies; Proceedings of the American Chemical Society; Le Practicien; The Inventors' Record; New York Public Health; The Scientific American; Society of Arts Journal; The Plumber and Sanitary Engineer; The Cowkeeper and Dairyman's Journal.

---

* *Zeitsch. f. Anal. Chem., 1880, 165.*

THE ANALYST.

AUGUST, 1880.

SOCIETY OF PUBLIC ANALYSTS.

THE NEXT MEETING of this Society will be held at Swansea during the week of the British Association Meeting, probably on Friday the 27th inst., but the usual circular notice will be sent to the Members.

ON PHOSPHORIC ACID IN POTABLE WATERS.

BY O. HEHNER.

Read before the Society of Public Analysts, on 2nd June, 1880.

IN January, 1879, I had the honour to describe before the Society a method for the determination of Phosphoric Acid as Phospho-molybdate,* and which in the main consisted in the precipitation at a low temperature of the phosphoric acid by molybdic solution, dissolving the precipitate, after washing with the least possible quantity of water, to neutrality, in dilute ammonia, evaporating the solution thus obtained with repeated addition of small quantities of water, and weighing the resulting residue. This, divided by 28·5, as I showed by numerous test experiments, very accurately indicates the amount of phosphoric acid. The method is evidently better adapted for the estimation of very small quantities of P_2O_5 than of more tangible amounts, since the compound ultimately weighed contains but a small fraction of phosphoric acid, a minute quantity of that acid furnishing a highly multiplied amount of residue, and also because we are already in possession of very excellent methods for the determination of P_2O_5, when occurring in moderately large quantity. The method, in fact, allows us to deal with quantities so small as to be quite unassailable by the usual magnesia process.

One of the chief objects I had in working out the method referred to, was to be in possession of reliable means to determine the proportion of phosphoric acid occurring in potable waters.

All unbiassed chemists are in the habit of basing their opinion as to the quality of given samples of water upon the figures resulting from a considerable number of different determinations, embracing chiefly the amounts of organic matter or some data measuring the same, their products of oxidation, and of some of the mineral substances invariably met with in sewage, namely, chlorides and sulphates, but the determination of that most important of the constituents of animal excreta—phosphoric acid—has been sadly neglected, although, to quote Mr. Wanklyn, "much nonsense has been talked about phosphates in drinking water." The fact is, that, as far as I am aware, the whole literature of water analysis does not include a single *quantitative* determination of phosphoric acid in drinking water, although in some cases the precipitate thrown down by ammonia has been put down as "iron, alumina, and phosphates" (Graham, Miller, and Hoffmann.) In mineral waters that acid has been again and again determined, but its estimation with a view to

* THE ANALYST, vol. iv., p. 23.

aid in the formation of a correct opinion on samples of drinking water has not, so far as I can ascertain, been systematically undertaken. The present paper is intended to form a first step in this direction, but it is put forward only tentatively and suggestively.

Wanklyn states, that "the fact has been overlooked that, except as infinitesimal traces, phosphates cannot exist along with carbonate of lime in a clear water." Now we may assume, that in presence of carbonate of lime phosphoric acid would be present only as tricalcic phosphate. One part of this, according to Voelcker, is soluble in 12,500 parts of pure water, or 100,000 parts of water might contain no less than 8·66 of P_2O_5, whilst the solubility is far greater still in the presence of ammonium salts, chloride of sodium, &c. It is also much increased by carbonic acid, never wanting in natural waters. R. Warington (*Chem. Soc. Journ.* [2], ix., 80) gives the solubility of tricalcic phosphate, taken in the form of bone ash, in water saturated with carbonic acid, as 1 part in 6,788, or 6·75 P_2O_5 in 100,000 parts of water.

Hence the quantity of P_2O_5, which may possibly occur in polluted drinking water, is by no means "infinitesimal." It will be seen that I have not met with any water containing anything like the quantity theoretically possible, but yet amounts were found which were not only quite appreciable, but quite as large as those of many other mineral constituents which we are in the habit of measuring.

In all cases the water analysed was perfectly clear, and had, when necessary, been freed from flocculent matter by filtration. A litre was employed whenever practicable, evaporated with the addition of nitric acid, first over the naked flame, then to dryness on the water-bath, to separate the silica, the residue taken up with a little nitric acid, the solution filtered through the smallest practicable filter, evaporated until but a few drops were left, and precipitated with molybdic solution. In such waters as contained much chlorine, this was as nearly as possible removed by repeated evaporation with nitric acid. In the case of samples highly charged with sulphate of lime the volume of liquid precipitated by molybdic solution was necessarily larger, to prevent the separation of the sulphate. The whole of the samples contained carbonate of lime.

In the following tables the samples are roughly classified under three heads. Class I., good and fairly good water; II., waters of low quality; and III., waters plainly polluted.

All figures are parts per 100,000.

I.

	Cl.	SO_3	N_2O_5	Free NH_3	Album. NH_3	Total Sol.	P_2O_5
Uxbridge Water Supply (deep chalk springs)	..	..	..	..	..	..	None
New River Water	..	..	..	..	..	..	0·008
Lambeth Water Company's Supply	..	..	..	..	..	..	0 020
Chalk	1·65	0·95	1·91	0·002	0·002	32·6	0·021
"	1·60	0·38	1 84	0·001	0·001	32·6	0·023
	1·69	3·50	0·33	none	0·003	27·3	None
	2·00	0·74	3·15	0·001	0·005	36·7	0·035
	3·39	2·61	3·29	0·002	0·010	27·2	0·034
	5·00	6·78	3·26	none	0 002	51·9	0·020
	11·30	6·87	3·18	none	0·004	53·1	0·018
	1·40	0·51	2·95	0·006	0·010	35·3	0·059
	6·12	1·27	1·69	0·005	0·001	40·3	0·074

II.

	Cl.	SO_3	N_2O_5	Free NH_3	Album. NH_3	Total Sol.	P_2O_5
.....	1·72	3·43	2·68	none	0·015	53·4	0·108
.....	5·43	3·11	2·38	0·007	0·014	39·4	0·045
.....	7·83	1·78	5·12	0·001	0·004	52·9	0·022
.....	5·90	24·83	6·70	0·003	0·006	107·9	0·033
.....	12·19	2·80	3·36	none	0·013	67·4	0·028
Water from Thames at Nine Elms Station, Half Ebb	..	..	..	..	..	..	0·078
Ditto, Half Flood	..	..	..	..	..	..	0·043

III.

	Cl.	SO_3	N_2O_5	Free NH_3	Album. NH_3	Total Sol.	P_2O_5
From Thames at Crossness	306·7	37·2	not determ.	0·112	0·046	648·8	0·240
....	11·8	17·69	3·47	0·022	0·014	90·7	None
....	24·95	36·14	21·03	0·032	0·065	234·6	0·484
....	3·34	4·27	3·75	0·029	0·013	28·9	0·025
....	7·60	21·77	0·04	0·073	0·004	74·3	0·025
....	3·20	4·29	3·24	0·049	0·011	55·8	0·070
....	11·06	19·60	19·89	0·288	0·013	117·8	0·100
....	12·36	2·81	20·51	0·005	0·021	116·6	0·039
....	10 70	17·38	15·97	0·001	0·033	120·0	0·553

On examining these figures, it will be seen that in really good waters the amounts of phosphoric acid are very small, the numbers being in all cases, with the exception of two, less than 0·4 per million. The two exceptions were waters which were not absolutely free from suspicion of pollution. Some of the waters of Class II., although high in nitrates, contain but little P_2O_5, but the majority of the undoubtedly polluted samples contain more than one unit per million ; in one case, that of a highly polluted well, as much as 5·5. In several of these samples the phosphoric acid is, however, very low, and from one even entirely absent. This may be due to one or both of two circumstances. Either the pollution is due to vegetable matter, or the phosphoric acid has been removed by vegetation or precipitation. One sample, however, which is not included in the table, although known to be sewage polluted and giving a thick brown precipitate with Nessler's re-agent, and abounding in chlorides and sulphates, contained but 0·39 parts per million.

On the whole, therefore, the figures go to show that the presence of phosphoric acid in larger quantity than 0·5 per million parts of water should be regarded with suspicion. On the other hand, the absence of phosphates affords no positive proof of the freedom from pollution.

The determination of phosphoric acid by means of the process which I have employed being so simple a matter, requiring so little water, and being capable of furnishing the analyst with a valuable help in forming an opinion as to the quality of drinking water, but I hope this communication may be the means of directing the attention of chemists to this but too much neglected constituent of potable water.

ON THE COMPARISON OF THE SCALE OF BAUME'S HYDROMETER FOR LIQUIDS HEAVIER THAN WATER WITH THE SPECIFIC GRAVITY.

By G. W. WIGNER, F.C.S.

Read before the Society of Public Analysts on 2nd June, 1880.

BAUME'S hydrometer is probably in more general use in chemical manufactories, and especially in sugar refineries in this country, than any other of the numerous arbitrary scales that have been from time to time proposed for determining the density of liquids. From a scientific point of view there is of course an objection to any arbitrary scale, based simply on the fact of its lacking a scientific basis, but a worse objection than this almost invariably arises from these arbitrary scales being from time to time altered or amended (which amendment in fact is only alteration under another name), so that it is difficult to secure instruments which shall correspond to the original or any other definite empirical standard.

This is especially the case in reference to Baumé's hydrometer, for, at the present time, it is possible to procure instruments which are guaranteed by the makers to be accurate, and which certainly are so far accurate that they correspond to the tables according to which the instruments have been constructed, and yet these instruments when purchased at different places show at the medium points of the scale differences corresponding to nearly 3°, while in the case of heavy liquids, such for instance as concentrated sulphuric acid, the indications vary more than 4°.

The English text-books contain but little information either as to the derivation of the original scale or the reasons for the different alterations that have been made in it. This is perhaps owing to the fact that scientific chemists in this country have shown less favour to such arbitrary scales than has been the case on the Continent. In America Casamajor has written and published several excellent papers on the subject, some of which have been reproduced in a monthly journal published here called the *Sugar Cane*. In France, Vacher, an instrument maker, has written two or three short papers on the subject, and on the allied subject of the effects of changes of temperature on the hydrometer readings. These publications, although good of their kind, are of comparatively little value to us in this country, because we have to face at the outset of the enquiry the plain fact that the so-called Baumé scales in use in this country, in France, and in the United States, differ very greatly from each other. Our national standards render no assistance in the matter, because if a Baumé hydrometer is sent to Kew for examination the report is simply + or — so many degrees, "*according to Dr. Ure*," thus falling back on an old, and I might say also, an obsolete table.

The cause of these discrepancies and this lack of a standard, arises no doubt from the wholly empirical manner in which the scale was originally formed by Baumé. A solution of salt was made, containing 15 parts by weight of salt in 100 parts by weight of liquid, and the hydrometer being floated first in pure water and then in this solution the space between the two points at which the level of the liquid stood was divided into 15 equal parts, and the scale continued both upwards and downwards. When this scale was continued upwards it was found that with a liquid having a sp. gr. of 1·520 the hydrometer marked 52°, and sulphuric acid of sp. gr. 1·845 marked 69½.

After a short time this mode of adjusting the starting-point of the scale was found to

be inconvenient in practice, and concentrated sulphuric acid was adopted instead by Gay Lussac. The sulphuric acid, which was taken for the comparison, was assumed to have a sp. gr. of 1·845 at a temperature of 60° F., and to mark 66° on the Baumé scale instead of 69½. The difference between the level at which this hydrometer floated in the acid and in water was divided into 66 equal parts, and hence another scale arose, according to which a liquid having a sp. gr. of 1·440 will mark 44° on the Baumé hydrometer.

Here, therefore, we have the two extremes, one in which 52° corresponds to 1·520, the other in which 44° corresponds to 1·440—the former the original scale, and the latter the scale at present in use in France, and to some extent in America, and also an imperfect, but I think quite accurate, account of how the different scales arose. Now both of these scales were empirical, and instrument makers in adjusting the instruments used more or less pure salt, *i.e.*, chloride of sodium, or common commercial salt, and more or less concentrated sulphuric acid, and so got scales differing within rather wide instrumental errors from these.

Many years ago—how many I cannot say, but probably not less than 15—an ingenious London hydrometer maker endeavoured to solve this difficulty by halving the difference, *i.e.*, he graduated his spindles so that 48° corresponded to 1·480, or just half way between the two extremes already referred to, and thus another entirely different scale was originated, according to which a liquid of sp. gr. 1·845 marks nearly 68° Baumé. This compromise scale, as I may call it, is strange to say the one which has for the last ten years or more been in almost exclusive use in England, and certainly as far as the sugar industry is concerned it has entirely superseded the use of the two older scales, namely, Baumé's original and Gay Lussac's. It naturally follows from this that out of some 24 different tables showing the comparison between Baumé degrees and specific gravity which have been published in this country, 12 or 14 different scales have been adopted, which naturally range themselves into three different groups.

First.—A group of which Ure's *Dictionary* is the type, and which adopted very closely Baumé's original figures—Ure, Fownes and Cooley in fact differing only in the second and third places of decimals.

Second.—A group in which the amended scale of Gay Lussac, as adopted by the French, has been taken as the starting point, and of which an illustration is given in another table published in Cooley; in a table published in Griffin's *Catalogue*; and in Squire's *Companion to the Pharmacopœia*. In these tables again the differences are mostly confined to the second and third places of decimals.

Third.—A group which finds fewer representatives among the published tables, but is nevertheless the scale, according to which, with slight variations, nearly all the instrument makers in London and other parts of England have for many years past constructed their instruments, and which holds the intermediate place between the last two groups.

I have recently compared a number of hydrometers graduated on Baumé's scale, and in practical use by manufacturers in England, and I find that, excluding slight instrumental errors, they are all graduated according to this scale, and it is therefore a matter of importance to be able to translate the degrees of this directly into specific gravity. This can be readily done by the following formula :—

$$\text{Sp. gr.} = \frac{148}{148 - d.}$$

Where d equals the number of degrees on the scale of the instrument, the formula is in

reality another way of expressing the fact that 48° Baumé corresponds to a specific gravity of 1·480 at the temperature of 60° F.

This table is in fact the one which, by universal consent of makers of instruments and chemical manufacturers, is now recognised as the English Baumé scale. All that I have done to it has been simply to re-calculate the figures on a true basis, which in some cases alters the scale by a small decimal from that according to which *some* of the instruments are graduated, but in the best instruments these figures will be found to be perfectly correct.

1	.. ..	1·0069	25	.. ..	1·2032	49	.. ..	1·4949
2	.. ..	1·0137	26	.. ..	1·2131	50	.. ..	1·5102
3	.. ..	1·0207	27	.. ..	1·2231	51	.. ..	1·5257
4	.. ..	1·0278	28	.. ..	1·3333	52	.. ..	1·5416
5	.. ..	1·0348	29	.. ..	1·2437	53	.. ..	1·5579
6	.. ..	1·0422	30	.. ..	1·2542	54	.. ..	1·5744
7	.. ..	1·0496	31	.. ..	1·2650	55	.. ..	1·5914
8	.. ..	1·0571	32	.. ..	1·2758	56	.. ..	1·6087
9	.. ..	1·0647	33	.. ..	1.2869	57	.. ..	1.6263
10	.. ..	1·0725	34	.. ..	1·2982	58	.. ..	1·6444
11	.. ..	1·0802	35	.. ..	1·3097	59	.. ..	1·6629
12	.. ..	1.0882	36	.. ..	1·3214	60	.. ..	1·6818
13	.. ..	1·0963	37	.. ..	1·3333	61	.. ..	1·7011
14	.. ..	1·1044	38	.. ..	1·3454	62	.. ..	1·7209
15	.. ..	1·1128	39	.. ..	1·3578	63	.. ..	1·7412
16	.. ..	1·1212	40	.. ..	1·3703	64	.. ..	1·7629
17	.. ..	1·1297	41	.. ..	1·3831	65	.. ..	1·7831
18	.. ..	1·1385	42	.. ..	1·3962	66	.. ..	1·8049
19	.. ..	1·1472	43	.. ..	1·4095	67	.. ..	1·8271
20	.. ..	1·1562	44	.. ..	1·4230	68	.. ..	1·8500
21	.. ..	1·1653	45	.. ..	1·4369			
22	.. ..	1·1746	46	.. ..	1·4519			
23	.. ..	1·1840	47	.. ..	1·4654			
24	.. ..	1·1935	48	.. ..	1.4800			

NOTE ON A SAMPLE OF ADULTERATED ASSAFŒTIDA.

By John Muter, Ph.D., F.C.S.

At the last meeting of the Society of Public Analysts I exhibited and made some short remarks upon a specimen of adulterated assafœtida, which had been forwarded to me by a member of the Pharmaceutical Society, as having been sold to the firm with which he is connected. The article, outwardly, possessed a very excellent resemblance to the drug as met with in tears, having the usual odour and other physical properties, except that the tears were, perhaps, rather too perfectly rounded. When each tear was opened there was to be seen a piece of stone snugly ensconced in the centre of it. Taking the average of three tears I found by weight—

Assafœtida	21·23
Stone	78·77
	100·00

The stone employed was a species of magnesian lime stone, as shown by the following analysis of it made by one of my advanced students, Mr. Orestes Pisani, M.P.S., after igniting off the assafœtida:—

Calcium carbonate	51·50
Magnesium carbonate	39·90
Siliceous matter	7·00
Iron and alumina	1·60
	100·00

There appears to be very little doubt but that the fabrication of the article has been most deliberately carried out, as the stones were all of nearly the same size, and carefully chipped to a suitable shape for resembling tears after receiving a coating of the gum-resin. That the stones had been covered by melting the assafœtida, and then dropping them into the liquid until they had taken up a sufficient coating, was rendered probable by the fact that, although the coating smelt fairly, it yet contained far too little of the volatile oil of the drug. In conclusion, it would seem advisable that pharmacists, having tear assafœtida in stock, should examine the same by cutting open a few of the more rounded fragments, as I have heard of the discovery of this adulterated article from more than one source lately, and anyone, innocently selling it, might be placed in an awkward position.

DETECTION OF WATER IN ALCOHOL AND ETHER.

On evaporating a mixture of solutions of two parts of citri; and one of molybdic acids, heating the resulting mass to incipient fusion, dissolving in from 30 to 40 parts of water, saturating strips of filter paper with the solution, and drying the same at 100°, a blue paper is obtained, which is bleached by water, and which may be employed as an indicator of the same in alcohol, ether, &c. *(Chemiker Zeitung, 1880, p. 307.)*—O.H.

ON THE SAPONIFICATION OF FATS.

For the saponification of fats there are frequently employed, instead of soda or potash, a number of basic oxydes, and it is commonly supposed that the result in such cases is practically the same, a soap or plaster resulting with the separation of glycerin. Very frequently oxyde of lead is the saponifying agent, the fat to be examined being thoroughly well mixed with its double weight of oxyde of lead and water, the mass heated to 90—100°C. with frequent agitation, the saponified product well washed with hot water, which, after filtration and evaporation, leaves the glycerin, which may be purified by treatment with alcohol. The insoluble lead soaps are dried, agitated with ether for the solution of the oleate of lead, whilst the stearate and palmitate remain undissolved.

Von der Becke, in making a comparative examination of the processes of saponification by oxyde of lead, by potash in alcoholic solution, and by lime, arrived at the following remarkable results:—

Cocoa butter and tallow gave only traces of glycerin on saponification by oxyde of lead (0·23 and 0·13 per cent. respectively); with lime they yielded 2·19 and 2·43 per cent., and with potass 5·99 and 7·84. Butter fat gave, with PbO 7·98, with CaO 7·99, and with KHO 10·59. Lard, by the same agents, in a similar order, 6·60, 8·27, and 9·27 per cent.; olive oil, with PbO 3·76, with KHO 6·41; rapeseed oil, 4·20 and 4·58; linseed oil, 4·40 and 6·20.

The various oxydes exhibited therefore a widely different behaviour with the several fatty matters.

A mixture of cocoa butter and tallow was likewise hardly attacked by PbO, whilst, curiously, a mixture of butter and cocoa butter gave, with the same oxyde, the full proportion of glycerin, 8·05 per cent.

Previous treatment with very dilute sulphuric acid at 150° C. renders both tallow and cocoa fat more readily amenable to decomposition with PbO.

If further investigation should prove the statements of Von der Becke to be correct, they might possibly furnish the means for solution of one of the most difficult and urgent of analytical problems, viz., the discrimination of the various fatty oils from, and detection of admixture with, each other. *(Zeitschr. f. Anal. Chem., 1880, p. 291).*—O.H.

ON THE ESTIMATION OF PHOSPHORIC ACID, BY ALFRED SMETHAM, F.C.S., &c.

A Reply by E. F. TESCHEMACHER AND J. DENHAM SMITH.

By the courtesy of Mr. Smetham we are in possession of his paper bearing the above-named title, and by the permission of the Editor of THE ANALYST, we take leave to remark upon some of the statements made therein.

The only difficulty of dealing with this pamphlet is that of knowing where to begin, as it bristles with misdescriptions, misdirections, misstatements, and mistakes. However, to follow the good rule of beginning at the beginning, the very title is a misdescription. When Mr. Square spoke of the Christian religion he was careful to define what he meant by the term. Mr. Smetham, when addressing his listeners upon one of the most widely extended subjects in analysis, omits to define what he means by "Estimation of Phosphoric Acid," which (from the paper) proves to be a very few experiments on two points only of a very limited division of his subject, together with a single experiment which has nothing to do with it. Whether this absence of, as it seems to us, requisite words in Mr. Smetham's paper is due to an absolute dislike of them, like M. Gambetta's dislike of the Jesuits, to a love of brevity, forgetful that brevity may lead to obscurity as well as to wit, or a failure to discern that, in print, at any rate, words, and also properly chosen words, are essential to an author who has a meaning to convey, and who would take pains to make that meaning clear, we cannot judge; but we fear the last must be the true reason for this failure, from his carelessness at times in their use, as we shall presently show. Our eye had not travelled down more than three or four lines of this thesis before it fell on one of these instances of carelessness and misdescription, wherein this author states that, "we issued, during the past year, a pamphlet on 'The Estimation of Phosphoric Acid.'" Now as our memory told us that this was a mistake, we looked up a copy, and there we find the title of our pamphlet to be, "On the Estimation of Phosphoric Acid, *by Magnesia, for Commercial Purposes*," *&c.* We had limited our researches, and had, of set purpose, been careful to describe our limits in the two clauses we have italicized, of Estimating Phosphoric Acid by "*Magnesia*," and "*for Commercial Purposes.*"

In this our object is made manifest, and we deny the competence of anyone so to dock our title as to convey to a reader or hearer a meaning of the widest kind, when we had described in so many words the exact limits to which we had confined ourselves. In his very next sentence we find it stated, "By these experiments they came to the conclusion, which had been previously arrived at by other chemists, that this salt—ammonia-magnesic phosphate—*is totally insoluble* in water containing one-eighth of its bulk of ·880 ammonia." The italics are ours.

This is too bad. We came to no such conclusion: indeed we stated that "eight filtrates yielded 0·25 grain of pyrophosphate, an average of 0·03 grains dissolved in wash-

waters;" and further, "when we maintain its insolubility, we mean its practical insolubility," not one word of *total insolubility* when discussing the absurdity of adding some 2 per cent. to the weight of pyrophosphate, which we characterized, and still characterize, as "a vamping up by ridiculous allowances," despite this author's recommendation to revert to this silly practice. As to the "other chemists, who had previously arrived at the total insolubility of this salt in ammonia-water," Mr. Smetham does not cite any one of the gentlemen who found this mare's nest, and who, if they exist in the flesh, have been wisely reticent of their discovery. He then notices the "high solubility" of this salt which was found by Fresenius, a strange and surely unfit term to apply to a salt of very slight solubility, but serving to illustrate this gentleman's vocabulary, and assures us of his belief that Dr. Fresenius "has since found occasion to modify this opinion," a belief which may or may not be well founded, as we are as little acquainted with the conclusions of Dr. Fresenius as this chemist is with ours. Nevertheless, he tells us that our "conclusions seemed to him to be at variance with what he should expect," when he could have made sure that there is no seeming nor guessing about our statements, and proceeds to say that our "experiments were conducted in a very crude manner." Why "very crude?" We have referred to our pamphlet, and finding them to be numerous, direct, and to the point, are curious to know wherein these experiments are "very crude." Mr. Smetham can employ terms in depreciation, but he cannot quote fairly.

He then tells us: "I started the following set of experiments in the hope of setting the matter at rest." This "set of experiments," we find, amounts to three. The first yields incorrect results, viz., "·0064 grammes of pyrophosphate in excess of the theoretical quantity, due, probably, to the fact that the phosphate had effloresced. This, however, is immaterial." So "probably," "immaterial," and the like, are fitting epithets for an experiment which is to "set the matter at rest." Would not "crude" in the sense of raw, rude, incomplete, apply here, especially as in describing these experiments, made to determine the solubility of the salt in question, this chemist nowhere states the quantities of the wash-water used?

The chemist is now rewarded for his pains; he finds the filtrates yield him ·0020, ·0060 and ·0160 grm., or, as it pleases him to write, "grammes," respectively, of pyrophosphate of magnesia, and sagely remarks, "From these experiments it is evident that ammonio-magnesic phosphate is perceptibly soluble in ammonia water." Indeed! But then, who ever doubted it? Not Dr. Fresenius; not Teschemacher and Smith, as our critic calls us. So far as our memory serves us, we have heard of none, excepting the band of "chemists who had previously arrived at the conclusion that this salt is totally insoluble in water containing one-eighth of its bulk of ·880 ammonia," known to and vouched for by Mr. Smetham; who then instructs us that should we rely on—we think he means Dr. Fresenius—we must add one milligramme of pyrophosphate for every 54 c.c. of solution; but should we prefer Mr. Smetham, then, for 54 c.c., we must substitute 100 c.c., 84 c.c., or 62 c.c., respectively, thus allowing us the privilege of choice as our wishes or inclinations may prompt between 62 and 100 in respect to these three experiments, which are to "set the matter at rest," when vamping up an analysis in the modern style. In the next paragraph we find "Teschemacher and Smith's statement, that no allowance should be made for the solubility is far from conclusive." May we be permitted to inform this

writer that misrepresentation is not criticism. We said nothing of the kind. What we did say, and what we say again, is, "That we should reject as worthless any process which permits of an error of 2 per cent."

In six more experiments Mr. Smetham disposes of the influences of citric acid, iron, and alumina on the solubility of the ammonia-magnesian phosphate, which may be investigated by the curious; then passes to the correction he thinks fit for the solubility of this salt, which he fixes at 0·18 per cent. of phosphoric acid; and, finally, "sketches the method he pursues," which he has "always found to give excellent results." If by "excellent" he means accurate, and he further means—which to us seems the only inference—that he is speaking of commercial samples of rock phosphate, we can but own to a disappointment somewhat akin to humiliation that a work of ours, which we maintain bears intrinsic evidence of much thoughtfulness and care, could, even in the case of a single reader, prove so utterly futile. His method is the method we published, but so altered by the omission of well-nigh every precaution we insisted on as requisite to ensure success, that it needs a parent to recognize the changeling. In page after page did we insist on the prime necessity of the most careful attention to *moisture*, showing by repeated instances the necessary fallacy of all results unless the moisture of a sample was carefully determined; and closing our reiterated caution on this point by saying that "our pains would be wasted and our chief aim thwarted unless we could set this matter of *moisture* to rights." Mr. Smetham must have had our monograph in his hand—probably he has read it, but most certainly not with the understanding; for the moisture is never once mentioned in the details of the method, of which he says "I have always found it give excellent results;" a statement which carries with it its own contradiction, as the neglect of this question of moisture necessarily vitiates the results of every analysis made by Mr. Smetham.

A SIMPLE PLAN FOR RAPIDLY AND SAFELY DRYING A SPECIFIC GRAVITY BOTTLE OR FLASK.

By J. Shea, M.D.

It not unfrequently occurs that a clean, *dry* sp. gr. bottle or flask is wanted for use, and in hurried drying sometimes get cracked. The following little device has been found useful:—

Wash the bottle or flask with distilled water and drain it for a moment or two. Then wash with a little strong alcohol and drain the bottle a second time. The alcohol need not be wasted, as it is but slighted diluted with the residual water from the first washing. When the bottle is again drained it remains wet with the diluted alcohol. Pour in a little dry ether and wash the bottle out with this. Again drain, and the warmth of the hand or very little extra heat will then completely dry the bottle or flask. The alcohol must of course be *strong*, and the ether *dry*, or the device fails.

ON THE ACTION OF WATER UPON MERCURIC SULPHATE.

By Charles A. Cameron, M.D., F.R.C.S.I.

In Berselius' *Treatise on Chemistry*—and in all its editions in German and French—it is stated that the action of water upon mercuric sulphate resolves it into an insoluble subsalt, and an acid soluble salt. The latter, it is stated, may be obtained by evaporating

its solution until crystals begin to form. These crystals are described as white needles, which attract moisture from the air, and are precipitated out of solution on the addition of concentrated acid. These statements in reference to the action of water upon neutral mercuric sulphate appear to have been copied into most works on chemistry of later date. In Fownes' *Manual of Chemistry*, 12th Ed., 1877, page 424, it is stated that water decomposes the (mercuric) sulphate, dissolving out an acid salt and leaving an insoluble yellow basic compound, formerly called *turpith*, or turbeth mineral, containing, according to Kane's analysis, $HgSO_4$, 2HgO, or 3HgO, SO_3. In Brande and Taylor's, Tidy's, and other modern works on chemistry, reference is made to a soluble acid—mercuric sulphate. In Watts' *Dictionary of Chemistry* the formula HgO, $3SO_3$, is assigned to this salt. This statement assumes that the action of water upon neutral mercuric sulphate is to resolve it into trimercuric sulphate and mercuric trisulphate:—

$$4\ HgSO4 = HgSO_4 = (Hg^{o})_2 + HgSO_4\ (SO_3)_2.$$

The formula assigned to the acid mercuric sulphate is a very unusual one. The salt is stated in Watts' *Dictionary* to be procurable by evaporating the liquid which remains when the basic salt produced by the action of water upon mercuric sulphate is separated. The results of my experiments show that an acid salt cannot be obtained in this manner.

Experiments.—Neutral mercuric sulphate was treated with water. The basic salt thereby formed was separated from the liquid by filtration and the liquid evaporated until a pellicle made its appearance upon its surface. A mass of crystals was obtained in this way, which were freed from adhering liquid and dried at 100° Cent. These crystals should, according to Watts' *Dictionary*, have the formula $HgSO_4(SO_3)_2$. On treating them with water they changed from a white to a yellow colour, and produced the basic salt. On being analysed the crystals proved to be wholly composed of the neutral sulphate $HgSO_4$.

A further quantity of neutral sulphate was decomposed by water, the proportion of water used being in the ratio of two molecules to four molecules of the sulphate. The basic salt having been separated from the liquid, the latter was allowed to evaporate spontaneously *in vacuo* over sulphuric acid. The crystals obtained in this way were placed upon a tile and allowed to drain during two days. They were pressed between sheets of bibulous paper, washed with bisulphide of carbon, dried, and analysed. They proved to be crystals of the neutral sulphate. Neutral mercuric sulphate was dissolved in dilute sulphuric acid, and the mixture allowed to evaporate spontaneously *in vacuo*. The crystals which formed consisted of simply neutral mercuric sulphate.

The action of water upon mercuric sulphate produces a basic salt and free sulphuric acid—$3HgSO_4 + 2H_2O = HgSO_4\ (HgO)_2 + 2H_2SO_4$. The free acid dissolves some mercuric sulphate, but no acid salt appears to exist—at least, it cannot be got out of solution. The last crystals that form spontaneously out of the most acid solution are simply composed of the neutral sulphate. When a large quantity of water is employed in decomposing mercuric sulphate, no mercury, or a mere trace, is to be found in the liquid when separated from the basic salt. On the other hand, more mercury remains in solution when three molecules of water are used in decomposing the neutral salt than when two—the theoretical amount—are employed. The neutral sulphate is more soluble in slightly diluted sulphuric acid than in the strong acid; but it is not sensibly soluble in very dilute acid.

It may be worth noting here that when basic mercuric sulphate is dissolved in selenic acid, and the mixture allowed to evaporate spontaneously, neutral mercuric sulphate makes its appearance; but when, on the contrary, basic mercuric selenate $HgSeO_4$ $(HgO)_2$ is dissolved in sulphuric acid, and the solution allowed to evaporate spontaneously *in vacuo*, neutral mercuric sulphate crystallizes out. It is stated in the books that the crystals formed by evaporating an acid solution of mercuric sulphate attract moisture from the air. This statement is incorrect. The crystals, when freed from excess of acid, are permanent in the air. It is stated that one part of basic mercuric sulphate dissolves in 3,000 parts of cold water. I find that a litre of water at 16° Cent. (60·8 Fahr.) dissolves 0·023 milligrammes of the salt, and at 100° C.; that is, 2·3 parts of the salt are soluble in 100,000 parts of water. The freshly precipitated salt, free from excess of acid, dissolves in time its weight of water at 16° C.

The only acid mercury salt described in the books are the salt which I have shown not to be really an acid one, and an acid selenite of mercury, which I have some reason to conclude has no real existence. The tendency of neutral mercury salts is to combine with alkaline bodies, and not with acids.

Basic mercuric sulphate dried at 100 C. dissolves to the extent of 0·023 gramme in a litre of water at 16° C. = 1 part of the salt in 43,478 parts of water. The salt, when freshly precipitated, dissolves to the extent of 0·031 gramme per litre of water = 1 part in 32,258 parts of water. The much greater solubility ascribed to this salt is evidently an error due to the determination of the solubility of a specimen containing free acid.

EXAMINATION OF DEPOSIT IN COMMERCIAL DILUTED PHOSPHORIC ACID.

By P. C. Jensen, Ph.C.

During the last six months I have been particularly interested in regard to a peculiar organized deposit, existing in a number of specimens of acid. phosph. dil. of commercial grades which have come under my observation.

If this diluted acid is made, either by burning phosphorus in air or oxygen, resulting first in the production of phosphoric anhydride (P_2O_5), which is afterwards dissolved in water, or by the process of the Pharmacopœia—namely, the action of nitric acid upon phosphorus—the resulting product is not likely to be contaminated with foreign substances or the germs of organic matter.

On the other hand, if this acid is made by dissolving glacial phosphoric acid in water, as prescribed or directed by some formulas yet in use among certain manufacturers on Continental Europe, or by the alternative process in the present U.S. Pharm., there is reason for the introduction of such matters.

Glacial phosphoric acid is made from bones, by a roundabout process, which is very apt to result in an impure product. It is to these conditions in its manufacture that I attribute the cause of the organized deposit in the diluted acid.

This deposit, like all fungous deposits, will increase by exposure to the atmosphere, with but very slight increase when air is completely excluded.

Chemical Behaviour of the Deposit.—1st. To a small portion of the deposit I added concentrated sulphuric acid; the substance turned black (charred), evidence of organic matter.

2nd. To a small portion of the deposit I added hydrochloric acid and potassic chlorate until the organic matter was oxidized, or broken up, as shown by the change of the solution from green to yellowish, constantly keeping up the measure by addition of water with constant stirring on a water bath at a temperature of 60° C., until sufficiently concentrated, and until chlorine was expelled. I then added ammonic carbonate, which produced a white precipitate. Another portion I treated with a solution of ammonic oxalate, producing calcic oxalate, insoluble in acetic acid, but soluble in hydrochloric acid—evidence of calcium.

I was unable to obtain any magnesium salt in the deposit, but I found a trace of hydrochloric acid ; no silicate was present.

3rd. The clear supernatant liquid of acid. phosph. dil., by addition of ammonic hydrate and ammonic carbonate, formed a white precipitate, which redissolved in acetic acid with effervescence. Then, on addition of ammonic oxalate, white calcic oxalate formed, insoluble in acetic, but soluble in hydrochloric acid. This furnishes conclusive evidence of lime both in the supernatant liquid and in the deposit.

Microscopical Examination of the Deposit.—For microscopical examination I employed a magnifying power of 75 diameters, being unable to use the high power with equal accuracy. The minutest quantity under the low power represents a fibrous network very analagous in appearance to the Tela Contexta, as found in the mosses, anastomosing and exhibiting very well-defined oblong muriform cells placed end to end. In the interstices of its central ramifications are seen small bodies resembling nuclei. These nuclei are nearly double the size of the diverging fibres constituting the mass of the deposit. The colour of the deposit is of a greyish white, with diffusive and elastic properties.—*New Remedies.*

THE MANUFACTURE OF ALUMINIUM, SODIUM, AND SIMILAR METALS.

A PATENT has been obtained by Mr. W. P. Thompson, of Tranmere, for a novel process of manufacture of aluminium, sodium, and similar metals, which, if successful, would very greatly reduce the present high price of these metals. Liquid iron, either alone or in conjunction with hydrogen or carbon is to be the reducing agent, and the operation is to be conducted in an apparatus similar to the well-known Bessemer converter. This apparatus is made up of two characters. After the iron has been fused in the one it is transferred into the second by turning the converter. Through a tube opening into this second chamber, hydrogen, or carburetted hydrogen is allowed to enter, and through another one chloride or fluoride of aluminium in a state of fusion or as gas. Hydrogen and ferric chloride escape, and in the converter remains iron alloyed with aluminium and carbon. This mixture is then again transferred to No. 1 chamber, where the carbon is to be burnt by a current of air. After retransferring to No. 2 the process of reduction is to be continued, until the iron is almost wholly consumed, when hydrogen alone is to be used as reducing agent. Thus an iron-aluminium alloy results.

For the preparation of sodium, hydrogen is not requisite. Iron, mixed with much carbon, is to be heated with caustic soda in the converter, and the sodium, said to be formed under these circumstances, is simply distilled off. When all carbon is consumed the iron may be worked into Bessemer steel or may be again re-carbonised.

Iron and potassium not forming an alloy the method is not well applicable for the preparation of potassium.

For the manufacture of pure aluminium, sodium is to be preferred in the manner described, and then in the chamber containing the metal, chloride or fluoride of aluminium is to be allowed to enter, air being excluded. The chamber is provided with stirring gear, and is lined with alumina, or a mixture of lime, magnesia and alumina.

The inventor will likewise apply his process to the preparation of magnesium, calcium, strontium and barium. (Patent 2101, March 27, 1879).

ADULTERATED DRUGS.

At the recent meeting of the Grand Jury of the County of Monaghan, Dr. C. A. Cameron, County Analyst, reported that amongst the articles analysed by him nine were drugs supplied to one of the Unions, and not one of which was pure. Sulphate of quinine, so called, did not contain a particle of that drug, but was composed wholly of sulphate of cinchonine. The "tincture" of perchloride of iron contained no spirit; aromatic sulphuric acid contained no bark; compound tincture of bark was deficient in extract, and did not contain all the ingredients which the Pharmacopœia directs. All the tinctures were deficient in spirit of wine. Etherial tincture of lobelia was made with methylated ether.

ANALYSTS' REPORTS.

Mr. J. Carter Bell, the analyst for Cheshire, reported that during the quarter ending June 30, he had analysed 212 samples. Of these 33 were adulterated, namely, 8 milks, 5 coffees, 6 mustards, 5 spirits, 7 oatcakes, 1 bread, and 1 butter. The oatcakes were adulterated with chalk, in some cases as much as 10 per cent. The report proceeded:—"I consider the use of chalk in food most injurious, for a person, making a hearty meal of oatcake, would take two ounces of chalk, which would seriously impair the digestive organs. Five samples of water were highly contaminated with sewage and vegetable matter, and were not fit for domestic consumption."

Mr. J. Carter Bell, Public Analyst for the Borough of Salford, in his report for the quarter ending June 30, stated that in that period he had analysed 124 samples. Of these 15 were adulterated, namely 3 of beer, 2 of mustard, 7 of butter, and 3 of milk. The adulteration was rather below the average during the quarter, the average of adulteration for the year 1879 being 19. The report continued:—"No Corporation in the kingdom pays such attention to the Adulteration Act as the Corporation of Salford. In some places the Act is a mere farce, for few, if any, samples are collected for analysis, and the consequences are that 'vitriol madness,' alumed bread, and milk and water are sold to the poor without let or hindrance. Such a state of things is almost unknown in Salford, owing to the energetic measures taken by the health committee in repressing adulteration." Salford stood far above all other boroughs in the kingdom as regarded the number of samples analysed, and in no borough was the Adulteration Act worked at a less expense in proportion to the work done than it was in Salford.

Mr. E. W. T. Jones, Public Analyst for the County of Stafford, in his report for the quarter ending last June, states that he examined 216 samples, of which 37 were adulterated, viz., 16 butter, 6 coffee—4 containing as much as 56, 57, 61, and 71 per cent. of chicory, 1 gin, 1 ground ginger—containing wheat flour coloured with turmeric, 8 milks, 4 mustards—containing wheat flour and turmeric, and 1 ale.

CORRESPONDENCE.

[The Editors are not responsible for the opinions of their Correspondents.]

RUGBY MILK.

To the Editor of "The Analyst."

Sir,—I had this week a sample of milk to analyse, which was supplied to one of the boarding houses. It contained—

Total solids	5·921
Fat	*nil.*
Ash	0·258
	S.G. 1006

The milk was very sour, and quite curdled. On standing, the curd settled down, leaving a clear supernatant liquid. Under the microscope, swarms of bacteria were detected.

I am unable to say if the acidity of the milk is accidental (from dirty can, &c.) or not.

I am happy to say that all the Rugby Milks are not as bad as the above, but they seem to be sophisticated.

The following analyses I made about a year ago:—

	Weight of 100 c.c. grms.	Total Solids.	Fat.	Solids not fat.	Ash.	
1	101·5	10·038	0·935	9·103	·49	
2	102·3	10·1025	·645	9·457	—	Same source.
3	102·3	9·579	·684	8·995	·557	
4	102·2	12·778	1·780	10·998	—	
5	102·5	13·317	3·263	10·057	·673	Same source.
6	102·6	10·809	1·676	9·133	·528	
7	102.2	10·176	1·497	8·679	·322	
8	102·2	11·252	1·604	9·648	·596	
9	101·9	10·098	2·031	8·067	·529	
10	102·9	14·868	1·749	13·119	—	
11	101·8	14·74	3·57	10·17	·658	

No. 5 I got from the can as the milkman was taking it home from the farm.

No. 4 is the same milk when sold in the town.

No. 10 is acknowledged skimmed milk from a farmer, and is better than some sold as fresh.

No. 11 is the milk supplied me by the vendor of Nos. 4 and 5.

I am, &c.,

A. PERCY SMITH.

LAW REPORTS.

Analyst's Certificate as to Milk must state that no change has taken place in the Sample to interfere with the Analysis :—

ADULTERATED MILK.—Robert Jackson was summoned by the police for selling milk adulterated with water at Old Sleaford. Mr. Jessopp appeared for defendant. Supt. Stevenitt deposed that on the 27th of May he purchased a quart of milk of defendant's wife. for which he paid 4d., and conveyed the same the next day to Dr. Graham, of London, whose certificate he then produced, which showed that the milk consisted of one-tenth of water. Mr. Jessopp for the defence, observed that he should before proceeding to answer the charge, raise a technical objection with reference to the words used by the Superintendent when purchasing the milk. According to the Act any person purchasing an article for analysis, must notify to the seller or his agent his intention of having the same analysed by the Public Analyst. The Inspector must, according to the Act, make use of the words "Public Analyst." Mr. Jessopp quoted an appeal case in the Exchequer Division, "Barnes *v.* Clipps," which was dismissed owing to the omission of the words "Public Analyst," by the inspector who purchased the article. Supt. Stevenitt recalled, stated that when he first bought the milk he told Mrs. Jackson it was for analysis; he asked her to divide it, and upon meeting with a refusal he said he should take it to the County Analyst who would divide it; he said County not Public. This objection was over-ruled, the Bench considering that County Analyst was sufficient. Mr Jessopp remarked that he had a further technical objection to raise with reference to the wording of the certificate. According to Stone's Justice's Manual, in the case of milk it must be specially stated by the analyst whether any change has taken place to interfere with analysis, and unless such statement were made the certificate did not conform with the Act. It was also shown that the analyst's certificate must be taken as *prima facie* evidence to save the expense and trouble of the analyst being present to prove the case. The Chairman observed that having taken their Clerk's opinion and duly considered the circumstances, it appeared that the analyst's certificate was not made out in conformity with the Act and they should therefore dismiss the case.

Sweet Spirits of Nitre :—

At the Stockport Borough Court House, on 17th July, Henry Charles Bennett was charged with selling, to the prejudice of Jacob Marshall, on the 3rd inst., a certain quantity of sweet spirits of nitre, the same not being of the nature, substance, and quality demanded by the purchaser. The Town Clerk prosecuted on behalf of the Sanitary Committee of Stockport; Mr. Glaisyer, of Birmingham, appearing for the defence. Jacob Marshall, inspector of nuisances, said that on the 3rd July, he went

to the defendant's shop and asked him for 4 oz. of sweet spirits of nitre. He paid 1s. 4d. for it, and then told the defendant that it was to be analysed by the Public Analyst, and divided it into three parts. One bottle was sent to the analyst, and afterwards his certificate was received and was to the following effect :—That instead of containing three per cent. of nitrous æther, the sample only contained 1·15 per cent., and that the specific gravity was ·844 instead of ·855. Mr. Oswald Wilkinson, Borough Analyst, was then called. He said he received a sample of sweet spirits of nitre similar to the one which had been produced in court, marked B. No. 2, from Inspector Marshall. He analysed it, and afterwards delivered a certificate to the inspector personally. He said the sample only contained 1·15 of nitrous æther. The British Pharmacopœia gave three per cent. as a fair standard of the quality of the article. He did not consider that a person asking for sweet spirits of nitre received what he desired when he only got an article containing 1·15 of nitrous æther. Sweet spirits of nitre was the same article that was mentioned in the British Pharmacopœia. Dr. Downs : What name had this formerly? Witness said that as far as he could remember, it had been known as sweet spirits of nitre or spirits of nitrous æther. He tested it by specific gravity. He did not use the tests recommended by the British Pharmacopœia, but those of Dupré. He tested it for the colour to the extent of five minutes. He had never made an experiment on an article containing pure nitrous æther. Here, at the request of the solicitor for the defence, witness described minutely the tests ordered by Dupré. He said he believed the nitrous æther to be the active medicinal principle. At once he would say the purchaser was prejudiced in receiving the article which the defendant had sold. To the best of his ability it was the nitrous æther that did the good for which the medicine was taken. He should think there was something present besides nitrous æther. Sweet spirits of nitre was the common name for spiritus ætheris nitrosi. Dr. Edwin Rayner, medical officer of health for the borough of Stockport, said that the article ought to contain more than two per cent. of nitrous æther. He had himself analysed specimens some years ago. It was a very common medicine, and was used very extensively by the people. It possessed certain properties which rendered it good for certain diseases. These properties were known, and the medicine was used by the public accordingly. The absence of nitrous æther would decrease the medicinal value of the drug. Cross-examined: The sample in question was not a good one, because it contained less than two per cent. Mr. Glaisyer having opened the case for the defence, Henry Charles Bennett said he was the defendant, and was a chemist and druggist in business in this town. He recollected the inspector coming on the 3rd June and asking for four ounces of sweet spirits of nitre, and paid 1s. 4d. He served him with the article commonly sold as sweet spirits of nitre. That article was in constant request by the public. He had supplied the British Pharmacopœia preparation, and he constantly had it brought back. He had complaints in every case about it, about its unpleasant smell, burning their throats, and the colour. He purchased the article he sold from Messrs. Evans, Son, and Co., Liverpool, in May. He supplied it to the inspector in the same condition as he received it. He kept both preparations in his shop. He had been in Stockport about three years. The difference in price was 4d. per pound between the two. The wholesale prices were 3s and 3s. 4d. One was sweeter than the other, and that was why they took it. He did not think that the sweet spirits of nitre was an inferior quality to the British Pharmacopœia. By Mr. Glaisyer : The reason for selling ·850 was that the customers would not have the other. He had not recently attempted to supply it. Professor Attfield said there were two distinct varieties of sweet spirits of nitre in this country ; some other varieties were imported. There were varieties in all countries on the continent, and that was perfectly well known. The materials used in these two varieties were quite distinct. The variety of the British Pharmacopœia is made from spirits of wine, nitric acid, copper, and sulphuric acid. The latter variety is made with the materials mentioned in the Pharmacopœia of 1809, 1836, and 1851. In the 1863 Pharmacopœia the ingredients are the same. The processes were practically the same. In this particular case he received a sealed sample on the 5th July. He analysed the contents of the bottle, and compared it with samples of perfect purity, made by himself, and it was quite as good as them. It was, in his opinion, a good sample of sweet spirit of nitre. It was as good in appearance and odour, and answered as well to the tests and specific gravity. The specific gravity is ·850. He considered that the analyst had obtained figures which were too low, and that he did so because the temperature that he observed was too high. The temperature he should have observed is 60 degrees, whereas he stated that he worked at 64½° Fahrenheit. In the Pharmacopœia these ingredients were ordered to be taken at 60 degrees, and that would partly account for the difference. He considered that he worked on too small a quantity. By Mr. Glaisyer : As regards the percentage of nitrous æther, no one knew what that percentage should be. The analyst found 1·15 of nitrous æther. He placed not the slightest reliance on any point by which the analyst got at 1·15 per cent. There might have been more or less. The process was wholly untrustworthy. He said that medical authorities could not agree as to the exact substance.

The benefit as a medicine might be due to nitrous æther or to ældhyde; it may be due to other ethereal bodies. It might be due to union of those substances. On this point medical authorities are not agreed. Michael Conroy said he was manager for Messrs. Evans, Son & Co., Liverpool. They were manufacturers of drugs and other medicines. They supplied the defendant with the sweet spirits of nitre in May last. The specific gravity was ·850. The new variety was dearer than the old, therefore it would be to their advantage to push the sale of the new. They sold about 3 gallons per week, whereas of the old they regularly sold from 120 to 150 gallons per week. The magistrates then retired, and after a brief consultation returned into court, when they said that they thought the evidence was in favour of the defendant, and therefore the case would be dismissed. Mr. Glaisyer then asked the bench for costs. They replied that they must consider the other side as well, but they had been thinking of that a while ago, and £10 would be allowed, but this was not to be taken as a precedent in any future cases.

Sunday Samples.—Salt in Milk :—

At Woolwich several points of public interest arose during the investigation of certain adulteration cases consequent on a Sunday collection of milk samples by the Woolwich Local Board of Health. In the case of John Chard and Joseph Brandon, the samples were found to be adulterated with 26 per cent. of added water and 100 grains of salt per gallon, and the blame was in both instances attributed to a man in the employ of the wholesale dealer, who was said to have admitted his guilt. The magistrate, Mr. Marsham, asked for what purpose the salt was introduced, and Mr. Hughes, the Local Board solicitor, said it might be to preserve the milk, but it was probably to increase the specific gravity and prevent the presence of water being detected in the lactometer. The Board's inspector said he had been informed by cowkeepers that the salt would give a "body" to weak milk and prevent the water from being discovered. Mr. Hamilton, the farmer by whom the milk was originally supplied, expressed a desire to take criminal proceedings against his agent for adulterating the milk and thereby damaging the trade, adding that he had such an abundance of milk that he hardly knew what to do with it. Mr. Marsham said it was a common complaint among milk sellers that they could not get a warranty from the wholesale dealers, and Mr. Hamilton replied that he was always ready to give a warranty if required. Mr. Hughes expressed a desire to have the agent present to answer the allegations made against him, and the cases were accordingly adjourned. The analyst's certificate in the case of James W. Headman, another milkman, showed an adulteration of 10 per cent. of added water, but the defendant declared that the milk only passed through the hands of himself and son, and was as pure as it could possibly be. All milk, he said, contained some water, that from cows in the shed more than from cows at grass. Mr. Hughes informed the magistrate that the analyst allowed 10 per cent. of water as a proper constituent of milk. The defendant repeated that his milk was pure, and requested that the analyst or his inspector would come to his shed, milk a cow himself, and then examine the sample and experiment, for which he offered to pay the expenses. Mr. Hughes said it was a fair challenge, and it was arranged that the inspector should take a sample direct from the cow and send it for analysis in the usual way, the defendant to pay one guinea expenses. For this purpose the case was adjourned for a fortnight.—*Times.*

Employer Fined for Addition of Water to Milk by his Servant :—

At Marylebone Police Court, Mr. Herbert Dodwell, farmer, of Lob Farm, Tetsworth, Oxfordshire, was summoned for selling milk found on analysis to be adulterated. The defendant has recently entered into a contract to supply the Royal Shorthorn Dairy Company, of Bridge Terrace, Paddington, with milk, and had formerly supplied the Express Milk Company for eight years. In consequence of an application made by the manager of the former company to the Inspector, he attended at Paddington Station on the arrival of three churns from the defendant, put seals on them, and gave notice of his intention to defendant to take samples. He did so in the presence of defendant, and had them analysed by the Public Analyst, whose certificates showed them to be adulterated with 18, 13, and 12 per cent. of added water respectively. Mr. Poland said the defendant was, by agreement with the Royal Shorthorn Dairy Company, under a forfeit of £20 on every occasion on which he should not supply pure milk to them. After careful inquiry they had found that a man employed by the defendant to cool the milk over the refrigerator, had added water to the milk, and on his being told that he would be called as a witness, he had admitted the offence. The defendant was exceedingly sorry, for the act of his man had made him liable to the law. The Rev. John Armstrong Coghlan, vicar of Tetsworth, and the Hon. Francis Parker, son of the defendant's landlord, both gave him a very excellent character; and Mr. George Barham, manager of the Express Dairy Company, said that during the eight years the defendant had supplied them with milk it had been invariably good. The magistrate said he was very glad indeed

that these steps had been taken. So far as the defendant was concerned, he was willing to believe the defence was a genuine one, but the evidence showed that the defendant did not attend personally to his business, but left it a great deal to his servants. Fined 20s., and £3 3s. costs.

No Adulteration, if Substance added is not Injurious to Health, and does not Interfere with Weight or Measure of Article Sold:—

At the Bolton Borough Court, Peter Featherstone, farmer, Turton, was charged with selling milk not of the substance or quality demanded. Mr. Hick, of the Town's Clerk department, applied for a remand. Mr. Fielding objected to this. His client had been summoned to answer the charge that morning, and was ready to do so. The Mayor agreed with Mr. Fielding, but granted a remand for half-an-hour. On the case being again brought forward Mr. Hick stated that the offence was rather an aggravated one, for defendant had been previously convicted. The Mayor thought those remarks ought not to have been made at that stage in the case. William James, Inspector of Nuisances, said he purchased a pint of milk from defendant in Ashburner Street. He asked for it out of a particular kit in defendant's cart, but defendant refused to allow this. On asking the price he was told it was 2½d. per quart, so he paid 1½d. for the pint, and then told defendant he should have it analysed. It was then divided into three parts, of which defendant kept one, and another portion was taken to Dr. Sergeant. He was aware that the ordinary price of new milk was 3½d. per quart, and on telling defendant for what purpose the milk was obtained, was informed that it was night's and morning's milk, but defendant did not explain definitely what he meant by that remark. Richard Bullough, shopkeeper, Ashburner Street, said that defendant supplied him with milk, and he had been in danger of being convicted on account of the quality which defendant supplied. Witness did not confine his purchases to defendant, for there were two other milk dealers of whom he bought. The price paid to defendant was 3d. per quart. Dr. Sergeant proved receiving the sample of milk from the witness James, which, when analysed, was found to contain 20 per cent. of water and was further weakened by the abstraction of the cream. Mr. Hicks applied for the full penalty of £20, under section six of the Food and Drugs Act, for it was quite evident from Dr. Sergeant's report that the milk was not only skimmed milk but was largely adulterated with water. The Mayor said that when James, the Inspector, demanded milk of a particular kit, and then learned that it was night's and morning's milk he would understand that it was mixed milk. Mr. Hick did not think so. Even if it were so, it would only apply to the mixing of different sorts of milk. The charge was for mixing water with the milk. The Mayor said the Act did not regard it as adulteration if any substance was mixed with an article, which was not of itself injurious to health, and which did not interfere with the weight or measure of the article sold. If the Act had mentioned the quality of the article there might be a case, but in the present instance he thought there was none. The prosecution had failed to make it perfectly clear that the measure had been increased, or that the water added to the milk was injurious to health. Addressing Dr. Sergeant, his Worship asked if this was so, and receiving for answer that it could not be proved that it was, the Mayor asked if water could be said to be injurious to health? Dr. Sergeant said it depended on the circumstances. If water was taken where milk was wanted then it was. The Mayor: I did not ask that. I asked if water ordinarily was injurious. Dr. Sergeant said that he could not say that it was. The Mayor resuming, said the Bench had decided to dismiss the case, as they thought the charge had not been established. Mr. Hick then applied for leave to state a fresh case, which was granted.

NOTES OF THE MONTH.

We have received a letter from Mr. Kingzett on the subject of the review of his work on *Nature's Hygiene*, which we published last month. We do not at present print it, as we think that from its nature Mr. Kingzett himself would be, on reflection, one of the last to really desire its public appearance. We may say, however, that our reviewer worked perfectly independently on his own convictions, without communication with any other parties, and that he did not review the work for any other journal than this one.

We observe from the *Cowkeeper and Dairyman's Journal* that it is proposed to have lectures on milk analysis delivered to the members of the Metropolitan Dairymen's Association. The fee for these lectures is to be two guineas, including practical illustrations.

Such lectures will, doubtless, be of great service by teaching the trade to take advantage of the low standard adopted at Somerset House, and showing them how, by regularly analysing their milk each morning, they may indulge in a remunerative amount of dilution without infringing that limit. The notice does not say who the lecturer is to be, but we presume that an eminent professor, who is already their own analyst, will officiate, as we observe from another part of the *Journal* that his fee for milk analysis is to be in future increased from 2s. to 3s. 6d. per sample. The Pharmaceutical Society's school has not of late been famed for full audiences, and on the principle that every little helps, the attraction of milkmen to Bloomsbury Square would not be a bad idea. How about *cramming*, however, which the professors there hold in such virtuous horror, for would not such demonstrations be a case of "cramming" on analysis of a very marked description.

It is curious to observe how little some analysts take advantage of the records of decisions printed regularly in our columns, and go blindly on in their old way. A very marked instance of this is seen in the report of a case of milk adulteration heard at Sleaford, which was dismissed on the ground that the certificate contained no statement as to whether the article was or was not in a fit condition for analysis. This point was raised and decided at the Wandsworth and Southwark Police Courts within six months after the passing of the Act; and had the analyst kept his eyes open and drawn the certificate as all his *confreres* have done for some years, the cases would not have been lost, and an unnecessary expense cast upon the authorities. One great object we have in view is, by our meetings and journal, to disseminate a knowledge of the decisions affecting the technical working of the Act, as well as to advance the science of food analysis, and analysts who neglect the opportunity of thus acquiring valuable practical hints have only themselves to blame when they suffer a check on a technical point.

According to Mr. Smith's letter in our correspondence columns, the Rugby boys are treated in the orthodox manner as far as milk is concerned, and the doctrine that strong meats are not suitable for babes and sucklings is rigorously adhered to in that classic seat of learning. It is to be feared that milk is, however, not always the staple fluid consumed by the modern Rugby boy, so perhaps its dilution does not so much matter.

The result of the Woolwich milkman's challenge to the analyst, reported elsewhere, proves that his guinea is lost, and that the natural milk of his cows proves to be above the Society's limits, and, therefore, above that of Somerset House.

Mr. Edge, a prominent member of the Manchester milk trade, has been indulging in some remarks against the analysts. He charges them with two perfectly new misdemeanours—at least, new to us. The first is, that the analysts never give the standard on which they base their opinion; and the second, that they nett a considerable fee for each conviction. We cannot, of course, positively assert that the Manchester analyst is not open to these charges; but all we can say is that if it be so (which we do not for a moment believe), then he differs in his mode of certifying and terms of appointment from most other analysts. We should think that the issuing of a certificate for a milk found to be diluted without inserting the total solids, fat, ash, &c., of the sample, is an unusual thing;

and we can assert in reply to Mr. Edge that, taken *en masse*, the analysts *do* give in every certificate the figures upon which they found their opinion, and that no analyst receives any fees depending on the number or success of the prosecutions for which his certificates are employed. Mr. Edge and his friends would make more converts to their way of thinking if they held to the exact truth, and did not make general charges against a body of men founded on wrong premises. If Mr. Edge can for a moment prove his assertions, then we will grant him space to do so; if not, he must in future abstain from such reckless statements regarding us.

At a recent meeting of the Bristol Town Council, Mr. F. W. Stoddart was appointed Public Analyst, in the place of his father, the late Mr. W. W. Stoddart.

Mr. J. Comyns Leach has been appointed Public Analyst for Blandford.

Mr. J. Pattinson has been appointed Public Analyst for Gateshead in the place of the late Mr. A. J. Edger.

Mr. W. F. Stock has been appointed Public Analyst for the County of Durham, also in place of Mr. Edger.

Dr. W. Morgan and Mr. J. W. Thomas have been appointed Public Analysts for the County of Glamorgan.

RECENT CHEMICAL PATENTS.

The following specifications have been recently published, and can be obtained from the Great Seal Office, Cursitor Street, Chancery Lane, London.

1879 No.	Name of Patentee.	Title of Patent.	Price.
4803	J. A. R. Hilderbrandt	Microscopes	2d.
4811	J. P. Kagencusch	Extracting Aluminium &c., from Clay, &c.	2d.
4870	J. Mactear	Furnaces for Chemical Purposes	8d.
5143	Ditto	Obtaining Crystallized Carbon	2d.
4891	F. White	Chemical Compound for Treatment of Hides	2d.
4896	Ditto	Manufacture of Chloride of Lime	2d.
4903	C. E. Scribner	Telephones	8d.
4918	W. R. Lake	Manufacture of White Lead	6d.
4970	Ditto	Farinaceous Food	6d.
5030	T. Morgan	Manufacture of Caustic Soda	2d.
5031	O. E. Pohl	Manufacture of Sulphates of Soda and Potassa	2d.
5041	E. Edmonds	Extraction of Iodine from Sea-wrack and Seaweed	6d.
5105	C. Wigg	Manufacture of Sulphates of Soda and Potassa	2d.
5109	R. Powell	Manufacture of Sulphite of Lime	6d.
5121	J. B. Freeman	Preparations of Zinc White	2d.
5127	T. A. Edison	Electric Lamps	6d.
5129	A. Fryer	Manufacture of Sugar	6d.
5156	S. Pitt	Obtaining Electric Light Regulators	8d.
5163	G. W. Von Nawrocki	Manufacture of Magnesia-Hydrate of Magnesia	2d.
5177	J. Mackenzie	Lighting Gas by Electricity	6d.
5197	H. J. Haddan	Purifying Gas	4d.
5206	G. André	Electric Lamps	6d.

BOOKS, &c., RECEIVED.

The Chemist and Druggist; The Brewers' Guardian; The British Medical Journal; The Medical Press; The Pharmaceutical Journal; The Sanitary Record; The Miller; Journal of Applied Science; The Boston Journal of Chemistry; The Provisioner; The Practitioner; New Remedies; Proceedings of the American Chemical Society; Le Practicien; The Inventors' Record; New York Public Health; The Scientific American; Society of Arts Journal; Sanitary Engineer of New York; The Cowkeeper and Dairyman's Journal; Hydro Incubation by T. Christy; Report on Certain Epidemic Outbreaks of Enteric Fever by the Medical Officer of Health for Glasgow.

THE ANALYST.

SEPTEMBER, 1880.

SOCIETY OF PUBLIC ANALYSTS.

A GENERAL MEETING was appointed to take place at Swansea, on the 27th Aug., but has been adjourned till November next, in London. We print some of the papers announced for the meeting.

ON THE ESTIMATION OF THE INSOLUBLE FATTY ACIDS IN BUTTER FAT.

By J. WEST-KNIGHTS, F.C.S., F.I.C.

ALTHOUGH much has been written within the last few years on this subject, the estimation of the insoluble fatty acids is still a very tedious process, and liable to serious error, chiefly on account of the difficulty of effectually washing a fatty substance with water, without incurring loss, and of the difficulty of transferring the fatty acids, when washed, to a vessel suitable for drying and weighing them in.

In the modification of the process about to be described, it is hoped that these difficulties have been removed, and the estimation rendered less tedious, more expeditious, and above all more accurate than the usual method of washing either in a flask or on a paper filter.

It is based on the insolubility of the oleate, stearate and palmitate of barium or calcium, and on the ready solubility of the butyrate, &c., of those metals.

Weighing the precipitate obtained by carefully neutralizing the saponified butter fat with acetic acid, and adding solution of barium or calcium chloride, and washing with boiling water, was first tried, but in practice it was so difficult to exactly neutralize the soap solution, and either fatty acids were precipitated or carbonate formed from the slight alkalinity, and the precipitate was with difficulty dried for weighing, and the results were unsatisfactory, probably partly owing to inconstancy in the composition of the precipitate ; and it will also be evident that the weight of the precipitate so obtained would not be directly comparable with the weight of insoluble fatty acids in different fats on account of the different combining proportions of the oleic, stearic and palmatic radicles.

It was therefore found necessary to weigh the fatty acids in a free state. To accomplish this, the acids were liberated, after washing the salt containing them, in contact with ether and a portion of the ethereal solution so obtained, evaporated to dryness.

In practice the process is conducted as follows :—A portion, 1—3 grammes, of clarified butter-fat is saponified by heating on the water-bath with about twice its volume of alcoholic potash, and the occasional addition of a few drops of boiling water, the combination is completed in about twenty minutes ; the solution is then diluted to about 300 c.c.

with cold distilled water, and solution of $BaCl_2$ added until a curdy precipitate separates, and the liquid is no longer rendered milky by a fresh addition, the precipitated salt is collected on a filter and washed with warm water, then transferred to one of the tubes described by Dr. Muter in his paper on the "Estimation of Oleine in Fats" (THE ANALYST, Vol. II., p. 74), which is a long graduated tube of 250 c.c., graduated from the bottom upwards, and furnished with a well ground stopper and a stopcock, which is placed at 50 c.c. from the bottom. As the mouths of these tubes are rather narrow, and consequently inconvenient for the introduction of the precipitate, the author uses one that has been cut off just below the shoulder and having a large stopper ground to fit accurately in the tube itself, which is one inch in diameter. Hydrochloric acid is added to the tube, which already contains the precipitate and the water used in washing it into it, when the fatty acids are liberated ether is added; if the watery liquid reaches above the stopcock, as it probably will if much water was required to transfer the precipitate, about 50 c.c. only of ether should be added at this stage. The tube, well shaken, is allowed to stand until the liquids have separated perfectly; now if the stopper be removed and the tube inclined forward, it is easy to draw off the bottom liquid from the cock until the level of it falls considerably below the cock when the tube is upright, without any loss of ethereal solution The rest of the ether is now added (a total quantity of 100 c.c. is sufficient) and the tube once more shaken and allowed to stand; the volume of the ethereal solution is now read off from the graduations of the tube and noted.

It is only required now to remove an accurately noted quantity of the ethereal solution to a tared flask; distil off the ether and weigh the fatty acids that remain; before measuring the required quantity for evaporation, about 1 c.c. should be drawn off in order that the delivery tube of the stop-cock may be filled and no correction needed for the quantity it would retain if the measurement had been commenced with the tube empty.

This method has been used in the author's laboratory for over six months, and has been found very satisfactory, as the whole operation can be concluded in a very short time, and very concordant results can be obtained in two analyses of the same fat, as the following extracts from the laboratory note-book will show:—

	Quantity taken.	Insoluble fatty acids.	Per cent.
No. 1. Butter fat	3·097 grm.	= 2·728	= 88·08
No. 2. Butter fat (Same as No. 1)	1·180 ,,	= 1·038	= 88·00
No. 3. Lard	1·016 ,,	= ·9769	= 96·15
No. 4. Almond Oil	1·179 ,,	= 1·1321	= 96·02
Theory for pure Oleine		=	95·70

Either barium or calcium chloride may be used for the precipitation, but barium is preferred, especially for fats or oils containing much oleine, as the salt produced is less apt to stick to the sides of the beaker, and it is more easily washed with hot water, not being so liable to run into a plastic mass.

ON A NEW METHOD FOR THE ESTIMATION OF ORGANIC CARBON IN POTABLE WATERS.

PRELIMINARY NOTICE.

By ALFRED SMETHAM, F.C.S.

It will, I think, be allowed that the estimation of the organic matters actually existing in potable waters is of the utmost importance in deciding their adaptability to domestic

purposes. Unfortunately, the quantities to be dealt with are so exceedingly small, that any attempt to arrive at an intimate knowledge of their constitution is at present, practically impossible, and we are, therefore, compelled to have recourse either to comparative methods or to determine but part of their constituents. The methods by which these ends are attained are well known to all chemists. The old "ignition process," has long been abandoned as untrustworthy; and this, as far as my memory serves me, is the only method which attempts to determine the total amount of organic matters present. The processes which have found most general acceptation, are—1st, the Combustion Process, devised by Drs. Frankland and Armstrong; 2nd, the Albuminoid Ammonia Process, by Prof. Wanklyn; and, 3rd, the Permanganate Process, which has been enlarged upon of late by Dr. Tidy. The first of these methods may be designated for convenience an *absolute* method, whereas the other two must be considered as comparative. But although it is true that the last two processes give but comparative results, they possess a redeeming feature in the fact that they are applied to the water without previous treatment, whereas it is necessary in applying the first process to evaporate the water to complete dryness. The relative value of the different processes have, however, been so completely discussed that any criticism of mine would be presumptious. Before leaving this part of my subject, however, I must make mention of the process of Messrs. Wanklyn and Cooper, by evaporation with alkaline permanganate, which seeks to attain the same object as the process I am about to describe, but as I have seen no detailed account of accurate experiments I am unable to comment upon it.

The belief that greater reliance could be placed in the results if an accurate method could be devised for the estimation of the carbon and nitrogen without evaporation to dryness, induced me at the beginning of last year to start the experiments the result of which I propose to bring before your notice. I may, however, observe that all my attempts to obtain accurate results for the nitrogen have utterly failed.

The experiments which I made at the commencement were numerous, and resulted for the most part in failure, due either to the unsuitability of the apparatus used, or ignorance of the requisite precautions. It is needless, however, to state my failures and disappointments, but I will as briefly as possible describe the process and apparatus which I at present use.

The process is essentially an oxydation of the organic matter by means of bichromate and permanganate of potash in a sulphuric acid solution.

One litre of water under examination is acidified with phosphoric acid and evaporated in a water-bath with due precautions to about 50 c.c. It is then transferred to a small retort connected with an absorption tube, containing perfectly clear baryta water, to which in turn are attached two more washing tubes. The first bulb tube must be sufficiently large to allow about 100 c.c., to be contained in it; the second tube is intended as a "tell-tale," and the third to prevent the absorption of carbonic acid from the atmosphere.

Before use the parts are thoroughly cleansed, and baryta water, or caustic potash, is then placed in the last bulb-tube, and the other parts connected. An aspirator is then attached to the tubule of the retort and a current of washed air drawn through the apparatus. About 20 c.c. of a perfectly bright and clear solution of caustic baryta are then placed in the large bulb-tube, and a suitable quantity in the "tell-tale," and the whole apparatus attached again as quickly as possible.

The water which has been evaporated with phosphoric acid, is then gently boiled until

the steam enters the absorption tube. The baryta water should remain perfectly clear, but if not the distillation must be continued until the last traces of CO_2 are expelled and the baryta water renewed.

The apparatus is then allowed to cool, and 1 gram of bichromate of potash, and 1 gram of permanganate of potash, together with 20 c.c. of sulphuric of 1·4 sp. gr. are then introduced. It is needless to state that special precautions must be observed in order to ensure the purity of the chemicals used, and that one or more blank experiments must be made.

A small gas flame is then placed under the retort and the liquid distilled very slowly. The steam is condensed in the U tube, and the carbonic acid, which accompanies it, is absorbed by the baryta water. No precipitation should take place in the second tube. The distillation is continued until about 20 c.c. remain in the retort.

When the operation is complete the precipitate in the tube A is filtered and washed first with water saturated with carbonate of barium, and finally with a little boiling water.

The apparatus which I have used up to the present to prevent the absorption of carbonic acid from the atmosphere during the washing, has consisted of a cap of india-rubber, which is affixed to the funnel containing the filter, and through which the contents of the U tube could be thrown upon the filter and washed without fear of absorption of CO_2 from the air. The method of Drs. Dupré and Hake, as given in the *Journal of the Chemical Society* (March 1879), will, however, I believe be found more convenient, but I regret to say that, up to the present, I have been prevented by stress of work from trying it. I have, however, to express my thanks to Dr. Dupré for the information he has given me upon this point.

The washed precipitate is then dissolved in a little dilute hydrochloric acid and converted into sulphate of barium, in precisely the same way as suggested by Dr. Dupré. From the weight of the precipitate, the amount of carbon is readily calculated. Owing to the high molecular weight of $BaSO_4$ a very small quantity of carbon will produce a tangible precipitate, the weight of the resulting $BaSO_4$ being nearly twenty times as great as the original carbon.

The precautions to be observed are chiefly the following:—Perfect expulsion of CO_2 from the water, perfect purity of chemicals, sufficient time during the distillation, complete washing of the resulting $BaCO_3$ without loss or absorption of CO_2 from atmosphere.

The sulphuric acid will, of course, decompose the nitrates and chlorides in the water, and the corresponding acids will distil, but as these form soluble salts they do not interfere with the operation. I have not found that more than traces of sulphuric acid are carried over, but even should there be a small quantity, the resulting $BaSO_4$ is retained on the filter and does not interfere with the accuracy of the determination.

The heat must be so regulated that the steam carried over will all condense in the forepart of the U tube. In practice I have found the apparatus to answer well, there being no chance of loss of CO_2 by any unnecessary apparatus.

The oxydation would appear to be complete in nearly all cases—the substance, as far as my experiments have extended, which has proved most refractory, being urea, but this even yields about 80 per cent., and in one case, by the subsequent addition of 10 c.c. of strong sulphuric acid and a little permanganate of potash, I obtained results slightly above the theoretical. This leads leads me to hope that, by continuing the distillation a little longer, better results may be obtained.

I do not propose to give a statement of the experiments I have made, as I intend reserving these until I have completed the series which I have sketched out, but I will give the actual figures which I obtained from five substances, which I think may be considered as typical.

1st. ·0500 of sugar (Tate's crystals which on polarization and analysis proved to be quite pure) were treated as stated above.

Carbon found	·02147	gram.
Carbon present	·02105	,,

2nd. *Benzoic Acid.* Quantity taken, ·0300 gram.

Carbon found	·02042	gram.
Carbon present	·02065	,,

3rd. *Isinglass.* Quantity taken, ·0580 gram.
(Schorlemmer states percentage of carbon as 49·3.)

Carbon found	·02857	gram.
Carbon present	·02859	,,

4th. *Picric Acid.* Quantity taken, ·1080 gram.

Carbon found	·03432	gram.
Carbon present	·03395	,,

5th. *Urea.* Quantity taken, ·0590 gram.

Carbon fonnd	·00932	gram.
Carbon present	·01180	,,

In another experiment by the subsequent addition of 10 c.c. of strong sulphuric acid and a small quantity of permanganate of potash, figures slightly above the theoretical were obtained.

Urea. Quantity taken, ·1015 gram.

Carbon found	·02092	gram.
Carbon present	·02030	,,

The quantities operated upon are about 10 times as great as in the London waters and consequently the errors would be proportionately diminished.

The process requires accuracy of manipulation and the strictest attention to the precautions before mentioned, but the same must be said of any process having to deal with the small quantities of organic matters present in drinking waters.

It is, I am aware, a serious objection to the process that no account is taken of the organic nitrogen, but the carbon alone is useful, and in conjunction with the other constituents will throw a considerable amount of light on the purity.

I may here be allowed to say a few words on the necessity of making a complete, or tolerably complete, analysis of every sample of water before reporting. To trust merely to two or three determinations I believe to be an error into which many chemists fall; and although I allow that in many instances a water may be condemned even on a single test, still no true opinion can be formed without a much more complete analysis than is sometimes made. In doubtful cases especially, no pains should be spared to make the analysis as complete as possible. Were the noxious matters known with certainty we might be able to detect them in the water, but as we are as yet without definite knowledge on this point, it is the duty of the chemist to condemn any water which bears evidence of contamination with drainage or sewage matters to any considerable extent. The amount of contamination which we consider to be innocuous is a purely arbitrary quantity, and each chemist must be his own judge and base his opinion on a consideration of the whole of the constituents, and his knowledge of the history of the water. Taken, therefore, in conjunction with the other constituents, I believe the carbon to be very useful in determining the adaptability of a water to potable purposes.

THE EFFECTS OF ALUMINA SALTS ON THE GASTRIC JUICE IN THE PROCESS OF DIGESTION.

By Henry A. Mott, Jun., Ph.D.

This paper gives a description of the experiments made by the author upon living dogs, to show the effects of alumina salts on the system, when alum is used in the preparation of baking powder.

Two dogs, of 30 lbs. and 35 lbs. weight, were given eight biscuits each, containing about a teaspoonful of "alum baking powder:" in about four hours both were very sick and vomited, with trembling in the limbs, bowels at first very loose, afterwards constipated; the next day appetite did not return and one of them vomited frequently.

Three more dogs, weights varying between 10 lbs. and 40 lbs., were fed with biscuits containing half as much of the alum baking powder as the above: the smallest dog was sick and vomited one and-a-half hours after, the second was very loose in the bowels, and the largest very constipated; the next day all were extremely constipated, and the smallest dog would eat no more of the biscuits.

Three more dogs were fed with biscuits made with "cream of tartar baking powder" in the same proportion as in the case of the first two (viz.: 20 teaspoonfuls to a quart of flour); their weights were 15 lbs., 20 lbs. and 35 lbs. respectively: the two largest were fed entirely on the biscuits for two days, ate well, and were not in any way affected; the smallest dog was fed on the biscuits for four days and ate with the same appetite without showing the slightest sign of sickness.

Four dogs were fed with precipitated hydrate of alumina mixed with meat: one weighing 18 lbs. was given 163 grains mixed with meat: after two hours he vomited for nearly three hours; another of 20 lbs. weight was given 54 grains: in four and a half hours he was sick; the other two were similarly affected. The meat was vomited during the night undigested.

One dog was fed with phosphate of alumina mixed with meat, and although he did not vomit he quickly lost his liveliness and brightness of eye and was evidently quite sick.

Four more dogs were fed with meat mixed with burnt alum: all of them were taken with violent sickness, and vomiting, and trembling in the limbs, when so little as one-fourth or one-eighth of an ounce only had been taken.

The author next describes experiments made with gastric juice.

To 3 grms. of gastric juice obtained from healthy dogs was added ·0403 grm. fibrine, and kept at a temperature of 95—100° F. for half-an-hour; the fibrine was entirely dissolved.

To 3 grms. more of the gastric juice was added 0·5 grm. hydrate of alumina and ·0403 grm. fibrine: after two hours at a temperature, 85—100° F. and twenty-three hours at ordinary temperature, only one-fourth of the fibrine was dissolved.

To 3 grms. more was added 0·5 grm. alum and ·0403 fibrine: after two hours at 95—100° F., and twenty-three hours at ordinary temperature, three-fourths of the fibrine only was dissolved.

To 3 grms. of the juice was added 0·25 grm. of coagulated white of egg: after two hours' digestion at 95—100° F., half was dissolved; and on the addition of 3 grms. more, and a further digestion of two hours, it had completely disappeared.

To 3 grms. of gastric juice and ·25 white of egg, was added ·031 grm. of hydrate of alumina: after two hours' digestion at 95—100° F., and 15 hours' contact at ordinary temperature, not a particle had dissolved.

To 3 grms. of gastric juice and ·25 grm. of white of egg, 0·25 grm. of alum was added: after digestion, as before, not a particle of albumen had dissolved.

To 3 grms. of gastric juice and 0·1 gramme of white of egg, 0·1 grm. of phosphate of alumina was added: after digestion, as before, none of the white of egg had dissolved.

The author further had dogs that had been fed with food containing hydrate and phosphate of alumina for four days, killed and examined: he found alumina in the blood, heart, liver, spleen and kidneys.—*Journal of the American Chem. Soc., Vol. II., No. 1.*—J.W.K.

ANALYSES OF BLACK AND WHITE MUSTARD.

By Charles H. Piesse and Lionel Stansell.

The seeds of black and white mustard, *Sinapis nigra* and *S. alba*, when crushed and sifted constitute the mustard farina of commerce; both species are cultivated in this country, a considerable quantity, however, being imported from abroad. In the manufacture, the seeds of both variety in suitable proportions are crushed between rollers, then pounded and sifted. The residue in the sieve is called dressings; what passes through is farina or flour of mustard. This is re-sifted, yieiding three qualities: (*a*) superfine, (*b*) fine, and (*c*) seconds. The seeds are tough and difficult to powder: the best method on a small scale is to pulverise them in an ordinary morter with a large cast iron pestle.

The farina of black and white mustard differs but little in appearance, the brown being, however, slightly darker. In the unground state the seeds of white mustard are of a yellowish straw colour, those of brown a dark brownish purple.

A. 1 gram white seeds, Yorkshire, contain 170 seeds.
B. 1 ,, ,, ,, Cambridge, ,, 172 ,,
C. 1 ,, brown ,, Cambridge, ,, 944 ,,

100 seeds of A weigh ·5882 grm., B ·5814 grm., C 0·1059 grm.

Methods of Analysis Employed.—The *Sulphur* was estimated by oxidation with concentrated nitric acid, and subsequent precipitation with barium chloride.

For the determination of *Nitrogen* the soda-lime method was employed, the evolved ammonia being passed into standard acid. Mustard contains so large a proportion of fat, that during the combustion the amount of tar produced considerably interferes with the subsequent titration. It was therefore found necessary to exhaust a weighed quantity of the crushed mustard seeds (previously dried) with petroleum ether, to collect the exhausted mustard on a weighed filter and to dry it, then after re-weighing to calculate the ratio between the original mustard and that free from fat and moisture. A weighed quantity of

this exhausted mustard was then used for the estimation of the nitrogen. By this expedient the production of tar during the combustion was almost entirely prevented. The amount of nitrogen, after subtracting that contained in the potassium myronate*, in the case of black mustard, is multiplied by 6·25 to obtain the albuminoid substances.

Substances Soluble in Water (Myrosin and Albumin).—The amount of myrosin and soluble albumin appears not to differ in either variety. About two grammes of substance well digested for twelve hours with cold water, the fluid then filtered into a quarter litre flask, and the seeds washed thoroughly with cold, warm, and finally boiling water. Of the filtrate, 50 c.c. were evaporated to obtain the total soluble matter; 100 c.c. were boiled, and the coagulated albumin collected on a weighed filter.

Fat and Cellulose.—(*a*) About 2 grams of finely pulverised seed well dried; (*b*) extracted with petroleum ether, the insoluble matters collected on a weighed filter, dried and weighed; (*c*) boiled successively with very dilute hydrochloric acid, caustic soda, and hydrochloric acid, being washed with boiling water each time, finally with alcohol, dried, and weighed as cellulose.

Estimation of the Volatile Oil.—The distinguishing characteristic of brown mustard is the occurrence in it of potassium myronate, which, in presence of water, is acted upon by a peculiar ferment—myrosin, contained in the seed, whereby it is decomposed, yielding potassium, hydrogen sulphate, glucose, and allyl iso-thiocyanate, the pungent oil of mustard:—K, $C_{10}H_{18}NS_2O_{10}$=$KHSO_4$+$C_6H_{12}O_6$+C_3H_5,CS, N. 100 parts potassium myronate yield 23·855 volatile oil.

It is remarkable that the yield of volatile oil is greater when the brown mustard is mixed with some of the white. The results of many experiments have led to the following process:—

About 25 grams of the crushed brown seeds are mixed with about a quarter of their weight of white seeds (also crushed), in a 500 c.c. flask, 300 c.c. cold water added and allowed to stand for five or six hours. The highest yield of oil is obtained by standing for this length of time, and sensibly diminishes after six hours, gradually decomposing in contact with the myrosin; the yield after the lapse of 48 hours will reach only about two-thirds of that originally present, while after a week not one-third of the whole will be obtained. We have found after numerous trials that not less than three hours nor more than six should be allowed to elapse between the addition of the water to the mustard and its distillation, the rule finally adopted being to allow the mixture to stand for five hours. The flask is then to be connected with a small Liebig's condenser, and the liquid distilled until no more oily drops are seen to come over. The distillate is received in a small flask (150 c.c.), containing 30 c.c. ammonia sp. gr. 0·88. When the distillation is judged complete, the flask is disconnected and, after removing from the flame, shaken. If the steam possesses the sharp pungent odour of mustard oil, the contents are further distilled. This test is very sensitive. When the boiling proceeds rapidly, after 50 c.c. have come over, it will almost invariably be found that the mustard is entirely deprived of volatile oil. The distillation finished, the condenser is well rinsed out with cold distilled water into the receiver (this is necessary), the flask corked and put aside until the oily drops have quite disappeared, being occasionally shaken for this purpose; at least 24 hours are usually requisite. When the change is complete the flask is covered with a porcelain crucible lid,

* Potassium myronate contains 3·37 per cent. of nitrogen.

and boiled for a few minutes to expel the ammonia, transferred to a weighed platinum basin, and evaporated to dryness on the water-bath, subsequently dried in the water oven, and weighed. The amount of thio-sinamine thus obtained is multiplied by ·85344: the product is the quantity of allyl iso-thiocyanate contained in the mustard operated upon. If the factor 3·5775 be used, the amount of potassium myronate is ascertained.

Thio-sinamine is formed by the union of one molecule of ammonia with one molecule mustard oil.

$$CS,N,C_3H_5 + NH_3 = CS,\begin{cases} NH,C_3H_5. \\ NH_2. \end{cases}$$

ANALYSES OF WHITE MUSTARD.

	Mustard Whole Seeds.		Mustard Farina.		
	Yorkshire.	Cambridge.	Superfine.	Fine.	Seconds.
Moisture	9.32	8·00	6·30	5·78	6·06
Fat	25·56	27·51	37·18	35·74	32·55
Cellulose	10·52	8·87	3·90	4·15	9·34
Sulphur	0·99	0·93	1·33	1·22	1·26
Nitrogen	4·54	4·49	5·05	4·89	4·25
Albuminoids	28·37	28·06	31·56	30·56	26·56
Myrosin and Albumin	5·24	4·58	7·32	6·67	6·11
Soluble Matter	27·38	26·29	36·31	36·60	33·90
Volatile Oil	0·06	0·08	0·03	0·04	0·03
Ash	4·57	4·70	4·22	4·31	4·30
,, Soluble	0·55	0·75	0·44	0·55	0·33

ANALYSES OF BROWN MUSTARD.

	Mustard Whole Seeds.	Mustard Farina.		
	Cambridge.	Superfine.	Fine.	Seconds.
Moisture	8·52	4·35	4·52	5·63
Fat	25·54	36·96	38·02	36·19
Cellulose	9·01	3·09	2·06	3·26
Sulphur	1·28	1·50	1·48	1·30
Nitrogen	4·38	4·94	5·01	4·31
Albuminoids	26·50	29·81	30·25	26·06
Myrosin and Albumin	5·24	6·46	6·78	6·14
Soluble Matter	24·22	31·64	32·78	31·41
Volatile Oil	0·473	1·437	1·500	1·381
Potassium Myronate	1·692	5·141	5·366	4·940
Ash	4·98	5·04	4·84	4·91
,, Soluble	1·11	1·01	0·98	0·77

In the process of manufacture, the sifting chiefly removes the husk, and dries the farina, the other constituents being, as it were, concentrated. This is well seen in the amount of volatile oil in brown mustard. Again, the fat, which averages about 25 per cent. in the seeds, reaches 37 per cent. in the farina; the sulphur is increased nearly one-half of one per cent., and so on with the other constituents; while the cellulose falls about two-thirds and the moisture about one-half.

The white seeds differ in composition from the brown, chiefly in not yielding volatile mustard oil, in the fact that the sulphur is lower, and the soluble matters higher in the former than in the latter.

The results of over 40 experiments upon the amount of volatile oil present in brown mustard are here shown, a few of the separate determinations being given:—

					Volatile Oil per cent.
Whole Mustard Seeds...	0·486	0·465	0·468	...	Average 0·473
Brown Farina, Superfine		1·439	1·436	...	do. 1·437
Do. *do.* Fine	1·51	1·49	1·50	...	do. 1·500
Do. *do.* Seconds	1·358	1·418	1·367	...	do. 1·381

Characteristic Tests.—I. The aqueous extract of white mustard yields with solution of ferric chloride a deep blood-red colouration; this reaction is so slight as to be scarcely apparent with a similar extract of black mustard.

II. The aqueous extract of white mustard acquires in a few hours a powerful odour of sulphuretted hydrogen: that of the black mustard smells only of the pungent mustard oil.

ANALYSES OF ASH OF MUSTARD SEED.

	White Seeds.		Brown Seeds.
	Yorkshire.	Cambridge.	Cambridge.
Potash	21·29	18·88	21·41
Soda	0·18	0·21	0·35
Lime	13·46	9·34	13·57
Magnesia	8·17	10·49	10·04
Iron Oxide	1·18	1·03	1·06
Sulphuric Acid	7·06	7·16	5·56
Chlorine	0·11	0·12	0·15
Phosphoric Acid	32·74	35·00	37·20
Silica	1·00	1·12	1·41
Sand	1·82	1·95	1·38
Charcoal	12·82	15·14	7·57
	99·85	100·48	99·70

When the charcoal and sand are deducted, the following is the percentage composition of the ash. An analysis made in 1850 by Way and Ogston of White Mustard is appended:—

	White Seeds. Yorkshire.	White Seeds. Cambridge.	White. Way & Ogston. 1850.	Brown Seeds. Cambridge.
Potash	24·98	22·64	25·78	23·59
Soda	0·21	0·25	0·33	0·38
Lime	15·79	11·19	19·10	14·95
Magnesia	9·58	12·58	5·90	11·06
Iron Oxide	1·38	1·23	0·39	1·16
Sulphuric Acid	8·28	8·58	2·19	6·12
Chlorine	0·12	0·14	trace.	0·16
Phosphoric Acid	38·48	41·97	44·97	40·99
Silica	1·17	1·34	1·31	1·55
	99·93	99·92	99·97	99·96

The ash for analysis was obtained by careful incineration at a heat below visible redness.

It will be noticed that the ash consists mainly of potassium, calcium and magnesium phosphate, with a very minute proportion of chlorine; and that no carbonates are present. Practically no difference exists between the ashes of the two varieties, so that no analytical indications can be obtained from the mere examination of that constituent.

We append a few reactions of thio-sinamine likely to prove of interest:—

I. Thio-sinamine dried at 100° is an oily substance, which solidifies when cold after some time. It dissolves readily in hot water, and crystallises therefrom in beautiful tufts of crystals (monoclinic).

II. Treated with nitric acid, it is partially oxidized, though even boiling with the concentrated acid for half-an-hour failed to effect complete decomposition, as evidenced by the percentage of sulphuric acid obtained by precipitating the liquid with barium chloride.

III. Silver nitrate added to an aqueous solution of thio-sinamine gives a white curdy precipitate, which redissolves less and less perfectly until the silver salt is in excess, when the precipitate remains permanent.

IV. Mercuric chloride gives a reaction precisely similar to silver nitrate.

V. Platinic chloride gives an abundant curdy orange-yellow coloured precipitate, which does not redissolve in the excess of thio-sinamine, nor in cold water. In hot water it dissolves after first melting and floating to the surface, and on cooling separates as an opaque mass of the consistence of balsam tolu, in which condition it remains. This salt, as well as the two before mentioned, is readily soluble in alcohol.

VI. Mayer's reagent (HgI_2+KI) yields a dirty white coloured precipitate, which coheres in a few hours to form a number of oily drops. This change occurs at once on heating. The precipitate is only slightly soluble in either hot or cold water.

VII. Nessler's solution gives an insoluble yellow precipitate.

VIII. Picric acid only affords a precipitate in strong solutions.

For kindly placing at our disposal the various samples of mustard seeds and farinas, we are indebted to Messrs. Keen, Robinson, Bellville & Co., to whom we return our best thanks.

CORRESPONDENCE.

[The Editors are not responsible for the opinions of their Correspondents.]

To the Editor of "The Analyst."

Sir,—In your issue of this month there appears a criticism on my paper on the Estimation of Phosphoric Acid by Messrs. Teschemacher and Smith, in which the authors assert that my paper "bristles with misdescriptions, misdirections, misstatements and mistakes," and then go on to justify this statement. The objections brought against it seems to consist chiefly of the following:—brevity of diction, the omission of part of a long title, a misquotation from their pamphlet, and the omission of any remarks on the estimation of moisture. 1st. With regard to my brevity of diction I have nothing to say, except that it was a perfectly safe point of attack, since no one can accuse your correspondents of a like error. What Mr. Square and the Christian religion, M. Gambetta and the Jesuits have to do with the point at issue I fail to see! 2nd. More than half a page is occupied in a long tirade against the omission of the words "by magnesia for commercial purposes." If the writers had read carefully they would have noticed that I did not quote the title at all, but simply stated that the pamphlet was on the Estimation of Phosphoric Acid, a statement which I presume was strictly accurate. It seems, however, that the clause "for commercial purposes" is quoted as an excuse for the neglect of the solubility. Those persons who only analyse "for commercial purposes," without regard to scientific accuracy, are

not worthy of the name of chemists, and if in their pamphlet there is no pretence to scientific accuracy all argument is at an end. 3rd. The misquotation of which I was guilty was that Messrs. Teschemacher and Smith had stated that ammonio-magnesic phosphate is "totally insoluble in water containing one-eighth of its bulk of ·880 ammonia." The experiments which I had in my mind when I made that statement were given at the end of their pamphlet. A certain quantity of ammonio-magnesic phosphate was taken, and dissolved and precipitated a great number of times, and, on finally weighing, the weight was actually found to have increased! It is therefore not merely totally, but even more than totally, insoluble! It is evident that impurities from some source had been introduced, and who can say that they were not sufficiently great to counterbalance a perceptible solubility? I must, however, apologise for the use of the word "crude," and assure the authors that nothing was more foreign to my mind than to say anything which should give annoyance. 4th. I made no reference to the determination of water. I was, until lately, under the impression that the merest tyro in analytical chemistry knew that to obtain accurate results the quantity taken for analysis must represent, or bear a determinate ratio to, the sample as received, otherwise the analysis is worse than useless. It would be an insult to the readers of THE ANALYST to describe in detail the method by which correction is made for moisture. Having now disposed of the principal objections, I may be allowed to say a few words on the general tenor of the criticism.

The only accurate method of determining the solubility is by treating the filtrates; the errors in weighing, &c., masking all attempts to obtain accurate results by treating the large precipitates. It will thus be seen that the precise quantity of phosphate solution taken is immaterial, the only precaution required being to remove the precipitate completely.

Messrs. Teschemacher and Smith make the statement that they never doubted the solubility. Why then, I ask, object to the exact quantity being determined? If my experiments are correct, the allowance ought to be made, and if not they should accurately determine the amount of solubility, and if they can refute my statements. There is, however, a considerable difference between "vamping up" an analysis by the addition of two per cent. which is known *not* to be in solution, and an addition of 0.18 per cent. based on careful experiments. In reply to the statement that the influence of citric acid, iron and alumina on the solubility are matters which "may be investigated by the curious," I would remark that these substances are usually present to a greater or less extent during the actual analysis, and will exert their influence on the solubility, and it is, therefore, more than a matter of curiosity.

Finally, your correspondents practically accuse me of plagiarism, and state that the process as given by me is theirs shorn of all precautions. It must be remembered, however, that I was talking to a body of well-trained chemists who understood their profession, and not to office-boys and clerks into whom I wished to instil sufficient knowledge to enable them to estimate phosphoric acid "for commercial purposes." I would, moreover, remind the writers that four years or so ago they omitted two of the most important precautions which must be observed in applying this method, viz., the purification of the precipitate by resolution and reprecipitation, and the fact that small quantities of phosphoric acid are taken down with the oxalate of lime. At the time that Messrs. Teschemacher and Smith ignored these points, I had already made several thousand analyses, observing these precautions. Some twenty years ago Dr. Voelcker published in the *Journal of the Royal Agricultural Society* the method in all its important particulars, and although he had improved the method very considerably, he does not claim originality.

When it is remembered the source whence Messrs. Teschemacher and Smith obtained their information on the points mentioned above, it is certainly too bad to even hint at plagiarism, and had they given the matter serious consideration they would, I doubt not, have refrained from making statements which are as ungenerous as they are unfair.

I am, &c.,

August 7th, 1880. ALFRED SMETHAM.

TO THE EDITOR OF "THE ANALYST."

SIR,—I thank you very much for the opportunity of saying a few words in reply to your remarks upon my letter that appeared in the *Cowkeeper's and Dairyman's Journal*. I do think it would have been more advisable to have reserved some of your remarks until I had failed to prove what I had stated. But you seem to me to have a settled conviction that no milk dealer could either speak the truth or be

honest; but I tell you that it is only the exception when they fail to do either. I know there are good men in the milk trade, who make good husbands, good fathers, good citizens, and good Christians.

You say the charges I have made are quite new to you. That may be, but they are an old standing grievance with us. For we endeavoured last year to introduce the following clause into the Sale of Food and Drugs Act:—"That the certificate of the Public Analyst shall in all cases contain the component parts as ascertained by quantitative analysis. If such certificate do not contain the component parts it shall not be received as evidence." We have also decided some time ago that in all cases that we defend the analyst shall be asked for each separate item in his analysis. In regard to the first point mentioned, that neither the standard or the result is given, my proof is that in every case that I have heard tried either in Manchester or Salford, I have never heard it mentioned once, unless in reply to some question asked. The usual programme is, "Have you received a certain sample of milk?" "Yes." "And what is your result?" And the stereotyped reply is, "So much added water; but the standard we take is a very low one, with a fair average milk it would be so much." By this system one standard is adopted, and we are often convicted by another. I appeal to you, sir, to say if this is either just or fair to us, and when such vague and indefinite assertions are taken as evidence I say it is impossible to put the slightest check upon any one, and a man might make five hundred blunders and never be found out. I think you will admit with me that this is a most unsatisfactory state of things when honest men's reputation is at stake. My reply to the second charge is, that in all convictions here we are charged twenty-one shillings for the analyst's fee, and I presume he will receive this sum the same as any other witness.

I wish to say that neither directly or indirectly do we wish to say one word against the Public Analysts. All that we want is fair play, and that when we leave the court, whether convicted or not, we are satisfied that we have had a fair trial. We would not have the Act removed if we could, and we neither give help or sympathy to those who would set it at defiance.

I am anxious to call your attention to the different results by different analysts. Some months since a friend of mine in Salford was fined for milk showing 9½ per cent. of cream, which in my opinion is good milk. The same day I had a sample taken at my own request; this showed 5½ per cent. of cream. The next day the inspector took a sample of the farmer's milk, and this showed 4½ per cent. of cream: this milk was no better than what I usually sell for skim milk, yet the Liverpool Public Analyst, to whom the sample was sent by the local authority, said it was very good milk for the time of the year. I was losing customers daily, the milk was so poor, yet could get no help, and my friend who was selling good milk was fined. Differences like this do shake our confidence in the work of the Public Analyst.

In conclusion, we think, as milk dealers, we have just grounds for complaint. We have suffered more than all the rest that come under this Act. We are entirely in the hands of the Public Analyst; only his word is taken, and to refer to Somerset House is useless, as the sample is decomposed when wanted. For years we have suffered for the sins of the farmers, and even yet it is the great source of adulteration, and little effort is made by those in authority to check it, even now they have the power. Only let these gentlemen do their duty and see that our milk supply is good to begin with, and there will be few milk dealers prosecuted.

Apologising to you for wishing to occupy so much of your space,

I remain, yours, &c., ROBERT EDGE.

To the Editor of "The Analyst."

Dear Sir,—One of the Dublin Police Magistrates has just decided that the person in charge of a milk cart, delivering milk from house to house, is justified in refusing to serve an Inspector. Perhaps some of your readers might know of cases in which a contrary decision was arrived at. If so, I would feel greatly obliged by their communicating with

Yours faithfully,

CHARLES A. CAMERON,

Royal College of Surgeons, Dublin, Public Analyst for Dublin.
24th August, 1880.

[*** Our Law Reports, in this number, contain a case of a man being fined £5 for refusing to serve an Inspector from a cart, and doubtless some of our readers could refer Dr. Cameron to similar decisions.—Editors.]

ANALYST'S REPORT.

At the quarterly meeting of the Bristol Council, the report of the Public Analyst was presented. Of twenty samples analysed, five were brought by the public and fifteen by the inspector. Two were found to be adulterated. On the suggestion of the Town Clerk the report was simply allowed to lie on the table, as the appointment of the analyst had not yet been confirmed by the Local Government Board.

A Libel on Chemists.—Among our Local Reports will be found an account of a prosecution at Greenwich under the Sale of Food and Drugs Act, in which a chemist was fined £5 and costs for selling tincture of quinine containing ·67 per cent. of quinine sulphate and ·66 per cent. of sulphates of other alkaloids. The tincture of the Pharmacopœia should contain 1·91 per cent. of sulphate of quinine. The defendant admitted that he had put six instead of eight grains into the tincture, and declined to say if what he put in was sulphate of quinine. It seems hardly necessary to spend words in condemning such proceedings. Chemists, of all persons, have reason to desire that any such fraud should be punished whenever it has been proved to have occurred. But for all that the trade must expect to share to some extent in the minds of an unreasoning public the obloquy which Mr. Morton has brought upon himself. But a great deal worse than Mr. Morton's delinquency, as it affects the trade, was the astounding evidence which is reported to have been given in his favour by a certain Mr. Benjamin Browning, M.R.C.S., of Rotherhithe, who said, "It was by no means uncommon to find other alkaloids in a sample of quinine. Sulphate of cinchonine was a common substitute for quinine, and was used to his knowledge in both University College and Guy's Hospitals. *If he were prescribing for a patient and prescribed quinine, cinchonine would be used unless the word* 'vera' *were written after quinine.*" We have had some experience of the enmity of the medical profession towards us, but that has not hitherto done us much harm. Better a thousand times that we should retain the enmity than that we should be subject to such friendly assistance as Mr. Browning, of Rotherhithe, has to offer. For six years the Sale of Food and Drugs Act has been in force. During all that time chemists have endured the close and even hostile scrutiny of the authorities. Most of the prosecutions undertaken against chemists have been defeated, though the chemist has had to bear ruinous costs in proving his innocence, and yet this Mr. Browning, M.R.C.S., Medical Officer of Health for Rotherhithe, has the hardihood to assert, or to imply, that chemists, as a body, are accustomed to substitute cinchonine at 3*s.* an ounce for quinine at 12*s.* That statement would hardly pass uncontradicted even in the Society of Public Analysts. We should much like to ask whether Mr. Browning is accustomed to dispense his own prescriptions: many people are apt to assume that the rest of the world is only a magnified reflection of their own important selves. Mr. Browning's uncontradicted libel has been telegraphed all over the country. Nearly every provincial paper has printed a more or less complete report of the case, and in his privileged position as a witness Mr. Browning has done us a wrong which he, at least, can never repair.—*Chemist and Druggist.*

LAW REPORTS.

Tincture of Quinine:—

At the Greenwich Police Court, on Friday, July 30, Henry Morton, chemist, Broadway, Deptford, appeared to an adjourned summons at the instance of the Greenwich Board of Works, under section 4 of the Sale of Food and Drugs Act, for having mixed a drug, to wit, tincture of quinine, with ingredients or materials so as to affect injuriously the quality or potency of such drug, with intent that the same might be sold in that state, and did sell such drug so mixed as aforesaid to Inspector Corden. Mr. J. Spencer, solicitor to the Greenwich Board of Works, appeared to prosecute; Mr. J. C. Scard, solicitor, defended. Thomas Corden, inspector of nuisances under the Greenwich Board of Works, said on June 16th he went into the defendant's shop in Deptford Broadway and asked for 3 oz. of tincture of quinine. The defendant served him, and witness paid 1s. 8d. He then divided the drug into three parts, and told the defendant he had purchased it for the Greenwich Board of Works for the purpose of being analysed by the Public Analyst. Whilst witness was engaged in gettingsome sealing-wax out of his pocket for the purpose of sealing up the bottles, the defendant seized two of the bottles containing the tincture of quinine, and went out of the shop into a room. When he returned he said, "I intend to

keep those two "—meaning the two bottles he had taken away—but afterwards said, "The fact is, I have thrown them away." The defendant said he would mix witness some more, as "he had made a mistake in the grains, having put six grains instead of eight grains to the ounce;" but witness refused this offer, took the remaining sample, and told defendant he should report the case to the Greenwich Board of Works. The certificate of the Public Analyst (Mr. Wigner) was then handed in: it set forth that the sample "contained quinine sulphate ·67 per cent.; other alkaloids and sulphates, ·66 per cent. Tincture of quinine, according to the British Pharmacopœia, should contain 1·83 per cent. of sulphate of quinine. This sample is, therefore, more than 60 per cent. deficient, and some other comparatively worthless alkaloids have been added to partially make up the deficiency." Mr. Wigner, the analyst, said the market price of sulphate of quinine was about 12s. per oz., and the other alkaloids 3s. The sample would have little value or effect as a medicine. The alkaloids would undoubtedly injuriously affect the potency and quality of the tincture of quinine. The certificate from Somerset House was produced by Mr. Spencer. It specified that the sulphate of quinine in the sample was not more than one-fifth of the proper quantity. Dr. B. Browning, M.R.C.S., was called for the defence, and said it was by no means uncommon to find other alkaloids in a sample of quinine. Sulphate of cinchonine was a common substitute for quinine, and was used to his knowledge in both University College and Guy's Hospitals. If he were prescribing for a patient, and prescribed quinine, cinchonine would be used, unless the word "vera" was written after quinine. Mr. Browning gave some further technical evidence, and said there were three other alkaloids used in quinine equal in quality and potency though not in market price. The defendant was then sworn, and said he sold the sample of quinine in a fair and honest way, to the best of his knowledge; but, as he told the inspector, he put six grains instead of eight to the ounce. Mr. Spencer: But was it sulphate of quinine you put in? Defendant (hesitating): I decline to answer the question. Mr. Scard objected technically to the summons being taken under the 4th section, which said, "except for the purpose of compounding;" and he would submit that, the sample having been mixed or made up on the premises, was therefore sold as a compound. He would submit that the summons might have been taken out under the 6th or 7th section, but not under the 4th. Mr. Marsham, the magistrate, said he thought the case came within the 4th section, for the evidence of the defendant himself only went to show that it came under the 4th section. Perhaps there was nothing in the sample deleterious, but he was convinced that the quality and potency of the drug had been affected by the addition of the alkaloids, whereby it would not have had the effect on the patient it should have had. It was a case he could not pass over lightly. As it was, the defendant had laid himself open to a penalty of £50 in this case, but he did not mean to inflict that penalty. He would fine the defendant £5 and 20s. costs. The defendant paid the money, and left the court.

Refusing to Serve Inspector from a Cart. Heavy Fine :—

At the Brentford Petty Sessions, John Nash, in the employ of Westlake and Co., dairymen, of 60, Norfolk Terrace, Westbourne Park, was charged with refusing to sell a pint of milk to Inspector Gregg. The inspector found him selling milk from a cart, and asked for a sample to inspect. The defendant skimmed his measure along the top, and offered the contents. The inspector asked him to put his measure into the can and take a fair sample. This he refused to do. The inspector asked for a sample out of another can, and offered 1s. as a fair price for the sample. He was again met with a refusal. The inspector also asked to look at the measures; but the man said they had got the Government stamp on, and that was quite enough. The defendant was fined £5.

Another Refusal to Serve. Under New Act Defendant may be called as Witness:—

At Lambeth Police Court on the 28th July, George Bayley, cowkeeper, Ivy Cottage, Wyndham Road, Camberwell Road, was summoned at the instance of the vestry for refusing to supply Donald McKay, one of the sanitary inspectors, with two-pennyworth of milk for the purpose of being analysed. Mr. Marsden, the vestry clerk, appeared in support of the summons. McKay stated that he saw the defendant in the street before seven o'clock one morning, and, producing a jug, asked to be supplied with two-pennyworth of milk from a can out of which he had supplied a customer. He took the mug and was serving him out of another can, which the witness refused, saying he was a sanitary inspector, and wanted the milk for an analysis. He tendered the money, and pointed to one of the three cans. He saw no milk marked "skimmed" on the cans. A point arose in this case under the new Act. A person named Smith, who said he was with the inspector, confirmed his evidence. On cross-examination he was asked if he frequently acted as a "detective" in such cases, and Mr. Chance, the presiding

magistrate, told him he need not answer such a question. Mr. Armstrong said he was instructed that the defendant denied the evidence given, but unfortunately he could not call him. Mr. Chance said, under the new Adulteration Act, defendants were competent witnesses. Mr. Armstrong said that as that was the case he should certainly call him, and also his friend who was with him. The defendant and his friend were called. They said that they had served a customer before McKay asked for milk, but refused to let him have milk out of one of the cans, as it was skimmed milk and so labelled. He (defendant) admitted that he knew McKay, and said milk dealers and cow-keepers "trembled" when they saw him. He trembled when he saw him. Mr. Chance told him that no one need "tremble" if he was selling a pure article. The defendant said he had offered to sell him milk, but he refused to have it. He said he had been before convicted, not for refusing to sell, but for adulterated milk, and had been twice convicted for the offence. Mr. Armstrong urged that as the defendant had offered to sell milk he could not be convicted of "refusing to sell milk" to the inspector. Mr. Chance said it would make the law nugatory if when a man has refused to supply milk out of one can, he could defeat the Act by saying that he had offered to sell it out of another can. In his opinion the case had been established, and he convicted the defendant, who had been before fined, in a penalty of £5 and costs. The money was paid.

Prosecution of a Large Farmer. Heavy Fine:—

Mr. Isaac Peart, of Jewin Farm, Welwyn, Herts, was summoned by the Metropolitan Dairymen's Society for selling to Mr. T. Edwards, of 35, Fonthill Road, Finsbury Park, milk which was adulterated with 17 per cent. of water. Mr. Ricketts prosecuted on behalf of the Society, and Mr. Besley defended. Mr. Edwards said he had been for the past two years in the habit of receiving churns of milk from the defendant daily at the Finsbury Park Railway Station. Finding that some of it was not pure, he communicated with the defendant, but without avail, and on July 6 a portion of one of the churns of milk was taken and, on analysis by Dr. Tidy, it was found to contain 17 per cent. of added water. Mr. Parish, the Society's Inspector, gave evidence as to taking the samples, and forwarding one to Dr. Tidy for analysis. The defendant, who said he kept over 100 cows and farmed 600 acres, swore that when the milk in question left his farm it was in the same state as given by the cows. Mr. Barstow said he considered the case fully proved, and as the defendant admitted that he was in a large way of business, he should inflict the full penalty of £20, and £5 costs.

Sale of Adulterated Milk by Boys:—

On the 11th August, a curious case of milk adulteration was before the magistrate at Lambeth Police Court. Lewis Champion, of Cambridge Villa, Avondale Road, Peckham, was summoned by one of the Sanitary Inspectors of St. Giles, Camberwell, for selling adulterated milk. In answer, a boy presented himself, and a female friend said he had sold her milk for which he was summoned. The Inspector said it was a serious case, and complaints had been made that boys were sent about the streets with milk adulterated to the extent of thirty-six per cent of water. The boy told him that his father had sent him out, and he had taken out the summons against his father, and he had left, and now sent the boy. The boy declared that he had "started" himself in business. The Magistrate asked him whether he meant that he had at his age (apparently about twelve years old) commenced business. The boy said he had, and it was explained by him that he had bought half a gallon of milk for elevenpence. The Inspector had not paid elevenpence for four quarts of milk. It was stated that there were eight quarts to a barn gallon. The Magistrate remarked that the boy was a "very young tradesman" to begin business at his age. The Inspector asked the Magistrate to grant a warrant against the father of the boy, who was no doubt keeping out of the way. The Magistrate said he could not grant a warrant against a person who had not been served with a summons. The Inspector said the father had better then be summoned. In answer to a question how so young a "tradesman" as the boy could find money to buy milk, it was stated by his female friend who accompanied him to the Court that he bought the milk out of his pocket money. The Inspector again urged upon the Court that it was a very bad case. Boys were sent about with adulterated milk with thirty-six per cent. of water, and then, when summoned, declared, as this boy had done, that he had bought the milk himself. In answer to the Magistrate, the boy said he had sold the milk as he had bought it, and mentioned the name of a dairyman. The Inspector said the tradesman whose name he had mentioned was a respectable person, whose milk had been analysed and found to be good. The Clerk of the Court suggested that the summons had better be withdrawn, and the matter brought before the Vestry of Camberwell. The summons was accordingly withdrawn.

Prosecution of Farmers. Reasonable Notice should be given of Intention to take Samples at Railway Station :—

At Westminster Police Court, Alexander Frazer and Campbell Frazer, gentlemen farmers, of Faygate, Sussex, appeared to summonses taken out by George Barham, of 28, Museum Street, Bloomsbury, charging them with selling to him, as the purchaser, milk which contained 13 per cent. of added water. Mr. Ricketts appeared for the prosecution ; and Mr. Besley, barrister, for the defendants. The prosecutor was the managing director and almost absolute owner of an association called the Express Milk Company, and the defendants entered into a contract to supply milk to be delivered at Victoria Station. On June 28 two churns of milk from the defendants' farm arrived at the station, and Mr. Maconochie, the complainant's manager, telegraphed to the defendants that a sample would be analysed, and invited their attendance. The churns were sealed up, and in the evening Parish, an officer of the Metropolitan Dairyman's Society, took samples of each, which were submitted to Dr. Corfield the analyst for the parish of St. George's, Hanover Square, who certified that they were adulterated with 13 per cent. of added water. Mr. Ricketts put in the contract by which the defendants agreed to supply pure milk, and, with the view of showing that the milk had not been tampered with since it left the defendants' farm, called a number of railway officials, who swore that it was safe and not touched while in their custody from Faygate Station to Victoria. Mr. Besley took several legal objections to the form of the summons, and denied that the defendants had watered the milk, or that it had been done on their farm. The defendants were the sons of General Frazer, and they had contracted with the plaintiff in the belief that he represented a *bonâ-fide* company, whereas the fact was that he was a speculator who he (the learned counsel) stated, had taken these proceedings merely for the purpose of advertising his milk. It was practically an impossibility for the defendants to have been present at the analysis at the time stated. Mr. D'Eyncourt decided that the summonses must be dismissed, because reasonable notice did not reach the defendants to enable them to be present when the milk was sampled.

Defendants may be called as Witnesses :—

William Austin, cheesemonger, Atlantic Road, Brixton, was summoned by Inspector Baxter for selling as butter "bosh." A witness was called who said he asked for a pound of shilling butter, and was supplied with "bosh," or "animal fat" mixed with a little butter. The Inspector said he took the butter into the shop, and divided it into three parts, and told the defendant it was to be analysed, and he then said he told the person to whom he sold it that it was for cooking purposes, and not for eating. The witness denied the statement. The defendant called a witness, who said he heard some of the statement. The defendant said he sold but a small quantity, and did not wish to "push" the article in his trade. His butter was 1s. 4d. per pound, and he intimated that real butter could not be purchased at one shilling per pound. Botts, Baxter, and Box said they had purchased butter at the time for one shilling per pound. The defendant said he did very little in the article now complained of, and he denied that he had sold it as "butter." Mr. Chance advised him to do less. He imposed a penalty of 5s. and 12s. 6d. costs on the defendant. Such stuff had better not be sold. Under the new Act, defendants are competent witnesses, and the privilege does not seem to be known.

Rum 31° under proof. Ingenious Defence :—

Charles Roberts, landlord of the Sovereign public house, 61, Osnaburgh Street, Regent's Park, was summoned by William Rouch, one of the sanitary inspectors for St. Pancras, for selling, to the prejudice of the purchaser, a pint of rum which had been adulterated by water so as to reduce the strength of the spirit more than twenty-five degrees under proof. Mr. Ricketts, solicitor, prosecuted on behalf of the St. Pancras Vestry, and said that under section 6 of the new Act it was a good defence if it was shown that the strength of the rum had not been reduced more than twenty-five degrees under proof. Here the rum was found to be 6¼ per cent. less than was allowed by the statute. The defendant said the only way in which he could account for the percentage of water was that his barmaid used a measure which she had previously been rinsing, and the moisture in the measure would reduce the strength. The inspector, in answer to the magistrate, said there had never been a complaint against the house before. Samples had been had from the house, but they had always been good. The defendant remarked that if he had intended to defraud he would have done it in a different manner, for he might have sold rum to answer the same purpose that would cost 3s. less. Mr. Ricketts, in answer to Mr. Sheil, said the Vestry did not press for a vindictive penalty. Defendant was fined 40s. and 2s. costs.

NOTES OF THE MONTH.

We have received a second letter from the author of *Nature's Hygiene*. Mr. Kingzett should remember that the *book* was *sent* to us for review, and that we criticised its tendency, and not Mr. Kingzett's personal ability as a chemist. The latter point we perfectly recognise, and only regret that he should have allowed himself to issue a work which while in its title purely scientific should yet introduce the mention of a special commercial article. We have no desire to detract one iota from the purely chemical merit of Mr. Kingzett's experiments, and we hope that he will be satisfied that no personal slight in this direction was for a moment intended.

In another column we print Mr. Edge's reply to our remarks in the last number of this journal. Our readers will see that we are credited with thinking that "no milk dealer could either speak the truth or be honest." Such an idea is absurd, and we do not for a moment hold this opinion; but what we say is that, through want of technical chemical knowledge, Mr. Edge has been led in the utmost good faith to make perfectly erroneous statements, which are simply a repetition of similar charges urged from time to time by unscientific persons. If Mr. Edge were a chemist he would know that no opinion can be formed upon a milk without a quantitative analysis, and that the analyst, according to the schedule of the Act, ought to give his quantities. The words are quite plain "that it consists of parts as under;" then follows the analysis of the milk, and lastly come the "remarks," in which the inference to be drawn from the figures is stated. It is therefore clear that the charge against analysts in general of not giving quantitative results must fail. The second charge made, namely, that the analyst has a direct interest and monetary benefit from convictions, is now toned down by Mr. Edge to the fact that when called upon as a witness he has the usual fee. This is a very different state of matters, because the fee as witness being payable whether the prosecution is successful or not, the charge formerly made was evidently untenable. We would, however, point out to Mr. Edge that the Act expressly provides that to save expense the analyst need not be called, and if the Association purposely incurs this expense they have only themselves to blame. In London the attendance of an analyst in court is a thing almost unheard of. If the certificate is disputed the duplicate sample is simply sent to Somerset House, when their certificate decides the case, and no costs of professional witnesses are incurred by either side. It is therefore clear that Mr. Edge's charge against analysts of having any monetary interest in prosecutions is unjust and ought to be withdrawn unreservedly.

In his letter Mr. Edge introduces a new charge, to wit, that a milk which has been slightly watered may pass an analyst. There can be no doubt that such is the case, but at whose door does the fault lie? Unquestionably it is at that of the trade societies. When the Act passed, the Society of Public Analysts, after most careful consideration, fixed a fair standard not to be complained of by any honest dealer, but forthwith all the ingenuity and legal acumen of defending counsel was put to work to prove that in certain extreme cases milk might fall below this standard, and by continual arguments, coupled

with the fact that Somerset House took for its standard an abnormally low one, it has come to this, that "pure milk" by the common limit of purity may and often does contain 10 per cent. of water if the original article *were rich*. All this suited the Societies very well until they in turn desired to use the Act against the farmers, and then, lo and behold, they object to the low standard which their own action has brought about. After all it is only human nature to wish a low standard of 8·5 solids not fat when they are defendants, then grumble when it passes as watered milk when sold to them, and then abuse analysts if they do not always use the Society's standard of 9·0 per cent.

Then, again, on the question of cream, mentioned by Mr. Edge, the milkmen have again themselves entirely to blame. The lowest honest natural fat was taken by us as 2·5, but some excuse for skimming beyond that was necessary, and therefore the theory that milk served from a can might perfectly innocently lose its fat to the extent of at least one-half, was started, and an eminent professor retained to prove it experimentally. The defence was successful, and, as an analyst has no means of knowing from whence a sample comes, it follows that milks have to be passed which on their very face bear evidence of loss of cream. This re-acts of course against the milkmen when they desire to prosecute the farmers, and then they blame the analysts instead of themselves.

The *Chemist and Druggist* for once speaks out manfully on the tincture of quinine case, and objects to the defence evidence as ridiculous, but it cannot help giving the analysts a little kick although it practically admits that in this instance at least the Public Analyst had a *raison d'être*. It says that statements like those of Dr. Browning "would hardly pass unchallenged even in the Society of Public Analysts." After all Dr. Browning's statements are simply a *reductio ad absurdam* of a style of defence on the part of the chemists and druggists which we have often had occasion to challenge and which has before been found successful on grounds very little better.

Bristol possesses an analyst whose report of the results of 20 samples has been simply ordered to lie upon the table because his appointment has not yet been approved by the Local Government Board. Surely it is a pity that such a waste of energy and money should have taken place, and the authorities should not have first seen that they had their officer's qualifications approved before sending in samples to him.

A correspondent in a contemporary says:—A poor ill-used dairyman of Ramsgate has been fined for only adding 53 per cent. of water to his milk. I presume he supplied the Cockney visitors. Last year the Margate magistrates, at the end of the season, fined a lot of milkmen for watering the skim, and it was really heart-rending to hear those men argue that if the system of persecution continued, they would never be able to make out the quantity of sky blue demanded by the visitors. They considered the Margate water nourishing stuff, and quite worth 5d. a quart.

Mr. F. W. Stoddart has been appointed Public Analyst for Salisbury, in the room of his late father.

Soothing Powders.—At an inquest held on August 3rd, by Mr. Brian, Coroner for Plymouth, an infant, aged 10 weeks, was proved to have died of narcotic poisoning after the administration of part of a powder purchased from a local druggist, and described as a "Steedman's Soothing Powder."

A dealer, at Ballynaninch, Co. Down, has been fined £2 for selling flour adulterated with oat flour, and containing fungi, as certified by Dr. C. A. Cameron, County Analyst.

RECENT CHEMICAL PATENTS.

The following specifications have been recently published, and can be obtained from the Great Seal Office, Cursitor Street, Chancery Lane, London.

1879 No.	Name of Patentee.	Title of Patent.	Price.
4104	H. E. Newton	Apparatus for Concentrating Acids	6d.
5102	H. R. Snelgrove..	Manufacture of Gas	6d.
5310	H. A. Bonneville	Manufacture of Gas	6d.
5323	H. C. Bull	Manufacture of Gas	6d.
1880			
18	J. W. Swan	Electric Lamps	2d.
45	J. Mactear	Obtaining and Supplying Carbon	2d.
53	W. R. Lake	Production of Phosphoric Acid in Manufacture of Glass	4d.
79	R. Werdermann..	Producing and Utilizing Electric Currents..	6d.
91	W. R. Lake	Microphonic and Telephonic Apparatus	8d.
158	L. J. Crossley	Microphonic and Telephonic Apparatus	6d.
109	J. Kidd	Apparatus for Carburetting Illuminating Gas	6d.
147	F. Zimmermann	Tannic Acid..	4d.
203	J. Clark	Developing Electric Light	2d.
225	W. R. Lake	Purifying and Refining Paraffin	6d.
263	W. L. Wise	Producing Anhydrous Sulphuric Acid	4d.
569	H. Y. Attrill and W. Farmer ..	Manufacture of Gas	10d.
1553	C. D. Abel	Electric Lamps	6d.
2037	W. Clark..	Electric Lamps	6d.

BOOKS, &c., RECEIVED.

Spon's Dictionary of Arts and Manufactures, Part II.; Tables for Analysis of a Simple Salt by A. Vinter; Contributions to the Chemistry of Bast Fibres, by E. J. Bevan and C. F. Cross; The Chemist and Druggist; The Brewers' Guardian; The British Medical Journal; The Medical Press; The Pharmaceutical Journal; The Sanitary Record; The Miller; Journal of Applied Science; The Boston Journal of Chemistry; The Provisioner; The Practitioner; New Remedies; Proceedings of the American Chemical Society; Le Practicien; The Inventors' Record; New York Public Health; The Scientific American; Society of Arts Journal; Sanitary Engineer of New York; The Cowkeeper and Dairyman's Journal.

THE ANALYST.

OCTOBER, 1880.

ON THE MANUFACTURE OF SUGAR FROM THE SUGAR CANE.

By R. H. Harland, F.C.S.

The art of manufacturing and refining sugar has now attained to the rank of the second industry in the world. The two sources from which the supply of sugar is derived are the beet root and sugar cane—the one growing in Europe, the other requiring the heat of a tropical climate to bring it to maturity. Many other plants also have the property of producing crystallizable sugar, identical in chemical composition with that prepared from the beet or cane; notably the sugar maple (*Acer. saccharum*), from which a large quantity of sugar is manufactured in Canada, the United States, and Borneo, but the supply is now gradually falling off on account of the destruction of the maple forests.

The sugar obtained by the natives of Bengal and Siam from the various species of palm is, on account of the crude way in which it is manufactured, of very inferior quality, and is mainly consumed in the countries where it is grown. The juice of the Nipah palm (*Nipa fruticans*) is almost equal in saccharine richness to that extracted from the cane, with the advantage that it is much cleaner, and contains no coloring matter or chlorophyll the vegetable matter being easily precipitated, giving a liquor as clear as spring water. This species of palm flourishes near the sea, or on the edges of brackish pools, and takes up a large quantity of salt, which makes its appearance in the juice in varying quantities; sufficient, in some cases, to give the liquor a decidedly saline taste. Were it nor for this drawback, I have no doubt that a large quantity of excellent sugar would be obtained from this source.

Since the time when the beet root was first experimentally cultivated for sugar, it has, by careful cultivation become the source of nearly half the total quantity of sugar which is produced at the present day. It is not, however, entirely due to the agriculturalist that beetroot sugar is able to compete so successfully with cane, but a great deal of the success attending its production is due to the fact that the manufacturer called in the assistance of chemistry and chemists, to enable him to decide on the most scientific and profitable method of working; and although the average quantity of crystallizable sugar contained in the beetroot juice is only half that which is contained in the juice of the sugar cane, and other impurities are likewise present which have to be removed previous to the evaporation of the liquor to form the best crystals, yet the quality of the product is superior to and commands a much higher price than the raw cane sugars which are imported to this country from the colonies, and which require to be refined previous to consumption. Of course, Demerara sugars, and also sugars from other countries where the vacuum pan is in use, compete favorably with the refined article, either on account of their peculiar color or some other distinguishing mark which renders them pleasing to the eye, and even, perhaps, from the fact of their containing a proportion of uncrystallizable sugar (molasses), they are more palatable to the public, who, for some purposes, prefer the impure article to the pure loaf sugar.

The reason for the difference in quality between the colonial cane sugar and continental beet sugars is easily found when we take into consideration the difference in the mode of manufacture, and also the fact that the extraction of sugar from the beet has been investigated scientifically by some of the leading continental chemists, and chemistry and proper chemical supervision rule all the operations from the manuring of the root to the time when the sugar is turned out of the factory in an almost chemically pure condition. That this is so, is proved by the fact that almost every chemical journal issued contains the results of some research or enquiry into one or other of the important operations connected with its manufacture or the products produced therefrom; and, further, every manufacturer knows so well the great importance of chemical analysis, that hardly one beetroot sugar factory is without a chemist. Now, in the case of the sugar-cane planter: he begins by manuring his land with some compound which is very likely to be quite unsuitable for the variety of cane which he wishes to grow; perhaps he does not consider it necessary to trash his canes or clean them so as to allow the rays of the sun to exert their action on the cane, and assist in producing the saccharine matter; but leaves them to grow as best they may until the time comes for cutting and extracting the sugar; in many cases the boiling-house is unable to keep pace with the cutting, from bad weather or other causes, and a stock of canes are standing at the mill, and perhaps remain exposed to the atmosphere for some days, but this is not of so much importance, as I shall afterwards show (except in the case of canes that have been grown on land that is poor in lime salts: in this instance the juice is generally very acid, and rapidly undergoes fermentation even before it is expressed from the canes), as a practice which I have frequently seen followed of leaving a portion of the juice to stand all night, or cleaning and evaporating the juice to a density of 18° to 20° B., and allowing it to stand—say for 8 to 12 hours—to settle, thus causing fermentation to set up, and consequent loss of crystallizable sugar and formation of molasses; in fact, in many boiling-houses the operations are conducted entirely by rule of thumb, and the overseer in charge knows little or nothing about the composition or properties of the substance which he is manufacturing.

Of course these remarks do not apply with the same force to estates which work with the triple-effect and vacuum pan, but even in many of these cases mistakes are made, and losses of sugar occur which would be prevented and remedied if a system of analysis were carried out. Occasionally, syrups are allowed to stand too long a time before re-boiling, under the supposition that on account of the density they will keep any length of time, but in hot climates the temperature is so favorable to fermentation, that in syrups of a density of 38° to 40° B. crystallizable sugar is converted into glucose, although the appearance of the surface of the liquor would not seem to indicate that any chemical change was taking place; indeed, it is not even necessary that the sugar should be in the form of syrup to allow of this change taking place, for low sugars will form molasses and drain rapidly when heaped in bulk or stowed in a ship's hold, owing to rapid conversion of crystallized sugar into glucose by the action of fermentation. This is a well known fact, and the loss of weight in cargoes of raw sugar is constantly being determined; but the actual loss of crystallizable sugar caused by drainage and deterioration, and formation of probably not less than from 2 to 4 per cent. more glucose in the raw sugar than it contained when shipped, is a fact that, up to the present time, has been lost sight of. In one instance, where a

ry sugar, containing 88 per cent. crystallizable sugar, 3 per cent. uncrystallizable, and ·92 ash,

was stored for six months in a warehouse in Manila: at the end of that time the bags were quite wet and sticky, and molasses was draining away in considerable quantities; the sugar then showed a loss of 6 per cent. in crystallized sugar, and formation of nearly 5 per cent. of glucose, besides being very acid to litmus paper. A sample of Taal sugar, kept in a well stoppered bottle in the laboratory for one year, showed a decrease of 1½ per cent. in the crystallizable sugar, and a corresponding increase in the amount of glucose. Another very common mistake in sugar houses abroad consists in sending molasses to the distillery before the whole of the sugar has been obtained; these molasses should be re-boiled to a jelly, and allowed to crystallize slowly in tanks, by which means a further supply of sugar is obtained which would otherwise have been converted into alcohol.

It will be seen from what has already been said, and it is also a well-known fact, that a great waste of sugar goes on in the process of open-air boiling, and many mechanical contrivances have been invented in order to obtain the sugar in a solid form at as low a temperature as possible; the best of these, and the one which is now adopted in all countries that send to England and elsewhere sugar suitable for direct consumption, is the vacuum pan; but in many sugar-producing countries the vacuum pan has not been adopted, either from want of capital, or from a conservative tendency on the part of the planter, who prefers to go on spoiling his sugar by open-air boiling to adopting machinery which would in a very short time pay for itself in the quality and increased price of the article produced.

In the colony of Queensland, which in point of time is one of the youngest of the sugar-producing countries but which has gone far ahead of older settlements, a high-class vacuum pan sugar is produced polarizing 97 to 98 per cent., from juice of which the following analyses are specimens:—

CANE JUICE EXPRESSED FROM CANES GROWN IN THE MARY DISTRICT, QUEENSLAND, AUSTRALIA.

	Gingham Cane.	China Cane.	Mixed Samples from various species of Cane.
Baumè at 15·5° C	11·5° ..	10·5° ..	11·6°
Crystallizable Sugar	19·50 % ..	16·40 % ..	18·30 %
Glucose	·25 ..	·41 ..	·45
Ash (Soluble Salts)	·70 ..	1·11 ..	·37
Other organic matters	1·17 ..	2·51 ..	3·14
Total solid matter	21·62	20·43	22·26

These juices all yield very good sugar, giving on the average of one season's work 1·25 lbs. of sugar per gallon of juice at 10° B., of which 65 to 70 per cent. is nearly white crystals, and compares very favorably with colonial refined sugar; the remaining quantity is sugar of a lower grade, and obtains a ready sale as "pieces." This result is obtained without the use of bone-black, and the only method of purification adopted is the plan of precipitating the vegetable "feculences" with milk of lime, and removing them by skimming as they rise to the surface of the liquor when heat is applied.

The manner in which these juices behaved in the boiling-house was very different, great difficulty being experienced in the treatment of the China cane juice, the sugar produced being worse in quality and deficient in quantity when reduced to the standard of 10° B. as compared with the juice from the Gingham cane which was easily converted into sugar of excellent quality; the reason of this is apparent from the analyses, the China cane containing a larger quantity of ash or soluble salts which have the property of converting crystallizable sugar into glucose during the operation of boiling. It is curious to note the

difference in quality between these two samples of juice, especially as the two species of cane were grown on one plantation under similar conditions, it is evident that the China cane has the property of abstracting from the soil a larger proportion of mineral salts, and these salts, when soluble, go greatly towards explaining low yield of sugar and large quantity of molasses; these analyses show the necessity of studying the compositition of the juice from the various species of cane so as to determine the most suitable class of cane to grow, and also the kind and proportion of manure to employ so as not to increase more than is absolutely necessary the quantity of those salts which are so detrimental in the process of manufacture to the quality and quantity of the sugar produced.

The Philippine Islands export large quantities of raw sugar. The production is said to amount to nearly 200,000 tons per annum, but none of the sugar exported is of good quality, as the following analyses of dry sugars will show :—

	Yloilo Sugars, No. I.	No. II.	No. III.	Zambales Imitation Yloilo.
Crystallizable Sugar	85·30	81·60	78·60	82·10
Glucose.....	5·80	8·30	9·10	7·70
Ash	·94	1·02	1·90	2·00
Moisture	5·06	6·06	5·56	4·20
Unknown organic matter.	2·90	3·02	4·84	4·00
	100·00	100·00	100·00	100·00

	Cebu Sugar, superior.	Cebu Sugar, current.	Pampana (new Sugar), unclayed.	Laguna Sugar.	Taal Sugar.
Crystallizable Sugar..	81·20	71·00	78·40	82·70	70·6
Glucose	7·80	10·90	10·60	5·70	12·0
Ash	2·15	2·56	1·80	1·34	3·5

The Zambales sugar is the same number by Dutch Standard as No. 1 Yloilo. The proportion in which these sugars are produced is $\frac{1}{3}$ of No. 1, to $\frac{2}{3}$ of No. 2, to $\frac{1}{3}$ of No. 3. The insoluble organic matter in these sugars is generally less than ·2 per cent., and is of a very slimy nature; the remaining soluble unknown organic matter is the amount which it is necessary for the bone-black to absorb. Of course all these sugars are produced by a similar arrangement to the copper-wall, and in some districts the destruction of sugar by burning in the process of evaporation, is exceedingly large. The cane juice expressed from the ripe canes is of fair quality, and will compare favorably with the Queensland samples. A sample from the Taal district, which is extremely fertile and well suited for sugar plantations, showed to analysis :—

Crystallizable Sugar	18·30
Glucose	·10
Ash.....	·30
Other organic matter	3·25
	21·95

With a vacuum pan and proper machinery a juice of this quality should yield excellent grocery sugar. It would hardly be of such good color as the Queensland sugar on account of the large proportion of green coloring matter (chlorophyll), a portion of which was not precipitated by neutralization with milk of lime, but the sugar would compare very favorably with crystallized Demerara. At the present time the quality of the sugar produced from this juice corresponds to the analysis of Taal sugar given above, the article being fit for nothing but brewing black beer.

In one district in Luzon, where the cane grows luxuriantly often to a height of 12 feet, and one stool produces four or five canes, the crushing season lasts considerably longer than in other districts, and the sugar produced is of superior quality. The soil being

extremely fertile, a sample was analysed, and showed the following results on the dried sample :—

CANE SOIL FROM CAMARINE SIN, LUZON.

Silicious matter	53·39 °/₀
Alumina	13·16
Oxide of Iron	4·80
Oxide of Manganese	·10
Oxide of Magnesia	·42
Potash and Soda, as Chlorides	1·14
Carbonate of Lime	1·60
Sulphuric Acid	·09
Phosphoric Acid	·25
Carbonic Acid	Traces.
Organic and Volatile Matters	25·05
	100·00
Moisture in Sample before drying	6·79 °/₀

Unripe canes invariably contain a large quantity of glucose, which is probably converted in the process of ripening into crystallizable sugar.

The following analyses are of canes known to be in an unripe condition and juice from them:—

UNRIPE CANES.		JUICE FROM UNRIPE CANES.			
Crystallizable Sugar..	10·00	Crystallizable Sugar	8·60 °/₀	7·76 °/₀	7·24
Glucose	2·80	Glucose	3·10	2·30	2·50
Ash	·74	Ash	·21	·25	·34
Soluble Ash .... ·32		Unknown Organic Matter..	1·27	1·74	2·89
Woody Fibre	12·26				
Water	74·20	Total Solid Matter.....	13·18	12·05	12·97
	100·00				

In order to ascertain whether the juice of the cane underwent any decomposition when the canes were kept for some time previous to crushing, the following experiments on unripe canes were made. These canes were selected, as it was thought probable that they would deterioriate more rapidly on account of their acidity, and the fact of their containing less saccharine matter.

Two plants were selected, each having two healthy canes growing from the one stool; the juice from one of these was expressed and analysed immediately, the other was put aside in the laboratory for eight days, at the expiration of which time the juice was expressed and submitted to analysis.

FIRST EXPERIMENT.			
Weight of Cane	1 lb. 10¼ oz.	..	2 lbs. 8¼ oz.
Loss of Weight in 8 days	..	..	4·75 oz.
Equals per cent.	..	..	11·8 per cent.
Baumè of Juice	5½°	..	5¾°
Crystallizable Sugar	5·99 per cent.	..	7·33 per cent.
Glucose	1·70	..	1·50
Ash	·30 ..	..	·32
Unknown Organic Matter	2·27 ..	..	1·99
Total Solid Matter	10·26	..	11·14
Reaction	Slightly acid.	..	Slightly acid.
SECOND EXPERIMENT.			
Weight of Cane	2 lbs. 1¼ oz.	..	2 lbs. 6¼ oz.
Loss of Weight in 8 days	..	..	4·7 oz.
Equals	..	..	12 per cent.
Baumè	5½°	..	5½°
Crystallizable Sugar	8·17 per cent.	..	6·54 per cent.
Glucose	1·90 ..	..	1·40
Ash	·26 ..	..	·24
Unknown Organic Matter	·87 ..	..	2·34
	11·20 ..	..	10·52
Reaction	Slightly acid.		Slightly acid.

These results show that no fermentation of the juice had taken place during the time the canes had been exposed after cutting; in fact, the singular result of the glucose being less in the exposed samples, would seem to indicate that a ripening action had been going on; these results must be taken for what they are worth, but they would certainly seem to indicate that canes could be kept and transported long distances without undergoing loss of crystallizable sugar; but this, of course, only applies to sound canes, and the result might be quite different in cases where the rind of the cane was cracked or eaten into by rats.

ADULTERATION OF FOOD IN CANADA.

The following Annual Report of the Commissioners of Inland Revenue has just been issued. It forms the introduction to a volume of 83 pages containing the detailed reports of the four analysts—Messrs. Ellis, Edwards, La Rue, and Fraser.

The reports, as usual, set out in full the name of each vendor convicted, with the details of the adulteration. It includes, also, the full analysis of every sample of milk submitted to the analysts.

INSPECTION OF FOOD.

To the Honourable

The Minister of Inland Revenue.

SIR,—I have the honour to submit my Fourth Report respecting the analysis of Food, together with the reports of the analysts appointed under the Act, and tabulated statements prepared in this Department of the results of the analysis of the various samples submitted to them.

1. The following statement is a summary of the whole number of samples analyzed.

Name of Sample.	Genuine.	Adulterated.	Doubtful.	Total.
Allspice	6	10	..	16
Baking Powder	19	5	..	24
Bread	23	1	..	24
Butter	146	67	14	227
Cassia	..	1	..	1
Cloves	7	9	1	17
Cinnamon	3	16	..	19
Ginger	5	6	..	11
Guano	..	5	..	5
Honey	2	..	..	2
Mace	5	1	..	6
Milk	167	76	8	251
Nutmegs	3	..	..	3
Pepper	22	21	1	44
Potted Meats and Fish	37	..	1	38
Self Raising Flour	16	1	..	17
Sugar	81	9	11	101
Tea	52	6	6	64
Water	25	1	..	26
Total	619	235	42	896

2. From the above it will be seen that eight hundred and ninety-six samples have been analyzed, two hundred and thirty-five, or a little more than twenty-six per cent., were adulterated, and forty-two are returned as doubtful.

3. By the following table it will be seen that a perceptible improvement has taken place. In 1876 the percentage of adulteration was 51·66; in 1879 it has fallen to 26·22 per cent.

Year.	Genuine.	Adulterated.	Doubtful.	Total Number Analyzed.	Percentage of Adulteration.
1876.....	87	93	..	180	51·66
1877.....	241	247	..	488	50·61
1878.....	523	271	19	813	33·33
1879.....	619	235	42	896	26·22

4. The analysis of twenty-four samples of baking-powder shows that injurious chemicals have not been used to any great degree, as only five samples out of the twenty-four were found to be adulterated.

5. The important article of bread appears to be fairly free from adulteration, for out of twenty-four samples analyzed but one was adulterated.

6. Two hundred and twenty-seven samples of butter were analyzed during the year. Of these seven were adulterated and fourteen were classed as doubtful. The adulterations being principally salt and water; but in a number of cases the butter was rancid, probably owing to carelessness in packing.

7. Of one hundred and seventeen samples of condiments analyzed, sixty-four were adulterated and two were of doubtful chaarcter. The adulteration of this class of food is still very large, but there has been a gradual improvement, as the following table will show:—

Year.	Genuine.	Adulterated.	Doubtful.	Total Number Analysed.	Percentage of Adulteration.
1876.....	5	39	..	44	88·63
1877.....	24	83	..	107	77·57
1878.....	26	108	..	134	80·59
1879.....	51	64	2	117	54·70

8. Two hundred and fifty-one samples of milk were analyzed. Of these seventy-six, a little more than thirty per cent., were adulterated, and eight samples were returned as doubtful. This shows an improvement of ten per cent. upon last year's analysis.

9. Of one hundred and one samples of sugar analyzed nine were adulterated and eleven doubtful.

10. Of sixty-four samples of tea analyzed six were reported as adulterated and six doubtful.

11. Of twenty-six samples of water analyzed only one is returned as bad.

Respectfully submitted,

A. BRUNEL,

Commissioner of Inland Revenue.

Department of Inland Revenue,
December, 22nd 1879.

AN IMPROVEMENT IN THE MODE OF ESTIMATING NITRATES BY CRUM'S METHOD.

By Alfred H. Allen.

I have, of late, been in the habit of employing a nitrometer for the estimation of the nitrates and nitrites in water. Half a litre or 250 c.c. of the sample is evaporated almost to dryness and transferred to the tapped limb of a nitrometer filled with mercury, the total volume of liquid, *plus* the rinsings, being restricted to 2 c.c. Concentrated sulphuric acid is then run in till the total bulk of the liquid is 5 c.c., when the tube is agitated as usual, the open end of the nitrometer remaining firmly clamped in the support. In the ordinary course of working, it would now be necessary to allow the whole of the mercurial froth to subside, adjust the level of the mercury in the two limbs, read off the volume of gas, observe the temperature and barometric pressure, and calculate the observed measure of gas to the standard conditions. Instead of doing this, I employ a double nitrometer-stand, and

make a test experiment, side by side with the sample. The standard solution I employ is one of nitrate of potassium, containing 5·055 grammes of the salt per litre. 20 c.c. of this solution contain ·1011 of KNO_3, and yield 23·58 c.c. of nitric oxide gas, measured at 15·5°C (not 0°C.) and 760 m.m. pressure. Care is taken to make the volume of liquid and acid in the standard tube identical with that in the experimental nitrometer. On the surface of the mercury in the open limb of each nitrometer, I pour 5 c.c. of a mixture of three volumes of concentrated sulphuric acid with two of water, so as to have a liquid of the same density and measure as that in the tapped limbs.

After the completion of an experiment, the level of the *aqueous* liquids in each limb is made identical. By operating in this manner it becomes unnecessary to wait for the subsidence of the persistent mercurial froth which is often produced, and the reading may be taken as soon as the evolution of gas has ceased. As the temperature, barometrical pressure, and tension of aqueous vapour in the two nitrometers are necessarily identical, it only remains to compare the volume of gas yielded by the sample with that obtained from the 20 c.c. of standard nitre solution, in order to ascertain the amount of nitrates, &c., in the water.

20 c.c. of nitre solution equal ·054 grammes of N_2O_5.
,, ,, ,, ,, ·062 ,, ,, NO_3.
,, ,, ,, ,, ·014 ,, ,, N.

In an actual experiment, I obtained from a quarter litre of drinking water 27·0 c.c. of nitric oxide, while the gas from 20 c.c. of the nitre solution measured, under similar conditions, 23·9 c.c. Hence

23·9 : 27·0 = 0·054 : 0·061 N_2O_5.
23·9 : 27·0 = 0·014 : 0·0116 N.

These figures work out to 17·08 grains per gallon of N_2O_5, and 3·25 grains of N.

In practice it is not necessary to make a test experiment every time. If the tap of the nitrometer be tight, the standard measure of gas obtained from the nitre solution may be kept for an indefinite period.

Test experiments which I have made with solutions of nitrates have shown that the method is capable of very considerable accuracy, and might probably be found very convenient for the assay of commercial nitre and nitrate of soda.

Crum's process is one which is well known to give good results, and the nitrometer has been applied to it independently by other chemists; but the method of working above described adds so much to the rapidity and convenience of the process in actual practice, that it appeared desirable to call attention to it.

ON A SUBSTITUTE FOR ALUM IN MAKING BREAD.

By C. Estcourt, F.I.C.

About six months ago my attention was called to the use, by bakers, of a compound (in a liquid state) which, it was said, would replace alum completely. As is the case in connection with all trade secrets, there was a difficulty in obtaining any definite information which would enable one to form a judgment upon the matter. It happened, however, that about the time named I received from a baker a small bottle of this liquid, together with a loaf in

which I was informed it had been used. The loaf, upon analysis, gave alumina equal to 21 grains alum per 4 lb. loaf; so I drew the not unfair inference that some ingenious person had introduced to the baking trade some compound of alumina, not alum itself, and could therefore assert that no alum had been used in the compound.

A qualitative analysis of the liquid showed Al—Ca in small quantity, Mg—NH_3—Na in large quantity, whilst the acids present were found to be phosphoric, HCl. and H_2SO_4, but principally H_2SO_4, which it was assumed was used to keep the phosphates in solution.

Upon the evidence of the Al found in the loaf I gave the opinion that the use of the liquid would be improper and unsafe.

Since then, upon various occasions, I have received samples of liquid said to be (in the principal constituents) like the one I had examined, but said to be so improved as to contain no alumina. All these samples, however, differed one from another so much, that I advised the persons consulting me it was unsafe to use them without guarantee that no fresh changes would be made in them by the vendor. During the past month I have again had submitted to me for examination, by a large baker here, a sample of the liquid, together with a loaf in which it is said to have been used. The sample is now declared by the inventor to be perfection, and certainly practically gives no alumina in bread in which it is used.

I give below the result of quantitative analysis of the liquid :—

Sp. gr. at 60 = 1174.

	In 100 parts by measure.
Free Phosphoric Acid, calculated as $H_2P_7O_8$.	14·58
Magnes. Pyrophosphate	6·94
Ditto Sulphate	6·39
Sodium Chloride	traces.

The compound is therefore mainly magnesium phosphate kept in solution by phosphoric acid.

The bread sent was said to have been made from poor English flour, which would not, owing to deficiency in gluten, have made a presentable loaf without alum. It was found to be beautifully white, firm, and yet well ærated. The air spaces of the loaf, shown when it was cut through, were very numerous and of a uniform size. The total amount of alumina found in it equalled rather less than 10 grains of alum per 4 lb. loaf, which, as will be remembered, does not much exceed the quantity allowed for by some analysts as being naturally present.

Whether or not such a compound can be safely used in bread is a question of vital importance, both to the general public and the baking trade. If the compound is declared by competent medical authorities to be innocent in its results in the small quantities used, there is no doubt it will be a great boon. Wet harvest times result in large quantities of wheat, which wheat, when ground, cannot by itself be made into presentable food for man without the use of the admittedly injurious drug—alum. Thus this quality of wheat is not available for use by bakers who prize a good name; but if the use of this compound can be proved to be innocuous it would render possible the use of such flour to the mutual advantage of both the public and the agriculturists—the one obtaining cheaper bread, and the other being saved from that partial ruin which is so often the result of a bad harvest. I am making experiments as to quantities used, and will give the results in a future paper.

ABSTRACTS OF PAPERS READ BEFORE THE BRITISH PHARMACEUTICAL CONFERENCE AT SWANSEA.

Determination of the Strength of Alcoholic Solutions of Chloroform.

Report on Commercial Specimens of Sal Volatile and Chloric Ether.

By J. C. Thresh, F.C.S.

Mr. Thresh had sent a letter to about 100 chemists, including the heads of most of the best-known dispensing establishments, asking them what they were in the habit of dispensing and retailing when chloric ether (eth. chlor. or sp. eth. chlor.) and sal volatile (sp. ammon. co. or sal volatil) are prescribed or asked for.

The replies showed that 27 firms used sp. chlorof. B.P., 11 used Duncan's chloric ether only, 14 used a solution of chloroform in alcohol stronger than the B.P.; 6 others who replied used special products of their own.

Respecting sal volatile, 44 employ sp. ammon. arom. B.P., exclusively, both in dispensing and retailing; 6 use sp. ammon. co. P.L., 1836; 6 use special preparations of certain makers. Many chemists, the author added, invariably use sp. ammon. ar. B.P., for dispensing, but retail special preparations as sal volatile.

Mr. Thresh had also obtained samples of chloric ether and sal volatile from manufacturers or large wholesale houses, with three from retail houses.

All the firms to whom he wrote sent two or more samples, in many cases with replies explaining what course they usually followed under the circumstances. Many, for chloric ether, supplied Duncan's preparation; others "special distilled products;" others the B.P. sp. chloroformi; and others, solutions of chloroform in spirit, stronger than the B.P. preparation. The samples obtained were 20 in number, sp. gr. from ·861 to ·922, and in percentage of chloroform (by volume) from 2 to 12¼ per cent. He was rather surprised at the small percentage of chloroform contained in the distilled "chloric ethers.' There seems to be an impression abroad that this preparation, though more miscible with water than the B.P. sp. chloroformi, is richer in chloroform. This is a fallacy. The preparation which so many understand to be intended when "chloric ether" is prescribed contains only from 2 to 3 per cent. of chloroform, although, judging from its specific gravity (which has deceived so many), it would contain 7 to 9 per cent.

With regard to sal volatile Mr. Thresh found that with perhaps one exception, every wholesale house made a sp. ammon. co., besides the B.P. sp. ammon. aromat.

His examination of the samples sent him proved that the special preparations varied in specific gravity from ·840 to ·954, and the percentage of ammonia from ·813 to 2·326. He was not surprised to meet with a good deal of variation in these articles, but he thought it was unsatisfactory that the samples of B.P. should also prove very different in their chemical characters. Among these the specific gravity ranged from ·865 to ·894, and the percentage of ammonia from 1·067 to 2·849. It was also found that there was no ratio whatever as to the proportion of ammonia present in the free form, or as carbonate.

Restoration of Discoloured Syrup of Iodide of Iron.

By T. B. Groves, F.C.S.

The author agrees with other writers that this syrup, if made according to the British Pharmacopœia, with pure sugar will keep fairly well, so that well-accustomed dispensing

establishments fail to see any difficulty in the matter. But those who perhaps are not called upon to dispense the article once in a month often find on searching the cupboard that the syrup without some treatment is not presentable.

The discoloration of syrup of iodide of iron is doubtless due mainly to the presence of free iodine; when turbidity is present there is probably also a basic persalt of iron in suspension which adds to the effect. To get rid of both of these it is only necessary to dilute the syrup with say a third of its volume of water, to boil briskly for a few minutes, then filter through paper, and finally reduce by evaporation to its original bulk. The syrup will then have resumed its original appearance.

The strength of the preparation will not have been materially altered by this treatment, for it takes a wonderfully small quantity of iodine in the free state to colour a large amount of liquid. This treatment by boiling was not new. "It had been suggested," Mr. Groves said, "by some writer whose name I have unhappily forgotten, but whose useful, though often unused, suggestion has not escaped me."

Mr. Groves had made some experiments with the object of avoiding the delay attendant on the process already mentioned.

When a persalt of iron is brought in contact with a soluble iodide, the salt is reduced to the proto condition, and free iodine is eliminated. It was at one time thought that under these circumstances a per-iodide was formed, but Mr. Squire, jun., some years since proved conclusively that such was not the case by showing that the colour could be removed from such a liquid by simply shaking it with an ordinary solvent for iodine, such as benzine or chloroform. However, if to such a liquid containing iodine in solution, caustic potash or soda be added, precipitation of ferric oxide will result, and the iodine will combine with the base of the precipitant. Applied to a discoloured syrup of iodide of iron the process does not answer, and that probably because the sugar exercises a solvent action on the precipitated oxides. In fact, it is after filtration more discoloured than ever.

Mr. Groves had formerly pointed out the effect produced by the presence in the syrup of a trace of phosphoric acid, which, by seizing at the moment of its formation the per-oxide of iron and rendering it insoluble, effectually prevented the reaction ending in the elimination of free iodide that would otherwise have resulted. Syrup, even dilute, would keep for years after being so treated, but of course one gets instead of the discolouration the slight turbidity occasioned by the deposit of perphosphate of iron; this, however, being colourless and easy of removal by deposit or filtration, is of but little moment. Addition of phosphoric acid to syrup already discoloured is of no avail; the mischief has been done, and no persalt remains for it to act upon. If, however, previous to the addition of the acid, a few drops of liquor potassæ be stirred into the syrup the colour disappears almost immediately, and, the acid being in slight excess, will not again return.

Thus he found by experiment that when to half a fluid ounce of syrup discoloured by one drop of liquor ferri per-chloridi, he added enough liquor potassæ (the amount would vary according to the acidity of the syrup) to produce a distinct greenish colouration, the further addition of two drops of dilute phosphoric acid restored the syrup to its original tint.

Mr. Groves prefers this method to the well-known use of hyposulphite for this purpose, though he expected it would be regarded as hateful and unorthodox by some.

CORRESPONDENCE.

[The Editors are not responsible for the opinions of their Correspondents.]

To the Editor of "The Analyst."

Sir,—I notice in the July number of The Analyst you give the analysis of some canned tomatoes. You say "both are preserved in water," and give the percentage of solid matter present as "5·52." I think you are mistaken as regards the water. No water is added in canning tomatoes in this country. The main trouble with the canners is the excess of juice contained in the tomatoes.

I have just determined the amount of water in a tomato selected as an average. It was perfectly ripe, and when skinned and cored weighed 127·5 grams. On drying, it left a residue of 7 grams of solid matter, or 5·49 per cent., a result sufficiently near your own figures.

Having just visited one of the largest factories about, you may be interested in a description of the process used.

The tomatoes are raised in the surrounding country here—chiefly in Arlington and Belmont, which lie about six or seven miles north-west from Boston. The kind preferred at present are known as the Boston Market; these are a smooth, compact tomato, weighing from 150 to 200 grams; they are very solid being well filled with meat and very few seeds. These are brought in daily and sold to the factories. At the factory they are emptied a bushel at a time into a wire basket, and then scalded by dipping into a tank of boiling water. They are then removed to a large table, when they are sorted into firsts and seconds only, the ripest being packed as firsts. They are then measured out into pails holding about a peck each, and passed on to the skinners who carefully skin and core them. They are then ready for packing. The cans are filled by hand, the tomatoes being packed as closely as possible into the can. It is found at this stage of the operation that the juice is present in excess and a considerable portion of it is thrown away. No water is ever used, as the tomatoes furnish more than enough. After the cans are filled to within an eighth of an inch of the top, the lid is placed upon them and soldered fast. A small hole is then punched in it, and the cans are placed in a hot bath until steam issues from the hole; they are then removed from the bath and allowed to cool slightly and sealed; they are then returned to another bath in which they are boiled from 30 to 45 minutes; from this bath they are removed to a cooling room. Next morning, when cooled, they are stacked. At the end of the packing season the cans are examined and those which have spoiled are rejected. The condition of a can can almost always be told from an examination of the outside. A can in good order has the ends concave. If, on the other hand, the ends are convex, it is almost certain that the can is spoiled.

Yours respectfully,

Boston, Mass., August 23rd, 1880. S. P. SHARPLES.

REVIEWS.

Tables for the Analysis of a Simple Salt. For use in School Laboratories.

By A. Vinter, M.A. London: Longmans, Green & Co.

This little pamphlet gives in its first pages the more simple and characteristic tests for the metals and basic radicles, following which are a series of tables for the detection of bases and acids.

Although this work might have been written with ease by any fairly good chemical student with a text-book of qualitative analysis before him, yet it certainly does contain errors that even a student would hardly have made. For instance, under "Iron," after heating the salt with Na_2CO_3 and KCN upon charcoal, the following test is given:—"Dissolve the powder in HNO_3 + HCl.; add to the solution a solution of ferrocyanide of potassium and observe the deep blue precipitate." The presence of "aqua regia," together with ferrocyanide of potassium is certainly calculated to give an unreliable result. Under "examination of solution for acid." "Calcium chloride precipitates." "In neutral solution." Carbonic, white, soluble in acetic acid." We do not know of any *soluble* carbonate that gives a

neutral solution. Other instances might be given that would certainly mislead the examiner of a "simple salt."

We have already quite sufficient works upon qualitative analysis; but should the subject be split up into a number of small branches, and each of these have works especially devoted to their attention (even supposing them to be free from error) we fear that our bookshelf will become filled with a mass of useless material.

> "There have been many chemistries of late,
> For now-a-days each chemist writes a book;
> Some have a lucky, some a luckless fate."

Contributions to the Chemistry of Bast Fibres.

By E. J. Bevan and C. F. Cross. Manchester: Palmer & Howe, Princess Street.

This work is printed from a paper read before the Owen's College Chemical Society and gives the results of a carefully conducted research, more especially upon jute.

The preparation and estimation of pure cellulose in the fibre occupies a great portion of the paper. Several methods were employed: Schulz's, with dilute HNO_3 and $KClO_3$; Müller's, by treating the fibre with bromine water; and a process devised by the authors, which seems to have been the simplest and best. The jute was boiled in weak alkali and exposed in the moist state to the action of chlorine; the chlorinated fibre plunged into a boiling solution of sodium sulphite, and then into a boiling solution —1 per cent.—of NaHO. Pure cellulose was thus obtained with a single chlorination, giving a higher yield by about 3 per cent. than the other methods, and the fibres were less broken. Chlorine forms a yellow compound, soluble in alcohol, and glacial acetic acid, from which it is precipitated by water. It is coloured violet by ammonia; with sodium sulphite "the orange yellow slowly gives place to a magnificent magenta of great purity." It dissolves in concentrated sulphuric acid, and has the following formula: $C_{19}H_{18}Cl_4O_9$. A body giving the same reactions was prepared from Esparto. Other products were obtained and analysed a carbohydrate reducing Fehling's solution, &c.

This is a very interesting paper, and it may become of much value when the authors have finished their research, and applied their methods to the numerous other vegetable fibres now in general use.

LAW REPORTS.

Milk Certificate should state whether any Change has taken place in constitution of Sample:—

At Lambeth, a milk dealer named Martial, carrying on business in Waterloo Street, Camberwell, appeared to a summons taken out by the Vestry of Camberwell for selling adulterated milk. Mr. Massey, 316, Camberwell New Road, for the defendant, said he had to make an objection which he thought his Worship would agree was fatal to the case being proceeded with. According to the 18th section of the Act a certain form of certificate was to be given by the analyst, and his Worship in the schedule of the Act would find the following words appended: "In the case of a certificate regarding milk, butter, or any article liable to decomposition, the analyst shall specially report whether any change has taken place in the constitution of the article, that would intefere with the analysis." The certificate of Dr. Bernays produced merely stated the milk was adulterated to the extent of 8 per cent. of added water but did not report as required, and he (Mr. Massey) contended that the certificate was not sufficient, and the summons must be dismissed. Inspector Mackay, on the part of the prosecution, said such an objection had not before been raised. Mr. Saunders said that might be so. He was of Mr. Massey's

opinion, and therefore dismissed the summons. Mr. Massey asked for costs, but Mr. Saunders declined to grant any, on the ground that the case had not been heard on its merits. Mr. Mackay declined the risk of an adjournment.

Skimmed Milk.—Large Profits and Small Fines.

Richard Wright, milkseller, of Handsworth, was summoned, at the instance of Mr. Horder, Inspector under the Food and Drugs Act, for selling adulterated milk. The defendant said he sold the milk for Mrs. Bullock, but it was proved that he bought the milk, which was skimmed, from Mrs. Bullock's bailiff at 3½d. per gallon, and sold it to Mr. Horder's assistant at 4d. per quart. The analyst's certificate stated the milk to contain 17 per cent. of added water. The defendant was fined 5s. and £3 16s. costs, with the alternative of one month's imprisonment.

A Milkman Eight Times Fined:—

At the Manchester City Police Court, on the 25th ult., Richard Melling, farmer, Crowcroft Farm, Levenshulme, was summoned for selling milk which had been adulterated with water. Mr. Rook, Superintendent of the Corporation Nuisance Department, prosecuted, and Mr. Cobbett appeared for the defence. Inspector Sherwin deposed that he purchased a quart of defendant's milk on Sunday, the 1st August, for analysis. Mr. Estcourt, the City Analyst, stated that the milk contained 14 per cent. of added water. Mr. Cobbett said the defence was that just before the inspector asked for the milk the defendant's supply had run short. In order to furnish the rest of his customers with milk, a quantity was purchased from another milk dealer, who was unknown, and it was from that milk the inspector obtained his quart. Mr. Rook said that the defendant had already been convicted seven times, and had paid an aggregate of £110 in fines. In February, 1875, the defendant was fined £15 and costs for selling adulterated milk; in July, 1876, £20 and costs by the county magistrates; in November, 1877, Margaret Melling, defendant's daughter, refused to supply milk to an Inspector, and a fine of £10 and costs was imposed; in September, 1878, Eliza Melling, defendant's wife, declined to serve an Inspector, and the Bench inflicted a penalty of £10 and costs; in December, 1879, defendant was fined £10 and costs for selling adulterated milk, and during the present month his wife refused to supply milk, and a fine of £5 and costs was imposed. The Bench remarked that it seemed to pay the defendant better to incur heavy fines than to sell pure milk. He would be fined £20 and costs.

At the Northern Divisional Police Court, Dublin, Maria M'Gowan, dairykeeper, of 1, Vavasour Place, was summoned for selling milk adulterated with 13 per cent. of water. The Magistrate remarked that on a former occasion, when a question was raised about milk adulterated to the extent of 13 per cent., which was certified by Professor Tichborne to be pure after it was condemned by Dr. Cameron, the sample was sent over to Somerset House, and a certificate came back agreeing with Professor Tichborne's analysis, that the milk was pure. After that, he did not known what course to adopt in future, but he supposed he would have to make that allowance in the analysis. However, in the present instance, he would allow the case to stand for the return of Dr. Cameron, who was at present on leave.

Refusal to Serve Inspector by Milkman Delivering Milk at Houses. Summons Dismissed:—

In the Southern Divisional Police Court, Dublin, before Mr. O'Donel, a number of summons come on for hearing, in which several milk vendors in the Pembroke Township were charged with having refused to sell samples of milk to the Sanitary Inspector of the Commissioners. In the case of Patrick M'Donnell, the inspector deposed that on the 19th inst. he saw the defendant selling milk at various houses, but when he demanded a sample of milk, and tendered a penny for it, the defendant refused to sell. Mr. Curran, for the defence, contended that the law requires that the exposure for sale should be in a public place, in order that the refusal to sell might become an offence. There was no exposure for sale in a public place in this instance, and the fact of the demand of the inspector having been made on the road would not bring the case within the section. Mr. Fitzgerald, for the Commissioners, contended that the facts of the case were sufficient to warrant the Court holding that the sale was in a public place. His Worship held that the summons could not be sustained. It appeared that if the milk had been sold to purchasers in pursuance of a contract, the inspector would be entitled to demand the sample, whether the delivery was made in a public place or not. No evidence was tendered that in any of the cases immediately before the Court any such contract existed. Mr. Fitzgerald asked to have a case stated for the superior Court. The Magistrate suggested that, before doing that, he should in future bring the householders into Court to see if a contract existed.

Percentage of Adulteration should be Stated:—

At the Wolverhampton Police Court last month, before Mr. W. F. F. Boughey, stipendiary, Mr. Charles A. Hickman, grocer, Sedgley, was summoned by Mr. J. G. Horder, Inspector under the Sale of Food and Drugs Act, for selling coffee not of the nature and substance demanded by the purchaser. An assistant to Mr. Horder went to defendant's shop, on July 23rd, for a quarter of a pound of coffee, which was served in a canister supplied by Cassell, Smith & Co., on which were the words "Mixture of Chicory and Coffee." A certificate from Mr. Jones, the County Analyst, was put in, stating that the article "was practically all chicory." Mr. Willcock, for the defendant, said that the Act of Parliament required that the percentage of adulteration should be stated, and that there was no case. The Stipendiary concurred, and the case was dismissed.

Sale of Paregoric containing no Opium: —

At the Town Hall, Sheffield, before T. W. Rodgers, Esq., and David Ward, Esq., Mr. Stephen Middleton, grocer, 51, Harvest Lane, was summoned under Section 6 of the Sale of Food and Drugs Act, for selling 4 oz. of paregoric, which was not of the nature and substance demanded by the purchaser, being destitute of opium. The Town Clerk (Mr. Yeomans) prosecuted, and Mr. Parker Rhodes, of Rotherham, defended. On June 25th Inspectors Brammer and Rummings, of the Health Department, went to the defendant's shop, and asked for 4 oz. of paregoric. They were not aware that the defendant sold paregoric; but, being in the neighbourhood, went in for the purpose. The defendant took down a bottle from a shelf behind him, and remarked that he was not obliged to sell any of it to them. He was told that if he refused to sell he was liable to a penalty of £10 under the Act, and the defendant thereupon sold 4 oz. of what purported to be paregoric. He previously told the officers to look at the labels upon the bottles, which said "Paregoric substitute, without opium. This article is guaranteed to contain no opium, or any other ingredient prescribed by the new Pharmacy Act, 1868." The defendant, in giving the officers 4 oz. of the contents of the bottle, remarked, "I give it you for what it is worth." The officers then paid 1s., and divided what they received into three portions, one of which was left with the defendant, one was reserved for themselves, and the remaining portion was at once forwarded to Mr. A. H. Allen, the Borough Analyst, to be analysed. Mr. Allen said he found as the result of his analysis that the sample was destitute of opium, which was the most important ingredient in the medicine known as paregoric or paregoric elixir. The material being destitute of opium, he was of opinion that it was not paregoric. Cross-examined by Mr. Parker Rhodes, Mr. Allen said in what was popularly known as paregoric, opium was a constituent part. The word "paregoric" signified soothing. Opium was not the only sedative known to medical science. Dr. Hime, Medical Officer of Health, said opium was an essential part in the composition of paregoric. In its popular sense, paregoric was a medicine containing opium, and included other ingredients. Cross-examined by Mr. Parker Rhodes: In Dr. Pereira's *Materia Medica* it was stated that there could be paregoric without the presence of opium, but that was not the common belief. Mr. Parker Rhodes, for the defendant, said he was instructed to appear, not by the defendant, but by the firm who manufactured the compound. The reason it contained no opium was this: The law prohibited grocers selling any poisonous ingredient, such as opium, and in order that the paregoric might be sold by them, another and weaker article was substituted by the manufacturers, which did equally well. The defendant was well aware of the purpose for which the officers entered his shop, and until he was threatened with a penalty of £10 he did not wish to sell them that for which they asked. He then told them frankly that he sold it for what it was worth, and showed them the label on the bottle, which said "Paregoric substitute." The officers were determined to get it, whatever it was, and they obtained that for which they asked. Several persons who were in the shop at the time strongly bore out Mr. Parker Rhodes' statement; and the maker of the compound, Mr. William Parkinson, wholesale chemist and druggist, of Burnley, spoke as to the nature of the drug. The Bench retired to consider their decision, and, upon their return into court, Mr. Rodgers said that in their opinion the defendant had done everything to show the officers that the drug they insisted upon having was not paregoric, but only a substitute for paregoric, which did not contain opium. The real question in the case was whether he sold it to them as and for paregoric, intending to deceive, or whether he sold it for what it was. Inspectors Brammer and Rummings had not given their evidence to the satisfaction of the Bench, and on behalf of the defendant there had been an overwhelming amount of testimony that could not be cast aside, that the defendant did not pass the drug off as paregoric, but only for what it claimed to be. Alderman Ward said he cordially agreed with Mr. Rodgers' remarks, and he thought the defendant had conducted his business in a very proper way. The case was then dismissed, and the Town Clerk asked

permission to withdraw two similar cases which he had intended to have brought forward. The Bench consented to this course being pursued. Mr. Parker Rhodes asked for costs for his witnesses. The magistrates declined to grant them, as they believed it would have saved much trouble, and in every way been more straightforward, if the defendant had at once told the officers, when they asked for paregoric, "I don't keep the article." He had not done so, and therefore they could not allow costs.

Adulterated Milk :—

Mr. Harding, clerk of the Kensington Vestry, supported the following summonses :—Arthur Ayres, of 34, Dartmoor Street, Notting Hill, was fined £1 and costs for selling milk adulterated with 10 per cent. of added water.—William Gardener, of Dalling Road, Hammersmith, was summoned, but the case was dismissed.

James Johnson, of Chesson Road, Fulham, was summoned for selling milk to Inspector Francis, of the Board of Works, adulterated with 20 per cent. of added water. Mr. Jones, clerk of the Fulham Board of Works, attended to support the summons and other cases. The defendant said he sold the milk in the same condition as he purchased it. Mr. Paget inflicted a penalty of 40s., with 12s. 6d. costs.

Alfred Roughton, a general dealer, of Greyhound Road, Fulham, was next summoned for selling milk adulterated with 40 per cent. of added water. In this case the inspector purchased the milk of the defendant's wife in the shop. The defendant said he purchased milk of Mr. Johnson, the defendant in the first case, giving 1s. 10d. per gallon for it. Therefore he thought he had a superior article, and he sold it as he he purchased it. Mr. Paget said it was the worst case of adulteration he had ever heard, the water in the milk being nearly one-half, and it was sold to be given to children and sick people. He fined the defendant £5 with 12s. 6d. costs. The defendant said he was not able to pay the money. Mr. Paget then made an order for the defendant to be imprisoned for one month in default of sufficient distress.

John Hanson, of Fulham Fields, was summoned in respect of milk adulterated with 16 per cent. of added water. Mr. Claydon, who defended, said the milk was supplied to defendant by a respectable firm, and he sold it in the same state as he received it. He (Mr. Claydon) asked the magistrate to bear in mind that cows did not give milk of the same quality at all times. Mr. Paget said it was so, but in this case the certificate of the analyst stated the milk contained added water. Mr. Claydon said he did not know how the analyst was able to come to that conclusion, but he was not prepared to advise his client to incur the expense of the attendance of the analyst to give his reasons. Mr. Paget fined the defendant 40s., with 12s. 6d. costs.

Mr. Jones, clerk of the Fulham Board of Works, supported summonses against persons for selling adulterated milk. The first case was against Hastings Wigmore, of 37, Moore Park Road, Fulham, for selling milk adulterated with 12 per cent. of added water. Mr. Paget inflicted a penalty of 20s. and 12s. 6d. costs.—The summons against John Harrison, of Salisbury Terrace, Fulham Fields, for selling milk adulterated with 16 per cent. of added water, was adjourned for the production of additional evidence.—George Connell, of the Royal Dairy Farm, Wellesley Road, Gunnersbury, was summoned for selling milk adulterated with 18 per cent. of added water. The defendant said the milk was purchased in the street, and he told the inspector that he could not guarantee it as it came from the country. Mr. Gregg declared that the milk was purchased in the shop. The Chairman explained that it did not matter whether the milk was bought in the shop or in the street. The defendant was liable, and would have to pay £1 and costs.

Refusing to Serve. Cases Dismissed :—

At the Northern Divisional Police Court, Dublin, Michael Condraw, a milk-boy in the employment of Mr. T. M. Donnall, dairyman, Mountpleasant Place, was summoned before Mr. O'Donel for having refused to give a sample of milk for the purpose of analysis to Mr. J. Madden, inspector of nuisances under the Pembroke Township Commissioners. Mr. Madden stated that on Aug. 19th he met the defendant serving milk on the Shelbourne Road, when he asked for a pennyworth, telling the boy who he was, and that it was required for purposes of analysis. The lad said he should wait until he came down from the next house and ran on. When he came down from the house he refused to give the milk; some time after he ran up to witness with the milk-can, and offered to give milk out of a different can, but witness refused to take it. Mr. Curran submitted that this disclosed no offence, as the 17th section of the Act under which the prosecution was brought required that the milk should be sold by retail or exposed for sale. In the present instance the milk was not exposed for sale, as the defendant was merely engaged in delivering milk at houses. The magistrate (Mr. O'Donel) held the point raised a good one, and dismissed the summons, but at the request of Mr. Fitzgerald, said he would state a case for the purpose of having the point argued.—William Doyle, dairyman, of Sandymount, was summoned for a similar offence, and a like rule was made.—Mary Smith, 14, South Lotts Road, dairykeeper, was

summoned for refusing to sell milk exposed for sale in her shop to a sanitary inspector, for the purpose of being analysed. Defendant denied that she owned the shop, alleging that she was only left in charge of it by Mrs. Redmond, the owner. As the inspector swore, however, that he had seen her behind the counter on three different occasions previously, she was fined £2.

Adulterated Milk.—Samples taken at Railway Station.:—

At Southwark, Mr. J. M. Sawyer, a farmer, residing at Chadhurst Farm, Dorking, appeared in answer to a summons issued against him by Mr. C. Puttock, a dairyman, living in Sayers Street, New Kent Road, for a breach of agreement in not supplying him with pure and fresh milk as contracted for from March 25th, 1880, to March 25th, 1881. Mr. W. P. Ricketts, solicitor, appeared for the prosecution. Mr. A. Parish, inspector for the Metropolitan Dairy Society, was also in attendance. It appeared from the evidence of Mr. C. Puttock, the plaintiff, that having received numerous complaints from his customers of the indifferent quality of the milk dispersed by him he felt rather annoyed, and having procured the services of Inspector Parish they went to London Bridge Station, to which the cans or churns full of milk were sent. On the 27th of June last, having had the cans sealed by the inspector, a telegram was sent to Mr. Sawyer to meet them at London Bridge Station on the following day, the 28th June, when the milk cans would be opened and three divisions would be made, one of which Sawyer could have, one would be kept by the dairy inspector, and the third would be sent to the Public Analyst. This had been done, and the latter had certified that it was adulterated with water to the extent of 18 per cent. The contract between complainant and defendant was then read by Mr. Ricketts, which ran substantially as follows:—"Chadhurst Farm, Dorking, April 6th, 1880. A contract entered into between Mr. C. Puttock, 4, Sayers Street, New Kent Road, and Mr. J. M. Sawyer; the latter to sell all the milk produced by his cows from March 25th, 1880, to March 26th, 1881, the milk to be delivered, carriage paid, to London Bridge, pure and fresh daily." Some other ordinary clauses followed. The Magistrate said in his opinion the case should not have been brought before him; it was a county court case, and he considered that the defendant's contract begun and ended, as regarded the purity of the milk, at Dorking. Mr. Ricketts disagreed with his Worship. The contract to deliver the milk pure and fresh in London was very distinct indeed. His Worship said there was a very similar milk case pending just now, and perhaps an adjournment might be advisable. Mr. Ricketts said: Very well. I suppose your Worship will grant a case, and let this be adjourned *sine die* till a decision is arrived at in the other. Mr. Puttock said all he wished to prove to his customers was that he endeavoured to sell pure milk from the cow, and the *laches* on the part of the defendant in not sending him milk as contracted for and guaranteed by him to the public as unadulterated had done him a serious trade injury.

Prosecution by Metropolitan Dairymen's Association. £20 Fine. Appeal:—

Isaac Peart, a farmer, of Irvingbury Farm, Welwyn, Hertfordshire, appeared to a summons which charged him with having sold a quantity of milk adulterated with water. Mr. Moore, for Mr. Ricketts, conducted the prosecution, and Mr. Besley, barrister, defended. The evidence went to show that the defendant had an agreement with Thomas Edwards, dairyman, of Fonthill Road, Finsbury Park, to supply him with 18 or 20 barn gallons of pure milk daily. This arrived in two consignments in the defendant's churns at Finsbury Park Station of the Great Northern Railway. In consequence of complaints, Mr. Edwards on the 6th of July awaited the arrival of the morning delivery, and then in the presence of the station-master and a witness named Parish, sealed up one of the churns and sent a telegram to the defendant, requesting his attendance at an examination of the contents for analysis. The defendant sent his son, in whose presence the churn was opened and samples of the milk taken. The certificate of Dr. Tidy, to whom the same was submitted for analysis, showed that the milk was adulterated to the extent of 19 per cent. Mr. Besley, in cross-examination of the witnesses, elicited that the prosecution was taken up and the expenses paid by the "Metropolitan Dairymen's Association." Parish was "an inspector" appointed to act for them. Parish was subjected to a long cross-examination, and admitted that he had gone a fortnight after the examination of the milk to the defendant's farm and been treated there by him, but denied that there was any suggestion that a £5 note to him and a subscription to the Association would prevent a prosecution. Mr. Besley, in his address for the defence, said that he had to raise a legal point which he thought was of vital importance in these prosecutions. It had been held to be necessary that there should be a purchase before there could be a prosecution. In this case there was no purchase, no agreement beyond a verbal understanding being proved. Before purchase it was also necessary that there should be a request embracing the nature, quality, and substance of the article required. In support of this Mr. Besley quoted Sandys *v.* Small, 3 Q. B., and Hutchinson's case, 4 Q. B. Reports. Dismissing the point which the Courts of Session in Scotland had held to be law, that a person purchasing for analysis could not be said to be prejudiced, a point overru ed by the High Court here, Mr. Besley submitted that the other points were clear. Further he submitted

that by the amending Act of 1879 only a medical officer, constable, or other public officer could prosecute in these cases. Mr. Besley read the third section of the Act to that effect. The Act, he said, did not exist to allow the Association mentioned to find a *raison d'être*. The Association was admitted to be the prosecutors in this case, and they could not be. Moreover, they had tried by their witness Parish to force the defendant to join the Association and give his subscription under fear of prosecution. The defendant was examined, and his son, and other witnesses were called to prove that the milk was not adulterated at the farm, and railway servants, to prove that it was not tampered with on the journey. The defendant gave a description of the visit of witness Parish, and ended by saying that the Association had since made him an hon. member. The magistrate, Mr. Barstow, decided against Mr. Besley, on all his legal points, and finding the case proved, ordered the defendant to pay a penalty of £25, £5 of the amount to be costs. Notice of appeal was given.

Overstocking a Cow:—

At the Northern Divisional Police Court, Dublin, Patrick Kean, of Newton, County Dublin, was charged with having "over-stocked a cow with milk, thereby causing it pain and suffering." Mr. Keely, a veterinary surgeon, deposed to having examined the cow, when he found that two of the teats had been plugged up artificially, so that milk could not flow through them. The greatest pain was caused to the animal in consequence of this. The Magistrate observed that this was a new method of procedure. The object was to keep the udder of the cow distended, so that it would fetch a higher price in the market, but the animal would be permanently injured. The defendant denied that he had used any instrument or adopted any means to plug the teats. He wished to have the case adjourned to afford him an opportunity of employing another veterinary surgeon to inspect the animal. The cow was in the police courtyard, and the Magistrate suggested that it should be milked in the presence of Mr. Keely to settle the question. The operation was accordingly performed in the presence of a large number of those who had been attending at the Court. Mr. Keely was examined, and deposed that milk had flowed through the teats, but only in the exercise of great pressure. He still remained of opinion that the animal had been tampered with in the way he had previously described. The defendant made repeated requests to give him an opportunity of procuring a veterinary surgeon, but the Magistrate considered that he had had sufficient time to procure a surgeon during the afternoon, and fined him 30s.

Coffee and Chicory:—

Several grocers were summoned before the magistrates at Barnsley, recently, for selling adulterated coffee. The first case heard was that of Mr. Matthew Dickinson, grocer, of Birdwell, who was charged under the Food and Drugs Act with selling coffee which was not of the nature and substance it ought to be. Superintendent Sykes visited defendant's shop at Birdwell on the 21st inst., when he purchased four ounces of coffee, for which he paid 5d., at the same time telling defendant that it would be sent to the analyst. He left defendant a portion of it, and sent a third of that purchased to Mr. Allen, the Borough Analyst, at Sheffield, keeping the remaining portion himself. The analyst reported that the sample contained 40 per cent. of chicory, a mixture of which with coffee was objectionable. Defendant said he sold the coffee as he purchased it. The Bench said they hoped it would be a warning to other shopkeepers, who were getting immense profits by selling adulterated articles. Defendant was fined £2 and costs, in all £2 15s. 11d.. Mr. William Heaton, also a grocer, of Birdwell, was charged with a similar offence. The same day Superintendent Sykes purchased four ounces of coffee for 3d. at defendant's shop, telling him for what purpose he required it. The analyst reported that the sample contained 50 per cent. of chicory. Defendant said he did not sell the coffee as being genuine, but as common, by which he meant that it was mixed. The Bench said genuine coffee could not be bought for the price, and fined defendant £2 and costs.

NOTES OF THE MONTH.

A quarterly meeting of the Birmingham and Midland Counties Grocers' Protection and Benevolent Association, reported in the *Grocer*, is characterized by a speech from the chairman protesting against the prosecution of persons for selling coffee mixed with chicory. In his remarks he brings up the case of a man who was actually fined for selling a mixture of 85 per cent. chicory and 15 per cent. coffee, and argues that because chicory is 8d., and coffee 1s. 8d. per pound, there was no fraud in selling this at 10d., especially as, in his opinion, good chicory is a better beverage than inferior coffee. We quite agree that it is no fraud to sell any mixture provided it is properly labelled as such, and the purchaser

honestly informed before buying what he is getting; but then, some grocers would like to be able to mix, and yet not declare so.

The next proposition—made by the same gentleman—was, that the Association should pay the fine of a member who had been mulct in £10 for selling butterine. This, he considered, a "most shameful fine," and urged that butterine was a good and wholesome article. So it may be; but was it sold in reply to a request for butter? We should like to hear this gentleman's opinion of a tailor who sold him cheap cloth trousers all wool, and then gave him a shoddy article which was innocent of coming direct from the sheep, although still wool being worked up from other materials as an imitation. Would he declare that such a wretch ought to be prosecuted, or would he sit down quietly and say, "It was my own fault. I should have known the market price of spun wool, and that I could not get real cloth at the money?" The public cannot be expected to know the real value of everything, and the only way to protect them is to see that traders, who pretend to sell a particular article at a low price to attract custom, shall honestly sell the commodity they seem to do.

In making these remarks, we must not be held to insinuate that grocers, as a body, really desire to fall in with the views of such gentlemen; because, at the very same meeting we find three British tradesmen, to their honour and credit, speaking out in the cause of absolutely fair dealing as follows:—

Mr. Batt *thought that butterine should be sold for what it really was—butterine, and not butter.*

Mr. Cole *thought it unfortunate that grocers should bolster up a 10d. article, which many were doing at the present time.*

Mr. Jephcott *did not like to see an article passed off as a luxury which contained 90 per cent. of chicory. They had better sell the article as chicory flavoured with coffee.*

Bravo Messrs. Batt, Cole, and Jephcott! We hail your remarks as specimens of real blunt truth, and if we lived in your county we should say these are the sort of men to deal with. We hope that the Birmingham public and newspapers will notice such open dealing, and that the reward which ought to follow will come apace.

Under the new Beer Duty Act the strengths of worts are to be expressed in terms of their specific gravities, and not in "lbs. per barrel." The *Brewers' Guardian* points out that no change need be made in the instruments used provided the "lbs. per barrel" indicated is multiplied by 2·777 and 1,000 added, which will give specific gravity. So far as analysts are concerned, the doing away of an antiquated standard, and the substituting of a definite one actually capable of absolute verification by the balance is certainly a step in the right direction, and one reflecting credit on the chemical authorities of the Inland Revenue.

Correspondence.—We have received another letter from Mr. Edge on the subject of Milk Analysis, but we have no space to print it.—Eds.

Adulteration of Drugs.—At a recent meeting of the Board of Guardians of Gorey Union, a resolution was adopted that, in future, all medicines supplied to the Union should be analysed by Dr. Cameron of Dublin. A similar resolution has been passed by the Newcastle Guardians, who have determined to have the contractor prosecuted if the drugs, on analysis, are found to be adulterated.

Our Smyrna correspondent informs us that the Chio islanders ask exorbitant prices for their turpentine this year, they having discovered that a special medical demand has sprung up.

SOCIETY OF PUBLIC ANALYSTS.

The following gentlemen have been elected Members of this Society:—Dr. S. A. Goldschmidt, F.C.S., of New York; Dr. J. Blake White, of New York.

RECENT CHEMICAL PATENTS.

The following specifications have been recently published, and can be obtained from the Great Seal Office, Cursitor Street, Chancery Lane, London.

1880 No.	Name of Patentee.	Title of Patent.	Price.
250	J. W. Swan	Electric Lamps	6d.
268	A. M. Clark	Obtaining Glucose and Alcohol	8d.
315	W. R. Lake	Apparatus for Generating and Utilizing Electricity	1/0
338	G. W. Von Naurocki	Treatment of Woven Fabrics	4d.
350	J. P. C. De Puydt & J. Cougnet	Electric Lamps	2d.
366	A. L. Bruce, G. Stenhouse, W. McCowan, and A. Haddon	Machinery for Treating Dextrine, &c.	8d.
385	T. F. Scott	Manufacture and Preparation of Starch	4d.
397	G. A. Harvey	Removing and Destroying Sewer Gases	2d.
441	C. Kisseler	Obtaining Ammonia in the Carbonisation of Bones	6d.
445	E. Posselt and R. Peters	Dyeing Cotton Aniline Black	6d.
317	H. White	Apparatus for Straining Paper Pulp	6d.
455	T. H. Blamires	Lamps for Electric Lighting	6d.
460	P. Corcoran	Liquid for Scouring, &c.	2d.
478	T. Morgan	Electro and Dynamo Electric Machines	4d.
479	T. J. Smith	Apparatus for Extracting Juices from Beetroot, Sugar Cane, &c.	2d.
512	McGaan	Spirits	4d.
516	A. Vanderghote	Apparatus for Saccharification	2d.
521	D. Hulett	Apparatus for Purifying Gas	8d.
529	W. R. Lake	Red Colouring Matter	4d.
536	J. A. Dixon	Colouring Matters	4d.
608	Carey, Gaskell and Hurter	Purification of Alkaline Solutions	4d.
938	F. C. Glaser	Bleaching Straw	4d.
572	H. J. Allison	Apparatus for Treating Beetroot	4d.
578	T. A. Edison	Electric Lamps	8d.
599	W. R. Lake	Anæsthetics	4d.
602	T. A. Edison	Utilization of Electricity	8d.
619	J. F. G. Kromscroder	Coal Gas	6d.
620	R. Cromlet	Purifying Oils	6d.
621	W. R. Lake	Refrigerating Apparatus	6d.
622	H. Bright	Softening Water	2d.
627	H. Palin	Extracting Pigments	4d.
630	R. T. D. Broguham	Electric Lighting	2d.
636	A. M. Clark	Electric Light	6d.
655	Collingridge & Lecerf	Brewing	4d.
837	E. Solvay	Hydrochloric Acid	4d.
838	E. Solvay	Hydrochloric Acid and Chlorine	6d.
839	E. Solvay	Chloride of Lime	2d.
840	E. Solvay	Cement	2d.
923	W. E. Gedge	Animal and Vegetable Extracts	4d.
553	G. W. Wigner	Electric Lamps	8d.
623	H. Elmore	Brewing	4d.
708	A. M. Clark	Cereals	8d.
730	W. R. Lake	White Lead	6d.
738	J. C. Blomfield	White Cement	2d.
742	J. W. Tongue	Cleansing Sugar Polluted Water	6d.
748	J. Duke	Manures	6d.
778	W. K. Lake	Yeast	4d.
789	C. Harrison	Inflammable Gas	2d.
796	J. W. Zambra	Thermometers	2d.
815	W. Morgan Brown	Moulding Sugar	6d.
1902	J. H. Radcliffe	Fire Extinguisher	6d.

BOOKS, &c., RECEIVED.

Alum—Its Effects when introduced into Pastry, by J. West Knights, F.C.S.; The Chemist and Druggist; The Brewers'Guardian; The British Medical Journal; The Medical Press; The Pharmaceutical Journal; The Sanitary Record; The Miller; Journal of Applied Science; The Boston Journal of Chemistry; The Provisioner; The Practitioner; New Remedies; Proceedings of the American Chemical Society; Le Practicien; The Inventors' Record; New York Public Health; The Scientific American; Society of Arts Journal; Sanitary Engineer of New York; The Cowkeeper and Dairyman's Journal; The Chemists' Journal; Alcohol Tables, by Stevenson.

THE ANALYST.

NOVEMBER, 1880.

SOCIETY OF PUBLIC ANALYSTS.

THE NEXT MEETING of this Society will be held at Burlington House, Piccadilly, on Wednesday, the 17th inst., at Eight o'clock.

ON THE ESTIMATION OF PHOSPHORIC ACID IN POTABLE WATER.

By J. WEST-KNIGHTS, F.C.S.

THE gravimetric method for the estimation of P_2O_5 in potable waters, proposed by Otto Hehner, F.C.S. (THE ANALYST, vol. iv., p. 23, and vol. v., p. 135), is undoubtedly an excellent one, and, with ordinary care and precautions, furnishes very accurate results. But still, I doubt whether water analysts, as a body, will avail themselves of the advantages to be derived from a knowledge of the proportions of P_2O_5 in a sample of water, obtained by that method, in forming an opinion as to its fitness for drinking purposes, for the simple reason that the process requires more time and attention than can be given without extra charge for the analysis, and, as many of us who hold public appointments are bound to report upon water for a fixed fee, it is obvious that if we attempt the determination at all, it must be by a more simple method.

The great accuracy with which minute quantities of substances in solution can be measured by depth of tint produced by re-agents, which, in more concentrated solutions, would have produced precipitates; or, in other words, the high tinctorial power of coloured substances that are very sparingly soluble is well known, and upon this fact the present method is based.

If to a very dilute solution of a phosphate, molybdate of ammonia is added, and the mixture boiled, no precipitate is produced, but a bright yellow colour which varies in intensity, in proportion to the quantity of P_2O_5 present.

To apply this to the estimation of phosphoric acid present in potable water, certain precautions are necessary. As silica gives a very intense yellow colour with the molybdate, it is obvious that that substance must be separated before titration, and as the quantity of nitric acid present has a great influence upon the intensity of colour produced, care must be taken always to have the same quantity in making the comparison.

The process is conducted as follows: ·50,425 grm. of crystallized non-effloresced sodic phosphate are dissolved in 1 litre of water; or, what is better, 50 c.c. of the standard solution of sodic phosphate that is used for the titration of uranic solution *(Sutton's Volumetric Analysis, 3rd edition, p. 220)*, are diluted to1 litre. Each c.c. of this solution equals ·0001 gramme of P_2O_5. A neutral solution of molybdate of ammonia is made by dissolving about 75 grammes of that salt in 1 litre of water.

70 c.c. of the sample of water are evaporated to dryness with HNO_3 and gently ignited to separate SiO_2, the residue is then taken up with 1 c.c. of dilute HNO_3 (1 : 5) and boiling

water, filtered, and the filtrate made up to 70 c.c. (the original volume). This is placed in a small beaker—capable of holding about 100 c.c., and put over the gas; as soon as ebullition has commenced, 1 c.c. of the molybdate solution is added, and the beaker placed on a sheet of white paper, the yellow colour observed, and imitated by using 70 c.c. of distilled water, 1 c.c. of the nitric acid, sufficient quantity of the phosphate solution, and 1 c.c. of the molybdate. The number of c.c. of the phosphate solution used divided by ten equals grains of P_2O_5 per gallon. The process very much resembles nesslerizing, with the exception that the comparison must be made whilst the liquids are quite hot, as the colour fades considerably on cooling.

The degree of accuracy obtained by this method, would, of course, vary with the capability of the operator for observing slight difference in the depth of tints, but I do not think anyone would fail to observe a difference of ·00005 grammes. When small quantities only are present, it is, of course, open to the analyst to concentrate the water to any convenient extent, in which case the accuracy of the estimation would be increased in like proportion. It will be readily acceded that such degree of accuracy is amply sufficient from a practical point of view; as I am sure no-one's opinion upon a water would be modified by a difference of ·00005 grammes of P_2O_5 in each estimation, when the total quantity present equals ten times that amount, as it always will, even in waters containing a very slight quantity, if a suitable degree of concentration has been obtained. The filter paper used must be washed with dilute nitric acid and boiling water before use, or a considerable error will be introduced.

I have worked this process repeatedly, side by side with the gravimetric method of Hehner, with very satisfactory coincidence.

The following is a short table of results obtained by this method, most of which have been verified by the gravimetric method :—

GRAINS PER GALLON.

WATER.	Total Solids.	Chlorine.	N as Nitrates, &c.	Free Amm.	Alb. Amm.	P_2O_5.
Shallow-well water, Ely.....	109·9 ..	6·80 ..	1·09 ..	·0028 ..	·0350 ..	·70
,, ,, ,, ...	104·3 ..	4·90 ..	1·38 ..	·0056 ..	·0126 ..	·75
,, ,, Swavesey	133·7 ..	15·40 ..	2·88 ..	·0056 ..	·0210 ..	1·20
River water, Cam	— ..	— ..	— ..	— ..	— ..	·35
,, ,, Ouse	— ..	— ..	— ..	— ..	— ..	·40
Cambridge Supply	26·0 ..	1.40 ..	·33 ..	·0140 ..	·0014 ..	·40
Shallow-well water.....	73·0 ..	4·4 ..	1·15 ..	·0210 ..	·0210 ..	·70

From the above table it will be seen that I have found far greater quantities of P_2O_5 than Mr. Hehner did, but this will no doubt be accounted for in the fact that my samples consisted chiefly of highly polluted shallow-well waters from the greensand, whilst his were (probably from deep wells) from the chalk formation, with the exception of those obtained from the Thames.

I shall not attempt to draw any lines between the quantities of P_2O_5 present in "good," "suspicious," and "plainly polluted" waters, for until further results have been obtained it would be impossible to do so; in the meantime, the estimation will certainly be of some value to those who take every item of a water analysis into consideration.

I have also applied this method to the estimation of P_2O_5 in wine, beer, and milk, with good results.

PHOSPHORIC ACID IN POTABLE WATERS.

By Sidney Harvey, Canterbury.

Having for a long time past found it necessary to take into account (at least qualitatively) the presence of phosphoric acid in samples of water daily submitted to me, I read with pleasure Mr. Hehner's paper upon the subject in the Analyst for August, and can fully endorse his statements therein.

Since the publication of the above paper I have made a fuller examination of the "total solid residue" resulting from every analysis, specially for the purpose of testing for and estimating the P_2O_5 almost invariably present, and it appears to me that the time has arrived when the amount of phosphoric acid in water should be included in a report, and should be accepted as another "clue" (and we have none too many) to aid us in our judgment of the purity, or otherwise, of a sample. Thanks to Mr. Hehner, his paper of January, 1879, embodying, as it does, an exact and easily worked process will greatly lighten the additional labour involved. The following are the analytical data of a water reported upon by me on October 25th, taken from an old and shallow well close to an ancient churchyard in this city, and which has been closed for many years.

The water was very clear, free from smell, deposited very little upon standing, and gave copious precipitates with oxalate of ammonia and chloride of barium, and contained, as usual in this chalk district, much carbonate of lime :—

	Grains per gallon.	Parts per million.
Combined Chlorine	10·01	143·
Total Solid Residue	95.9	1370
Nitrogen as Nitrates and Nitrites	5·023	71·7
Phosphoric Anhydride (P_2O_5)	1·03	14·71
Free Ammonia	—	0·01
Albuminoid Ammonia	—	0·09

Not only did the residue of 70 c.c. of this water, when suitably treated, give a considerable precipitate with molybdic solution; but a little of the water *itself*, when warmed, gave a very distinct yellow colour upon adding the above re-agent.

In conclusion, I may remark that I operated upon a sufficient quantity of water to ensure accuracy in my results, which I commend to the attention of those who may still doubt the possibility of the presence of phosphoric acid in water in anything more than a mere trace.

NOTE ON AN OLD TIN OF PRESERVED MEAT.

By G. W. Wigner, F.C.S., &c.

During the recent International Food Exhibition, Mr. Leonard Wallington brought under the notice of the judges a remarkable tin of preserved meat. This tin had been in Mr. Wallington's possession for twenty-nine years, and was, he supposed, some five or six years old when he received it. It was tinned (as appeared by the stamp on the tin) by D. Hogarth & Co. The tin was of what we should consider now to be unusual thickness. It had apparently been painted outside with an oxide paint; but, notwithstanding this, the exterior of the tin had corroded so much that in dusting it carefully two small scales were displaced, which left pin holes in the metal.

It was not convenient to open the tin for five or six days after this, and the contents began to smell. No odour had been perceptible in the first instance. When the tin was cut open, and the contents emptied in the form of a solid lump, two patches of decomposed meat were seen, each about 1½ inch by ¾ inch, spreading from the two pin holes. The rest of the meat was sound, and, after the removal of the decomposed patches, appeared to be in excellent condition. It was tainted, but it was clear that was due to the odour from the decomposed patches, for, when washed, all taint was removed.

The contents consisted of veal, with a large proportion of fat, and a few peas. The fat appeared to be entirely the natural fat of the meat.

The meat was analysed, and gave only ·68 per cent. of ash. This ash was free from lead, but contained minute traces of tin. The quantity was far too small to estimate quantitatively. It was unquestionably less than the proportion usually present in tinned goods one year old. The salt was also low, and this may have something to do with the absence of tin. Only ·09 per cent. was found. This looks as if the veal had been boiled, and the liquor decanted before canning.

The most important result was that lead was absent. There has not been time enough to assay the metal of the can; but it seems pretty well evident that it was really tinned iron plate, and not Terne plate, containing lead.

Thirty odd years is a long test for tinned meat; and it is remarkable that any portion of it should have been quite free from decomposition after that time. Such a successful result may possibly lead to the use of better and sounder tins than those now in vogue.

ABSTRACT OF A PAPER READ BEFORE THE CHEMICAL SECTION OF THE BRITISH ASSOCIATION.

On the Specific Rotatory Power of Cane and Invert Sugar.

By Alfred H. Allen, F.C.S.

The angular rotation produced by a plate of 1 mm. in thickness is 24 degrees for the mean yellow ray or transition tint. In Soleil's polarizing saccharimeter the 24 angular degrees are graduated into 100 divisions, and in using the instrument a solution of cane sugar is employed of such concentration that a column of two decimetres in length shall cause a deviation of 24 degrees, or 100 divisions.

If S be the apparent specific rotatory power of an optically active substance in solution; A, the angular rotation observed; L, the thickness in decimetres of the solution traversed by the ray of polarized light; and C the number of grammes of solid in each 100 c.c. of solution; the value of S can be found by the following equation:—

$$S = \frac{A}{\frac{L \times C}{100}}$$

It is agreed by numerous observers that the apparent specific rotatory power of cane sugar in aqueous solutions containing at least 10 per cent. of the solid is + 73·8° for the transition tint.

Substituting this value for S in the above equation; 24° for A; and 2 for L; we obtain—

$$73.8 = \frac{24}{2\ \frac{C}{100}}; \text{ whence } C = 16{\cdot}26$$

Hence the proper weight of sugar to be taken for use with Soleil's saccharimeter is 16·26 grammes, and not 16·19, 16·35 grammes, or any different weight. If it be contended that either of these alternative quantities is the right one to employ, it follows that + 73·8° is not correct for apparent specific rotatory power of cane sugar.

According to Tuschmidt, Casamajor, and many other observers, a solution of cane sugar which, before inversion, shows a deviation of + 100 Soleil divisions gives, after inversion, a negative rotation of — 44 divisions at 0° C, decreasing by one division for each rise of 2° C, so that the inverted solution will show a deviation of — 37 at 14° C, and — 36·5 at 15° C.

Many writers on the rotatory power of invert sugar have overlooked the fact that inversion causes an increase in the weight of solid matter in the solution, 95 parts of cane sugar yielding 100 parts of inverted sugar. This increase of weight ought to be taken into account in calculating the specific rotatory power of invert sugar, which at 15° C is really 25·6°.

$$Sj = \frac{-36{\cdot}5 + {\cdot}24}{2 \times \frac{= 16{\cdot}26}{95}} = -25{\cdot}6$$

This number corresponds to a value of — 25·94° for Sj at 14° C, instead of —25·0, as generally stated. If 16·19 grammes be adhered to as the normal weight of sugar per 100 c.c., the value of Sj at 14° C becomes — 26·05°, against — 25·0° as usually taken.

If the value of Sj for invert sugar be taken at — 26° (the mean of the above values) and O'Sullivan's figure + 57·6 be adopted as the value of Sj for dextrose, then the specific rotatory power of lævulose at 14° C is — 109·6°, instead of — 106°, as usually taken.

(26 × 2 + 57·6 = 109·6.)

To sum up, the corrected values of Sj are as follows:—

	Sj.
Cane Sugar	+ 73·8
Invert Sugar	— 25·6 at 15°
Dextrose	+ 57.6
Lævulose	— 108·8 at 15°

The deviation, according to the average results of various observers, produced by a plate 1 m.m. in thickness, is 24° for the mean yellow or transition tint, and 26·66° for the sodium ray. Hence the above values for Sj may be calculated to the corresponding values or S_D by multiplying them by the factor—

$$\frac{21{\cdot}66.}{24} = {\cdot}9025$$

ABSTRACT OF PAPERS READ BEFORE THE BRITISH PHARMACEUTICAL CONFERENCE AT SWANSEA.

Note on Indian Henbane.

By T. Greenish.

The official biennial henbane leaf has of late years become very scarce in this country, and it was with considerable interest that the author undertook the examination of a small sample of henbane leaf sent from India by Dr. Dymock. It arrived in a tin box without any particulars as to its being the produce of the annual or biennial plant, place of growth, character of soil, the result of cultivation, or otherwise. On removal from the tin the leaves had a clammy feel; they possessed an intense odour, very persistent on the hand, and generally stronger than that of ordinary henbane.

Dried at 80° F., it lost 7 per cent. The odour passed off almost entirely in the process of drying.

A tincture prepared by maceration was a brown-olive, whereas the official tincture is olive-green, and the colour more intense. A little added to water produced no opalescence, and gave only a tinge of colour; the official tincture, on the contrary, produced considerable opacity, which, on the addition of a little liquor potassæ, disappeared.

In the general structure of the leaf the author found no very material difference.

Extracts made from the two tinctures were relatively 3·43 for the Indian henbane, as compared with 4·20 for the British Pharmacopœia.

It might be worth while to make a tincture with the leaf without previously drying it, so that the strong odour which is probably due to some volatile principle, and also the acridity might be retained, and probably increase the therapeutic value of the product.

On the Detection of Amorphous Quinine in Citrate of Iron and Quinine.

By Dr. De Vrij.

Amorphous Quinine substituted for crystalline in the above is easily soluble in ether, and the substitution will not, therefore, be detected by the test of the Pharmacopœia. It can, however, be detected by transforming the separated quinine into a neutral oxalate. This oxalate after being thoroughly dried on a water-bath is dissolved in chloroform, and the solution, if necessary, filtered. If a few drops of water are put on the top of this solution in a test-tube the oxalate of quinine will take a part of the water and crystals of oxalate of quinine will appear in the chloroform, whilst the water on the top remains clear and uncoloured if the medicine is not sophisticated. If it contains, however, amorphous quinine the oxalate of this base will be taken up from the solution in chloroform, and the water on the top of this solution will be more or less yellow coloured by the oxalate of amorphous quinine which has been dissolved by the water.

The Presence of Arsenic in Tincture and Solution of Perchloride of Iron.

By F. W. Fletcher, F.C.S.

The author enumerated several observations of the presence of arsenic as an impurity in pharmaceutical preparations, and to that list he said he had the melancholy satisfaction of

contributing an addition. Having detected arsenic in samples of hydrochloric acid, many of which had been sold as pure, he thought that possibly a considerable portion of the liquor ferri perchlor. of pharmacy prepared with similar acid might contain arsenic. This had proved to be the case in samples of the liquor, and also of the tincture, which had been obtained from various eminent dispensing houses. In one instance the proportion of 33·8 grains As_2O_3 in the 100 fluid oz. of the liquor were detected. The other instances given showed 10, 12, and 13 grains per 100 fluid oz. of liquor.

The Gravimetric Estimation of Minute Quantities of Arsenicum.

By F. W. Fletcher, F.C.S.

After pointing out that the various processes in use for the estimation of arsenic, including those of Levol, Rose, and Herapath, are inapplicable to the determination of minute traces of this substance, the author described a method he had devised for the purpose, founded upon a reaction first observed by Soubeiran, viz., that when a stream of arseniuretted hydrogen is passed through a solution of nitrate of silver, a precipitate of metallic silver is obtained in accordance with the equation:—

$$\underbrace{6AgNo_3}_{1020} + 3H_2O + \underbrace{AsH_3}_{78} = 6HNO_3 + H_3AsO_3 + \underbrace{3Ag_2}_{648}$$

From which it is seen that for every 75 parts of arsenicum obtained in the state of AsH_3, no less than 648 parts of silver are thrown out of solution. "In other words, when the amount of arsenicum to be estimated does not amount to more than $\frac{1}{2}$ milligramme (or about $\frac{3}{1000}$ grain) the weight of the silver precipitate is so large as to be capable of accurate determination on any balance of average delicacy."

The author's apparatus consists of a hydrogen flask connected with a series of bottles containing decinormal solutions of lead acetate and silver nitrate. When the arsenical solution is added to the hydrogen flask arseniuretted hydrogen is passed into the solution in place of pure hydrogen. This decomposes the silver solution, and by weighing the precipitate of silver the proportion of arsenicum is estimated. One part of silver corresponds to ·1157 of arsenicum, or to ·1527 of arsenious acid. By testing in this way with known quantities of As_2O_3 such results as the following were obtained:—·00292 gramme gave ·00235 to ·00241 gramme, ·00584 gramme gave ·00525 and ·00519 gramme, ·01168 gramme gave ·01075.

The other substances which might form gaseous compounds with hydrogen were antimony, sulphur, tellurium, selenium, and phosphorus. Antimony should be especially sought for, phosphorus might be converted into phosphate, the rest would be arrested by the lead.

The author also described experiments by this method, whereby traces of arsenic had been estimated in subnitrate of bismuth, sheep's stomachs, &c.

INTERNATIONAL FOOD EXHIBITION.

The following are extracts from the Award of the Judges at this Exhibition, which was held at the Agricultural Hall, from the 13th to 20th October:—

The Exhibition is a remarkably representative one. As nearly as we can tell, there are close upon 8,000 different and specific varieties of food and food products, prepared

in various forms, and cooking utensils on exhibition. It would, of course, have been absolutely impossible, in the limit of a week, to test every one of these, but we have adopted the plan of selecting from those which were considered by each exhibitor, acting on behalf of the manufacturers, the best, and in very many cases also the worst of each class.

We have been much pleased by the almost entire absence of adulteration, properly so called; out of some thousands of samples examined, there have been less than five instances in which the article has not been fairly and honestly described by the name or label. This result is so far satisfactory, in that it shows that there is no commercial difficulty in the way of pure goods, which will meet all the requirements of the Sale of Food and Drugs Act, being turned out in sufficient quantities for sale.

There are a large number of samples of tinned fish exhibited, but a good many of these are of inferior quality, due, partly to the character of the tin in which they have been packed, and partly to overcooking. In one or two cases, however, these difficulties have been almost, if not entirely, overcome, especially in the case of salmon. The efforts of canners should be directed towards the proper enamelling of the tins and canning at a lower temperature.

The tinned meats were, as a rule, carefully prepared, and most of them were of a very satisfactory quality, and not so salt as it has hitherto been the custom to make them. The tongues especially showed a very great improvement on those which we have hitherto met with. The tinned poultry and game were all of good quality, and carefully tinned.

Of tinned fruits and vegetables, there were some half-dozen instances in which the old system of packing had been carried out, and inferior results had been obtained; but in all other cases, the improvement was so marked, that many of the samples exhibited were decidedly superior to the best of ordinary English produce sold by retailers. We may mention specially pines, apricots, peas, and haricot beans.

Samples of the so-called temperance drinks have been subjected to chemical examination, with the extremely satisfactory result that they all proved to be non-alcoholic and of good quality, and many of those which claim medicinal properties do really possess them.

Of wines, spirits, cordials, and bitters the display was small, but contained a few novelties, and those for which the awards were made, were excellent.

Condensed milk and children's foods show a slight advance on samples with which we have been previously acquainted, but even now there is room for considerable improvement, the sugar present being in our opinion much in excess of that required for the preservation of food.

We think the public, no less than the exhibitors, will be the gainers by the opportunity which has been afforded them of obtaining samples of various articles of food hitherto almost unknown to them. The foundation is well laid for an even larger Exhibition next year.

Among the most interesting of the medals awarded were a gold medal to Messrs. Thurbers, for an excellent show of tinned fruits, and silver medals, among others, as follows:—

For Tinned Meat, to Messrs. Miller & Halls.

For Pure Cocoa Extract, to Messrs. Fry & Sons.

For "Perfected" Cod Liver Oil and other Pharmaceutical Preparations, to Messrs Allen & Hanburys.

For Gas Cooking Stoves, to Messrs. H. Greene & Son.

For Dairy Produce, to the Aylesbury Dairy Company.

For Whole Meal Bread, to Messrs. Hill & Son.

For Pharmaceutical Preparations, to Messrs. Savory & Moore.

For Prepared Corn Flour, to the Oswego Company.

For Condensed Soups, &c., to Mr. H. W. Brand.

For Crystallized Sugar, to Mr. J. Duncan.

THE LOCAL GOVERNMENT BOARD AND THE SALE OF FOOD AND DRUGS ACT, 1875.

The Local Government Board have just issued their Annual Report for 1879, from which we extract the following:—

It is satisfactory for us to be able to state that, during the past year, a considerable number of additional authorities have availed themselves of the advantages to be derived from a compliance with the provisions of The Sale of Food and Drugs Act, 1875, in regard to the appointment of an analyst. From our last Report it will be observed that up to the 31st December, 1878, arrangements had been made by 201 authorities for the discharge of the duties of this office within their respective Districts, and that we were then in communication with those authorities from whom we had not received any report of an appointment having been made. During the year ended on the 31st of December, 1879, appointments under section 10 of the Act were reported to and approved by us in 34 additional cases, whilst two additional authorities made arrangements, under section 11, for the due discharge of the duties of the office within their Districts.

Up to the last-mentioned date the number of authorities who had appointed analysts under section 10, with our approval, the appointments being then in existence, was as follows:—

County Authorities	52
Municipal Corporations	139
District Boards and Vestries in the Metropolis	39
	230
Agreements entered into under section 11	7
	237

The counties generally are therefore provided with an analyst, and it is satisfactory to observe that a large majority of the boroughs to which the Act applies:—viz., those having separate Courts of Quarter Sessions or separate Police Establishments, have complied with the provisions of the Act in this respect. We have not failed to urge upon the remaining authorities who are empowered to appoint analysts under the Act, the desirability of their adopting a similar course.

The results of the analyses made during the year are shown in the abstract which is printed in the Appendix. It will be seen that the entire number of such analyses is 17,049, which exceeds by about 850 the number recorded in our last report. It would no

doubt have been still larger, if the operation of the Act had not been practically suspended, in a large number of districts, in the early part of the year, owing to some doubt which had been suggested, but in which we did not participate, as to the construction of the words "to the prejudice of the purchaser" in the 6th section of the Act of 1875. As soon, however, as this question was brought before the High Court of Justice (Hoyle *v.* Hitchman L. R. 4 Q. B. 233) it was decided that the words in question did not, as had been contended, defeat the object which the Act had been obviously intended to secure; and thenceforward samples were again submitted to the analysts, and proceedings were again taken in cases of adulteration. The decision of the High Court on this point was subsequently embodied in an Amendment Act, to which we shall presently refer.

The following Table shows the number of samples examined during the year, and the percentage of adulteration. It is necessary, however, to point out that such percentage is based on the results of all the analyses as given in the quarterly reports, and not merely on the number of cases in which legal proceedings were instituted. In many of the samples which are included under the general head of "adulterated," the amount of adulteration was so small that the analyst specially notes "no prosecution advised;" and in some instances prosecutions with regard to samples reported as adulterated eventually broke down because it was shown that adequate notice of the mixture (as of coffee with chicory, or mustard with wheaten flour) had been given to the purchaser.

	Examined.	Adulterated.	1878 Percentage of Adulteration.	1879 Percentage of Adulteration.
Milk	5654	101	21·6	19·4
Bread	1287	95	7·1	7·3
Flour	601	15	1·8	2·4
Butter	1306	171	12·6	13·0
Coffee	1244	236	18·5	18·9
Sugar	243	1	4·3	0·4
Mustard	922	176	19·5	19·0
Pickles (including Tinned Vegetables)	44	1	7·0	2·2
Jam	52	1	1·9	1·9
Confectionery	257	4	5·0	1·5
Wine	56	6	2·6	10·7
Beer	434	16	5·0	3·6
Gin	601	131	47·0	21·7
Spirits other than Gin	725	224	46·1	30·8
Drugs	613	171	25·4	27·8
Other Articles	3010	186	5·5	6·1
Total	17049	2535	17·2	14·8

It will be seen from this Table that the percentage of adulterated samples, which was 19·2 in 1877, had fallen from 17·2 in 1878 to 14·8 in 1879; but it must be pointed out that some of this diminution is more apparent than real; for it is due to the fact that the standard of strength for spirits fixed by the Sale of Food and Drugs Amendment Act is considerably lower than that previously adopted by Public Analysts in general, and thus many samples which would have figured as adulterated in 1878 appear as genuine in 1879. If we exclude spirits altogether from consideration, we find that the percentage of adulterated samples was 15·5 in 1877, 13·7 in 1878, and 13·8 in 1879.

About one-third of the whole number of samples examined were of milk, and we are glad to find that the improvement which we noticed last year has been continued, though

by no means to the extent that we desire. The percentage of adulteration has sunk from 21·6 in 1878 to 19·4 in 1879, and in the Metropolis from 25·4 to 23·3.

The proportion of adulterated samples of milk varies much in different districts. As regards the Metropolis, we find that in Hackney 19 samples out of 46 are reported as adulterated; in Fulham 17 out of 42; in St. Pancras 33 out of 93; in Kensington 13 out of 46; in Paddington 16 out of 66; while of 67 samples procured in St. James's, Westminster, and of 22 samples procured in Limehouse, all are pronounced genuine. As regards the large provincial towns we find that Birmingham has the enormous proportion of 37 adulterated samples out of 62 examined; Manchester 18 out of 52; Liverpool 32 out of 160; Bristol 50 out of 240; Sheffield 3 out of 23; and Leeds 2 out of 34.

It would be interesting to learn how far these differences accurately represent the relative advantages and disadvantages of the respective districts as regards milk supply, and to what extent they depend on the system of procuring samples, or on other conditions. Sometimes, indeed, science is called to the aid of the adulterating milkman, as in the case of a sample where just such an amount of sugar had been added as would bring the sample up to the specific gravity of genuine milk; or where an alkali had been introduced to conceal the badness of the milk that had become sour. Generally, however, water alone is employed, sometimes with profusion, sometimes in just such quantity as to reduce fairly rich milk to a fluid which it is hoped may at any rate pass as the product of ill-fed cows. Thus one sample examined by the analyst for Southampton contained no less than 48 per cent. of added water, while another, examined by the same analyst, was apparently of rich milk skilfully reduced to the limit. And the fact, to which we referred in our Report of last year, that the present state of science does not enable analysts to distinguish with certainty exceptionally poor, but genuine, milk from originally rich milk to which water has been added, no doubt prevents them from reporting against many samples which there is much reason to believe have been thus tampered with. In the interests of the public it is desirable that in those instances where the milk is so far below the average strength as to give rise to suspicion of its having been watered, but to suspicion not amounting to certainty, further samples of the milk sold by the same person should from time to time be taken and submitted to the analyst.

In some cases the plan adopted at Salford might be followed. There, whenever a sample of milk is found to be adulterated, the inspector at once inquires whence the vendor obtains his milk; a sample is then procured from the wholesale dealer, and if that is found to have been tampered with, then the inspector obtains samples from the can of the farmer who supplied the milk, immediately on its arrival in Salford. The analyst states that if this corresponds to the former samples, he makes a point of seeing the cows milked, and analyses a sample obtained in his presence, so as to leave no chance of an innocent person being convicted. He adds that the inspector has taken several samples on Sunday when the milkmen thought he was in church, and that one of the samples of milk obtained on that day contained as much as 35 per cent. of water.

This last proportion is no doubt unusually large, but in the majority of cases entered as adulterated in the return it would seem that the addition of water has been very freely made; and the entire money loss sustained by the consumers, to say nothing of the loss of nutriment, must amount in the aggregate to an enormous sum.

Anything like an exact estimate of such loss is, of course, out of the question. If, however, we assume that in London each person consumes only a pint of milk weekly, or rather over half a quarter of a pint daily (and this, considering that over one-eighth of the entire population consists of children under five years of age, is probably a moderate estimate), the yearly consumption of the Metropolis * alone will be found to amount to nearly twenty-three millions gallons a year, representing, at 5d. a quart, an expenditure not far short of two millions sterling. If nearly a quarter of this milk be adulterated with about 16 per cent. of added water (and this seems from the analysts' reports to be the average proportion), it follows (on the hypothesis that the samples analysed are fairly representative of the entire supply) that Londoners are paying between £70,000 and £80,000 a year for water sold under the name of milk. This unremunerative outlay might certainly be diminished with advantage, by the more extended use of the Sale of Food and Drugs Acts.

It may be further observed that persons who adulterate are not likely to be very particular as to the quality of the water which they use for the purpose; and this is the more important, considering the part which water has been frequently shown to play in the dissemination of infectious disease. It is to be hoped, therefore, that in districts in which the Act has hitherto been allowed to be inoperative, active steps will be taken to check the adulteration of this article of universal consumption.

Of the bread examined it will be seen that, as in previous years, about 7 per cent. of the samples are reported against, and of flour about 2½ per cent. The usual adulterant is alum, and there has been in some instances a difference of opinion among analysts as to whether samples containing a large proportion of alumina had in effect been adulterated with alum or not. From a Report of the Chemists of the Inland Revenue Department, which has been laid before us, there seems to be no doubt that some descriptions of flour, especially that made from Egyptian wheat, contain appreciable quantities of clay, which cannot be separated by the miller, and it is most important that analysts should be careful to distinguish between accidental impurity of this kind and wilful adulteration. For this purpose it is represented in the report in question as necessary that they should not omit to use such tests as will determine whether the alumina be present in an insoluble condition, as it would be if derived from earthy matter, or in a soluble form, as it would be if existing as alum.

The sale of butterine in the place of butter is apparently on the increase, and is no doubt commonly effected without notification to the purchaser. Correspondence on the subject of the manufacture in the United States of this article (which is also known as Bosch and Oleo-margarine, and is produced from beef fat) was forwarded to us by the Board of Trade, and has subsequently been published as a Parliamentary Paper. From a despatch from her Majesty's Consul General in New York, dated the 16th September, 1879, it appears that the total quantity of "Oleo-margarine" exported from New York amounts to about 6,000,000 lbs. annually, of which the greater part is shipped to Rotterdam, Hamburg, and Bremen, where it is mixed with milk and colouring agents to give

* Through the courtesy of the various Railway Companies we have received returns from which it appears that the quantity of milk brought to London by railway now amounts to nearly twenty million gallons annually. If we assume three million gallons as produced within the Metropolitan area, or brought thither otherwise than by railway, the entire consumption would correspond with that estimated in the text. We cannot find that any statistics on the subject have been previously collected.

it a resemblance to butter, and is then churned and converted into butterine, and reshipped, chiefly to this country. Reports and chemical analyses demonstrating its perfect wholesomeness and its extreme unwholesemeness appear side by side in the paper referred to. Its opponents assert that samples have been found invested with organisms of a parasitic character, which may be transferred in a living condition into the systems of those who make use of it. On the other hand the Board of Health of New York pronounce it to be a "good and wholesome article" of food. In this country a Public Analyst of high reputation is of opinion that "the public should know that genuine butterine, which can be purchased retail at less than 1s. a pound, is often more palatable and more digestible than the inferior Canadian and other butters which are washed up and prepared for the English markets, and sold at a little higher price." However this may be, it is desirable that butterine should not be sold as butter; and proceedings taken under the Sale of Food and Drugs Act in relation to it will conduce to this end.

The percentage of adulterated samples of coffee continues high, mainly in consequence of the practice of selling mixtures of chicory and coffee as coffee, without adequate notification to the purchaser. Of course the mixtures duly labelled as such are not classified as adulterated. It may be interesting to observe, however, that one such mixture, on being analysed, was proved to consist of 90 per cent. of chicory and only 10 per cent. of coffee.

As to the adulteration of mustard, the observations in our last Report still apply. For table purposes, probably many people would not prefer ground mustard seed to the preparations ordinarily sold as mustard, which consists for the most part of mixtures of mustard flour, wheat flour, and a little turmeric. Such preparations, however, if sold as mustard without notification to the purchaser, are classified as adulterated.

Of sugar only one sample was found adulterated out of 243 examined; and experience seems to show that this article is very little tampered with, and that the practice of "sanding the sugar," if it existed in the times of heavy duties and high prices has now been virtually abandoned. Of jam, the one adulterated sample was reported to be extensively composed of seaweed. Of confectionery, all but four samples out of 257 are returned as genuine, from which it may be inferred that the use of poisonous colouring matters is now rare. In one or two cases, however, chromate of lead appears to have been used for this purpose; and in one instance a sample of sweets, sold as "cider cream," was found to consist of strong vinegar, flavoured with a little acetate of amyl, as to which the analyst remarks, that he is "not suprised to hear that an uncomfortable feeling is experienced in the stomach after drinking so delectable a compound."

Of wines, it will be seen that only 56 samples have been examined, and it should be stated that three out of the six reported against were sold as "unfermented wines," and consisted of sugar, water, and tartaric acid, with a little flavouring and colouring matter. Other "unfermented wines" was found to be pure grape juice, mixed with a small quantity of sugar.

The adulteration of beer seems of late years to have been steadily on the decrease, the percentage of adulterated samples having fallen from 9·3 in 1877 to 5·0 in 1878, and 3·6 in 1879. In the Metropolis, moreover, only one sample out of 98 examined in 1879 was found to be adulterated. In a single instance a trace of tobacco was found, but excess of salt was generally the ground of condemnation. On this point we may refer to the

remarks in our report of last year, merely adding that salt seems to be occasionally employed, not, as suggested, for the sake of inducing thirst, but with the notion of making beer keep the better for it.

As regards spirits it may be said that the adulteration continues to be of an innocuous character, only water being usually added. In comparing the percentage of adulterated samples with that shown in the returns for 1878, it must be borne in mind that, as we have stated above, the standard fixed by the Amendment Act of 1879 is a low one (as any standard of minimum strength must necessarily be), and that much which was before generally ranked as diluted spirit may now be sold as genuine.

We regret to find that drugs continue to be largely adulterated, no less than 171 samples being reported against out of 613 submitted to analysis. One result of adulteration of drugs is that a person habituated to the use of a certain medicine in an adulterated state, may be seriously affected by suddenly taking the genuine article. Thus "paregoric" is a popular domestic medicine, practically identical with the officinal preparation formerly called compound tincture of opium, of which opium is the leading ingredient. Certain samples, however, of so called paregoric which were analysed in Derbyshire, contained no opium whatever, and large doses might be habitually taken without producing the sedative effect desired, whereas if the patient were suddenly supplied with genuine paregoric, and were to take it in the quantities to which he had been accustomed, the change might be attended with unexpected and possibly disastrous results. Similarly, in the case of sweet spirits of nitre, some samples were found entirely destitute of the nitrous ether which is the most important constituent of the real compound, and others were diluted with amounts of water varying up to 40 per cent. of the whole. Cream of tartar has been found largely mixed with sulphate of lime; and tartaric acid with lead in quantity sufficient to injure health. Fluid magnesia has been reported to have only 2·3 grains of magnesia per fluid ounce, instead of the 5 grains which is the proper proportion; and tincture of rhubarb bought at one shop has been found of scarcely more than half the strength of that bought at another. We must repeat the opinion which we have expressed in former years that this state of things demands serious attention, and that strong efforts should be made to secure the sale of genuine drugs of proper strength.

Of the articles not specified by name in the Table, we may particularise, among those broadly classified as adulterated, samples of infants' food, of sardines, and of ærated waters, which contained lead in greater or less proportion. The introduction of this substance in the processes of manufacture had been doubtless unintentional, but was not the less unwholesome on that account. In the case of the ærated waters the analyst for Newport (Mon.) observes that "lead is a cumulative poison, and as it is somewhat readily acted upon by prepared water charged with carbonic acid gas, this metal should not be used in the construction of the apparatus employed." He further reports, what has been observed in many instances elsewhere, that some of the samples of so-called "soda water" contained no alkali whatever, but consisted simply of water charged with carbonic acid gas.

In several cases the specimens of vinegar analysed were found to be infested with immense numbers of particularly active animalcules, known as vinegar-eels; and in one instance hydrochloric acid was reported to have been added to vinegar.

Of the 17,049 samples above referred to, the greater part were purchased by officers appointed under section 13 of the Act of 1875, and only 528, or little more than 3 per

cent., by private individuals. It is significant that in the latter class of samples the proportion adulterated is 25 per cent., compared with 14·5 per cent. in the former. In some articles the difference is especially marked. In milk, for instance, of the 176 samples procured by private purchasers, no less than 80, or 45·5 per cent. were adulterated; while of the inspectors' samples the proportion was 18·6. Of course this difference is mainly to be accounted for by the fact that a private individual does not, as a general rule, take the trouble and incur the expense of submitting a sample for analysis, unless he has very strong grounds for suspecting adulteration. But there is reason to believe that in some cases the inspectors appointed under section 13 are known to the tradesmen, and are supplied, when recognised, with articles superior to those which would be sold to an unofficial customer. An illustration of the practice referred to is furnished by the analyst for Cumberland, who reports that a sample of milk "contained such an abnormally high percentage of cream as to suggest the idea that the vendor, knowing the purpose for which the milk was bought, determined to supply the inspector with a good article, and added a considerable proportion of cream to it." No doubt in some cases adequate precautions have not been taken to ensure that the articles purchased on behalf of the Authority are fair specimens of those usually sold to the public; and difficulty in this respect has perhaps occasionally arisen from an erroneous assumption that the officers authorised under section 13 of the Act must personally make the purchases, and that, therefore, in order to escape detection, an adulterating tradesman has only to make himself acquainted with the officers so authorised. We may, however, observe that there is nothing in the Act to prevent the inspector from taking proceedings under it when the actual purchase has been made, not by himself, but by a substitute; and as a matter of fact, it is not an infrequent practice of inspectors to adopt this course.

We may refer with satisfaction to the passing of the Sale of Food and Drugs Amendment Act of 1879, to which we called the attention of the Authorities in our circular letter of the 31st December last, and which has effected some important amendments in the law. By expressly declaring that when an article may have been purchased solely for analysis, it shall be no defence to allege that the purchaser was not prejudiced thereby, it disposes of the objection to which we have previously referred, as for a time interrupting the administration of the principal Act; and it also enacts that it shall not be a good defence to prove that the article analysed, though defective in nature, or in substance, or in quality was not defective in all three respects. It makes special provision for procuring samples of milk in course of delivery, under contract, to the purchaser or consignee, and it is hoped that this enactment, by making the consignor liable to a penalty, will afford to dairymen protection against the consignment to them of adulterated milk. A further amendment of the principal Act is made by the clause which extends its operation to articles sold in the streets.

The difficulty, on which we enlarged in our last Report, of determining, in the absence of a recognised standard, the precise point at which a compound of alcohol and water ceases to be spirit and becomes spirit-and-water, has been finally disposed of by the provision that the sale of spirits, to which only water has been added, shall not constitute an offence under the 6th section of the principal Act, if such admixture has not reduced brandy, whisky, or rum, more than 25°, or gin more than 35°, under proof. In one or two instances it seems to have been assumed that this amending provision operates to prohibit

altogether the sale of spirits under the standard strength, but we have had no hesitation in expressing our opinion that the clause in question does not affect the operation of section 8 of the principal Act, and that the vendor of any spirits reduced by water below the standard strength would not be guilty of an offence under the last-named Act, if he could show that adequate notification of the dilution had been given to the purchaser.

Other clauses effect certain changes in the incidence of the charges of the execution of the Acts, and make special provision with regard to the time within which a summons is to be served, and also with regard to the period to be allowed before such summons is returnable.

We trust that under the law as it now stands, it will be found practicable still further to reduce the amount of adulteration. The progress already made is substantial, and would, no doubt, be much accelerated, if private individuals would avail themselves more largely of the legislative provisions for their own protection.

The following is a list of the total number of samples, examined and adulterated, in England and Wales, during 1879 :—

TOTAL NUMBER OF SAMPLES.

	Examined.	Adulterated.	Proportion adulterated. 1879.	1878.
The Metropolitan District	4595	585	12·7	12·6
COUNTIES.				
Bedford	288	35	12·1	7·7
Berks	153	12	7·8	8·1
Bucks	4	0	0·0	0·0
Cambridge	78	19	24·3	25·8
Chester	670	103	15·3	27·9
Cornwall	7	3	42·8	26·6
Cumberland	111	14	12·6	62·5
Derby	104	31	29·8	21·1
Devon	80	21	26·2	13·5
Dorset	—	—	0·0	—
Durham	678	202	29·7	16·6
Essex	216	14	6·4	71·4
Gloucester	765	58	7·5	7·8
Hereford	—	—	0·0	—
Herts	3	3	100·0	14·6
Hunts	3	0	0·0	—
Kent	389	108	27·7	13·1
Lancaster	2037	356	17·4	24·7
Leicester	257	25	9·7	11·1
Lincoln	322	53	16·4	26·5
Middlesex	69	16	23·1	23·1
Monmouth	116	29	25·0	33·7
Norfolk	24	7	29·1	33·3
Northampton	157	25	15·2	21·0
Northumberland	181	23	12·2	38·8
Nottingham	63	12	19·0	19·4
Oxford	28	7	25·0	46·2
Rutland	—	—	—	—
Shropshire	9	0	0·0	17·6
Somerset	956	54	5·6	11·0
Southampton	528	111	21·0	26·2
Stafford	1072	137	12·6	15·9

	Examined.	Adulterated.	Proportion adulterated. 1879.	1878.
Suffolk	1	0	0·0	—
Surrey	528	70	13·2	22·4
Sussex	427	43	10·0	14·7
Warwick	271	62	22·8	22·6
Westmoreland	6	1	16·6	45·9
Wilts	35	2	5·7	15·4
Worcester	185	23	12·4	16·1
York, E. Riding	159	29	18·2	21·8
,, N. Riding	132	19	14·3	17·8
,, W. Riding	707	149	21·0	16·9
WALES.				
Anglesey	13	2	15·3	7·4
Brecknock	59	39	66·1	—
Cardigan	—	—	—	32·3
Carmarthen	35	6	17·1	28·1
Carnarvon	—	—	—	—
Denbigh	4	1	25·0	—
Flint	27	2	7·4	—
Glamorgan	482	25	5·1	9·7
Merioneth	—	—	—	—
Montgomery	1	0	0·0	—
Pembroke	—	—	—	—
Radnor	—	—	—	—
Totals	17049	2535	14·86	17·18

ANALYST'S REPORT.

Mr. J. Carter Bell, Analyst for Salford, in his quarterly report states:—During the quarter ending September 30, 1880, I have examined 154 samples. Of these 24 were adulterated, consisting of 9 milks, 9 wines, 5 breads and 1 butter. The five breads contained a chemical compound which is known by the name of baker's mixture. This is now being sold in Salford to bakers for the purpose of mixing with inferior flour. It is made from phosphates of alumina, lime and magnesia, with sulphuric and hydrochloric acids, and I have found that it has the effect of spoiling the bread, and making it injurious to health. It also contained a considerable amount of arsenic, the consequence of its being made from impure materials. I need not say how dangerous it is to introduce such a mixture into bread. I have also examined nine samples of so-called unfermented wines and two of ordinary tent wines. Of these nine samples, three bearing labels stating that the bottle contained "pure grape juice," "virgin fruit of the vine," &c., consisted of sugar, tartaric acid, salicylic acid and colouring matter with a considerable quantity of copper —the result doubtless of ignorant or careless manufacture. Grape juice was in my opinion entirely absent. Another sample, labelled "Pure and genuine unfermented fruit of the vine," was evidently a composite article artificially made, and so carelessly prepared as to contain alchohol. One sample of unfermented wine imported from abroad contained some grape juice, but the presence of alcohol and an abundance of yeast cells showed that fermentation had not been arrested. One example was labelled "The Selected Wine of the Temperance Fraternity." This was an ordinary low class fermented wine containing a large amount of alcohol. Of the nine samples of the so-called unfermented wines only one was genuine, and what it professed to be, "Pure grape juice entirely free from alcohol." The samples of tent were sweet and highly alcoholic wines, one sample containing as much as 40 per cent. of proof spirit. This wine had evidently been strongly brandied, no natural wine containing anything like this proportion of alcohol. The number and variety of these so-called unfermented wines testify to a large demand for articles of this class, but my examinations point to the necessity of a very careful discretion in their selection. Three samples of water taken from the lodge of a manufactory were so highly contaminated with sewage matter as to make them dangerous to health. The report was adopted.

LAW REPORTS.

What Addition of Water Constitutes Adulteration :—

Thomas Noddle, a milk dealer, of Mount Street, Leeds Road, Bradford, Yorks., was recently summoned for selling adulterated milk. The town clerk, Mr. W. T. McGowen appeared in support of the summons, and Mr. Berry represented the defendant. Inspector Chambers said that on the 6th September, he went to the defendant's house and purchased a pint of milk from Noddle's daughter. He submitted the sample to Mr. Rimmington, Borough Analyst, who certified that in his opinion the milk had been adulterated by the addition of 5 per cent. of water. In cross-examination by Mr. Berry, witness said that he gave a penny for the pint of milk. The girl did not tell him it was Sunday's milk. For the defence Mr. Berry called the defendant's daughter, who stated that Inspector Chambers asked her for a pint of new milk, but that she told him they had no new milk, and gave him some of the previous day's, which had had the cream skimmed off. The Chairman said it was drawing the matter very finely to prosecute when the milk was adulterated to the extent of 5 per cent. only. The summons would be dismissed. The Town Clerk said he would ask the Bench if he was to understand that where milk was adulterated to the extent of not more than 5 per cent. it would be necessary for him to bring cases into Court. The Chairman stated that the Bench were divided in their opinion as to the present case. Mr. Gurney was of opinion that an addition of 5 per cent. of water was adulteration, whilst he (the Chairman) believed that the thinness of the milk might be caused by poor pasturage. Mr. Gurney said that if the analyst were to come into Court and swear that five parts of water in 100 had been added to the milk, he would feel no hesitation whatever in convicting. He considered that a man had no right to adulterate a little any more than he had to adulterate a great deal. The Town Clerk again asked for their Worships' instructions as to what course he should adopt in similar cases in future. Mr. Berry complained that the Town Clerk was trying his best to terrorise the Bench. Mr. Mossman explained that the summons was dismissed because the Bench were divided in opinion.

MIDDLESEX SESSIONS.

Analyst's Certificate as to Milk must be in Exact Words of Act as to No Change having taken place in Sample. Conviction on Certificate not so Worded, Quashed on Appeal :—

This was an appeal by Mr. Peart against the decision of the Clerkenwell police magistrate. Mr. Besley was counsel for the appellant; and Mr. Mead for the respondent, the sitting magistrate at Clerkenwell. The appellant, Mr. Isaac Peart, farming 600 acres in Hertfordshire, and having a herd of about 80 cows, supplied every morning two churns to Mr. Edwards, a milk dealer of Fonthill Road, Finsbury Park. The price was 1s. 9d. for 17 pints, which is a "barn" gallon, and the seller paid carriage to Finsbury Park station, receiving payment for the milk supplied every fortnight. This arrangement had been in existence about two years, and on the 6th of July, on the arrival of the churns at Finsbury Park Station, Mr. Edwards caused one to be sealed, and telegraphed to Mr. Peart that at six o'clock in the the evening samples for analysis would be taken. Mr. Peart's son attended, and the samples were taken. On the 7th of July, Dr. Tidy, the Public Analyst, received one sample, and on the 12th of July gave a certificate that he found 17 per cent. of added water. On the 24th of July, Parish, who is employed by the Dairymen's Protection Association, to which Mr. Edwards belongs, visited Mr. Peart at his farm, and on the 28th of July a summons was taken out for the offence under section 6 of the Act of 1875, in which Mr. Edwards was described as the prosecutor. The hearing was on the 11th of August, and Mr. Barstow decided against several legal objections, and fined Mr. Peart the *maximum* penalty of £20 and costs. Against this conviction the appeal was brought. The case was partly heard on Saturday, the 16th October, and adjourned until to-day (23rd), when, at the conclusion of the evidence for the respondent, it was decided upon a point of law, and Mr. Peart and his witnesses were not called, and the merits, as far as Mr. Peart was concerned, were not gone into. The objection was this. The Act of 1875 requires a number of conditions precedent to the taking proceedings for any penalty, and one is that when the Public Analyst has issued his certificate the purchaser may take proceedings, and must take them in a reasonable time, and the certificate must "specify whether any change had taken place in the constitution of the article so as to interfere with the analysis." Dr. Tidy having certified that the milk was fresh when delivered to him, omitted to report specially as required.

Mr. Besley submitted that the summons having issued, and the adjudication followed upon an informal certificate, the conviction could not be sustained.

After hearing Mr. Mead, *contra*, and considering their decision in private,

The Assistant-Judge said that the very precise provisions of the statute with respect to the certificate of the analyst—requiring a "special report" as to certain matters—were obviously intended for the protection of the seller. Those provisions would be practically a dead letter, if an informal and insufficient certificate, such as that upon which the conviction proceeded in the present case, might be

amended and supplemented by *viva voce* evidence given upon an appeal heard possibly several months afterwards. The conviction would, therefore, be quashed, but as the omission was that of the public officer, there would be no order as to costs. Several prosecutions for selling adulterated milk having failed recently in consequence of similar informality, the Assistant-Judge expressed the wish of the Bench that their decision in this case would lead to a more strict observance of the requirements of the statute. Conviction quashed without costs.

NOTES OF THE MONTH.

There is really nothing to note this month except the amusing exposure of so-called "temperance wine," which, it seems, is tartaric acid, sugar and salicylic acid, and colouring matter. Some few samples, which really contained grape juice, had fermented in the bottles or casks, and so were distinctly alcoholic. We believe an attempted prosecution broke down on the point that, because tartaric acid existed in grapes, therefore it might be said to be really although indirectly produced from grapes.

Here is a true story of the failure of a prosecution which had better be studied by inspectors. A man was summoned for selling adulterated milk, and the usual evidence was taken; but the inspector forgot to say that he paid for the article. Then the defence counsel says, quietly addressing the prosecutor, "Is that your case, Mr. —— ?" "Yes." "Very well; I object that my client is summoned for selling milk, and there is no evidence that it was sold before the court. *Prosecuting Counsel:* "Oh, I will soon set that right." *Defending Counsel:* IT IS TOO LATE, *you said your case was closed.*" And it *was* too late, and the milkman never forked out any money with so much joy as that which he handed to his counsel.

Here is another hint to inspectors. A milkman, about to deliver milk at a large parochial establishment, suddenly notices the inspector lying in wait to demand a sample, and so off he drives. The inspector follows, and about 100 yards away he arrests the horse and insists on a sample, which was found to be somewhat more than half water. But in court the case breaks down because the Act says the sample shall be taken at the place of delivery, and this was obtained 100 yards away! So inspectors sent to catch a man delivering at a certain place may, in future, save their legs and wind, for it is no use trying to take the sample if he once drives off before they have time to demand it at the place itself.

We commend to the careful attention of all Public Analysts the important decision (reported on another page) by the magistrates at the Middlesex Sessions, and especially the remarks of the Assistant Judge in giving the decision. The analyst had stated in his certificate that a milk was quite fresh when brought to him, that he analyzed it immediately, and that it contained 17 per cent. of added water. This might have been considered by most people a reasonable compliance with the provisions of the Act, but the vendor, who was convicted and fined, appealed, and the conviction was quashed on the ground of the exact words of the Act not having been used, that "no change had taken place in the constitution of the sample that would interfere with the analysis." Of course the legislature *may* have intended that these exact words should always be used, and not words to a similar effect, though we have our doubts about such an intention; but as this appeal decision will, no doubt, govern all future cases, it behoves all Public Analysts to be more careful in future, and adhere literally to the strict letter of the law.

PUBLIC ANALYST FOR MONTROSE.—At a meeting of the Public Commissioners of Montrose the chairman pointed out that, notwithstanding the fact that the Sale of Food and Drugs Act had been in force since 1875, no steps had been taken by the Board to put it in force in the burgh. He thought it was high time that something should be done regarding it. In other burghs in Forfarshire the question had been taken up, and persons who had infringed the Act had been punished; and he thought there was nothing more diabolical than the adulteration of food and drugs. The attention of the Superintendent of Police had been directed to the matter, and a report upon it from that gentleman was submitted to the meeting. After some discussion it was resolved to appoint Mr. Macdougald, Dundee, Public Analyst for the burgh on the same terms as were paid him by the Forfar authorities—namely, 7s. 6d. for each sample analysed by him, and a guinea per day, besides travelling expenses, when giving evidence in court.

RECENT CHEMICAL PATENTS.

The following specifications have been recently published, and can be obtained from the Great Seal Office, Cursitor Street, Chancery Lane, London.

1880 No.	Name of Patentee.	Title of Patent.	Price.
73	W. J. Menzies	Utilizing Caustic Soda for Household Use	2d.
791	A. P. Chamberlain	Manufacture of Gas	6d.
804	C. Von Buch	Crystallization of Carbon	2d.
830	C. Von Buch	Obtaining Crystallization of Carbon	2d.
832	R. T. Brougham	Electric Lamps	6d.
842	A. M. Clark	Producing Electric Light	6d.
847	J. H. Wolfram	Production of Collodio-Bromide of Silver Emulsion	4d.
849	H. J. Haddan	Dynamo-Electric Machines	6d.
850	D. H. Dade	Application of Silicate Cotton or Slag Wool to various purposes	6d.
861	W. Spence	Refining Saccharine Vegetable Juice, Muscovy Sugar, &c.	4d.
872	D. G. Fitzgerald	Magneto-Electric and Dynamo-Electric Machines	6d.
896	J. P. Rickman	Manufacture of Ammonia and its Compounds	6d.
907	F. H. Engel	Husking or Decorticating Corn	6d.
917	W. R. Lake	Manufacture of Preserved or Condensed Milk	4d.
925	J. H. Guest	Electric Lamps	6d.
941	R. H. Courtenay	Telephonic Apparatus	2d.
1151	R. H. Courtenay	Muro-Telephonic Apparatus	2d.
952	S. Pitt	Manufacture of Steel	2d.
967	S. Clift	Manufacture of Coal Tar Products	2d.
976	W. Jones and J. Walsh	Furnaces for Manufacture of Sulphates of Soda & Potash	6d.
987	Sir H. and A. G. Bessemer	Treatment and Manufacture of Iron	8d.
993	W. J. Williams	Treatment and Manufacture of Phosphates	4d.
1004	J. H. Johnson	Production of Cyanides of Metals of Alkaline Earths	4d.
1019	T. Twynan	Manufacture of Magnesia	2d.
1032	J. Wadsworth	Utilizing Excrementitious Matter	8d.
1034	E. Edmonds	Carburetting Air	4d.
1051	F. M. Lyte	Treatment of Ores, &c.	10d.
1058	H. Wiggin and A. S. Johnstone	Treating Nickel and Cobalt	4d.
1078	A. Chapman	Apparatus for Recovering Soda Ash from Waste Liquors	6d.
1081	F. H. Higgins	Obtaining Ammonia and Ammoniacal Salts from Urine, &c.	6d.
1086	J. H. Johnson	Telephonic Apparatus	2d.
1088	F. G. Harvey	Treating Cane Juice for Evaporating Purposes	6d.
1119	W. Foulis	Purifying and Cleansing Gases	2d.
1136	J. H. Johnson	Magneto-Electric and Dynamo-Electric Machines	4d.
1149	S. Pitt	Manufacture of Zinc White and Metallic Zinc	6d.
1178	J. Perry	Dynamo or Magneto Electric Machine	6d.
1239	E. Quin	Composition as a Substitute for India Rubber	2d.
1259	J. H. Johnson	Electro-Magnetic Motors, &c.	6d.
1266	C. D. Abel	Clarifying and Drying Loaf Sugar	6d.
1298	C. D. Abel	Manufacture of Wrought Iron	4d.
1286	J. H. Johnson	Telephones	6d.
1305	W. R. Lake	Treating Woven Fabrics	2d.

BOOKS, &c., RECEIVED.

The Chemist and Druggist; The Brewers' Guardian; The British Medical Journal; The Medical Press; The Pharmaceutical Journal; The Sanitary Record; The Miller; Journal of Applied Science; The Boston Journal of Chemistry; The Provisioner; The Practitioner; New Remedies; Proceedings of the American Chemical Society; Le Practicien; The Inventors' Record; New York Public Health; The Scientific American; Society of Arts Journal; Sanitary Engineer of New York; The Cowkeeper and Dairyman's Journal; The Chemists' Journal.

THE ANALYST.

DECEMBER, 1880.

SOCIETY OF PUBLIC ANALYSTS.

A GENERAL MEETING of this Society was held at Burlington House, Piccadilly, on Nov. 17. In the President's absence, the chair was taken by Vice-President Dr. Blyth.

The minutes of the previous meeting were read and confirmed.

Mr. Hehner and Mr. Hobbs were appointed Auditors to examine the accounts for the current year.

The following gentlemen were proposed for election, and will be balloted for at the next meeting:—W. H. Ellis, M.B., Public Analyst of Toronto, Canada, as a Member; and Mr. W. Bouchier, Assistant to Dr. Bernays, of St. Thomas's Hospital, and Mr. B. A. Burrell, Assistant to Mr. T. Fairley, Leeds, as Associates.

Mr. Hehner read a paper "On the Occurrence of Tin in Articles of Food and Drink."

Dr. Dupré read a paper "On some Points of Water Analysis."

Mr. Wigner gave a short abstract of an essay "On Food Adulteration," which had won a prize offered by the American National Board of Trade.

NEW YORK, Nov. 22.—BY CABLE.

THE Committee of the National Board of Trade of the United States have awarded the first prize of 500 dols. for the best essay and draft of an act to prevent injurious adulteration of food or drugs, and to regulate the sale of food and drugs without imposing unnecessary burdens on commerce, to Mr. G. W. Wigner, analyst and F.C.S., of London. The second prize was awarded to Mr. Davis, analyst, of this city. The Committee also find that no widespread or dangerous adulterations of foods or drugs prevail in America.—*Standard.*

REMARKS ON SOME POINTS IN WATER ANALYSIS.

By A. DUPRE, PH.D., F.R.S.

Read before the Society of Public Analysts, 17th November, 1880.

IN the remarks I am about to make there is, probably, little that is new to chemists frequently engaged in water analysis, and I have been induced to bring them forward chiefly in the interest of our younger members.

During the past year I have examined many samples of water which had been purposely polluted by typhoid and other stools, with, or without, the addition of urine. In the course of this work many points connected with water analysis have again strongly impressed themselves on my mind, some of which I will now lay before you.

In the first place, I would caution analysts, most strongly, against the adoption of any general standards of purity, such as are laid down by some chemists. We may, of course, find waters of such absolute purity that we can at once safely pronounce them fit for all

domestic uses, but short of this highest purity it is dangerous to rely on any general standards. The only safe standard to go by, in any individual case, is the standard of purity furnished by unpolluted waters of the district from which the sample under examination has come. This, no doubt, is difficult, perhaps impossible, to obtain in every case, but it might be within the power of our Society to furnish such standards for almost every district within the United Kingdom. Referring to the above-mentioned examinations, I may say that I was almost always able to detect, even very minute traces of pollution, if I had a sample of the unpolluted sample water for comparison. The water, chosen for the experiments, however, itself varied so much from week to week that, without such a direct comparison, even considerable amounts of pollution, comparatively speaking, would have escaped detection by the ordinary analytical methods.

Phosphoric Acid.—During the last ten years I have tested every water that has passed through my hands for phosphoric acid, but have recorded the results somewhat roughly only as, none, very minute trace, minute trace, trace, &c., &c., and I am glad to see that this question has been taken up by Hehner and others in a more definite form. The conclusions I have come to are the following:—The presence of more than traces of phosphoric acid is nearly always a sign of pollution, while the occurrence of much phosphoric acid may be taken as an all but certain sign of sewage or similar pollution, more particularly when taken in conjunction with the standard of the district. On the other hand the absence, or comparative absence, of phosphoric acid cannot be taken as proving the absence of such pollution, because phosphoric acid may have been abstracted from the water by filtration through the soil and by other means; its absence, in such cases, may thus merely prove that the soil through which the water has percolated has not yet been saturated with phosphoric acid, or that other influences causing its removal are present.

Permanganate Test.—For many years past I have applied this test to every water analysed, and I have a very high opinion of its value. I know of no test which so certainly distinguishes between unpolluted deep well waters, which often yield analytical results generally indicative of pollution, and even the purest shallow well water. Deep well waters, when really unpolluted, absorb scarcely even a trace of oxygen from permanganate, whereas even the best shallow well waters always absorb a very measurable amount. Were I to be pinned down to the use of a single test I should choose this, and I never report on a water without having applied it.

Heisch's Test.—I can speak, I am happy to say, very strongly in favour of this simple test. I have applied it recently to a number of purposely polluted waters, previously alluded to, as well as to the waters used in their preparation, and I have, in every case, been able to pick out the polluted sample even when the chemical tests had left me in very considerable doubt. The only difference in my mode of applying the test, and that first recommended by Mr. Heisch is, I believe, this: he kept his bottles exposed to the light, but at the temperature of the laboratory; I have kept them at a temperature of between 98° and 100° F. I am still continuing my examination of this test, but meanwhile would most strongly recommend its use to my fellow analysts.

Nitric Acid.—One of our leading water analysts, as is well known, entirely neglects this, in my opinion, highly important feature. Whatever may be said, and truly said, as to the innocuous character of nitrates themselves, they are, without a doubt, *mainly derived*

from nitrogenized organic, chiefly animal, matter. In deep well waters, which are above suspicion of pollution from sewage or surface drainage, the presence of nitric acid need not perhaps be taken into consideration; but the case is widely different when we are dealing with spring, ordinary well, or river water. In all such the presence of notable quantities of nitric acid is a sure sign of previous pollution and as, at present at least, we are not able to differentiate between the various kinds of organic pollution, a water in which sewage, or similar pollution can be proved should always be rejected. In this respect the determination of the nitric acid, taken in conjunction with the standard, in this respect, of the water of the district from which the water under examination has come, is of the highest value, and will often lead us to a correct conclusion as to the character of the water. It must be remembered that the rate of oxidation (nitrification) depends on a variety of conditions and a water which at one time contains much nitric acid and little or no organic matter may, under somewhat altered conditions, contain little nitric acid and much organic matter, even though the degree of pollution has been the same in both cases.

Chlorine.—This is one of the few characteristic constituents of sewage which, when once in a water, suffers, as a rule, little or no diminution. The amount of chlorine, therefore, found in a water, when compared with the prevailing standard of the district (not with some fixed standard devised to fit all cases) is one of the very best guides towards the formation of a correct judgment.

Alkalies.—I generally content myself with obtaining a rough notion as to the amount of alkali salts present by a comparison of the total hardness of, and the total dry residue yielded by, the water. In most pure potable waters the greater part of the saline constituents consists of lime and magnesia salts, or in other words, the total hardness accounts for most of the saline constituents. In polluted water this is no longer the case, and in these the total hardness often represents but the smaller portion of their saline constituents. Here again the comparison of any special sample with the prevailing type of the district is of great value. In connexion with this, I may be permitted to draw attention to the fact, pointed out some years ago in Germany, that we may sometimes be able to detect whether the pollution found is due to animal or human urine, by estimating the relative proportions of sodium and potassium present. In human urine sodium is the predominating alkali metal, in the urine of cattle and horses potassium preponderates.

Sample Taking.—In taking a sample, from an ordinary shallow well more particularly, it is advisable to have the well pumped for some time, dry if possible, and to take the sample only after the well has partially refilled. In wells which are not very much used a very great improvement in the quality of the water often takes place while it remains in the well, and the analysis of such a sample may lead us to entirely erroneous conclusions. If expense is no consideration it would be well to take two samples of the water, one before, one after the pumping. A material difference between these two samples would, in itself, be strong evidence against the well.

Lastly.—I would ask analysts not to assume too readily that even a very bad sample of water is perfectly safe after it has been boiled. It is only necessary to remember that the controversy regarding so-called spontaneous generation, which has now been carried on for many years, is due, entirely, to the extreme difficulty of killing all living germs in the fluids experimented on. Would any advocate for spontaneous generations be listened to

for one moment if he had simply boiled his solutions in an ordinary tea kettle? I am of course far from affirming that the boiled water is not as a rule more safe than the unboiled water, but its *absolute safety* should not be taken for granted.

P.S.—Since reading the above I find that I have omitted to mention one point I wished to bring forward. The tint produced by the Nessler reagent in the ammonia distillate corresponds, at all events nearly always, with the tint produced in the standard ammonia. This is not, however, the case with the distillate containing the albuminoid ammonia. In this latter the tint produced is occasionally of a decidedly yellower tint than that produced in the standard ammonia, due, perhaps, to the presence of some compound ammonias. Much to my regret I have not, hitherto, noted this down in my laboratory book, but shall do so in future. I mention the point because other analysts may have been more careful in this respect than I have been, and if they would give us their experience it is not improbable that we may gain one more valuable guide through the tangled path of water analysis.

In reply to Dr. Blyth, Dr. Dupré said he had not tried Wanklyn's moist combustion process, but he had tried a somewhat similar one, namely, warming the water for some time with an alkaline solution of permanganate and estimating the amount of permanganate remaining, a test which had been in use in Germany for a number of years. He was not, however, so far, entirely satisfied with the test. Chiefly because he found it almost impossible to obtain an alkaline solution of permanganate which, on heating for some time, did not suffer some decomposition.

Mr. Heisch, in reply to a question from Mr. Harvey, said he always kept his sugar solutions in as bright a light as he could; it makes the growth come on much quicker. He could quite confirm what Dr. Dupré had said as to destroying germs. Boiling did not do so, and he did not find any difficulty in getting his growths almost as easily as if the water had not been boiled.

Considerable discussion then ensued with regard to the suggestion thrown out by Dr. Dupré as to the practicability of obtaining reliable standards of the various water supplies, and ultimately a committee was appointed to arrange the matter and report thereon.

ON THE OCCURRENCE OF TIN IN ARTICLES OF FOOD AND DRINK, AND ON THE PHYSIOLOGICAL ACTION OF TIN COMPOUNDS.

By Otto Hehner, F.C.S.

Read before the Society of Public Analysts, on 17th November, 1880.

In July, 1878 (*Chemical News*, xxxviii., p. 971,) Mr. A. E. Menke first drew attention to the occurrence of tin in canned goods. He detected and determined the metal in pineapple, apples and in lobster. Mr. Menke's results have since been confirmed by other chemists; but as far as I am aware no extended series of analyses has yet been published, with a view to ascertain whether the presence of tin in canned food is exceptional or general.

In the case of acid substances, such as fruits, &c., one might fairly expect a notable solvent action upon the metal, but there appeared but little probability of any such action in the case of neutral or alkaline matters, such as meats, oils and milk. Mr. Wigner, in

his several papers in recent numbers of THE ANALYST, does not mention whether he found the samples, upon which he reported, to be free from tin, whilst Mr. Dyer, in a communication to one of the daily papers, expressly states that he did not detect tin in canned meats.

The *method of analysis* I adopted was as follows :—About 30 grammes of the article to be examined were incinerated in a platinum basin, the ash heated with strong hydrochloric acid, the acid for the most part boiled off; about 30 to 40 c.c. water added, boiled and filtered. This alternate treatment with acid and water was repeated, if necessary, until H_2S no longer indicated the presence of tin. The clear and, as a rule, colourless solutions thus obtained were precipitated with H_2S, and the precipitate thus obtained, when necessary, further treated in the usual manner.

The following *vegetable foods* all gave abundant yellow precipitates of stannic sulphide :—

French asparagus, American asparagus, peas, tomatos, peaches (three different brands), pineapple (two different kinds), white cherries, red cherries, marmalade.

In several cases the inner surface of the canister was found much corroded. So considerable is the proportion of dissolved tin in most of the acid fruits, that tin reactions can readily be obtained from two or three grammes of the substances. A metallic taste is sometimes perceptible.

The following *animal foods* were examined :—

Corned beef (five different brands), ox cheek, ox tongue (three kinds), collared head, tripe, oysters, sardines in oil, salmon, salmon cutlets, lobster, shrimps, curried fowl (two kinds), boiled rabbit, boiled mutton, roast chicken, roast turkey, ox cheek soup, gravy soup, sausages, condensed milk (three brands).

With the exception of the sausages the whole of these samples contained more or less tin. The amount found in one of the soups was 35 milligrammes of tin in one pound canister; in a tin of condensed milk 8 milligrammes; in a pound tin of preserved oysters 45 milligrammes, besides a considerable quantity of copper.

The metal is to be found throughout the mass of the liquid soups and pasty curries, but resides chiefly on the outer surface of hard meats, such as corned beef. In many cases the canisters were much discoloured and blackened on the inner surface, but in others the surface of the metal was perfectly bright, although there was an abundance of tin in solution.

From the results given, it appears, beyond doubt, that tin is most readily acted upon by articles of food, vegetable and animal. Vegetable acids dissolve it abundantly, even if the contact be only of very short duration. Several samples of *ginger ale* and *lemonade*, which I have recently tested, gave distinct tin reactions. Even carbonic acid attacks the metal. In aerated waters kept in syphons, the mountings of which consist of pure block tin, the metal is almost invariably found in solution, and on shaking pure tin filings, or tin foil, with carbonated water, a sufficient amount of tin dissolves in a few days to produce a marked colouration with H_2S. The metal dissolves as a stannous compound, and H_2S gives a brown colouration. Now, seeing how frequently aerated beverages are reported to be impregnated with lead, and yet how rarely lead enters into the composition of the pipes and cylinders of soda-water machines as now used; considering further the difficulty of identifying lead when present only in traces, I cannot but believe that in many cases tin has

been mistaken for lead. Metallic tin readily precipitates lead from its solutions, and even from tin containing lead acids do not extract the lead until much of the tin has dissolved, and the proportion of lead in the residue has become considerable. Thus from solder lead can be dissolved simultaneously with the tin. I would advise, therefore, in testing aerated beverages for metallic contamination, to oxydise any stannous salt present, by the addition of a few drops of chlorine water, and after the expulsion of the excess of chlorine to test with H_2S. If a *black* colouration be then obtained, and copper be absent, the presence of lead can safely be declared.

It also follows, that there is but little danger to be apprehended from the employment of impure tin for the manufacture of tin plates. The tin effectually protects the lead from being dissolved. It is from the solder that contamination with lead might ensue.

Seeing then the general occurrence of tin in canned foods, and in articles of drink, the question naturally suggests itself,—*Is tin, when taken into the system, injurious to health or not?*

The opinions of toxicologists on this point seem to be somewhat divided, and not very pronounced. Most of the works on the subject do not refer to it at all, whilst Taylor dismisses the compounds of tin in his work on "Poisons" with half a dozen lines. According to Woodman & Tidy (*Forensic Medicine*, p. 229), the chlorides of tin are accredited with being active and irritant poisons. Orfila states that oxide of tin is likewise poisonous, but this assertion has been contradicted by others. Pereira, again, declares that chloride of tin acts topically as an astringent, irritant and caustic, and that when taken as a poison, it causes convulsive movements of the muscles of the extremities and of the face. Some poisoning cases, of old date, are likewise on record, one with fatal result.

No doubt the condition of the compounds of tin would, to a great extent, determine whether or not they would prove injurious. Thus tin chloride might be expected to show physiological action, whilst ignited stannic oxyde from its insolubility would prove harmless. The state of oxydation might also modify any action; thus one would conjecture that stannous compounds would be more active than stannic salts. Under the circumstances obtaining in canisters in which food is preserved, stannous compounds in a hydrated and soluble form would predominate.

The following experiments may prove interesting, especially since the physiological action of the compounds of tin is but very partially studied:—

A half-grown, apparently healthy guinea-pig took with its ordinary food 25 milligrammes of tin in the form of *stannous hydrate*. This had been freshly precipitated, and had not been dried, but was given shaken up in water. There was no apparent effect. The solid excreta contained much tin after the lapse of a few hours, whilst the metal could not be detected in the urine. Two days afterwards the animal took 50 milligrammes of tin, as stannous hydrate. After three hours it appeared ill. Next morning it was dead. The quantity of fæces passed since the administration of the second dose was very small, and the size of the fæces had diminished extremely, about to that of those of a mouse. On dissection the stomach was found practically empty, the colon distended with food, the small intestines empty. The liver, kidneys, lungs and heart were separately examined. They all contained traces of tin, the largest quantity being apparently in the

liver. The main part of the dose given, however, remained in the food contained in the colon, so that comparatively little of the oxyde had been dissolved and absorbed. Death therefore had been produced by a far smaller quantity than that administered, and was apparently due to the astringent and irritant action of the metal.

Another somewhat stronger guinea-pig took 30 milligrammes of tin in the form of *stannic hydrate*, also freshly precipitated and moist. As no ill effect seemed produced, another 45 milligrammes was given on the same day. The fæces contained much tin. Next day the animal further took two doses of stannic hydrate of 75 milligrammes in each. A few hours afterwards it appeared ill; its abdomen was distended, whilst the fæces were diminishing in size. Next day the pig seemed quite well again, and took, without apparent ill effect, three doses of 75 milligrammes each. Thus altogether it had in three days 450 milligrammes of tin, as stannic hydrate, without much injury, although the astringent effect of the tin had become visible.

On the day following, when it seemed in perfect health, it took 50 milligrammes of tin in the form of *stannous hydrate*. It was ill next day, and did not take any food until its death, three days afterwards. The few excrements passed during that time were very small, much like those observed in the case of pig No. 1. They contained much tin. The stomach was practically empty; the colon and bowels filled with semi-fluid green offensive matter, containing much tin. The liver contained a notable quantity of tin, and the lungs, heart, and kidneys, traces of the metal.

From these experiments, it appears that whilst stannic hydrate, from its comparative insolubility in gastric juice, is without much effect in the doses given, stannous hydrate, very soluble as it is in dilute acids, is a powerful irritant poison.

The spasmodic twitching mentioned by Pereira was quite pronounced in the case of animal 2.

It would be interesting to ascertain whether tin, when given continuously in small doses, accumulates like lead.

Canned goods are doubtless but rarely consumed so continuously and in such quantity as to be positively poisonous on account of the tin they contain dissolved, although circumstances are imaginable, as on board ship or on Arctic expeditions, under which poisonous symptoms might become pronounced. But even the occasional consumption of such goods, containing as they do a poisonous metal in a soluble form, *cannot but be more or less injurious*. Of the mysterious poisoning cases recently repeatedly traced to canned goods, the tin may possibly have been the cause. Knowing, then, that such articles of food do constantly contain more or less tin, the employment of tin canisters, of tin saucepans, and tin cooking utensils, ought to be much discouraged by Public Analysts and by medical men. The danger may be small, but every item which is inimical to the health of human beings ought to be avoided when once pointed out. On the same principle, we condemn the presence of copper and lead, even in small quantities, in articles of food and drink.

The trade in canned goods is one of enormous magnitude, and the subject of the purity of these goods is one proportionally important. Surely, human ingenuity will devise means to protect the substance of the canisters from being attacked and corroded by the contents. Such protection has already been attempted more than once, many of the French preserved vegetables being put up in canisters varnished on the inner surface. The varnish is,

however, burnt away on the seams during the closing of the tins, leaving the solder exposed, and thus not only tin, but lead, is frequently found in the contents of such "protected" goods.

Dr. Wynter Blyth said it struck him as possible that Mr. Hehner had rather too readily assumed that the tin in the meat and the vegetables he had examined was in a soluble form, but it was he (Dr. Blyth) thought more likely that very minute particles of tin had been rubbed off by the mere friction of the vegetable or meat, and therefore if it was of frequent occurrence in tinned meats, they had to deal with the question of whether tin in a metallic state was poisonous. When he was in medical practice he frequently gave metallic tin in a finely divided state, and he had certainly never seen any bad action follow. He had given at least 350 milligrammes in a finely divided state, and seen no deleterious action arise from it. With regard to the black precipitant it was well not to be too hasty in putting down that as lead. He had always found considerable difficulty in discriminating between dark discolouration when there was only that to work upon, and that was all there was when there was a mere trace in water. With regard to the symptoms about the excrement being small, it struck him as being on account of the loss of appetite.

Dr. Dupré said that in lemonade the lead was traceable to the citric acid used, where, although the action of the lemonade on the vessel in which it was contained was slight, it was nevertheless almost impossible to get citric acid or tartaric acid free from lead.

Mr. Dyer said that the letter, to which Mr. Hehner had referred, was written just after an inquest on a child, who had died from eating poisonous tinned meat (or supposed so). Everyone who had tasted it had experienced symptoms of poisoning. The medical man who attended the child did not appear to have made any analysis either of the meat or of the stomach, but he expressed an opinion that the death was due to metallic poisoning, and suggested that it was owing to the hydrochloric acid used in the process of soldering having dissolved some of the tin. He had also had another case, of ox tongue. Cases of poisoning were by no means confined to *tinned* meats, many cases happened with untinned—for instance, with sausages. Referring to another point, he wished to ask if any member had had any experience in finding the presence of small quantities of zinc. He had had cases of water being contaminated with small quantities of zinc, evidently derived from galvanic tanks. He wanted to know what quantity was considered dangerous. The point seemed rather obscure.

Mr. Wigner said, having had much experience in all kinds of canned goods, he was sure that 20 or 30 milligrammes of tin in the pound could be detected by the taste. He had as yet only found one sample of canned fish which was free from tin present in the fish. This was a tin of prawns, and they had probably been canned less than a month. He did not think that in the case of fish it was merely as Dr. Blyth had suggested, the mechanical adherence of the tin. In nearly every case condensed milks, which had been kept more than a month or six weeks, tin and lead were both present. As to the meats, he had during the late Food Exhibition examined something like 50 different brands of Tongues, Hams, Chicken, Corned Beef, Roast Beef, &c., and there was only one tin (or brand) in which tin was present in any appreciable quantity; equal to about 0·5 milligrammes in the pound instead of the 10 milligrammes spoken of by Mr. Hehner. He believed the solder, used to

fill up the blow holes of the tins, most frequently contained bismuth, and that was at the bottom of the galvanic action which was set up. In the last number of THE ANALYST he referred to a very old can of meat, which was free from tin. With regard to canned fruits he had tried more than 300 varieties, and only about 8 or 10 had turned out bad. He thought an alteration in the character of the tin, or rather of the tinning, would meet the difficulty.

Mr. Helmer, in replying, said he did not think there was the slightest doubt that the tin was in a dissolved state, for it was found not only in solid meats but in soups and curries and in compressed meats; also one could plainly see that it was not metallic tin; it was not only on the outer surface that the tin was found, but in the parts near the surface as well. He thought Mr. Wigner was very fortunate in getting samples free from tin, as he himself had obtained his indiscriminately, and invariably found tin.

ON THE COMMERCIAL ANALYSIS OF CINCHONA BARKS.

BY JOHN MUTER, M.A., PH.D., F.C.S.

THE immense mass of writing on this subject places the analyst, seeking a good commercial process, much in the position of the patient who was killed by having too many doctors. Having, however, had occasion to study every proposed method from time to time, and being often asked for information, I now take the opportunity of laying before our readers the actual process which I find best in practice, and which I have modified from those originally proposed by De Vrij & Moëns.

As to the actual extraction of the crude material I will say nothing, except to state that, of the *published* processes, the extraction of the bark (previously mixed with milk of lime and dried) by successive portions of methylated spirit of 93 per cent., and then converting into sulphates and distilling off the alcohol, is the best, provided the alcohol is only strong enough (which may be cheaply attained by placing a quantity of freshly ignited potassium carbonate in a bottle of the strongest methylated spirit sold) and the bark and spirit are boiled together under an upright condenser. Bark analysts have generally an extraction process, which they keep secret, suitable to the method used by the chief manufacturers for whom they work; and I do not mean to infer that I, in practice, always use the extraction mentioned, but I say it is the best published process.

Suppose, therefore, that the bark has been extracted and the alkaloids obtained as sulphates in solution, I begin by the very old method of adding to a very concentrated solution—a distinct excess of sodium hydrate, and shaking out with 50 c.c. of chloroform, and then successively with three quantities of 25 c.c. each. This I find will bring back invariably 5·99 out of 6 grammes of pure mixed alkaloids, and is decidedly the most accurate method, given practice in the way of shaking, &c., so as to get the chloroform to settle quickly. The chloroform should be received into a small tared 5-ounce squat beaker, placed under a Wynter Blyth's recovery apparatus, and the residue dried in the bath at 212°, and then heated in the air bath to 240° F., and the fused mass weighed.

The total alkaloids are then dissolved in absolute alcohol, and the solution divided into two equal portions by weight, and treated as follows:—

Portion A is placed under a burette containing volumetric sulphuric acid (11·6 grms. acid of 1843 sp. gr. in 1 litre of water each c.c. of which = ·1 gramme crystallized sulphate

of quinine) and titrated until just faintly acid to delicate litmus paper, and the acid used is noted as a guide for future operations. The spirit is then evaporated off, and the residue is dissolved in water at 185° F., using 5 c.c. of water for each c.c. of volumetric acid taken, and if not all soluble, then volumetric acid is to be dropped in until all is dissolved. The whole being still kept at 185°, very dilute sodium hydrate (4·74 NaHO per litre) is to be cautiously added, stirring well until the whole is *just all but neutral*. The amount of volumetric acid used to dissolve over that required at first to titrate, will be an index of the soda required, because the solutions are to be made to balance each other. The whole is now rapidly cooled to 60°, and kept at that point for an hour, and then filtered through a pair of filters previously mutually counterbalanced, and the filtrate received into a graduated c.c. measure. The crystals are washed with 1·5 c.c. of water at 60° for each c.c. of acid used in the titration, and when drained, well pressed, and dried first at 212°, and then gradually up to 240° and weighed, using the outer filter as a tare. The filtrate and washings are measured and ·000817 added to the weight of crystals of QUININE SULPHATE for each c.c. of the fluid. If the last drops of water running from the crystals are still acid, then the funnel must be placed over an empty beaker, and the washing continued with saturated solution of quinine sulphate at 60° F. till all free acid is washed away, as if not the crystals will char in drying.

Portion B is rendered *just* acid with hydrochloric acid, the spirit evaporated off, and the residue dissolved in the least possible quantity of water at 100° F. Dilute soda is added to neutralization, and then excess of saturated solution of Rochelle salt, and the whole cooled to 60° for an hour with frequent stirring. The precipitate is collected on a pair of mutually counterbalanced filters, washed with say 100 c.c. of water at 60°, and the filtrate and washings received into a measure. The precipitate is dried at 220° and weighed, using the outer filter as a tare, and ·00083 is added for each c.c. of filtrate. The quinine sulphate previously found is multiplied by ·915, and the answer is deducted from the weight of the mixed tartrates, and the balance multiplied by ·804 gives CINCHONIDINE. The filtrate from the tartrate is concentrated to its original volume, cooled, rendered just faintly acid by a drop of dilute acetic acid, and excess of saturated solution of potassium iodide is added with constant stirring. After an hour or so at 60° it is collected like the cinchonidine, and treated in every respect the same, and weighed, and the weight having had ·00077 added for each c.c. of filtrate and washings, is multiplied by ·7168, and result is QUINIDINE.

The filtrate from the quinidine is made distinctly alkaline by sodium hydrate, and the precipitated cinchonine and amorphous alkaloid are filtered out in a similar manner, washed and weighed. The precipitate is then treated with spirit of 40 per cent. to dissolve out the amorphous alkaloid and again weighed, and the difference is AMORPHOUS ALKALOID, while the last weighing is CINCHONINE. This is the worst separation in the whole process, but as cinchonine is the least valuable alkaloid it is not of any great consequence. The weight of the cinchonine and amorphous alkaloid together must have deducted from it ·00052 for each c.c. of the filtrate from the quinidine hydriodide, and ·00066 for each c.c. of filtrate rom the cinchonidine tartrate, and the balance is then the true weight, which, minus the amorphous alkaloid, gives the cinchonine.

The process is very expeditious, both portions going on at once, and the whole can be

done in six hours. Of course, like all others, it requires experience, especially to see that the neutralizations are carried to the exact point, and the quantities of water properly judged, but, given that, I have frequently got back with it 99 per cent. of mixed pure alkaloids, and for Indian Barks it works very well indeed. There is nothing special in the actual separations, but only in the general manner of working, and the saving of time by using the two solutions, and in the collection on double filters so as to compensate the amount of solution absorbed in every case, and in the allowances which are not exactly perhaps theoretical, but what I have practically found the best. No allowance is mentioned for the solubility of cinchonine because it is very slight and not important. The allowance on the first step of *B* is a practical one based upon a usual sort of mixture of quinine and cinchonidine, but is to be modified according to the quinine found in part *A*. In practice, however, it is usually close enough.

SUBSTITUTE FOR ALUM IN MAKING BREAD.

By J. Napier, F.C.S.

I read with great interest the article by Mr. C. Estcourt, on the above subject, in the October number of The Analyst. Having since then obtained a sample of the liquid from Manchester, I am able to give some further information about it. The liquid is called "yeast improver," and is recommended to be used in the proportion of eight ounces per sack of flour (280 lbs.). It is manifest that this solution is not intended as a substitute for yeast, but merely as an adjunct in the case of new flours, and many English flours, where the binding qualities—so essential to making a good, easily-digested loaf—are somewhat lacking. Indeed, with some home flours it is almost impossible to get a satisfactory result.

I found the liquid to contain the ingredients, and in similar quantities, as Mr. Estcourt stated: phosphates of lime and magnesia, held in solution by phosporic acid. Having certain misgivings as to the purity of the materials used in manufacture, I tested for arsenic and other metallic poisons, but these were completely absent; so also were free sulphuric and hydrochloric acids. Alumina was present to the extent of ·06 per cent.

Using eight ounces per sack of flour—making 100 loaves,—thirty-five grains of the liquid will be found in every 4-lb. loaf. The free phosphoric acid in this quantity will not neutralise more than one-tenth the amount of earthy and alkaline phosphates naturally present. The percentage of alumina cannot be any objection to the use of the liquid, there being only ·021 grain—equal to ·13 grain alum—introduced into each 4-lb. leaf.

From the absence of impurities, it is very evident this liquid must be made from very pure materials. This is in striking contrast to the results of analysis of the sample reported to the Salford bench by Mr. J. C. Bell as being made from phosphates of alumina, lime, and magnesia.

I think it only remains for our chemical authorities to say whether or not this liquid, in the small quantities used, is injurious to health; but I think there can be little doubt that their decision will be in its favour.

The use of bread containing this solution will be decidedly beneficial in the case of children, where a plentiful supply of earthy phosphates is requisite.

LAW REPORTS.

What is Fair Notice to the Public that Milk Sold is Skimmed:—

At Worship Street, William Brainwood, a milk seller, of 480, Old Ford Road, Bow, was summoned for selling milk adulterated with 25 per cent. of water. Mr. B. J. Abbott defended. The evidence of William Walter Burrows, sanitary inspector of Bethnal Green, proved that on August 24th he purchased a pint of milk from the defendant in the street. The defendant vended his milk in the thoroughfares, going about with a van and large cans of milk. In reply to Mr. Abbott, the witness said he saw a printed card in the van stating that the milk was "country skim'd milk, sold as adulterated milk," at 2d. a quart; but he did not see it until after he had stated the purpose for which he had bought the milk. The defendant then told him that it was sold as adulterated. Witness did not believe that the card could be seen, because the defendant went from door to door serving the milk from a can he carried, and the van was in the road. Mr. Abbott relied on the notice, but the magistrate considered that under the circumstances it was no notice to the public. A certificate of Dr. Tidy, analyst for the parish, was put in, showing that an addition of water to the extent of 25 per cent. had been made, besides the abstraction of cream. Mr. Abbott then said that the defendant denied the addition of water, and asked for an adjournment to enable the defendant to have the sample left by the inspector analysed. The magistrate refused to allow any adjournment, and said he was satisfied, in the absence of any defence, with the evidence. Mr. Burrows added that the defendant had before been fined £5. The magistrates now fined him £10 with 2s. costs, or six weeks' imprisonment.

Objection that Sample not Personally Analysed by Public Analyst overruled:—

At the Hull Police Court, John Stephenson, cow-keeper, of Thearne, was summoned before Mr. E. C. Twiss, Stipendiary Magistrate, for selling, to the prejudice of the purchaser, a quantity of milk which was not of the nature, substance, and quality of the article demanded by such purchaser. The prosecution was instituted by the Urban Sanitary Authority of the Corporation and Mr. G. P. Spink appeared in support of the information. Mr. Laverack represented the defendant. Mr. Dale, Sanitary Inspector of the Hull Corporation, stated that on the morning of the 14th September, he saw defendant supplying customers with milk, and witness procured from him a pint of new milk, for which he paid 2d. He informed the defendant that he had purchased it for the purpose of being analysed by the Borough Analyst, to whom one-third of the pint was subsequently forwarded. Another portion was given to defendant, and the third part witness retained. Witness put in the analyst's certificate, which certified that the milk contained 25 per cent. of water. Mr. Laverack: He told you he had no milk to spare, I believe? Witness: Yes. Mr. Laverack: You got about the last he had? Witness: Yes; there was a little left. William Fox, assistant to the Borough Analyst, deposed that on the date named Mr. Dale brought them a quantity of milk which he had purchased from the defendant. Witness made the analysis. Mr, Baynes was present when it was made, and superintended it. They found only 6·25 of solids, not fat, and the results gave 25 per cent. of water. Mr. Twiss: According to your analysis I make it 31 per cent. of water. Witness: Yes, it is 31 as matter of fact. The whole analysis was in favour of the milk. It was not of the nature, substance, and quality of new milk. After cross-examining the witness as to the quantities contained in the analysis, Mr. Laverack submitted that the Act of Parliament was not complied with, first of all because the milk was not personally analysed by the "Public" Analyst. He said it was to be analysed by the "Borough" Analyst. The directions contained in the Act must be strictly complied with. Mr. Dale said that he mentioned Public and Borough Analyst to the defendant. Mr. Laverack considered it hardly fair to his client that this should be stated after he had raised his objection. Mr. Spink said he took it that Borough Analyst meant Public Analyst. In reference to the first objection, Mr. Twiss said that his impression was that if the Public Analyst were present from the commencement of the analysis to its fulfilment, and if he had somebody acting under his supervision the objection could not be sustained. Mr. Laverack said that being the case he would beg leave to call the defendant before his Worship decided the second point. The defendant was then sworn. He stated that on the morning of the 14th inst. his milk was sold out before had served all his customers, and he therefore purchased two gallons of milk from a milkseller named George Smith, for which he paid 1½d. a pint. He had disposed of nearly the whole of his extra supply when the inspector came up and purchased a pint of it. He (defendant) bought the milk in belief that it was as good as his own. Mr. Twiss: If that is the case Smith ought to be in defendant's place. Mr. Spink (to defendant): Did you never water your milk? Witness: No. Mr. Spink: Is it the custom of the trade to water it? Witness: Yes, a little sup. His Worship said that defendant and others could not be allowed to sell milk

which was adulterated in this manner. If they purchased an extra supply they must know its quality, for the public must be protected. With regard to the second point raised by Mr. Laverack, he must believe the inspector's statement and overrule the objection. Defendant would be fined 20s. and costs.

Milk Adulterated through it Raining while Milking going on :—

Francis Mallisan, cowkeeper, of Hull, was summoned for a similar offence. In this case the analysis was also made by Mr. Fox, Mr. Baynes's assistant, and the certificate showed that the milk was adulterated with ten per cent. of water. In reply to his Worship Mr. Fox said a cow in the very weakest condition would give nine per cent of solids. This was their standard. In this the analysis showed only eight per cent. which gave adulteration to the extent of ten per cent. Defendant's excuse was that whilst milking the cows in the field on the morning of the 14th ult. it rained very heavily, and he thought about a pint of water fell into each of the milking buckets. That was all the water in the milk that he was aware of. He was not in the habit of watering his milk, not even to the extent of a table-spoonful. Many persons said his old milk was as good as new. His Worship said the evidence showed that the milk was adulterated. If it had been adulterated in the way defendant described he must be more careful in the future. Fined 20s. and costs. Defendant: May I ask if you are allowed to put any water in then? His Worship: No, certainly not.

Fine French Coffee containing 90 per cent. of Chicory :—

At the Bilston Police Court, before Mr. Boughey, the stipendiary for the South Staffordshire district, Mr. Richard Pinfield, grocer, of Ettingshall, was summoned by Mr. Horder, the inspector under the Food and Drugs Act, for selling coffee "not of the nature and substance demanded by the purchaser." Samuel Toy, assistant inspector, stated that on July 23 he went to defendant's shop, and purchased a quarter of a pound of coffee. The coffee was in a canister, labelled "Fine French Coffee," and on the label was a statement to the effect that it was a blend of fine East India and other coffees, carefully prepared by the new French process, whereby the aroma and properties of the coffee were carefully developed. The contents of the canister were analysed by Mr. E. W. T. Jones, the official analyst, who certified that the mixture contained 90 per cent. of chicory. The stipendiary said the mixture was not coffee; it was merely "stuff," and he could call it nothing else. As, however, the costs would be something heavy, he would in this instance only inflict the nominal fine of 5s. and the costs, £1 10s.—At the same Court, Mr. Isaac Boyard, grocer, of New Village, near Wolverhampton, was also charged by Mr. Horder with selling adulterated coffee. Samuel Toy, assissant inspector, said he went to the defendant's shop on July 23, and asked for two ounces of coffee. The coffee was given to him wrapped in a paper, on which were printed the words "Chicory and Coffee." The coffee was given to Mr. Jones, the analyst, who found that it contained 72 per cent. of chicory. Defendant was fined 10s., and £1 9s. 6d. costs.—Mr. William Phillips, grocer, of New Village, Bilston, was also summoned by Mr. Horder, the inspector under the Food and Drugs Act, for selling mustard not of the nature and quality demanded by the purchaser. Samuel Toy, assistant inspector, said he went to the defendant's shop on July 23, and purchased two ounces of mustard. The mustard was sent to Mr. Jones, the analyst, who found that it contained 49 per cent. of wheat flour. Defendant was fined 5s. and costs, amounting in the whole to £1 10s. 6d.

London Mustard containing Wheaten Flour :—

At the instance of the Glasgow Sanitary Department, A. M'Lean, provision merchant, 295, South Wellington Street, in that city, was charged before Sheriff Balfour with having sold adulterated mustard. On October 14 Robert Inglis, one of the sanitary officers, purchased a quarter of a pound of mustard in Mr. M'Lean's shop, and on being analysed by Dr. Wallace the mustard was found to contain 25 per cent. of wheaten flour. It appeared that the mustard had been sold by a girl, in the absence of the ordinary shopkeeper, and had been taken loose from a canister on which was printed a statement to the effect that the mustard was "London mustard," and a mixture of farina and choice condiments. This intimation was hardly noticeable to purchasers, and the girl did not intimate to the inspector that the mustard was a mixture. In the circumstances, the Sheriff held that while an offence had technically been committed against the Act, it was not a serious offence, and he would only fine Mr. M'Lean in the expenses of the prosecution—25s.

At the Rushall Police Court lately, before Messrs. F. James, S. Stokes, and T. A. Negas, a number of grocers were summoned for an alleged violation of the Adulteration of Food and Drugs Act. The first case was that of Mrs. Caroline James, who was summoned by Mr. J. G. Horder, the county inspector, for supplying goods not of the nature and substance demanded by the purchaser. Mr. Williams (of the firm of Duignan and Co.) appeared for the defendant. Mr. Horder said that on October 9 he went to defendant's shop and purchased two ounces of coffee. The sample, on being analysed by the county analyst, was found to contain 50 per cent. of chicory. In cross-examination the witness said the mixture

was wrapped in a paper on which was printed "This is a mixture of chicory and coffee." The Bench considered the notification on the wrapper to be quite sufficient intimation to the purchaser that it was not pure coffee, and dismissed the case.—Mr. George Cresswell, grocer, of Walsall Wood, was charged with a similar offence. Mr. Bagnall (of the firm of Rowlands and Bagnall, Birmingham), instructed by the Birmingham and Midland Counties Grocers' Protection and Benevolent Association, appeared for the defendant. In this case Mr. Horder said the mixture contained 51 per cent. of chicory. The other facts were similar to those given in the preceding case, and the magistrates dismissed the case.—Sarah Stevens, of Walsall Wood, for selling coffee containing 63 per cent. of chicory, and William Bates, of Rushall, for having sold a mixture containing 69 per cent. of chicory, were also charged with a like offence. As the facts were at all fours with the previous cases, the summonses were dismissed.—Thomas Henry Whitehouse, of Sheffield, was summoned for having sold as half a pound of butter a mixture containing 92 per cent. of foreign fat. The witness for the prosecution said defendant stated at the time of the purchase that he had bought it for butter. Defendant was fined £1, and £1 8s. 6d. costs.

Coffee Adulteration.—Extraordinary Defence:—

Mr. Charles Isaac Walton, tea dealer, 233, Hoxton Street, was summoned at Worship Street Police Court by the inspector for the Vestry of St. Leonard, Shoreditch, for selling coffee as pure which was adulterated. Mr. Walker, Vestry Clerk, appeared for the prosecution, and Mr. Wontner for the defence. Evidence was given that three-quarters of a pound of coffee was purchased and was asked for as genuine. It was laid on the counter on an open paper and then was divided into three parcels and put in paper bags and sealed. One was left with the vendor, one was sent to the analyst, and one retained by the inspector. The certificate of Dr. Stevenson was put in, certifying that the sample contained the foreign ingredients as under: Chicory, 20 per cent. Mr. Wontner, for the defence, said he had a strange answer. They had sent the samples left to Dr. Hassall for analysis and he certified that the quantity of chicory was 30 per cent. But they believed that it was genuine coffee. They had a parcel of pure coffee which they sold from, and they could only account for it by the supposition that chicory was in the bags when the coffee was put in. Mr. Walker said that was a very improper statement. He should have to ask the inspector if the bags were clean and empty. The inspector was recalled and said the bags were new from the stationer's and had never been opened and were quite empty. Mr. Wontner then said they could not account for it as they believed the coffee sold was pure. He asked that the sample produced in Court should be submitted to the Government analyst at Somerset House. The magistrate consented, and the case was adjourned. At the adjourned hearing the certificate from Somerset House was put in, stating that it contained not less than 20 per cent. of chicory. Mr. Wontner called the proprietor and his employées to prove that the coffee was sent from the Mincing Lane establishment to this and several other places. They sent a canister to each of pure, labelled as such, and it was sold as such in the full belief that it was pure. The magistrate said there were some peculiar circumstances about the case which it was not for him to decide. It was admitted that chicory was largely used for mixing with coffee in this place; whether this was a mistake or not he could not say, but the evidence put before him was not sufficient to induce him to impose a less penalty than £5 and £1 2s. 6d. costs.

Extensive Adulteration in Scotland.—Heavy Penalty:—

In Chambers lately, before Sheriff Balfour, Alexandra Young, milk dealer, and residing with his father, William Young, farmer, Waterbank, Carmunnock, was charged at the instance of the sanitary authorities with having, on 18th October, from a cart in West Bothwell Street, sold to William T. Armstrong, one of the sanitary inspectors, four pennyworth of cream diluted with 62½ per cent. of skim milk, two pennyworth of sweet milk diluted with 36 per cent. of skim milk, and one pennyworth of skim milk diluted with 20 per cent. of added water. In answer to the Sheriff, Mr. Young said he was guilty, and that he was 22 years of age. Mr. Ross, who acted for the prosecution, said this was one of the worst cases that had ever come before the Court, and the locality in which the milk was sold was a poor one, inhabited chiefly by working people. The Sheriff said it was a very serious offence. The adulteration was very great; it was the worst case that had come before him. The percentage of adulteration usually varied from five to twenty, but in the cream in this case there was more skim milk than cream, the adulteration being 62½ per cent. The accused: Well, it was the price I had to pay for it. The Sheriff (continuing) said that in whatever locality these sales had taken place the offence would be great, but it was worse being in a locality like Bothwell Street, where the people were poor. It would have been competent for him to inflict a penalty of £20 for each of the offences, but he thought it would be too hard to impose three times £20. He would treat the case as if there was only one offence, and impose a fine of £18, which was just £6 for each offence. This modification was made because of the youth and inexperience of the accused, and he hoped it would be a

warning to him for the future. Mr. Ross: Will your Lordship impose a substantial alternative in case of the accused not paying this large sum? The Sheriff: Have you any prospect of paying this penalty? The accused (who had a roll of notes in his hand) said he could pay it now, which he did.

Milkman Fined for Adding Water to his Employer's Milk.

James Haines, in the employ of Morgan Morgan, purveyor of milk, carrying on business at 68, Alscot Road, Bermondsey, was summoned to Southwark Police Court by Mr. H. Thomas, sanitary inspector, in the service of the Bermondsey Vestry, for selling him milk containing 16 per cent. of added water, and Mr. Morgan, the master, was charged with causing him to sell it. Mr. Harrison, vestry clerk, prosecuted, and Mr. Washington appeared for the latter. Mr. Thomas said that on the 14th ult. he caused a pint of milk to be purchased from Haines as he was serving customers in Grange Road. He told him he intended to have it analysed, when Haines said he sold it as he received it from his master. Witness took a sample to Dr. Muter, whose certificate showed that it contained 16 per cent. of added water. On mentioning the circumstances to Mr. Morgan, he said that Haines must have added water to it after he left the dairy, as all the milk was tested before it was taken away. Mr. Washington, on the part of Mr. Morgan, produced a certificate showing that all the milk was genuine when Haines took it from the dairy. Mr. Thomas was recalled by Mr. Washington, and he said that on Haines being called by his master in reference to the milk, he said, "I own putting water in the milk; I have done it three times." He had known Morgan for some time, and he believed him to be a very respectable tradesman. The defendant Haines here said it was quite true what Mr. Thomas had said. He had frequently put water in the milk, and his master knew nothing about it. Mr. Washington informed his worship that Morgan paid Haines 26s. a week, and gave him what milk he required for his own use. It was very serious for Mr. Morgan. The magistrate dismissed the summons against Morgan, and fined Haines £5, or one month's imprisonment.

For some years past large quantities of butterine have been disposed of in Dublin as pure butter. Hitherto the fraud has escaped almost unnoticed, to the great loss of dairy farmers. Recently, however, the authorities, aroused to action by the Rev. Canon Bagot and other members of the Agricultural Society, have set their faces against the practice. Several of the vendors of this stuff were brought before the police magistrates by the Corporation and sanitary officials lately, and fined in sums of £5 and £10. The certificate of Dr. Cameron, city analyst, set forth that the samples submitted to him consisted of a compound of foreign fats, instead of butter fats. In one of the cases the prosecuting official deposed that one of the cools of butter was marked butterine, but over the "ine" was placed a similar label marked 10d., so that the apparent marking on the cool was "butter 10d." The magistrate said this was a very bad case of deception, and imposed a fine of £10.

NOTES OF THE MONTH.

The Irish are credited with having a method quite their own of dealing with matters; but if the statement of a Dublin dairyman is to be believed, an inspector who took some milk from him, which proved on analysis to be adulterated, actually called on him before issuing the summons, and said, "What day was it that I took that milk from you? because I have forgotten the date." The milkman obligingly answered, "Och, sure! and wasn't it on [such a day]!" And then, after that, the inspector had him fined!

The Scotch, always "canny" in money matters, have also had their natural instincts exemplified lately. It seems that at a meeting to discuss the necessity of appointing an analyst, a saving ratepayer delivered himself of the following brilliant idea: "I don't see much use in gettin' an analyst. There's the pollis (policemen), they hae but little to do in the mornin'; they micht analeeze the milk, ye ken!"

Another case has been settled, which will be found in our police reports, in which the magistrate has decided against a mixture of 90 per cent. chicory and 10 per cent. coffee, sold in a canister labelled "fine French coffee," and having a statement to the effect that it was a blend of fine East India and other coffees, carefully prepared by a new French

process whereby the aroma and properties of the coffee were carefully developed. There being a large quantity of similar articles about in all the shop windows, we should suggest that it would be a useful amendment to the label to leave out the word "developed," and insert instead "modified by an admixture of a blend of the finest and most carefully prepared roots of chicorium." That would sound very nicely, and might save convictions; while such a description would almost be more eloquent than that found on a tin of mustard with flour and turmeric, met with in the Glasgow police reports, stating it to be "London mustard," and a "mixture of farina and choice condiments." After this we shall have the milkmen selling "the natural milk of the choicest and most beautiful Alderney and other cows, prepared by a process whereby its nutritive qualities are specially dealt with; and it is rendered more easy of digestion by infants through careful admixture with a well-known agent supplied by a beneficent Providence—namely, hydric oxide!"

RECENT CHEMICAL PATENTS.

The following specifications have been recently published, and can be obtained from the Great Seal Office, Cursitor Street, Chancery Lane, London.

1880 No.	Name of Patentee.	Title of Patent.	Price.
905	J. C. Loeffler	Covering Wire with Insulating Material	2d.
1295	E. M. Allen	Insulating Electrical Conductors	6d.
1304	W. R. Lake	Utilization of Bamboo Reed for Manufacture of Fibrous Materials	6d.
1310	W. C. Young	Manufacture of Sulphate of Ammonia	4d.
1324	T. Croysdale	Artificial Manure	4d.
1328	W. R. Lake	Telegraphic and Telephonic Apparatus	1s.
1329	W. R. Lake	Eliminating Phosphorus from Iron in Bessemer Converters	4d.
1354	C. D. Abel	Caloric Apparatus	6d.
1414	C. D. Abel	Caloric Engines	6d.
1365	S. Pitt	Preserving Alimentary Substances by Cold	6d.
1385	T. A. Edison	Electric Machines and Motors	6d.
1397	C. D. Abel	Electric Lamps	6d.
1402	C. D. Abel	Filters	6d.
1407	O. Heaviside	Electrical Conductors	6d.
1416	P. Jenzen	Production of Oxygen Nitrogen Gas	6d.
1456	C. Lowe and J. Gill	Manufacture of Coal Tar	4d.
1463	R. Evans	Preventing the Falsification of Cheques	6d.
1471	A. W. Gillman and S. Spencer	Manufacture and Treatment of Beer	4d.
1478	W. Mann and W. T. Walker	Purification of Coal Gas	6d.
1507	G. André	Electric Lamps	6d.
1510	G. Wells and A. Gilbert	Insulators	4d.
1511	J. H. Johnson	Telephone Switches	6d.
1512	W. A. Hills	Production of Tricalcic and Dicalcic Phosphates	4d.
1536	J. McLaren	Manufacture of Sugar	4d.
1546	J. H. Vale	Apparatus for Enriching Gas by Admixture of Hydro-Carbon Vapour	2d.
1552	A. M. Clark	Electric Lamps	6d.
1564	G. Davis	Prevention of Incrustation in Boilers	4d.
1615	E. P. Alexander	Treating Mineral Hydro-Carburets	2d.
1623	J. H. Johnson	Tanning or Preserving Hides or Skins	2d.
1649	W. R. Lake	Electric Lighting Apparatus	8d.
1672	S. A. Peto	Manufacture of Plumbago Crucibles	2d.
3228	H. H. Lake	Drying Sugar	6d.

BOOKS, &c., RECEIVED.

The Chemist and Druggist; The Brewers' Guardian; The British Medical Journal; The Medical Press; The Pharmaceutical Journal; The Sanitary Record; The Miller; Journal of Applied Science; The Boston Journal of Chemistry; The Provisioner; The Practitioner; New Remedies; Proceedings of the American Chemical Society; Le Practicien; The Inventors' Record; New York Public Health; The Scientific American; Society of Arts Journal; Sanitary Engineer of New York; The Cowkeeper and Dairyman's Journal; The Chemists' Journal.