

THE ANALYST

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

AN Ordinary Meeting of the Society was held at the Chemical Society's Rooms, Burlington House, on Wednesday, 4th November, 1925. Mr. S. F. Burford, Vice-President, was in the chair.

Certificates were read for the first time in favour of Messrs. John Douglas Barrett, B.Sc., A.I.C.; Arthur Frank Lerrigo, B.Sc., F.I.C., Oscar Adolf Mendelsohn, B.Sc., Harold Edward Monk, B.Sc., A.I.C., and Eric Voelcker, A.R.C.S., A.I.C.

Certificates were read for the second time in favour of Messrs. Alexander Bruce, B.Sc., F.I.C., Felix John Theodore Grigg, M.Sc., A.I.C., Sydney George Clarke, B.Sc., A.I.C., John Hanley, F.I.C., Arthur John Jones, A.I.C., Henry William Lawrence, F.I.C., Fred Mattingley, B.Sc., A.I.C., Bartle Frere Sawbridge, M.A., F.I.C., Harold Jacob Stern, Ph.D., B.Sc., A.I.C., and Major Clive Newcomb, M.D., F.I.C.

Mr. Theodore Rendle was elected a member of the Society.

The following papers were read:—"The Determination of Palm Kernel Oil and Butter in Margarine," by G. D. Elsdon, B.Sc., F.I.C., and Percy Smith, B.Sc.; "The Determination of Alcohol and Ethyl Chloride in Chloroform," by Clive Newcomb, M.D., F.I.C.; and "The Volumetric Determination of Soluble Sulphates by means of Barium Chloride and Potassium Stearate," by H. Atkinson, B.A., A.I.C.

Death.

We regret to record that one of our Members, Mr. R. W. Oddy, died on November 24th, at Rochdale, aged 74.

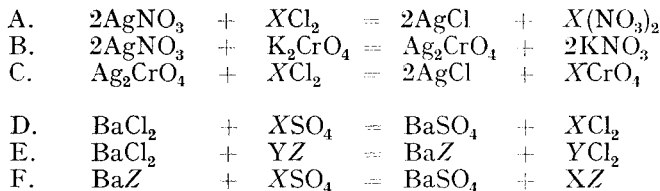
The Volumetric Determination of Soluble Sulphates by Means of Barium Chloride and Potassium Stearate.

BY H. ATKINSON, B.A., A.I.C.

(Read at the Meeting, November 4, 1925.)

OF the inorganic sulphates, that of barium is the only one which is sufficiently insoluble in water to be useful for the removal from solutions of the sulphate radicle, and the process finds universal application in gravimetric analysis. As barium does not form insoluble highly coloured salts, comparable with silver chromate, a volumetric determination of sulphates, on similar lines to that of chlorides by means of silver nitrate and potassium chromate, is unsatisfactory.

To compare these two series of reactions, we have the equations:



CONDITIONS FOR VOLUMETRIC DETERMINATION.—The conditions required are that YZ should be a soluble salt and BaZ insoluble, and that equation F should be from left to right, thus ensuring that all sulphates should be precipitated before BaZ is permanently formed.

Now BaZ has no striking colour, and another physical property has to be sought: if YZ is the salt of a weak acid and strong base, the change represented by equation E involves a change in hydrogen ion concentration, and the solution, which is originally alkaline, becomes neutral as the insoluble BaZ is removed from solution, and the change can be made visible by using a suitable indicator.

K. Jellinere and J. Czerwinski (*Zeitsch. anorg. Chem.*, 1923, **30**, 253) describe a process which they term "hydrolytic precipitation" for the determination of barium chloride, potassium chromate and methyl red being used as indicators. By adding excess of barium chloride, and determining this excess, sulphates may be determined.

Of the insoluble salts of barium with weak acids, the carbonate, phosphate, tartrate, silicate, molybdate, stearate, and saponified fats were examined with reference to the above reactions, and of these, the stearate appeared to satisfy equations E and F best of all.

As potassium stearate is only slightly soluble in cold water, aqueous alcohol was used, and this only in dilute solutions. There is also a tendency for the solution to deposit in course of time, but a solution with good keeping qualities was prepared as follows:—Alcohol of 95 per cent. strength was freed from acidity by distillation with potassium hydroxide. About 3 grms. of pure stearic acid were weighed into a flask of 500 c.c. capacity, and to it were added 22 to 23 c.c. of 0.5 N alcoholic potassium hydroxide solution and about 100 c.c. of the neutral alcohol. The solution was heated to boiling point, and the stearic acid dissolved. A few drops of phenolphthalein (which does not interfere with the subsequent titrations) were added and more alcoholic potassium hydroxide solution, drop by drop, or more stearic acid in small quantities, was added until the pink colour was just discharged. The liquid was then made up to 450 c.c. with neutral alcohol, and 50 c.c. of distilled water added, making a solution containing approximately 85 per cent. of alcohol; the flask was then corked and the liquid allowed to cool.

This solution of potassium stearate was standardised against 0.1 N barium chloride solution in the following way:—To 50–60 c.c. of distilled water in an Erlenmeyer flask were added 5.5 c.c. of the standard barium chloride solution and 15 drops of indicator (*). The colour at the beginning of the reaction was yellow. Twenty-five c.c. of the stearate solution were run in from a burette, with shaking, and the solution allowed to stand for about half a minute. If the colour was still yellow or a yellowish green, more stearate solution was added, 0.25 c.c. at a time, until the solution, on shaking, remained a distinct blue-green. The end point had then been passed, and the addition of one or two drops of barium chloride solution brought the colour back to the end point. This colour was not so bright a yellow as the original colour, but the solution was rather opalescent, and the colour was a pale yellow with a slight tinge of green in this dilute solution. The end point was characterised mainly by its decided change from a distinct green and the fact that one more drop of barium chloride solution produced no appreciable change.

Very little experience was required to determine this point to the nearest drop of 0.1 N solution, and as in sulphate determinations very little of this solution is used, the limit of error is less than the method demands.

It was noted, however, that in this and all titrations the end point had to be approached by the addition of stearate solution to a solution containing barium chloride and not *vice-versa*, as in the latter case a solution, which was presumably colloidal, was obtained on many occasions, and it was possible to add barium chloride to a point far beyond the end point without producing the desired colour change to yellow. In this condition the addition of a few drops of stearate solution, by coagulating the precipitate, actually changed the colour from green to yellow, a reversal of the required change.

When the true end point was reached, of course, the addition of a few drops of stearate solution changed the colour from yellow to green.

* The more suitable indicators were B. D. H. Universal Indicator and brom-thymol blue, and the former was preferred, as its colour range was wider and its end point, especially in presence of magnesium salts, was more definite.

The standardised solution could then be made up to 0.02 *N* by dilution with 85 per cent. alcohol, but was usually used at the strength determined.

The standard barium chloride solution was then titrated against standard sodium sulphate solution, different quantities being used; the procedure was as follows:—To 20 c.c. of each of a number of solutions made up from different known quantities of 0.1 *N* sodium sulphate and distilled water, were added about 10 drops of indicator, which assumed a yellow colour, and 1 c.c. stearate solution, which changed the colour to violet. The 0.1 *N* barium chloride solution was added gradually, with shaking, until the colour changed through blue and green to yellow, and then about 0.5 c.c. was added in excess. The solution was shaken for a few more seconds, and the excess of barium chloride was titrated with stearate. If the colour immediately changed to green on addition of stearate, there was no excess of barium chloride, and more was added, but if the momentary green colour immediately disappeared and gave place to yellow, the barium chloride was present in excess, and the excess was titrated just past the end point, to a permanent green. This colour was then again changed to yellow by the addition of one or two drops of barium chloride solution, and the result was the difference of the two readings, *i.e.* barium chloride minus potassium stearate.

TABLE I. Original volume of solution = 20 c.c.
containing

			Titration. Barium chloride solution.	Difference to 1/2 drop 0.1 <i>N</i> .
5 c.c. sodium sulphate =	5.04	0.1 <i>N</i>	4.95 c.c.	0.1 c.c.
10 " " "	10.08	"	9.8 "	0.28 "
15 " " "	15.12	"	14.55 "	0.45 "
20 " " "	20.16	"	19.45 "	0.7 "

A second addition of sodium sulphate to these solutions after the end point was reached once more turned the solution green (conforming with equation F).

The barium chloride solution was shown to be exactly 0.1 *N* strength by gravimetric analysis, but appeared to be strong in these titrations, and the divergence from 0.1 *N* increased with increasing concentration.

In confirmation of the above result, solutions were made up containing the same quantity of sulphates in different volumes of aqueous solution and titrated as above:—

TABLE II. Results:—5 c.c. 0.1 *N* sodium sulphate
in

1.	5 c.c. solution	4.8 c.c. 0.1 <i>N</i> barium chloride
2.	10 " "	4.85 " " " "
3.	20 " "	4.9 " " " "
4.	About 80 c.c. solution containing 20 c.c. solution of potassium stearate neutralised with barium chloride = 4.88 to 4.92 c.c.	

In the first three cases (Table I., *supra*) the precipitate coagulated and quickly settled, and the clear liquid was bright yellow and the end point sharp. In the

strongest solution duplicate titrations differed by as much as 1 or 2 drops of 0.1 *N* solution, and when still more sulphate solution was taken, *e.g.* 40 c.c. 0.1 *N*, the end point was still less definite.

CORRECTIONS TO BE APPLIED.—The differences recorded in the last column of Table S were then applied to corresponding titrations in the determination of sulphates in sodium sulphate solutions of unknown strength and compared with the gravimetric result as subsequently determined.

TABLE III. Results:—

A. 20 c.c. of solution containing

c.c.	BaCl ₂	Mean + Correction.	Calculated as BaSO ₄ . Grm.	Gravimetric result. Grm.
1	0.92			
	0.91	0.92 + 0.02 = 0.94	0.011	0.011
2	1.85			
	1.85	1.85 + 0.04 = 1.89	0.022	0.022
5	4.57			
	4.57	4.57 + 0.10 = 4.67	0.0545	0.055
10	9.08			
	9.10	9.10 + 0.28 = 9.38	0.1095	0.1098
20	18.05			
	18.0	18.02 + 0.70 = 18.72	0.2185	0.2195

Intermediate corrections are calculated by interpolation.

B. 20 c.c. of solution containing

c.c.	Corrected titration. c.c.	Actually present by gravimetric analysis. c.c.
0.5	0.63 of 0.1 <i>N</i>	0.66 of 0.1 <i>N</i>
1	1.32	1.32
2	2.70	2.65
5	6.63	6.60
10	13.23	13.2

C. Potassium sulphate

2	2.0 of 0.1 <i>N</i>	1.98 of 0.1 <i>N</i>
5	4.92	4.94
10	9.82	9.87

As a greater degree of accuracy is to be expected by taking greater quantities for titration up to the point where a less definite end point has the opposite effect, a solution containing 10 to 15 c.c. of 0.1 *N* in 20 c.c. was judged to be the best concentration, and in such a solution the limit of error would be about 0.05 c.c. in 10 c.c. or 1 in 200.

Samples of sodium sulphate were taken and made up to approximately 0.1 *N* solutions (8 grms. of the anhydrous or 16 grms. of the crystalline salt per litre).

Ten c.c. in each case were diluted with distilled water to a total volume of 20 c.c. and titrated.

TABLE IV. Results:—

	Corrected titration. c.c.	BaSO ₄ . Grm.	Gravimetric results. Grm.
D	10·23	0·1195	0·1192
E	10·25	0·1313	0·1315
F	9·6	0·1120	0·1123
G	11·18	0·1305	0·1310
H	11·23	0·1311	0·1309

EFFECT OF TEMPERATURE.—It was noticed that with solutions containing a comparatively high proportion of sulphates (more than 20 c.c. of 0·1 *N*) the lack of sharpness of end point was to some extent due to the slowness of arriving at this point. A yellow solution, which appeared to have reached the end point, gradually became green and then required more barium chloride solution to arrive at the new end point. If, however, the solution was heated to boiling point, the change to green was rapid. The liquid could not, however, be titrated in this hot solution, because the green colour persisted even after the barium chloride was added to excess, but if it was cooled again, the real end point could be arrived at more quickly and the "lag" eliminated.

With smaller concentrations of sulphates, the yellow colour, which changed to green on heating, reappeared on cooling, and there was no change in the end point. With these concentrations, therefore, no advantage was gained by heating the solution.

DETERMINATION IN PRESENCE OF ALKALINE EARTH METALS.—The question of determining sulphates in presence of metals which form insoluble stearates presents a new problem, but, as these can be eliminated by the reagent itself, the method becomes only a modification of the foregoing.

The metallic salts dealt with were calcium, magnesium and aluminium, but as the first two are neutral to the P_H indicator, whilst the salts of aluminium react acid, they will be dealt with separately.

Calcium and Magnesium.—When these salts were present in large quantity the amount of 0·1 *N* stearate solution required was large, and the method rather extravagant, but when present in small proportions comparable with those in potable waters, the direct precipitation of "hardness," as by soap solution, was tried.

Procedure.—A quantity of 100 c.c. of the water, or more if the sulphate content was very low, was neutralised to methyl orange with 0·1*N* hydrochloric acid (alkalinity or temporary hardness), and the liquid was boiled to remove carbon dioxide, and concentrated to about 60 c.c. It was then cooled, and about 15 drops of universal indicator were added. If the colour was red or green it was made yellow by the addition of a small quantity of 0·1 *N* sodium hydroxide solution or hydrochloric acid, the original titration for alkalinity being corrected by this amount. To this liquid was added 0·02 *N* stearate solution, with shaking, until the solution, which remained yellow at first or even turned orange, became yellowish green, green, and (when excess was added), blue-green. It was noticed that when magnesium salts were present the first change to greenish yellow

occurred before the titration was complete, but excess was required to arrive at a blue-green colour.

This excess was then titrated back with 0.1 *N* hydrochloric acid, the amount required being 2 or 3 drops, and the colour was compared with the standard colour obtained in the titration of barium chloride with potassium stearate in the standardisation of the latter.

This solution, without filtration, was used for the determination of sulphates in the same way as in the case of alkali sulphates, care being taken, as before, that barium chloride was added in excess, and that the end point was approached by titrating this excess with stearate and comparing the final colour once more with the standard.

It was noticed that if the solution contained too much alcohol the end point was disturbed, as even alkaline solutions in presence of too much alcohol failed to turn blue. The proportion of alcohol was therefore not allowed to exceed about 30 per cent., and, if the stearate titration raised the alcohol content above this amount, more water was added.

Three samples were prepared as typical potable waters by using known quantities of sodium sulphate, chlorides of magnesium and calcium, and sufficient sodium bicarbonate to make the solution appreciably alkaline, and were examined by the above method.

The calcium and magnesium solutions were prepared by dissolving weighed quantities of pure calcium carbonate and magnesia, respectively, in sufficient hydrochloric acid to effect complete solution and diluting (disregarding the excess of hydrochloric acid) to decinormal solutions.

The sodium sulphate was also used in decinormal solution, and the sodium bicarbonate was added in such quantity that, after neutralising to methyl orange, there should be an alkalinity of 200 to 400 parts per million, calculated as calcium carbonate.

One hundred c.c. of solution were taken. The first figure represents the number of c.c. 0.1 *N*, and the second figure represents the number of parts per million corresponding to this. The total hardness and permanent hardness are expressed as calcium carbonate.

TABLE V.

	Total hardness			Deter- mined.	Alka- linity.	Permanent hardness = Total Alkalinity.		Sulphates (SO ₃)	
	Added					Added.	Deter- mined.	Added.	Determined.
	CaO.	MgO.	Total.						
A.	5.5 275	1.5 75	7.0 350	7.05 352	5.80 290	60	62	2.30 92	2.27 c.c. 0.1 <i>N</i> 91 parts per million
B.	3.0 150	2.5 125	5.5 275	5.42 271	7.0 350	-75	-79	1.0 40	0.97 c.c. 0.1 <i>N</i> 39 parts per million
C.	1.5 75	3.0 150	4.5 225	4.45 222	5.65 282	-57	-60	0.25 10	0.27 c.c. 0.1 <i>N</i> 11 parts per million

The negative figures under permanent hardness signify alkalinity after boiling.

As the above samples were artificially prepared, and contained none of the traces of silica, iron, etc., likely to be present in well waters, other samples of well waters were chosen with varying quantities of sulphates, and the gravimetric and volumetric determinations were compared.

TABLE VI.

	Total hardness.	Alkalinity.	Permanent hardness.	Sulphates (SO ₃).	
				Volumetric result.	Gravimetric result. (parts per million.)
D	292	308	-16	1.5 c.c. 60	61.5
E	205	155	50	1.25 c.c. 50	49
F	200	175	25	0.9 c.c. 36	35
G				6.8 c.c. 272	279
H				10.87 c.c. 435	449
I				4.5 c.c. 180	183.5

As in the case of sulphates of alkali metals, the sulphate determinations fall short of the result as determined gravimetrically, but, if the same corrections are applied as in the previous determinations (see titration No. 4 in Table II.), the results are:—

TABLE VII.

	Corrected result.				Gravimetric result (parts per million).
A	2.27	+ 0.05	= 2.32 c.c.	= 93	92
B	0.97	+ 0.02	= 0.99	40	40
C			0.27	11	10
D	1.5	+ 0.03	= 1.53	61	61.5
E	1.25	+ 0.02	= 1.27	51	49
F	0.9	+ 0.02	= 0.92	37	35
G	6.8	+ 0.17	= 6.97	279	279
H	10.87	+ 0.30	= 11.17	447	449
I	4.5	+ 0.1	= 4.6	184	183.5

With a solution containing only a trace of sulphates, however, the agreement was not so good.

A sample of water which, by evaporation of one litre, was found to contain by gravimetric analysis 7 parts per million, gave, in two determinations by the above volumetric method only 2 parts and 3 parts per million. These determinations were made on 200 c.c. of the water, and the sulphate titration was only 2 and 3 drops of 0.1 *N* barium chloride solution. Although the difference is less than 5 parts per million, the determination is quite useless for sulphates in this small amount. A good agreement was obtained by a method which will be described later.

It will be seen from the other results, however, that the method does supply a rapid means of determining hardness and sulphates in potable waters where a high degree of accuracy is not required; the three determinations are all made on the same solution, and the results arrived at in about 20 minutes.

It compares favourably with other methods of volumetric determination used in water analysis, and has the advantage of speed.

PERMANENT HARDNESS.—As regards permanent hardness, the results by this method were compared with those obtained by the method involving the removal of hardness by boiling the water with a mixture of sodium carbonate and sodium hydroxide, and titrating the residual alkalinity on an aliquot portion of the cooled and filtered liquid. The results by the stearate method were always somewhat higher, equivalent to about 10 parts per million of calcium carbonate, and it was noticed that the filtered solutions from the above contained residual hardness which could be precipitated by potassium stearate, amounting to about 0.5 to 0.75 c.c. of 0.02 *N* solution per 25 c.c. of filtered liquid. This is equivalent to 2.5 to 3.5 mgrms. of calcium carbonate in 25 c.c. of filtered liquid or 50 c.c. of original water, equivalent to 10 to 15 parts per million.

If 200 c.c. water were originally used, the difference would be half this amount.

TABLE VIII. Results in parts per million from A, B and C in table:—

	Total hardness Alkalinity.	Permanent hardness by stearate method.	Permanent hardness by the above method.
A	60	62	50
B	—75	—78	—90
C	—57	—60	—70

TITRATION OF SULPHATES AFTER DETERMINATION OF PERMANENT HARDNESS.

—The solution remaining after the determination of permanent hardness by the method just described could also be used for the determination of sulphates, after boiling to eliminate carbon dioxide and precipitating the slight residual hardness by titrating with potassium stearate (about 1 c.c.) to a blue solution, and making the solution yellow again by the addition of one or two drops of 0.1 *N* hydrochloric acid.

This method has the advantage of economy in the use of the alcoholic stearate solution; the bulk is smaller and less indicator is required, and with solutions containing only traces of sulphates the results are more accurate, but the method is not so rapid as the one described previously.

TABLE IX. Results:—Sulphates, expressed as parts per million of SO₃.

	Stearate method (corrected result).	P.H. method (corrected result).	Gravimetric result.
1.	93	92	92
2.*	75.5	75.5	76
3.	—	69.5	66
4. (500 c.c.)*	—	6	6

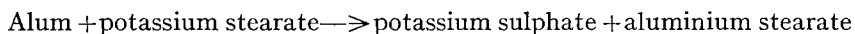
Two other samples were prepared from standard sodium sulphate and chlorides of magnesium and calcium.

	Titration. c.c.	Corrected. c.c.	Added. c.c.
5. Magnesium only	2.47	2.52 0.1 N.	2.50 0.1 N.
6. Magnesium and Calcium	4.92	5.02	5.00

The above determinations were made on solutions which at the beginning of the titration were neutral to the universal indicator, and it is evident that salts which contain a weak acid or basic radicle interfere with the titration. Carbonates and ammonia can be removed by boiling, and it was observed that the trace of carbon dioxide ordinarily present in distilled water did not interfere with the titration. In fact, the yellow colour which is given in distilled water to the universal indicator was taken as the starting point of the titrations. Natural waters, however, containing carbonates or bicarbonates had to be freed from carbon dioxide before a definite starting point could be arrived at.

Of the weak metallic bases, alumina was selected as an example.

A solution of alumina reacts acid to the universal indicator, and if potassium stearate is added the change—



—will occur, and the solution will become neutral when all the alumina is precipitated.

The determination of sulphates will then be conducted in the same way as for waters as already described.

OTHER METHODS.—Other methods tried were:—

(2) To 50 c.c. of a boiling solution of alum (not stronger than 1 per cent.) was added 0.1 N sodium hydroxide solution gradually from a burette until the solution was just alkaline on boiling (*i.e.* blue-green to the indicator). The solution was filtered hot, and the filter washed with hot water; the filtrate and washings were collected in a 200 c.c. graduated flask, cooled, made up to the mark. Fifty c.c. were concentrated to 20 c.c. for the sulphate determination.

(3) The alkaline solution containing the precipitate was transferred to a 100 c.c. flask, cooled, made up to the mark, and filtered through a dry filter, and 20 c.c. were taken in a pipette for the determination of sulphates. In both these determinations the filtered liquid was titrated to yellow with hydrochloric acid,

* As these samples of water had no permanent hardness, but were alkaline after boiling, the sulphates were determined in the concentrated and filtered solution without addition of "permanent hardness" solution.

traces of residual alumina were precipitated by addition of 1 c.c. of 0.02 *N* potassium stearate, and the excess stearate titrated back to yellow with 0.1 *N* hydrochloric acid.

The sulphates were then titrated as before.

(4) Two portions of 25 c.c. of alum solution (1 grm. in 500 c.c.) were pipetted into flasks and diluted to 35 c.c. To one was added gradually 5 c.c. of 0.1 *N* barium chloride solution, which was in excess of that required for the precipitation of all the sulphates.

The two solutions were then titrated to lemon yellow with potassium stearate solution, the difference being that required for the conversion into barium stearate of the excess of barium chloride after removal of sulphates.

This determination was accurate to 0.25 c.c. of stearate solution or 1 drop of 0.1 *N* solution.

As this solution introduced a correction which had not been determined hitherto, two more solutions were taken for comparison, one containing 5 c.c. of standard 0.1 *N* sodium sulphate solution in 35 c.c. with distilled water, and the other simply 35 c.c. of distilled water.

To the former were added 8 c.c. of 0.1 *N* barium chloride solution, and to the latter 3 c.c. of the standard barium chloride solution. Both solutions were titrated to a pea green colour with potassium stearate, and the difference between the two titrations gave the correction to be applied to the previous determination.

This correction was 0.1 c.c. for 5 c.c. of 0.1 *N* sodium sulphate solution, which is the same as the correction applied to the sulphates in water analysis.

TABLE X. Results:

Method.	Titration. c.c.	Alumina Al ₂ O ₃ . Per Cent.	Gravimetric determina- tion, Chancel's method. Per Cent.	Sulphates.		
				Corrected titration. c.c.	BaSO on 25 c.c. 1 Per Cent. solution.	Gravimetric deter- mination.
1	16 0.2 <i>N</i>	10.9	10.80	4.13	0.242	0.247
2	32.05 0.1 <i>N</i>	10.9	,,	10.36	0.242	0.242*
3	16.0 0.1 <i>N</i>	10.9	,,	10.4	0.243	0.247
	16.0	10.91		10.45	0.244	
4	16.1 0.1 <i>N</i>	10.95	,,	4.25	0.248	0.247
	16.1	10.95		4.21	0.2455	
	32.0	10.9		8.43	0.246	

In method (4), the sulphates are removed before the alumina is precipitated, and the volumetric result agrees better with the gravimetric determination.

SUMMARY.—(1) An aqueous solution of potassium stearate which has an alkaline reaction to the B.D.H. universal indicator, reacts with barium chloride solution, with the separation of barium stearate, and the solution becomes neutral when the whole of the stearate is precipitated.

* This determination was made on the filtrate, whilst other gravimetric determinations were made on the original alum solution. The low result and the low volumetric results in methods 1, 2 and 3 suggest that part of the SO₄ is carried down with the precipitate.

(2) In presence of alkali sulphates the barium is first precipitated as the sulphate, and the whole of the sulphate is removed from solution as barium sulphate before barium stearate is permanently formed.

(3) In volumetric titrations the end point is reached before the theoretical quantity of barium chloride is added, and this discrepancy varies with varying concentrations, but is constant for equal concentrations. The determination of sulphates in solution becomes possible, therefore, when the titration of a solution of sulphate of unknown strength is compared with that of a standard solution made up to approximately the same concentration.

(4) The end point of the titration, which is made visible by the change in colour to yellow of the B.D.H. universal indicator, is only sharp when the solution is fairly dilute, of the order of 0.05 *N* or weaker, and when it is approached by first removing the sulphates from solution by addition of excess of standard barium chloride solution, and titrating the excess of barium chloride with standard potassium stearate solution.

(5) Metals which form insoluble stearates (*e.g.* aluminium, zinc, calcium, and magnesium), must be removed from solution before the sulphates can be determined, but as they can be removed quantitatively by the potassium stearate solution itself, and the presence of the precipitate does not interfere with the subsequent sulphate determination, beyond making the solution more unwieldy and the colour change rather less sharp, their presence is not a serious obstacle.

(6) The limit of error is of the order of 1 drop 0.01 *N* (0.05 c.c.), and therefore depends on the total titration with barium chloride solution.

With a titration of 10 c.c. this represents an error of 1 in 200.

DISCUSSION.

Mr. RAYMOND ROSS said that if it were possible to determine the acidity of ammonium sulphate and total sulphate (?) by this method with sufficient accuracy it would be a great help commercially. He would like to know if an accuracy of 0.2 per cent. could be obtained for ammonium sulphate.

Dr. B. S. EVANS said that it would be useful to know the effect of large amounts of neutral salts on this method.

Mr. C. C. ROBERTS assumed that the author had considered the effect of any phosphoric acid present; it would doubtless be precipitated as barium phosphate.

An Electrometric Study of the Separation of the Iodide, Bromide, and Chloride of Silver.

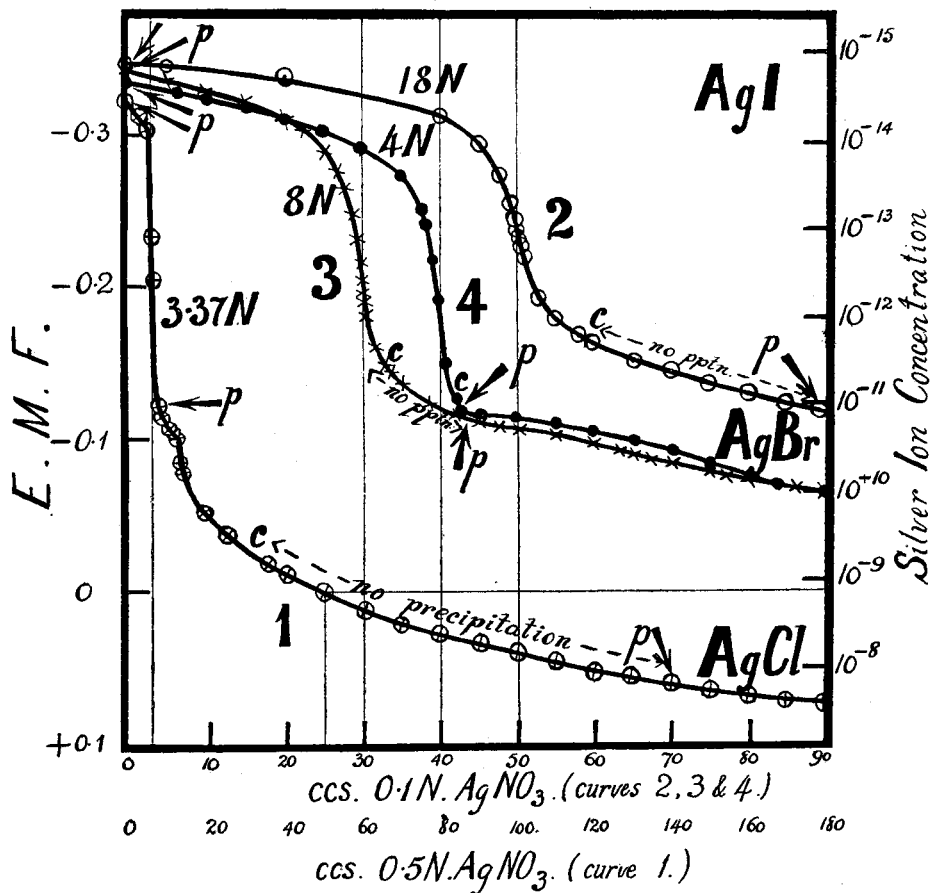
By HUBERT THOMAS STANLEY BRITTON, D.Sc., F.I.C., D.I.C.

THE solubility products of the iodide, bromide and chloride of silver are of the order 10^{-16} , 10^{-13} and 10^{-10} respectively, and consequently the success of a process of separating the halides as the silver salts depends on the efficiency by which very minute concentrations of silver ions can be obtained and controlled. Silver ion concentrations can be obtained by varying the ratio of ammonia to silver nitrate and, to some extent, the concentrations of the reagents, which range from 10^{-5} to 10^{-11} gram. ions per litre, as shown in Tables 6 and 7 of the author's paper in the December issue of the *Journal of the Chemical Society*. Still smaller concentrations are obtainable by employing still greater proportions of ammonia.

The following electrometric titrations of ammoniacal solutions of the three halides with silver nitrate solutions, in which a silver electrode was used, show that a continuous change in silver ion concentration, covering the whole range required for the separation, can easily be obtained, and that by employing suitable concentrations of ammonia and of silver nitrate solutions the change can be rendered sufficiently gradual to permit of the complete precipitation of one halide before the next begins to separate. Silver nitrate solution of a definite concentration was added to 100 c.c. of ammonium hydroxide solution containing varying amounts of the three halides of potassium. The first few drops of silver nitrate, in giving rise to an extremely high ratio of ammonia to silver nitrate, produced an excessively small concentration of silver ions, which gradually increased as the silver nitrate was added. The solubility products of the silver halides were thereby in turn exceeded. These concentrations were controlled electrometrically. A silver electrode was placed in a beaker containing the ammoniacal halide solution and connected through a salt bridge of saturated potassium nitrate solution with a normal calomel electrode. The E.M.F.s of this combination were measured after the addition of each amount of silver nitrate, the solution having been thoroughly stirred, by means of a potentiometer and capillary electrometer.

The first titration was done with dilute ammonia, (3.37 *N*) and 0.5 *N* silver nitrate solution, these concentrations having been chosen in order that the whole ratio range, and therefore silver ion range, might be covered in one experiment. Three millimols of each of the potassium halides were dissolved in the ammonia solution (*i.e.* equivalent to 0.4299 gram. AgCl, 0.5636 gram., AgBr, and 0.7046 gram. AgI). The changes in silver ion concentration which occurred as the silver nitrate was added are shown in Curve 1, the arrows indicating the beginning of precipitation, and "C" the point at which precipitation became complete, and the colloidal mother liquor had coagulated. The precipitation of silver iodide began with the first drop of silver nitrate and, as shown by the inflexion in Curve 1, its precipitation had become complete when the theoretical amount of silver nitrate had been

added, *viz.* 6 c.c. At that point the silver ion concentration suddenly increased from about 10^{-14} to 10^{-11} , when the silver bromide began to separate. This was when 6.8 c.c. had been added, there being thus only 0.8 c.c. between the end of precipitation of silver iodide and the beginning of precipitation of silver bromide. Throughout the addition of the 0.8 c.c. the silver iodide precipitate had not completely coagulated, and so it was impossible to say when the bromide had begun to



precipitate. The fact that the bromide began to be precipitated on the addition of 0.8 c.c. was ascertained by a separate experiment. The remaining section of the curve shows that the silver bromide was completely precipitated when 30 c.c. of silver nitrate had been added, and that a considerable amount of silver nitrate was required before the silver chloride began to separate. These concentrations of ammonia and silver nitrate thus permit of the quantitative separation of the bromide and the chloride, but not of the iodide from the bromide. The relatively large amount of silver nitrate which had to be added before the chloride began to precipitate makes it possible to prepare an ammoniacal solution of silver nitrate

whose silver ion concentration is intermediate between that required for the precipitation of silver bromide and that required for silver chloride. Thus it will be seen from Curve 1 that a solution containing 100 c.c. of 3.37 *N* ammonia and 50 c.c. of 0.5 *N* silver nitrate precipitated silver bromide completely, but did not precipitate silver chloride, excepting when the chloride concentration was exceptionally great.

The suddenness of the change in silver ion concentration after the precipitation of the silver iodide (Curve 1) rendered it impossible to obtain a separation of the iodide from the bromide by using such small concentrations of ammonia and silver nitrate. Titrations were next done in which the rate of change in the ratio of the ammonia to silver nitrate was more gradual, by using more concentrated solutions of ammonia and less concentrated solutions of silver nitrate. In each case 100 c.c. of the following solutions were titrated with 0.1 *N* silver nitrate:— Titration No. 2, 18 *N* ammonia containing 5 millimols of both potassium iodide and potassium bromide; titration No. 3, 8 *N* ammonia containing 3 millimols each of potassium iodide and potassium bromide; titration No. 4, 4 *N* ammonia containing 4 millimols of potassium iodide and of potassium bromide. All the titrations were carried out at room temperature, but it should be stated that during the addition of the first 40 c.c. of the silver nitrate to the 18 *N* solution of ammonia (sp. gr. 0.880), it was not possible to maintain that temperature on account of freezing which took place in the junction tube. In titration No. 2 the silver iodide was completely precipitated and the mother liquor had become clear long before the precipitation of the bromide commenced, some 30 c.c. of silver nitrate having been necessary. The use of an ammonia solution in No. 3 of approximately half the concentration used in No. 2 caused 10 c.c. of silver nitrate to be required between the end of the iodide precipitation and the beginning of the bromide. In both cases it was found possible in parallel experiments to separate the silver iodide completely by filtration through a Gooch crucible, and washing with a dilute ammonia solution. This was not the case in titration No. 4, for the end of the precipitation of the iodide was almost coincident with the beginning of the next precipitation.

It is possible to get from the curves an approximate idea of the amounts of iodide present. In Curve 1 the inflexion occurred when 6 c.c. of 0.5 *N* silver nitrate, the theoretical amount, had been added. In Curves Nos. 2, 3 and 4, the inflexions indicating the ends of the precipitation are somewhat inclined, but they cross the lines corresponding to the theoretical amounts of 0.1 *N* silver nitrate at points very near to the middle points. The sharp inflexion produced in titration No. 1, in which a dilute solution of ammonia was used, confirms the observation of Behrend (*Zeitsch. physikal. Chem.*, 1893, 11, 466), who found that the iodide could thereby be estimated in a solution which contained a little dilute ammonia. He showed that, although it was not possible to separate the three halides, the amount of each present in a mixture could be computed from the electrometric titration of the iodide, the titration of the total halides, and their gravimetric determination.

The following values show that the precipitations were determined by the respective solubility products, which were calculated by assuming that the potassium halides were completely ionised and multiplying the halide concentrations by the silver ion concentrations at which the various precipitations occurred. Mean values at 18°: $[Ag^+][I^-] = 7 \cdot 10^{-17}$, $[Ag^+][Br^-] = 2 \cdot 8 \cdot 10^{-13}$, $[Ag^+][Cl^-] = 1 \cdot 8 \cdot 10^{-10}$. Previous values: $[Ag^+][I^-]$, $2 \cdot 6 \cdot 10^{-16}$ at 20·8° C., Kohlrausch, *Zeitsch. physikal. Chem.*, 1908, **64**, 148; $[Ag^+][Br^-]$, $3 \cdot 1-5 \cdot 1 \cdot 10^{-13}$ at 18° C., Kolthoff, *Zeitsch. anorg. Chem.*, 1921, **119**, 209; $[Ag^+][Cl^-]$, $1 \cdot 1 \cdot 10^{-10}$, Melcher, *J. Amer. Chem. Soc.*, 1910, **32**, 54; $0 \cdot 87 \cdot 10^{-10}$ at 20·8° C., Kohlrausch, *loc. cit.*

It is intended to investigate the method suggested by these experiments from the analytical point of view, and especially to see if it is capable of separating halides when they happen to be present in traces.

The author thanks Prof. J. C. Philip, F.R.S., for the use of the apparatus, and the Department of Scientific and Industrial Research for a personal grant.

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Erratum :—In the paper on “The Reduction of Chloric Acid and Chlorates by Ferrous Sulphate” the words (p. 541, line 12) “mixture of potassium chloride and chlorate” should read “mixture of potassium chloride and perchlorate.”

Notes.

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

CRYSTALLINE DIGALLIC ACID AS A PRECIPITANT.

ALTHOUGH a great deal of work has been done on gallotannin, our present knowledge of it is most unsatisfactory. Thus we have described in the literature optically-inactive gallotannin [Karsten, Krecke, Nierenstein] and optically-active gallotannin which may [Feist, Fischer, Nierenstein] and may not [Sisley, Mitchell, Nierenstein] contain glucose. Furthermore, all recent work [Steinkopf, Iljin, Nierenstein, Feist, Karrer] goes to show that gallotannin is a mixture, and that even gallotannin when purified by Fischer's or Nierenstein's method contains free gallic acid [Nicholson, using Mitchell's colorimetric method].

It therefore seems desirable that gallotannin should be replaced in analysis [compare, for example, Powell and Schoeller, *ANALYST*, 1925, 498] by a more reliable reagent such as crystalline digallic acid. This substance possesses all the properties of gallotannin: it is precipitated by gelatin and alkaloids [Nierenstein, Fischer] and it gives the gold-beaters' skin test for tannins [Price]. The preparation of digallic acid from gallotannin [Nierenstein] or gallic acid [Fischer] offers no or very few difficulties, and the same applies to the separation of *m*-digallic acid from *p*-digallic acid, which are simultaneously obtained by Fischer's method [Nierenstein].

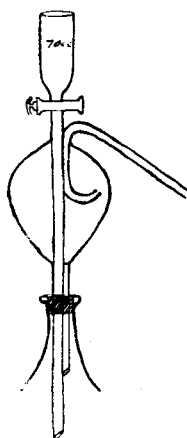
The use of Fischer's synthetic pentagalloyl-glucose is not suggested, since recent work has shown [Karrer] that there is a fundamental difference between

pentagalloyl-glucose as prepared by the Fischer-Freudenberg or by the Fischer-Bergmann method, which is very remarkable. Furthermore, it is found [Nierenstein] that pentagalloyl-glucose if prepared by either of these two methods does not give the gold-beaters' skin test for tannins. Pentagalloyl-glucose is therefore not a tannin, and it is to be regretted that recent work on the chemistry of ink [Zetsche] has been carried out on such a doubtful substance as pentagalloyl-glucose and not on such a well-defined product as digallic acid.

M. NIERENSTEIN.

THE UNIVERSITY, BRISTOL.

NEW SPLASH-HEAD FOR KJELDAHL APPARATUS.



IN determining nitrogen by Kjeldahl's method, there are distinct advantages in making the digestion with acid and subsequent distillation in the same flask, a 300 c.c. Pyrex flask being used throughout the operation. To obviate the difficulty of fitting a splash head and a tap funnel into a comparatively narrow-necked flask the piece of apparatus shewn in the sketch has been designed by my assistant, Mr. C. E. V. Sykes. The main feature is that the tube from the tap funnel passes through the centre of the bulb of the splash-head, the whole being sealed together, with the advantage that the splash-head and funnel are in one piece and that only a single hole is required in the rubber cork. To keep the liquid to be distilled at a small volume it is rendered alkaline with 50 per cent. sodium hydroxide solution, which ensures freedom from carbonates. This piece of apparatus has now been used for some considerable time in my laboratory with most satisfactory results.

HAROLD LOWE.

DAYLIGHT-SPECTACLES.

THE newest invention in technical optics is that of spectacles with blue glasses, the special colouring of which changes artificial light into the light of the colour and composition of daylight (*cf.* ANALYST, 1925, 362). It must be distinctly understood that their lenses act as colour filters only, and do not influence the sight of people of normal vision.

The daylight spectacles are intended to be used with gas-filled incandescent electric lamps, and show absolutely correct daylight colours with 200 Watt lamps; but they also give excellent results with lamps of other Watt values, and the difference is very slight. Obviously, stronger lamps than usual must be used, to allow for the loss of light through absorption of red and yellow rays. Apart from their value in many industries, such as dyeing, the "Lumina" spectacles have been found satisfactory for all laboratory purposes, and notably for matching the concentrations of H- or OH- ions by means of comparative colour scales.

H. WEISZ.

Notes from the Reports of Public Analysts.

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

CITY OF BIRMINGHAM.

REPORT OF THE CITY ANALYST FOR THE THIRD QUARTER, 1925.

OF the 1307 samples submitted for analysis, 1139 were analysed under the Food and Drugs Acts, 1079 being bought informally (31 adulterated) and 60 formally (25 adulterated). The percentage of adulterated samples was 4.9, as compared with 1.8 to 5.0 in the third quarters of the previous five years.

MILK.—Of the 615 samples examined, 6.8 per cent. were adulterated (2.3 per cent.).

CREAM.—Eleven samples were free from boric acid. Two others, though free from preservatives, were falsely labelled "Preserved Cream." Fifteen samples of preserved cream contained 0.10 to 0.22 per cent. of boric acid and had standard declaratory labels. One, however, was also incorrectly marked "Thick Rich Cream."

MARGARINE.—The average percentage of water in the 41 samples examined was 12.7, and 75 per cent. of them contained boric acid, the largest amount being 0.3 per cent.

LARD.—Forty samples of lard were genuine. One informal sample sold as "cooking lard," contained vegetable oils and was reported as adulterated. The term "cooking lard" is not generally known in the trade, but is used in Birmingham to describe foreign genuine lard, in contradistinction to English lard, which is sometimes used for spreading on bread and termed "eating lard."

CALCINED MAGNESIA. CARBONATE OF MAGNESIA.—At 5 shops when *carbonate of magnesia* was asked for, the genuine article was supplied, although in one case it was labelled "magnesia." There is some local practice for using the term "magnesia" for either compound. The B.P. requires magnesia not to lose more than 1 per cent. in weight when, heated to redness. This appears unduly stringent for samples sold in retail shops, but the loss should certainly not exceed 5 per cent. Samples from 3 vendors lost 31.4 per cent., 11.1 per cent., and 28.9 per cent., probably owing to their having been kept under unsuitable conditions. The vendors were cautioned. One informal sample consisted of heavy carbonate of magnesia, as did also the subsequent formal sample. The vendor was prosecuted and fined £1.

AMMONIATED TINCTURE OF QUININE.—Six informal samples contained from 1.92 to 2.04 grms. of quinine sulphate per 100 c.c. (B.P. requires 2 grms.), and 5 of the 6 were also in reasonable agreement with the B.P. standard for ammonia (about 0.9 gm. per 100 c.c.). A caution was given in respect of one sample, which contained only 0.7 gm. The deficiency was probably due to improper keeping.

J. F. LIVERSEEGE.

COUNTY BOROUGH OF SALFORD.

ANNUAL REPORT OF THE BOROUGH ANALYST FOR 1924.

DURING the year, 1700 samples were submitted, of which 1544 were taken under the Food and Drugs Acts, and 156 were sent by various Corporation Departments. Of the Food and Drugs samples, 66 (4.3 per cent.) were adulterated.

MILK.—Twenty-two of the 833 samples of milk (2.6 per cent.) were adulterated.

BUTTER.—Eighty-one samples were examined, all of which were genuine. Eighteen contained boron preservative (about 0.3 per cent. as boric acid).

MARGARINE.—None of the 18 samples was adulterated. Each of three samples tested contained boron preservative (0.3, 0.4 and 0.4 per cent. as boric acid). Proceedings were taken in the case of a sample of "Margarine blended with Butter," in which only 0.5 per cent. of butter fat was found. The Stipendiary, feeling bound by the case of *Anness v. Grivell*, dismissed the case, although he stated that he thought the public were being deceived.

In that High Court case, heard in 1915, the appellant had sold as "a very good mixture of butter and margarine," a substance containing 80 per cent. of margarine, 15½ per cent. of water, salt, etc., and only 4½ per cent. of butter. As Sec. 8 of the Act of 1899 prohibits the sale of a mixture containing more than 10 per cent. of butter the Court felt compelled to hold that no offence had been committed.

It was not pointed out to the Court, however, that the limit of 10 per cent. of butter does not refer to "mixtures of butter and margarine," but to margarine.

It would appear desirable either to attempt an alteration of the law by means of fresh legislation or to take a case to the High Court for further consideration.

CHEESE.—Twenty samples of cheese were found to be genuine (fat 15.5 to 50.5 per cent.) Of 55 samples of Cheshire cheese, 6 were returned as adulterated. For some time past large quantities of cheese, made from half-cream and three-quarter-cream milk have been imported from Holland, such cheese being exactly similar in texture, shape and rind to genuine Cheshire cheese. Proceedings were taken in two glaring instances, and fines of £2 and £3, respectively, were imposed.

DIABETIC FOODS.—Eleven samples were classed as genuine, notwithstanding the fact that some of them contained over 60 per cent. of starch. The samples were accompanied by a booklet giving analyses of the foods, and these were in reasonable agreement with the results found. It is questionable whether the purchasers understand the meaning of these analyses. The price charged for a diabetic flour, the analysis of which was very similar to that of ordinary wheat flour, was 7s. 6d. for a bag of about 6 lbs.

DRUGS.—Nineteen of 190 samples of drugs were found to be adulterated.

Almond Oil.—Of 34 samples examined 5 consisted of peach kernel oil. The vendor of one proved a warranty, and proceedings were then taken against the wholesale firm, who, however, proved to the satisfaction of the Court that when they gave the warranty they had reason to believe the description to be true (Subsec. 6, Sec. 20, Food and Drugs Act). Hence the matter could not be carried further, as the original dealers from whom the wholesale firm had bought the oil had not given a warranty and no sample had been purchased directly from them.

Paregoric.—Twelve samples were examined, of which 6 were satisfactory; the other six contained no tincture of opium, and were therefore classified as adulterated. Some of these opium-free preparations are sold as "Paregoric Substitute," or "Paregoric Essence," but these are misleading terms, and samples without opium sold in the Borough under such names will be condemned as adulterated.

Calcined Magnesia.—A sample lost 16·7 per cent. in weight on ignition. The vendor was informed and he destroyed the whole of his stock.

Turpentine.—Five of eleven samples were adulterated. They contained from 10 to 95 per cent. of turpentine substitute of a petroleum character. One sample was labelled "Blended Turpentine. Excellent for Household Cleaning Purposes. Not to be used for lotions or Medical Use. Not a pure Vegetable Spirit." It contained not more than 5 per cent. of turpentine. In view of the statement on the label, it is probable that no conviction would be obtained under the Food and Drugs Act, but possibly a prosecution under the Merchandise Marks Act might be more successful. The Health Committee of the Borough has given instructions that manufacturers should be approached to get the question of turpentine substitutes adjusted without legal action.

ARSENIC IN FOOD WRAPPERS.—Since the report on the presence of arsenic in the printing ink on wrapping papers (ANALYST, 1924, 49, 336), wrappers of all kinds have been tested, but no arsenic has been found on any of them. Eight samples of printing ink of various makes have also been examined, and in no case has the amount of arsenic found exceeded 10 parts per million—a quantity which, when used in the preparation of coloured wrappers, is infinitesimal and quite harmless.

G. D. ELSDON.

Legal Notes.

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

WATERED MILK: RELATED CASES TAKEN UNDER TWO ACTS.

Two related cases were heard at Great Missenden (Bucks.) Petty Sessions on October 19th. In the first case there were two defendants (mother and son), and in the second case one defendant (the mother), and the summonses were in respect of watered milk.

The case against the joint defendants was taken under Sec. 6 of the Food and Drugs Act. According to the prosecution, on September 13th, the day before the alleged offence, a sample was taken from a milk retailer who was supplied by the defendants.

Objection to this statement was taken by the solicitor for the defence, on the ground that nothing ought to be mentioned other than that concerned with the alleged offence. To this the prosecutors replied that under Paragraph 4 of the Schedule in the Milk and Dairies Consolidation Act they were entitled to introduce this matter, as it had a bearing on what followed.

The Chairman of the Bench said that under the circumstances it would be better, for the present, for the statement to be confined to the circumstances of the date of the alleged offence; it might be that antecedent matters could be introduced later.

Evidence was then given by the retailer that he had a contract to purchase milk daily from the defendants. He fetched milk from the farm on September

14th. On the previous day a sample of the milk he was delivering, and which he had fetched from the farm, had been taken.

Mr. Jenks (the inspector) stated that on September 14th he entered the dairy and saw both defendants. He informed them that a sample of milk taken from the retailer the previous day, and alleged to have come from the defendants' farm had been found not satisfactory, and he had therefore come to take samples at the place where the milk was handed to the retailer. Witness was shown the milk which was about to be supplied to the retailer; it stood in the dairy in two pails. He took samples with the usual formalities, and the certificate of the Public Analyst, Mr. E. W. Voelcker, now produced, showed that there was 8 per cent. of added water (7.82 per cent. solids-not-fat; 3.02 per cent. of fat).

On the following day, at 6 a.m., witness went to the farm again, where he saw the male defendant, and asked permission to take samples of the milk as it came direct from the cow. No objection was made, and, as each of the nine cows was milked, a sample was taken of the milk. The male defendant carried the milk to the dairy, 40 yards away, and witness examined the cooler and utensils, and found that they were dry and in order. Witness took samples of the bulk of the milk and sent one for analysis, and the certificate showed that it contained 3.7 per cent. of fat and 8.95 per cent. of solids-not-fat. If this were taken as the standard milk it showed that there was 12 per cent. of added water in the sample taken upon the previous day.

The solicitor for the defence now said that he withdrew the plea of "not guilty" for the female defendant, but asked that the case against the son should be dismissed, as he had no knowledge of the watering of the milk. After hearing the evidence of the son, the Bench dismissed the case against him upon payment of costs. The female defendant was fined £10, and the Analyst's fee of one guinea was allowed.

The second case, against the female defendant, was then heard. This, said the prosecution, was taken under Sec. 4 of the Milk and Dairies Act, according to which any person adding water to milk was liable upon a first conviction to a fine of £5. There was no obligation with regard to samples as there was under the Sale of Food and Drugs Act, although the defendant had been supplied with a copy of the Analyst's certificate.

The incidents arose during the time samples of milk were being taken in connection with the previous case. The inspector had accompanied the defendant's son when he took the first lot of milk to the dairy and placed it in the cooler. As a sample was to be taken, the defendant's son was asked to see that the milk was not interfered with. The matter cut both ways: if the sample of milk taken direct from the cows was bad, then defendants would not have been prosecuted in respect of the bad sample taken from the retailer; if it was good, they would be prosecuted. When the second lot of milk was taken to the dairy the inspector noticed that a pail of milk stood upon the table. When the defendant was remonstrated with, she explained that she had taken it out of the cooler, thinking the inspector had left. When asked whether she had measured it up for the retailer (mentioned in the previous case) she refused to answer. Witness proceeded to hand in the certificate of the Public Analyst on a sample of the milk in the pail.

The solicitor for the defence objected to this certificate being put in, as the regulations under the Food and Drugs Act had not been complied with, and, until they were complied with the analyst's certificate was not evidence.

To this the prosecution replied that the case was taken under the Milk and Dairies Act, under which the certificate was sufficient unless the defendant desired the analyst to be called as a witness.

The Bench, after consultation, decided that the case must go on. The certificate was then handed in, and showed that there was at least 13 per cent. of added water in the sample (7·39 per cent. of solids-not-fat and 3·6 per cent. of fat).

For the defence it was contended that the case for the prosecution had failed. The milk in the pail was intended for the house, and was never intended for sale. If so, the case must fail, because the dairyman could do what he liked with milk for the house and not for sale.

The Chairman here suggested that the defendant should be called, but the solicitor said she was an old lady, and would not attend the Court, but, that if she were called, it would make no difference. It was for the prosecution to prove that the milk was for sale. There was milk in the pail in the dairy; it was watered milk which had been watered after being taken from the cooler; and the justices might assume what was going to be done with it, but assumption was not enough—there must be proof that the milk was for sale, and not a bit of evidence had been called to show that it was for sale.

Defendant's son, called for the defence, was unable to say what sort of milk was used in the house. In cross-examination, he said that his mother never denied that she measured up the milk for the retailer, although she did not say she had done so.

The Bench imposed a fine of £5, and allowed a fee of one guinea for the analyst.

WATERED MILK AND A PUNCTURED COOLER.

ON October 26th a farmer (also described as a builder), of Hyde Heath, Bucks., was summoned at Amersham for having sold to an Amersham dairyman milk containing added water.

Two samples were taken from churns being delivered to the retailer at 9·30 a.m. on Sunday, September 13, and these, on analysis by the County Analyst, Mr. E. W. Voelcker, were found to contain only 7·5 per cent. of solids-not-fat and 2·7 per cent. of fat, and 7·7 per cent. of solids-not-fat and 2·4 per cent. of fat respectively.

A county inspector said that on September 18th he had visited the farm of the defendant, who remarked: "I am glad you have come; I have been expecting you. Have you seen the cooler?" Witness replied that he had seen the cooler, to which his attention had been drawn by the cowman. He had found upon one of its rounds a punctured hole about $\frac{1}{4}$ in. to $\frac{1}{8}$ in. in diameter. Witness had pointed out to the defendant that the cooler was a strong one, made of sheet copper and tinned over; that the hole certainly seemed to have been freshly made; that the edges of the hole turned inwards and not outwards; and, that from the freshness of the marks on the bright jacket, the edges seemed to have been recently made. To this the defendant had agreed, and he had also said that it looked as if a hole had been deliberately made.

A sample of the milk from the cows on the farm was submitted to the Public Analyst, whose report showed that it contained 3·6 per cent. of fat and 8·88 per cent. of solids-not-fat. Taking this as the standard, the other samples would contain 16 and 13 per cent. of added water, respectively.

The defendant, giving evidence, stated that he had not observed any leakage of water in the cooler on the Saturday morning; he had not cooled the milk himself on the Sunday morning (when the samples were taken), but on the Sunday afternoon the cowman informed him that he could not cool the afternoon's milk, as he had discovered a hole in the cooler.

In cross-examination about the appearance of the hole the defendant stated that, having been in the building trade for 40 years, he had some experience of bursts. At the place where this hole came in the cooler there must have been a weak spot. When the cooler was cleaned it was weakened, and eventually a small hole came. When the cooler was again scrubbed after the hole was made the edges would be forced inwards.

The cowman stated that he saw nothing wrong with the cooler on the Sunday morning, but in the afternoon he found that the water dripped out of the receptacle. He could not account for the hole, and had not punched it himself. He was handed delivery tickets, and said that they showed that on the two days prior to the samples being taken $11\frac{3}{4}$ gallons and $12\frac{1}{4}$ gallons were delivered, and upon the two subsequent days 9 and $9\frac{3}{4}$ gallons (previous evidence had shown that $11\frac{3}{4}$ gallons were delivered upon the day the samples were taken, and that defendant was under contract to supply the retailer with 12 gallons per day).

Here the defendant was recalled to explain that he had four cows going dry.

The Chairman of the Bench (Mr. Ernest Mathews) said that there must be a conviction, and there would be a fine of £5 in each case. Two guineas costs for the Public Analysts' fees was allowed.

CALOMEL OINTMENT DEFICIENT IN MERCUROUS CHLORIDE.

ON October 26, a firm of Holborn druggists was summoned at Bow Street Police Court for having sold calomel ointment deficient in mercurous chloride to the extent of 42·5 per cent. The Public Analyst's report on the sample showed that it contained 11·5 per cent. of mercurous chloride and 88·5 per cent. of benzoated lard, whereas calomel ointment, prepared according to the B.P., should contain 20 per cent. of mercurous chloride.

For the prosecution it was pointed out that the B.P. standard for calomel ointment up to 1914 was 10 per cent. of mercurous chloride, but that in that year it was changed to 20 per cent. The deficiency would have been more serious if the sample had been a preparation of medicine.

Mr. Glyn Jones, for the defence, said that he was prepared to admit the correctness of the analysis, and to plead guilty to the summons. The defendants still had certain customers who required the 10 per cent. ointment, whilst others asked for a 30 per cent. ointment. In this instance a new manager had supplied some of the ointment of 10 per cent. strength which had been prepared before he went to the firm.

A fine of £7 was imposed.

Ministry of Health.

MILK AND DAIRIES (CONSOLIDATION) ACT, 1915.*

[5 & 6 GEO. 5. CH. 66.]

MILK AND DAIRY ORDERS.

1.—(1) The Local Government Board may make such general or special orders (hereinafter referred to as Milk and Dairies Orders) as they think fit for all or any of the following purposes :—
 (a) For the registration with local authorities of all persons carrying on the trade of dairymen ;
 (b) for the registration with local authorities of all dairies ; (c) for the inspection of cattle in dairies ;
 (d) for the inspection by persons authorised by the local authority for the locality in which the dairy is situate of dairies and persons in or about dairies who have access to the milk or to the churns or other milk receptacles ; (e) for prescribing and regulating the lighting, ventilation, cleansing, drainage, and water supply of dairies in the occupation of persons following the trade of dairymen ; (f) for securing the cleanliness of milk stores, milk shops, and milk vessels used for containing milk for sale by such persons ; (g) for prescribing the precautions to be taken for protecting milk against infection or contamination ; (h) for preventing danger to health from the sale for human consumption, or from the use in the manufacture of products for human consumption, of infected, contaminated, or dirty milk ; (i) for regulating the cooling, conveyance, and distribution of milk intended for sale for human consumption, or for use in the manufacture of products for human consumption ; (j) as to the labelling, marking, or identification and the sealing or closing of churns, vessels, and other receptacles of milk for sale for human consumption or used for the conveyance of such milk ; (k) for prohibiting the addition of colouring matter ; and for prohibiting or regulating the addition of skimmed or separated milk or water or any other substance to milk intended for sale for human consumption, or the abstraction therefrom of butter-fat or any other constituent ; and for prohibiting or regulating the sale for human consumption of milk to which such an addition or from which such abstraction has been made or which has been otherwise artificially treated ; (l) for authorising the use in connexion with the sale of milk, of the designation " certified milk," for prescribing the conditions subject to which milk may be sold under such designation, and for prohibiting the use of such designation in connexion with the sale of milk in respect of which the prescribed conditions are not complied with ; (m) for authorising a local authority to make regulations for the purposes aforesaid, or any of them, subject to such conditions (if any) as the Local Government Board prescribe.

(2) A Milk and Dairies Order with respect to the inspection of cattle in a dairy may authorise the person making the inspection to require any cow to be milked in his presence and to take samples of the milk, and to require that the milk from any particular teat shall be kept separate and to take separate samples thereof.

(3) If any person is guilty of a contravention of, or non-compliance with, the provisions of any Milk and Dairies Order, he shall be guilty of an offence against this Act.

(4) Milk and Dairies Orders shall be made by the Local Government Board with the concurrence of the Board of Agriculture and Fisheries, and shall have effect as if enacted in this Act.

(5) All Milk and Dairies Orders shall be laid before each House of Parliament as soon as may be after they are made ; and if an Address is presented to His Majesty by either House of Parliament within the next subsequent forty days on which that House has sat next after the order is laid before it praying that the order may be annulled, it shall thenceforth be void, but without prejudice to the validity of anything previously done thereunder, or to the making of a new order. If the session of Parliament ends before such forty days as aforesaid have expired, the order shall be laid before each House of Parliament at the commencement of the next session as if it had not previously been laid.

(6) The Rules Publication Act, 1893, shall apply to any such order as if it was a statutory rule within the meaning of section one of that Act.

POWERS OF ENFORCING MILK AND DAIRIES ORDERS.

2. A local authority and their officers for the purpose of enforcing a Milk and Dairies Order and any regulations made thereunder shall have the same right to be admitted to any premises as a local authority within the meaning of the Public Health Act, 1875, and their officers have

* This Act came into operation on September 1st, and the Publication Committee has therefore decided that, for convenience of reference, it should be printed in full (*cf.* ANALYST, 1925, 453). It is sold by H.M. Stationery Office. Price 6d. net.—EDITOR.

under section one hundred and two of that Act for the purpose of examining as to the existence of any nuisance thereon, and if such admission is refused, the like proceedings may be taken, with the like incidents and consequences, as to orders, payment, penalty, costs, expenses and otherwise, as in the case of a refusal to admit to premises for any of the purposes of the said section one hundred and two :

Provided that nothing in this section shall authorise any person, except with the permission of the local authority under the Diseases of Animals Acts, 1894 to 1914, to enter any cowshed or other place in which an animal affected with any disease to which those Acts apply is kept and which is situated in a place declared under those Acts to be infected with such disease.

POWER TO STOP SUPPLY OF MILK LIKELY TO CAUSE TUBERCULOSIS.

3.—(1) If the medical officer of health of a county or county borough is of opinion that tuberculosis is caused or is likely to be caused, by the consumption of the milk supplied from any dairy in which cows are kept within such county or county borough, the provisions of the First Schedule to this Act shall have effect with respect to the reports to be made and the steps to be taken with a view to stopping the supply of milk from the dairy, and, with a view to stopping such supply, orders may be made in accordance with that schedule, subject to such right of appeal and the payment of compensation in such cases as are provided therein.

(2) Where an order stopping the supply of milk is made under the said schedule a dairyman shall not be liable for an action for breach of contract if the breach is due to such order.

(3) If any dairyman, whilst any order made in accordance with the said schedule prohibiting the supply or use of milk is in force, supplies or uses any milk in contravention of this order he shall be guilty of an offence against this Act.

(4) The Local Government Board may by order direct that the council of any non-county borough within the county, which is a local authority for the purposes of the Diseases of Animals Acts, 1894 to 1914, shall exercise and perform within the borough the powers and duties of the county council under this and the next succeeding section, and where such an order has been made with respect to any non-county borough this and the next succeeding section shall apply as if the borough were a county borough.

OBLIGATION TO INSPECT DAIRIES IN CERTAIN CASES.

4.—(1) If the medical officer of health of any local authority has reason to suspect that tuberculosis is caused, or is likely to be caused, by the consumption of any milk which is being sold or exposed or kept for sale within the area of the local authority, he shall endeavour to ascertain the source or sources of supply, and on ascertaining the facts shall forthwith give notice of them to the medical officer of health of the county or county borough in which the cows from which the milk is obtained are kept, whether the dairy where they are kept is within or without the area of the local authority, unless the local authority are themselves the council of that county or county borough.

(2) On the receipt of such notice it shall be the duty of the medical officer of health of the county or county borough to cause the cattle in the dairy to be inspected, and to make such other investigations as may be necessary.

(3) Sufficient notice of the time of the inspection shall be given to the local authority whose medical officer of health gave the notice, and to the dairyman to allow that officer or a veterinary inspector or other veterinary surgeon appointed by the authority, and, if desired, another veterinary surgeon appointed by the dairyman being present at the inspection if either party so desire.

(4) The council of the county, or county borough on whose medical officer of health the notice is served shall send to the medical officer of health of the local authority who gave the notice copies of any reports which may have been made by the medical officer of health making the inspection, and of any veterinary or bacteriological or other reports which may have been furnished to him, and shall give him information as to whether any action has been taken upon those reports and as to the nature of that action.

PROHIBITION OF SALE OF TUBERCULOUS MILK.

5. If a person—(a) Sells, or offers or exposes for sale, or suffers to be sold or offered or exposed for sale, for human consumption or for use in the manufacture of products for human consumption ; or (b) uses or suffers to be used in the manufacture of products for human consumption ; the milk of any cow which has given tuberculous milk, or is suffering from emaciation due to tuberculosis, or from tuberculosis of the udder, or from acute inflammation of the udder, or from any of the diseases specified in the Second Schedule to this Act, he shall be guilty of an offence against this Act, if it is proved that he had previously received notice from an officer of a local authority, or that he otherwise knew, or by the exercise of ordinary care could have ascertained, that the cow had given tuberculous milk, or was suffering from any such disease.

PROVISIONS AS TO SELLING MILK IN A PUBLIC PLACE.

6. Every person who, himself or by his servant, in any highway or place of public resort sells milk from a vehicle or from a can or other receptacle shall have conspicuously inscribed on the vehicle or receptacle his name and address, and in default shall be liable on summary conviction to a fine not exceeding two pounds.

PROVISIONS AS TO CONDENSED, SEPARATED, OR SKIMMED MILK.

7. Every tin or other receptacle containing condensed, separated, or skimmed milk must bear a label, clearly visible to the purchaser, on which the words "Machine-skimmed Milk," or "Skimmed Milk," as the case may require, are printed in large and legible type, and if any person sells or exposes or offers for sale condensed, separated or skimmed milk in contravention of this section he shall be liable on summary conviction to a fine not exceeding ten pounds.

POWER TO TAKE SAMPLES OF MILK.

8.—(1) It shall be lawful for an inspector of the Local Government Board, or the medical officer of health of a local authority, or any person provided with and, if required, exhibiting an authority in writing from such an inspector or from the local authority or medical officer of health, to take for examination samples of milk at any time before it is delivered to the consumer :

Provided that the powers of a medical officer of health and of a person authorised by him or by the local authority under this section shall, except so far as the Local Government Board may otherwise direct, be exercisable only within the area of the local authority.

(2) The result of an analysis or bacteriological or other examination of a sample of milk taken under this Act shall not be admissible as evidence in proceedings under this Act, or in proceedings under the Sale of Food and Drugs Acts, 1875 to 1907, unless the provisions of the last-mentioned Acts which relate to the division of samples into parts are complied with, but if those provisions have been complied with, the result of the analysis shall be available for proceedings under the said Acts (as if it had been procured in accordance with those Acts) as well as for proceedings under this Act :

Provided that no proceedings shall be taken against any person unless at the time the sample was taken the milk was in his custody or control or was contained in a churn or other receptacle which had been sealed or closed in accordance with a Milk and Dairies Order.

(3) The medical officer of health or any other officer authorised for the purpose by a local authority within the area of which milk from any dairy situate outside that area is being sold or exposed or kept for sale, may by notice in writing require the medical officer of health or other authorised officer of any other local authority, being an authority for the purposes of the Sale of Food and Drugs Acts, 1875 to 1907, to take samples of the milk at that dairy or in the course of transit from that dairy to the area of the first-mentioned local authority.

(4) Upon receipt of such notice it shall, subject to the provisions of subsection (1) of this section, be the duty of the medical officer of health or other authorised officer of the other authority as soon as practicable to take samples and to forward, for analysis or bacteriological examination, to the officer who gave the notice a part of any sample so taken, and in taking a sample the officer shall, if so required by the notice, comply with the provisions of the Sale of Food and Drugs Acts, 1875 to 1907, which relate to the division of samples into parts.

The authority requiring the samples to be taken shall be liable to defray any reasonable expenses incurred, the amount whereof shall in default of agreement be settled by the Local Government Board.

For the purpose of the Sale of Food and Drugs Acts, 1875 to 1907, the sample shall be deemed to have been taken within the area of the officer who gave the notice, and proceedings under those Acts may be taken either before a court having jurisdiction within the district for which that officer acts or before a court having jurisdiction in the place where the sample was actually taken.

(5) In any proceedings under the Sale of Food and Drugs Acts, 1875 to 1907, or this Act, the production of a certificate of the officer who took the sample under this section that the provisions of this section, as to the manner in which samples are to be dealt with, were complied with shall be sufficient evidence of compliance, unless the defendant requires that officer to be called as a witness.

(6) In the exercise at any railway station or upon any railway premises of the powers conferred upon him by this section, such inspector, medical officer of health, or other person so authorised as aforesaid shall conform to such reasonable requirements of the railway company owning or using such station or premises as are necessary to prevent the working of the traffic thereat being obstructed or interfered with.

AMENDMENT OF SALE OF FOOD AND DRUGS ACTS.

9.—(1) The provisions of the Sale of Food and Drugs Acts, 1875 to 1907, in reference to the taking of samples of milk, and any proceedings in connexion therewith shall be amended in accordance with the provisions contained in the Third Schedule to this Act.

(2) So much of any contract, made after the thirteenth day of August nineteen hundred and fourteen, whether made before or after the passing of this Act, as requires a purveyor of milk on a sample of his milk being taken under the Sale of Food and Drugs Acts, 1875 to 1907, to send to the person from whom he procured the milk any part of such sample or to give such person notice that a sample has been so taken, shall be null and void.

APPOINTMENT OF VETERINARY INSPECTORS.

10.—(1) A local authority may, and when required by the Local Government Board shall, appoint or combine with another local authority in appointing one or more veterinary inspectors or employ for the purposes of this Act and the Milk and Dairies Orders any veterinary inspector appointed under the Diseases of Animals Act, 1894, and any local authority may, and when required by the Local Government Board shall, provide or arrange for the provision of such facilities for bacteriological or other examinations of milk, as may be approved by the Board.

(2) Any order requiring a combination of local authorities for the purposes of this section may provide for all matters incidental to such combination, and in particular how the expenses incurred are to be apportioned.

REGULATIONS AS TO IMPORTED MILK.

11. The Local Government Board shall make regulations under the Public Health (Regulations as to Food) Act, 1907, for the prevention of danger arising to public health from the importation of milk and milk products intended for sale for human consumption or for use in the manufacture of products for human consumption.

ESTABLISHMENT OF MILK DEPOTS.

12.—(1) The sanitary authority of any district may, with the approval of the Local Government Board, establish and thereafter maintain depots for the sale at not less than cost price of milk specially prepared for consumption by infants under two years of age, and purchase and prepare milk and provide such laboratories, plant, and other things, and exercise and perform such other powers and duties, as may be necessary for the purposes of this section.

(2) The Local Government Board may attach such conditions to their approval as they may deem necessary.

ENFORCEMENT OF DUTIES OF LOCAL AUTHORITIES.

13.—(1) If a local authority fail to fulfil any of their duties under this Act, or under any Milk and Dairies Order, the Local Government Board may after holding a local inquiry make such order as they think necessary or proper for the purpose of compelling the authority to fulfil their duties, and any such order may be enforced by mandamus.

(2) Where the authority in default is a district council, the Local Government Board may determine that all or any of the powers of the council under this Act or the Milk and Dairies Orders be transferred to the county council, and those powers shall be transferred accordingly, and section sixty-three of the Local Government Act, 1894, shall apply as if the powers had been transferred under that Act.

PENALTY FOR OBSTRUCTION.

14. If any person obstructs any inspector or other officer of the Local Government Board, or any medical officer of health, or any veterinary inspector or surgeon, or other officer of or person employed by a local authority, in the execution of his powers under this Act or any Milk and Dairies Order, or fails to give any such officer all reasonable assistance in his power, or to furnish him with any information he may reasonably require, he shall be guilty of an offence against this Act.

SUPPLEMENTAL PROVISIONS.

15.—(1) The Local Government Board may by order apply for the purposes of this Act the provisions of any public general Act relating to the holding of local inquiries by the Local Government Board, and the expenses of such inquiries, and the powers of the persons holding any such inquiry, and the manner in which notices may be served.

(2) A local authority may delegate to a committee any of their powers or duties (other than the power of raising rates) under the provisions of this Act or of any Milk and Dairies Order, and in such case anything required or authorised by those provisions to be done to or by the local authority may be done to or by the committee to which such powers and duties have been so delegated.

(3) For the purpose of the exercise and performance of their powers and duties by sanitary authorities under this Act and the Milk and Dairies Orders the purposes of this Act and those Orders shall be deemed to be included amongst the purposes of the Public Health Act, 1875, or the Public Health (London) Act, 1891, as the case may require.

(4) Any inspection of cattle made in pursuance of this Act or any Milk and Dairies Order shall be carried out by a veterinary inspector or other properly qualified veterinary surgeon.

COMPENSATION TO EXISTING OFFICERS OR SERVANTS.

16. If in consequence of the passing of the Milk and Dairies Act, 1914, or this Act, or of anything done in pursuance or in consequence thereof any officer or servant of any local authority who held office at the passing of this Act suffers any direct pecuniary loss by abolition of office, or by diminution or loss of fees or salary, he shall be entitled to have compensation paid to him for such pecuniary loss by the local authority, and such compensation shall be determined in accordance with and subject to the conditions prescribed by section one hundred and twenty of the Local Government Act, 1888, and that section with the necessary adaptations shall apply accordingly.

EXPENSES OF LOCAL AUTHORITIES.

17. The expenses of local authorities under this Act and the Milk and Dairies Orders shall be defrayed—(a) in the case of a county council, out of the county fund, as expenses for general county purposes, or, if an order of the Local Government Board so directs as respects any such expenses as expenses for special county purposes charged on such part of the county as may be provided by the order; (b) in the case of the common council, out of the general rate; (c) in the case of the council of a metropolitan borough, as part of the expenses incurred by the council in the execution of the Public Health (London) Act, 1891; (d) in the case of the council of a municipal borough or urban or rural district, as part of their general expenses incurred in the execution of the Public Health Acts.

PROVISIONS AS TO OFFENCES.

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

(2) Proceedings against a dairyman for failure to comply with an order made under the First Schedule to this Act, requiring the dairyman not to supply milk from a dairy, may be taken before a court of summary jurisdiction, either in the place where the offence was committed or in the place where the dairy is situated, and shall be taken only by the authority by which the order was made.

(3) Where the occupier of a dairy is charged with an offence against this Act, he shall be entitled upon information duly laid by him to have any other person whom he charges as the actual offender brought before the court at the time appointed for hearing the charge; and, if, after the commission of the offence has been proved, the occupier of the dairy proves to the satisfaction of the court—(a) that he has used due diligence to enforce the execution of this Act and the Milk and Dairies Orders; and (b) that the said other person had committed the offence in question without his knowledge, consent or connivance; that other person shall be summarily convicted of the offence, and the occupier shall be exempt from any fine, and the person so convicted shall, in the discretion of the court, be also liable to pay any costs incidental to the proceedings.

(4) When it is made to appear to the satisfaction of the authority by or on whose behalf proceedings are about to be taken—(a) that the actual occupier of the dairy has used all due diligence to enforce the execution of this Act and the Milk and Dairies Orders; and (b) by what person the offence has been committed; and (c) that it has been committed without the knowledge, consent, or connivance of the occupier of the dairy and in contravention of his orders; proceedings shall be taken against the person who is believed to be the actual offender without first proceeding against the occupier of the dairy.

(5) The duty of taking proceedings for enforcing the provisions of section five of this Act shall rest on the county council or county borough council, without prejudice however to the power of a sanitary authority in a county to take such proceedings, and the duty of taking proceedings for enforcing the provisions of any Milk and Dairies Order shall rest on the local authority prescribed in the order, and the clerk of the local authority, or other officer whom the local authority may appoint, shall have power, if so authorised by the local authority, to institute and carry on such proceedings:

Provided that in cases where the Local Government Board make an Order under section three of this Act directing that the council of a non-county borough shall exercise and perform

within the borough the powers and duties of a county council under sections three and four of this Act, the duty of taking proceedings for enforcing the provisions of section five of this Act in such borough shall rest on the council thereof and not on the county council.

(6) Notwithstanding anything contained in any Act to the contrary, all fines imposed in any proceedings instituted by or on behalf of a local authority in the exercise of their powers and duties under this Act shall be paid to the authority and carried to the credit of the fund out of which the expenses incurred by the authority under this Act are defrayed.

(7) The foregoing provisions of this section shall not apply as respects offences under section six or seven of this Act, but in any prosecution of any such offence the summons shall state particulars of the offence or offences alleged, and also the name of the prosecutor, and shall not be made returnable in less than fourteen days from the day on which it is served, and there must be served therewith a copy of any analyst's certificate obtained on behalf of the prosecutor.

INTERPRETATION.

19.—(1) In this Act, unless the context otherwise requires,—

The expression "dairy" includes any farm, cowshed, milk store, milk shop, or other place from which milk is supplied on, or for, sale or in which milk is kept or used for purposes of sale or manufacture into butter, cheese, dried milk or condensed milk for sale, and, in the case of a purveyor of milk who does not occupy any premises for the sale of milk includes the place where he keeps the vessels used by him for the sale of milk, but does not include a shop from which milk is not supplied otherwise than in the properly closed and unopened receptacles in which it was delivered to the shop, or a shop or other place in which milk is sold for consumption on the premises only ;

The expression "milk" includes cream, skimmed milk, and separated milk ;

The expression "dairyman" includes any occupier of a dairy, any cowkeeper, or any purveyor of milk ;

The expression "purveyor of milk" includes a seller of milk, whether wholesale or by retail ;

The expression "medical officer of health" includes any duly qualified medical practitioner authorised by the council to act on behalf of the medical officer of health ;

The expression "veterinary inspector" means an inspector being a member of the Royal College of Veterinary Surgeons or having such other veterinary qualifications as may be approved by the Board of Agriculture and Fisheries ;

The expression "sanitary authority" as respects London means the sanitary authority for the purposes of the Public Health (London) Act, 1891, and elsewhere the council of a borough or of an urban or rural district, and the expression "sanitary district" means the district of such authority ;

The expression "common council" means the mayor, aldermen, and commons of the City of London in common council assembled.

(2) Where milk is sold or exposed or kept for sale it shall be presumed to be sold or exposed or kept for sale for human consumption or for use in the manufacture of products for human consumption, unless the contrary is proved.

(3) Where milk is kept in any dairy, or in the custody or possession of any dairyman, it shall be presumed to be kept for purposes of sale, or manufacture for sale, unless the contrary is proved.

(4) The expression "local authority" in this Act shall include sanitary authorities and county councils, but with respect to the provisions of any Milk and Dairies Order, the order may prescribe by what local authority or authorities the several provisions thereof are to be enforced and executed, and any such order may provide for the giving of assistance and information by county councils to sanitary authorities and by sanitary authorities to county councils for the purpose of their respective duties under this Act or under any Milk and Dairies Order.

(5) The Scilly Islands shall be deemed to be a county and the council of those Islands the council of a county, and any expenses incurred by that council under this Act or the Milk and Dairies Orders shall be treated as general expenses of the council.

APPLICATION TO LONDON.

20.—(1) Section fifty-three of the Public Health Acts Amendment Act, 1907 (which confers powers to require dairymen to furnish lists of sources of supply), shall apply to London as if it were herein re-enacted with the substitution of references to sanitary authorities and districts of sanitary authorities for references to local authorities and districts of local authorities, and any penalties imposed by the said section as so applied shall be recoverable summarily.

(2) Any provisions of the Public Health Act, 1875, applied by this Act shall for the purposes for which they are so applied, extend to London, subject to necessary adaptations.

(3) A Milk and Dairies Order affecting London shall provide for the exercise and performance by sanitary authorities in London of all powers and duties under the order which would have been imposed or conferred on sanitary authorities if this Act had not been passed and the order had been made under section twenty-eight of the Public Health (London) Act, 1891, as amended by sections five and six of the London Government Act, 1899, except that the order may provide for the exercise and performance by the London County Council of powers and duties relating to the inspection of cattle in dairies.

(4) Nothing in this Act, or in any Milk and Dairies Order, shall affect the powers with respect to the registration of dairymen and purveyors of milk within their own area conferred on sanitary authorities in London by section five of the London County Council (General Powers) Act, 1908.

(5) The borrowing of moneys by any metropolitan borough council for the purposes of this Act shall be subject in all respects to the provisions of sections one hundred and eighty-three to one hundred and eighty-nine of the Metropolis Management Act, 1855, as amended by any subsequent Act.

(6) Where the authority in default is a metropolitan borough council the provisions of section one hundred and one of the Public Health (London) Act, 1891, shall apply in all respects as if such default had been made under the said Act.

SHORT TITLE, COMMENCEMENT, EXTENT, REPEAL, AND SAVINGS.

21.—(1) This Act may be cited as the Milk and Dairies (Consolidation) Act, 1915, and shall come into operation on such date not being later than the expiration of one year after the termination of the present war as the Local Government Board may by order appoint.

(2) This Act shall not extend to Scotland or Ireland.

(3) The enactments specified in the Fourth Schedule to this Act shall, except so far as they relate to Scotland or Ireland, be repealed to the extent mentioned in the third column of that Schedule, and there shall also be repealed, as from the expiration of one year after the commencement of this Act, so much of any local Act as deals with any of the matters dealt with by any of the provisions of this Act :

Provided that nothing in this repeal shall affect any order or regulations made under any enactment mentioned in the said Schedule, but any such order or regulations shall, until altered or revoked, continue in force as if made under this Act.

(4) Nothing in this Act shall prejudice or affect the enactments relating to milk and dairies mentioned in the Fifth Schedule to this Act or any other enactments relating to milk and dairies, except so far as such enactments are expressly repealed, amended, or extended by this Act.

SCHEDULES.

FIRST SCHEDULE.

PROCEDURE FOR STOPPING SUPPLY OF MILK UNDER SECTION THREE.

(1) The medical officer of health of the county or county borough in which the cows from which the milk is obtained are kept shall report the matter to the council of such county or county borough (hereinafter referred to as the responsible authority).

(2) His report shall be accompanied by the veterinary or bacteriological reports which have been furnished to him.

(3) On the receipt of the report or a copy of the report from the medical officer of health, the responsible authority may serve on the dairyman notice to appear before them, or furnish an explanation in writing, within such time not less than forty-eight hours from the time of the service of the notice on him as may be specified in the notice, to show cause why such an order as is hereinafter mentioned should not be made.

(4) The notice shall be accompanied by a copy of the reports made in respect of the dairy.

(5) The responsible authority if, in their opinion, the dairyman has failed to show cause why an order should not be made, may make an order prohibiting him, either absolutely or unless such conditions as may be prescribed in the order are complied with, from supplying for human consumption, or using or supplying for use in the manufacture of products for human consumption, any milk from the dairy or from any particular cow or cows therein until the order has been withdrawn in accordance with the provisions of this Schedule.

(6) The order shall specify the grounds on which it is made.

(7) On the making of such an order a copy of the order shall forthwith be served on the dairyman, and notice of the facts shall also be served on the Local Government Board and the Board of Agriculture and Fisheries.

(8) Where no order is made, the responsible authority shall allow the dairyman any reasonable expenses incurred by him in showing cause why the order should not be made.

(9) An order prohibiting the supply or use of milk made under this Schedule shall forthwith be withdrawn, and notice of withdrawal served on the dairyman as soon as may be after the responsible authority or their medical officer of health is satisfied that the milk supplied from the dairy is not likely to cause disease.

(10) The medical officer of health shall have power to withdraw an order if so authorised by the responsible authority.

(11) If a dairyman is aggrieved by the making or continuance of an order prohibiting the supply or use of milk, he may by complaint under the Summary Jurisdiction Acts appeal to a court of summary jurisdiction.

(12) A court of summary jurisdiction on such appeal may confirm, vary, or withdraw the order and may direct to and by whom the costs of the appeal are to be paid.

(13) Pending the determination of the appeal, an order shall remain in force unless previously withdrawn.

(14) If an order prohibiting the supply or use of milk is made against a dairyman he shall unless the order has been made in consequence of his own default or neglect be entitled to recover from the responsible authority full compensation for any damage or loss which he may have sustained by reason of the making of the order. The dairyman shall also be entitled to full compensation for any damage or loss which he may sustain in consequence of the responsible authority unreasonably neglecting or refusing to withdraw an order made against him.

(15) In the case of an appeal under this Schedule being allowed, the court to which the appeal is made shall determine and state whether the order, the subject of appeal, was made in consequence of the default or neglect of the dairyman or the withdrawal has been unreasonably neglected or refused.

(16) Any dispute as to the fact of damage or loss or as to the amount of compensation shall be settled by arbitration in the same manner as provided by the Public Health Act, 1875, and any sum awarded as compensation shall be recoverable as a civil debt.

(17) If the compensation claimed does not exceed twenty pounds it may at the option of either party instead of being settled as hereinbefore provided be settled by, and recoverable before, a court of summary jurisdiction.

SECOND SCHEDULE.

DISEASES OF COWS IN ADDITION TO TUBERCULOSIS TO WHICH SECTION FIVE APPLIES.

Acute mastitis; Actinomycosis of the udder; Anthrax; Foot-and-mouth disease; Suppuration of the udder; Any other disease affecting cows which by a Milk and Dairies Order is declared to be a disease for the purposes of section five of this Act.

THIRD SCHEDULE.

AMENDMENT OF SALE OF FOOD AND DRUGS ACTS.

(1) Where, under the Sale of Food and Drugs Acts, 1875 to 1907, a sample of milk is procured from a purveyor of milk, he shall, on being required to do so by the person by whom or on whose behalf the sample was taken, state the name and address of the seller or consignor from whom he received the milk.

(2) The local authority in whose district the sample was taken may take or cause to be taken one or more samples of milk in course of transit or delivery from such seller or consignor.

Within sixty hours after the sample of milk was procured from the purveyor he may serve on the local authority a notice stating the name and address of the seller from whom he received the milk and the time and place of delivery to the purveyor by the seller or consignor of milk from a corresponding milking and requesting them to take immediate steps to procure, as soon as practicable, a sample of milk in the course of transit or delivery from the seller or consignor to the purveyor, unless a sample has been so taken since the sample was procured from the

purveyor, or within twenty-four hours prior to the sample being procured from the purveyor, and where a purveyor has not served such notice as aforesaid, he shall not be entitled to plead a warranty as a defence in any such proceedings :

Provided that the purveyor shall not have any such right to require that such a sample shall be taken in cases where the milk, from which the sample procured from the purveyor was taken, was a mixture of milk obtained by the purveyor from more than one seller or consignor.

If a purveyor has served on the local authority such a notice as aforesaid, and the local authority have not procured a sample of milk from the seller or consignor in accordance with the foregoing provisions, no proceedings under the Sale of Food and Drugs Acts, 1875 to 1907, shall be taken against the purveyor in respect of the sample of milk procured from him.

(3) Any sample of milk so taken in the course of transit or delivery shall be submitted for analysis to the analyst to whom the sample procured from the purveyor is or was submitted.

(4) If proceedings are taken against the purveyor of milk, a copy of the certificate of the result of the analysis of every sample so taken in the course of transit or delivery shall be furnished to the purveyor, and every such certificate shall, subject to the provisions of section twenty-one of the Sale of Food and Drugs Act, 1875, be sufficient evidence of the facts stated therein, and shall be admissible as evidence on any question whether the milk sold by the purveyor was sold in the same state as he purchased it.

(5) The local authority of the district in which the first-mentioned sample was taken may, instead of, or in addition to, taking proceedings against the purveyor of milk, take proceedings against the seller or consignor.

(6) If a sample of milk of cows in any dairy is taken in course of transit or delivery from that dairy, the owner of the cows may, within sixty hours after the sample of milk was procured, serve on the local authority a notice requesting them to take immediate steps to procure as soon as practicable a sample of milk from a corresponding milking of the cows, and the foregoing provisions shall apply accordingly :

Provided that the person taking the sample shall be empowered to take any such steps at the dairy as may be necessary to satisfy him that the sample is a fair sample of the milk of the cows when properly and fully milked.

FOURTH SCHEDULE.

ENACTMENTS REPEALED.

Session and Chapter.	Short Title.	Extent of Repeal.
41 & 42 Vict. c. 74.	The Contagious Diseases (Animals) Act, 1878.	The whole Act so far as unrepealed.
49 & 50 Vict. c. 32.	The Contagious Diseases (Animals) Act, 1886.	The whole Act so far as unrepealed.
62 & 63 Vict. c. 51.	The Sale of Food and Drugs Act, 1899.	Sections nine and eleven.
4 & 5 Geo. 5. c. 49.	The Milk and Dairies Act, 1914.	The whole Act.
5 & 6 Geo. 5. c. 59.	The Milk and Dairies Acts Postponement Act, 1915.	In section one "the Milk and Dairies Act, 1914, and" and "the Local Government Board and" and "respectively."

FIFTH SCHEDULE.

ENACTMENTS SAVED.

The provisions of the Public Health Acts and the Public Health (London) Act, 1891, with respect to nuisances and the sale of food so far as the same relate to milk and dairies.

The Sale of Food and Drugs Acts, 1875 to 1907, so far as they relate to the sale of milk.

The Public Health (London) Act, 1891, sections sixty-nine and seventy-one.

The Public Health Acts Amendment Act, 1907, sections fifty-three and fifty-four.

The Infectious Diseases Prevention Act, 1890, section four.

Fuel Research Board.

REPORT FOR PERIOD ENDED 31ST DECEMBER, 1924.

THIS report is issued after an interval of 5 years, although reports on special aspects of the work have been made from time to time, and it is proposed in future to issue annually a general progress report.

PHYSICAL AND CHEMICAL SURVEY OF THE NATIONAL COAL RESOURCES.—This survey purposes to disclose the best means of preparing each type of coal for market, and, by defining the varieties of coal occurring within even the same seam, should find uses for much coal not at present in demand. The work involves the co-operation of the mine owners and managers, and includes analyses of the various seams and a determination of properties not thus disclosed. Reports on several special seams have already been issued. Work on the preparation of thin sections and photo-micrographs of coal is being undertaken at the Lomax Palaeobotanical Laboratories in connection with the Lancashire and Cheshire Coal Research Association, and many sections have been prepared and a list of the seams studied issued, together with a detailed report of the "Lanterne" seam in South Wales. Owing to the fact that no standard methods of analysis or of sampling have been agreed upon, there is a consequent variation in recorded results according to varieties of procedure, and in 1921 a Committee was appointed to investigate the question. An interim report on Methods of Analysis was published in 1923 (*ANALYST*, 1924, 49, 36), and the recommendations made have been adopted by the Fuel Research Board for the purposes of their work. It is intended to review this publication periodically, so as to present an authoritative statement of the best current practice in the methods of valuing coal. It has been shown, since the report was issued, that the results obtained by the modification of the Kjeldahl method for determining nitrogen agree closely with those obtained by a modification of the Dumas method. In connection with sampling, special experiments are in progress, and a report is shortly expected to be published dealing with (a) sampling *in situ*, (b) sampling a consignment for special tests such as boiler trials, and (c) commercial sampling. The question is assuming increased commercial importance in other countries also, and there is a tendency to buy to specification which will lead to disputes unless standard methods of sampling and analysis are agreed to.

WORK IN CONNECTION WITH THE GAS INDUSTRY.—One of the recommendations of the Board in connection with the subsequently evolved Gas Regulation Act of 1920 included the method of charge on the "therm" basis, and an independent committee investigating the point stated in its report that "after careful consideration of all the evidence available we are unanimously of opinion that the method of charging for gas on the basis of its heating properties, *i.e.* by the therm, is the best safeguard of the consumer," and, further, they recommended "that the method of charging for gas on the therm basis should be continued and extended to all statutory gas undertakings within the scope of the Gas Regulation Act." Alteration of methods of production with a view to economical working was made possible by the passing of the Act, and investigations into the practice of introducing steam into the interior of vertical retorts showed that the thermal value of the gas produced per ton of coal, as well as the quantities of tar and ammonium sulphate, is considerably increased thereby at the expense of a reduction of less value in the amount of coke, and the tests were in agreement (in so far as they were comparable) with others made by the Gas Investigation Committee of

* Obtainable at Adastral House, Kingsway, W.C.2. Price 1s. 6d. net.

the Institution of Gas Engineers. Tests on a technical scale have been carried out on a large number of British coals, and they are summarised in a table showing the gain in therms per ton of coal and the reduction in calorific value, and in detailed reports of some of these coals the cost of these gains in fuel, gas, steam and coke are shown, with indications how the yields may be modified by varying conditions other than temperature and percentage of steam. By using a comparatively low carbonising temperature with higher temperatures towards the bottom of the retorts to remove volatile matter from the coke; by restricting the steam to the least that will create enough pressure in the coke chamber to exclude air and prevent overheating and in injecting it at the lowest possible point, and also by increased cracking of the liquid hydrocarbons and the omission of condensed tar in the collecting main, it has been found possible in the station retorts to increase the calorific value of the gas produced. An introduction of 5 per cent. of air during carbonisation with 20 per cent. of steam reduced the heat required per ton of coal as fuel 1.4 therms, and increased the gas yield from 17,900 to 18,900 cb. ft., but at the expense of a reduction in calorific value of 25 B.Th.U.'s per cb. ft. in the gas made, in addition to the coke consumed in the retort, and without increase in the yield of ammonia. Experiments are in progress to determine the distribution of temperature in the coal as it passes through the retorts. Replacement of the cast-iron shutters and linings of the sight-holes of the retorts by fireclay plugs caused a saving of about 3 therms per hour in the gas used for heating the setting of 4 retorts, or some 7 therms per ton of coal carbonised. Where an accurate measurement of the heat used is required water gas has been adopted at the Fuel Research Station as the standard fuel for heating retorts, etc., and all varieties of coke produced from large scale carbonisation experiments are tried in the water gas plant to ascertain their suitability for production of the gas. Differences in the cokes thus brought to light have been found to be mainly caused by variations in the nature and amount of the contained ash, and the effect of the ash and clinker on the refractory linings of the generator is being studied.

LOW TEMPERATURE CARBONISATION.—An assay apparatus for the study of yields and quality of the products of low temperature carbonisation, in which a few grms. only of coal are used, showed such concordant results over a prolonged period in parallel use with trials on a technical scale that the apparatus is in constant use at the station, and its use has been recommended in the standard methods of coal examination.

Briquetting by Carbonisation.—The first method tried was to carbonise coal in thin layers in horizontal steel retorts heated externally to 600° C. It was very successful, but the cost of charging and discharging the trays made it unsuitable. Cast-iron of a suitable composition has been found to resist a temperature of 650° C. without "growth." Four cast-iron vertical retorts have been erected which appear able to carbonise a blend of coals suitably broken down and mixed, so as to produce a satisfactory smokeless fuel, with a reasonable yield of oil and no more than a reasonable amount of fines, but it cannot be expected, nor is it economically necessary, to avoid all production of coke breeze. Sutcliffe and Evans have shown that some coals, at least, may be formed into strong briquettes without any binder if finely ground and subjected to a pressure of about 10 tons per sq. in., but on a technical scale difficulties were experienced, and the briquettes became weaker with rise of temperature above about 220° C.

Products of Low Temperature Carbonisation.—About three quarters of the weight of coal remains as coke, which ignites easily and burns evenly (see domestic heating), and radiates more heat than an equal weight of raw coal. One ton of an average gas coal carbonised at about 600° C. in externally heated retorts produces

3000 or more cb. ft. of gas of a calorific value of 700–1, 100 B.Th.U's per cb. ft. The amount is generally equivalent to 30–35 therms or about 10 per cent. of the heat value of the coal. Analyses of gases from typical coals are as follows:—

Type of coal (bituminous).	Strongly caking.	Medium caking.	Non- caking.	Medium caking blend.
CO ₂ , H ₂ S, etc.	5.4	7.1	11.1	7.2
C _n H _n	11.5	8.6	9.4	9.6
O ₂	1.8	1.3	1.7	1.9
CO	5.0	5.4	7.1	7.1
H ₂	15.7	16.0	17.6	15.0
C _n H _{2n+2}	49.8	52.4	41.8	48.3
N ₂	10.8	9.2	11.3	10.9

100.0

The saturated hydrocarbons are chiefly methane, and the value of n in C_nH_{2n+2} is about 1.25. In a calorimeter the gas requires primary as well as secondary air for complete combustion. Light spirit for manufacture of motor fuel can be recovered by gas scrubbing to the amount of 1¼ gallons per ton of coal.

Low Temperature Tars differ in composition from ordinary gas tars, and are unsuitable for marine purposes, since, when mixed with natural fuel oils in unsuitable proportions, they form gummy resinous precipitates, although, if distilled, a suitable fuel oil can be obtained, but about 40 per cent. of pitch also results. Experiments are in progress towards the adaptation to the low temperature products of the Lessing process for the production of fuel oils, from high temperature tars. The adaptation is possible, but at a very small throughput, and much further work is required.

INTERNAL COMBUSTION ENGINES.—The equipment of the Station is not primarily intended for the testing of engines, but comparative tests of fuels can be made. The Dorman engine has been used for a long series of tests on the behaviour of mixtures of petrol, benzol, alcohol, and tetralin, and a report will be published. A producer has been designed for use with a motor lorry using charcoal as fuel and no steam. The gas contains about 31 per cent. of carbon monoxide, 7 of hydrogen and 60 nitrogen, with a calorific value of about 126 B.Th.U. per cb. ft. Although satisfactory in the Dorman engine, there were difficulties in starting, and a higher compression ratio appears to be required.

POWER ALCOHOL.—Difficulties have been encountered both in evolving a chemical process for the production of alcohol from waste cellulosic materials and by the use of micro-organisms, and possibilities of success cannot at present be surmised. The present position and future development of the acid hydrolysis of cellulosic materials, with consequent fermentation of the carbohydrates produced, has received much attention at the Royal Naval Cordite Factory. Wheat and rice straws and grasses from S. Africa have been used, and satisfactory conversions with dilute acid at moderate temperatures and pressures were obtained, but the provision of acid-resisting autoclave material has been a difficulty. However, laboratory experiments indicate the possibility of dispensing with autoclaves. Although the production of alcohol from ethylene has been the subject of prolonged experiments by two firms, no technical results appear to have been achieved, nor has water gas so far proved a commercial starting point. There is little prospect of any production on a large scale from the specially grown Jerusalem artichoke and sugar mangold, but the possibilities in the Dominions,

Colonies and Protectorates appear to be relatively much greater than in this country.

PEAT.—At present peat can only compete with coal as a fuel in localities of production, owing to the large proportion of moisture present, (92–95 per cent. in undrained bog, and up to 88 or 91 per cent. in drained bog), and the necessity of drying, which involves labour and space. The Peat Investigation Officer keeps in touch with all work in this connection carried out by other bodies.

DOMESTIC HEATING.—Nearly 20 per cent. of the total coal consumption is domestic and its combustion forms a large contribution to the smoke pollution of the atmosphere. Most sitting room grates radiate 20–24 per cent. of the theoretical heat value of the coal, although the air flow produced varies. Coke and anthracite radiate a greater proportion of their potential heat, particularly low temperature coke, which reaches 30 per cent. in a grate giving 24 per cent. with coal, and which is easy to light and maintain. A report on the design of domestic grates by Dr. M. Fishenden is being printed as Technical Paper No. 13. D. G. H.

ABSTRACTS OF PAPERS PUBLISHED IN OTHER JOURNALS.

Food and Drugs Analysis.

The Rupp Method for the Detection of Chlorine in Milk. J. T. Keister. (*Amer. J. Pharm.*, 1925, 97, 638–642.)—In the Rupp test for chlorine (*U.S. Dept. Agr. Bull.*, No. 1114, 1922) the acidified milk is first heated to break up the protein-chlorine combination, and the liberated chlorine made to react with potassium iodide to give free iodine, which is identified by the blue colour produced with starch. This test, however, is interfered with if more than 1 part of copper in 425,000 of milk is present, and it is 8 times more sensitive to copper than to chlorine. The average amount of copper present in milk is about one part in 2,000,000, but it is conceivable that under certain conditions bottled milk might take up a significant proportion of copper, so that milks giving positive Rupp tests should have their copper content determined. D. G. H.

The Chlorine-Lactose Ratio and Determination of Chlorine in Milk. J. Drost. (*Zeitsch. Unters. Nahr. Genussm.*, 1925, 49, 332–342.)—The value of the ratio of chlorine to lactose for purposes of milk control is discussed, and is shown to be much affected by errors in the chlorine figure. For this determination the author adds to 10 c.c. of the milk 5 c.c. of nitric acid of sp. gr. 1.165, and, after shaking, 5 c.c. of 0.1 *N* silver nitrate solution; the mixture is vigorously shaken and protected from direct sunlight; then 1 c.c. of a 10 per cent. solution of iron alum is added, and the mixture titrated back with 0.1 *N* ammonium thiocyanate solution. This solution is added slowly and with constant shaking until the addition of 1 drop gives a permanent red colour. The determination of chlorine by ignition after the addition of sodium carbonate is liable to give seriously low results. H. E. C.

Fluorine in Egg Yolk. H. Ulex. (*Chem. Zeit.*, 1925, 49, 845.)—Fresh egg yolk shows a strong precipitate when tested for fluorine by the lanthanum acetate method (*cf.* Abstr., p. 637). This is due to the normal fluorine content of the yolk, and should be borne in mind in cases where the material is to be tested for fluoride added as a preservative (*cf.* ANALYST, 1924, 49, 453). W. R. S.

Isolation of Natural Crystallised Lecithins. H. H. Escher. (*Helv. Chim. Acta*, 1925, 8, 686–691.)—The method adopted by the author to obtain crystalline lecithin was as follows: (1) Egg-yolk or finely divided ox-brain is carefully dehydrated and the phosphatids and other fats and allied bodies then so completely extracted that boiling alcohol or chloroform fails to remove anything from the residual snow-white powder. (2) The concentrated extracts are treated with acetone, which precipitates the whole of the phosphatids and separates them from phosphorus-free fats and from cholesterol and its esters. (3) Adherent solvent is eliminated and the pure phosphatids kept in closed glass vessels until further treatment. (4) The true lecithins are then separated from the other phosphatids by means of absolute alcohol; the residue remaining dissolved in the alcohol at -35° C. amounts to about 75 per cent. of the total phosphatids and consists of the lecithins. By removal of the alcohol and repeated crystallisation from ether at low temperatures, alternated with separations of the material, sparingly soluble in alcohol, snow-white crystals 1 mm. in length, melting at $244-245^{\circ}$ C. and having the iodine value 50, are obtainable. T. H. P.

Determination of Cane Sugar in Condensed Milk. K. Scheringa. (*Pharm. Weekblad*, 1925, 62, 1034–1035.)—The official method of the Dutch *Codex Alimentarius* can be considerably shortened by the use of the following method:—A clear filtrate is prepared in the usual way from 33·330 grms. of the condensed milk diluted to 100 c.c., and the sugar is inverted. If the dextrose content is represented by a , and the optical rotation by b° , the percentage of sucrose in the total sugar is obtained by means of the formula

$$\frac{11.1 - \frac{10}{a} \times b}{0.151^{\circ}}$$

This is based upon the facts that an inverted 10 per cent. solution of anhydrous lactose has a rotation of $+11.1^{\circ}$ in a 200 mm. tube at 20° C., and that an inverted 10 per cent. solution of sucrose has a rotation of -40° ; whence each per cent. of sucrose in the lactose causes a reduction in the rotation of $\frac{11.1 + 4}{100} = 0.151^{\circ}$.

In practice, there is a small error, since the amount of dextrose found does not correspond exactly with the total sugar content. According to Schoorl's tables, 100 mgrms. of anhydrous lactose are equal in reducing power to 100.5 mgrms. of dextrose, and 100 mgrms. of sucrose to 100.9 mgrms. of dextrose. In applying this correction to the formula above, a is replaced by $\frac{100}{100.7} \times a = 0.9993 \times a$.

Lemon Juice. A. Azadain. (*Ann. Falsificat.*, 1925, **18**, 412-414.)—The juice of lemons cultivated in Egypt, and sweetened and imported juices gave the following analytical figures:—

	Adalia lemon.	Baladi lemon.	Sweetened juice.	Lime juice E.E.F.	Lime juice L.R.
Sp. gr. at 15° C.	1.036	1.040	1.038	1.035	1.024
Dry extract, per cent.	7.84	9.71	9.20	9.40	5.90
Ash, per cent.	0.35	0.31	0.29	0.37	0.22
Acidity (citric)	6.40	7.70	6.04	6.50	4.94
Refractometer at 15° C.	46.5	—	47.3	—	35.2
Phosphates (P ₂ O ₅)	0.017	0.028	0.016	—	0.017
Sulphates (SO ₃)	trace	0.003	0.004	—	0.024
Pectic material	0.29	0.32	0.39	—	—

In addition, "sweetened juice" contained 3.6 per cent. of total sugar, and lime juice "E.E.F." salicylic acid. Formalin is sometimes found as preservative.

D. G. H.

Volatile Constituents of Valencia Orange Juice. J. A. Hall and C. P. Wilson. (*J. Amer. Chem. Soc.*, 1925, **47**, 2575-2584.)—The juice was extracted by crushing the fruit, and was immediately distilled at a pressure of 120 mm., and at the rate of 12 litres per hour, practically all the odorous constituents passing into the distillate. The first distillate contained some peel oil, which was separated. After several re-distillations the remaining small bulk of distillate was separated into fractions soluble in ether and soluble in water, and by suitable treatment the constituents in each were identified as far as possible. Those very soluble in water were: ethyl alcohol, acetone, acetaldehyde and formic acid; those less soluble: an olefine alcohol (C₁₀H₁₈O) constituting 90 per cent.; constituents insoluble in water included an amyl alcohol (probably iso-amyl), phenylethyl alcohol, and esters of formic, acetic and caprylic acids.

D. G. H.

Detection of Diethylphthalate. S. Levinson. (*Ind. Eng. Chem.*, 1925, **17**, 929.)—A modification of the resorcinol test is recommended. Ten c.c. of the sample (*e.g.* a mixture containing denatured alcohol) is evaporated to a small volume, 1 gm. of boric acid is added, and the mixture evaporated to dryness; 1 gm. of resorcinol is then added, the mixture again heated, cooled, dissolved in water, and the solution rendered alkaline with sodium hydroxide. A fluorescence indicates the presence of diethylphthalate.

W. P. S.

Studies of Tests for Diethylphthalate. H. Leffmann and M. Trumper. (*Amer. J. Pharm.*, 1925, **97**, 507-510.)—The phenol test, which is usually made by the addition of the phenolic body followed by concentrated sulphuric acid, can be somewhat simplified by preparing the sulphonic acid beforehand. This procedure, however, offers no advantage when using Andrew's resorcinol test. Sulphuric acid solutions of pyrocatechol, hydroquinone, pyrogallol, and naphthol were not satisfactory. Acetone and acetaldehyde, common impurities in

crude spirit, were tested for fluorescence ; only temporary effects were produced when small amounts of acetaldehyde were present and high temperatures were used ; the results with acetone were negative. D. G. H.

Determination of Chloroform in Chloroform Liniment. T. M. Willgerodt. (*Amer. J. Pharm.*, 1925, 97, 584-586.)—Five c.c. of the liniment are pipetted into a 100 c.c. pressure bottle containing 40 c.c. of alcoholic potassium hydroxide (30 grms. in 30 c.c. of water and methyl alcohol to 100 c.c.). The bottle is closed, shaken, and heated for 10 minutes on a boiling water bath, the mixture then transferred to a 500 c.c. flask, the volume made up to the mark, and 10 c.c. made up to 100 c.c. with a few c.c. of nitric acid, a little water, 50 c.c. of 0.1 *N* silver nitrate solution and more water. After shaking, the chlorides are filtered off, and to a 50 c.c. aliquot portion a few c.c. of ferric ammonium sulphate solution are added, and the whole titrated with 0.1 *N* potassium thiocyanate solution, each c.c. of silver nitrate corresponding to 3.98 mgrms. of chloroform. D. G. H.

The "Hesperidin" of certain Plants. O. A. Oesterle and G. Wander. (*Helv. Chim. Acta*, 1925, 8, 519-536.)—The hesperidin-like compounds contained in *Scrophularia nodosa*, *Hyssopus officinalis*, buchu leaves, *Conium*, pennyroyal, *Mentha crispa*, *Mentha pulegium*, *Toddalia aculeata*, and *Linaria genistifolia*, are identical and consist of a rhamnoglucoside of luteolin methyl ether, $C_{34}H_{44}O_{21} + 2H_2O$, for which the name diosmin is proposed. The sugar-free component, 1:3:3'-trihydroxy-4'-methoxyflavone, is termed diosmetin. The name "hyssopin" given by Oesterle to the rhamnoglucoside occurring in hyssop plants attacked by fungi, is to be discarded. T. H. P.

Biochemical, Bacteriological, etc.

Nature of Urinary Protein. A. Hynd. (*Lancet*, 1925, 209, 910-915.)—Experimental evidence is submitted which shows that the protein excreted in the urine is not always identical. In 12 cases of "albuminuria of pregnancy" without convulsions the specific rotation of the urinary albumin averaged -55.81° , and thus agreed with that found for human serum albumin under similar treatment, *viz.* -54.47° . On the other hand, the urinary proteins in the 14 cases of eclampsia (convulsions) investigated were sharply divided into two groups, one group of 6 having an average $[\alpha]_D$ of -56.37° , and the other group of 8 having an average $[\alpha]_D$ of -38.5° . The optical activity of the former agrees well with that of serum albumin (-54.47°), whilst that of the latter approximates closely to that of cows' lactalbumin (-41.17°). Accordingly it is suggested (a) that in certain types of eclampsia the urinary albumin may be mainly lactalbumin ; (b) that eclampsia may be an anaphylactic reaction due to the circulation in the blood of this foreign protein ; and (c) that the mammary gland may be an important factor in the causation of eclampsia.

Studies of Acidosis. XXI. Colorimetric Determination of P_H of Urine. A. B. Hastings, J. Sendroy, Jr., and W. Robson. (*J. Biol. Chem.*, 1925, **65**, 381-392.)—The colorimetric determination of the P_H value of urine is described. The urine is collected and kept under oil. Two c.c. are pipetted, without exposure to air, into a test-tube containing 1 c.c. of indicator solution and 7 c.c. of redistilled water under oil. As a control tube, another 2 c.c. portion is run into a similar test-tube with 8 c.c. of water. After gently stirring with a flat-ended rod, the unknown solution is brought to 38° C. in a water-bath and matched with pairs of standard indicator solutions, as previously described by Hastings and Sendroy, jr. (*J. Biol. Chem.*, 1924, **61**, 695) for blood plasma P_H measurements. To allow for the error introduced by dilution of the urine, 0.10 P_H is subtracted from the reading at 38° C. This is effective for 5- to 10-fold dilution. The corrected P_H value was within 0.05 of the electrometric P_H value at the same temperature. The apparatus required is an adequate number of clear glass test tubes (22 × 175 mm.) of uniform inside diameter, a calibrated micro burette graduated to 0.02 c.c., a 50 c.c. burette and a 3-row comparator block. The colour standards are prepared as outlined by tables. The indicators, brom-cresol green, brom-cresol purple and phenol red, covering a P_H range of 4.0 to 8.2, have been used. Chlor-phenol red may sometimes be useful for higher P_H standards. The apparent dissociation constants of the 4 indicators have been determined by the colorimetric method at 38° C. and 20° C. A comparison of electrometric and colorimetric P_H determinations in urine has been made. P. H. P.

Two New Enzymes present in the Emulsin of Almonds. M. Bridel. (*Compt. Rend.*, 1925, **181**, 523-524.)—Emulsin from almonds, if in sufficient concentration and allowed to act for a sufficiently long time in aqueous solution, hydrolyses monotropitoxide. The hydrolysis does not cease with the formation of primeverose, but continues until that compound is decomposed into glucose and xylose. This is due to two enzymes which the author calls *primverosidase* and *primverase*, respectively. The reaction was followed polarimetrically over a period of a month at 30° C., and the products of the hydrolyses isolated in the usual way. H. E. C.

Carbon Trichloride as an Anthelmintic. M. C. Hall and E. B. Cram. (*J. Agric. Res.*, 1925, **30**, 949-953.)—Experimental administration of carbon trichloride in powder form and in solution proves that its anthelmintic power is less than that of its related compounds, carbon tetrachloride, chloroform and ethylene dichloride. This appears to be due to its relative insolubility in water; although it is freely soluble in oils, in water it is only soluble in 10,000 parts. The order of efficacy of the above-named compounds is carbon tetrachloride, chloroform, ethylene dichloride, carbon trichloride (C_2Cl_6), but their solubilities are 1 in 1250, 1 in 161, 1 in 120, and 1 in over 10,000. H. E. C.

Vitamin B in Excreta of Rats on a Diet Low in this Factor. W. D. Salmon. (*J. Biol. Chem.*, 1925, **65**, 457-462.)—The faeces of rats may be rich in vitamin B even when the diet consumed is low in this factor. Rats that were

declining on the basal diet, although they had access to the excreta, resumed growth when the diet was supplemented with 20 per cent. of extracted velvet beans. When the faeces were not available the decline was comparable to that on the basal diet. Thus the extracted beans did not contain a demonstrable amount of vitamin *B*, but they increased the vitamin *B* content of the faeces. The growth of rats receiving 10 per cent. of dried faeces from the above diet was comparable with the growth of the rats of Steenbock, Sell and Nelson (*J. Biol. Chem.*, 1923, 55, 399) that received 40 per cent. of corn or oats as the source of vitamin *B*. Moulds growing on the faeces did not increase the vitamin content of the faeces under the conditions of the experiments. Possibly the vitamin is synthesised by intestinal bacteria. The consumption of faeces by rats on diets low in vitamin *B* may result in significant error.

P. H. P.

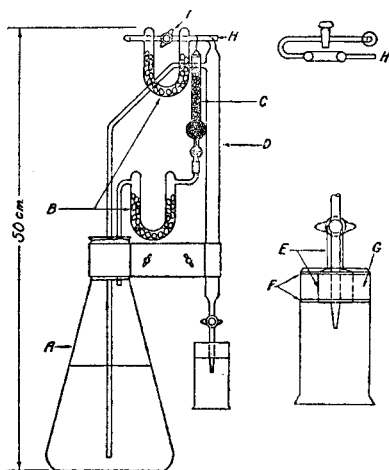
Concentration of Vitamin B. II. P. A. Levene and B. J. C. van der Hoeven. (*J. Biol. Chem.*, 1925, 65, 483-489.)—The Osborne and Wakeman concentrate of the extract of brewers' yeast can be further concentrated. An attempt was made to improve every phase in the preparation of the growth-promoting material. When concentrated previously it consisted of a mixture of organic and mineral substances. Attempts, which are described, were made to remove the mineral constituents of the active principle. By successive precipitation, first by lead acetate, and second by barium hydroxide, a product is obtained which contains 5.2 per cent. of nitrogen (calculated for the ash-free substance) and is potent in daily doses of from 2.0 to 4.0 mgrms. per day. By silica adsorption, a product is obtained from this which is potent in daily doses of 0.100 mgrm., and which contains 15 per cent. of nitrogen. The ash-free product from the material obtained by successive precipitation, as shown above, has an elementary composition approaching that of carbohydrates. It yields on hydrolysis reducing sugars, contains about 4 per cent. of nitrogen, and is potent in daily doses of 1.25 mgrms. per day. From it, by the silica treatment, a material is obtained which is potent in daily doses of 0.600 mgrm., and which contains only 4 per cent. of nitrogen. Thus silica adsorption did not greatly improve the more purified material, as it did the material containing phosphorus. Apparently the phosphorus-containing impurity is essential for the selective adsorption by silica.

P. H. P.

Rapid Method of Preparation of Silica-Gel for Bacteriological Cultures. M. Souleyre. (*Ann. Brass. et Dist.*, 1925, 23, 371-372; *J. Inst. Brewing*, 1925, 31, 471-472.)—The principle employed is the elimination of the potassium contained in the silicate used as the slightly soluble bitartrate, this salt being removed by filtration. One hundred c.c. of a solution of potassium silicate (sp. gr. 1.057) are poured rapidly into a mixture containing 40 c.c. of 20 per cent. tartaric acid solution, 1 c.c. of 84 per cent. phosphoric acid solution and 1 c.c. of sulphuric acid diluted with an equal volume of water. After 5 minutes, precipitation is accelerated by stirring, the precipitate allowed to settle, and the supernatant liquid filtered, the filtrate being designated A. A second solution, B, is prepared by mixing 2

volumes of potassium silicate solution (sp. gr. 1.085) with 1 volume of 5 per cent. potassium hydroxide solution. For the culture of yeasts a suitable medium is obtained by sterilising separately at 115° C. for 10 minutes. After cooling in a stream of water, liquids (a), (b) and (c) are mixed in the following order:—(a) 100 c.c. of solution A and 50 c.c. of beer wort; (b) 100 c.c. of sugar solution or other nutritive medium; (c) 50 c.c. of solution B; and they are then transferred immediately to sterile Petri dishes or test-tubes. Modifications of this medium are described for use in the culture of bacteria and nitrogen-fixing organisms. P. H. P.

Adjustment of P_H of Culture Media under Sterile Conditions. L. M. Christensen and E. I. Fulmer. (*Ind. Eng. Chem.*, 1925, 17, 935.)—An apparatus which can be sterilised readily is shown in the illustration. The flask *A* holds



about one litre and is closed by a plug of cotton wool which is covered with sealing-wax after the apparatus has been sterilised. The U-tubes *B* contain glass beads and a small quantity of concentrated sulphuric acid, and the tube *C* is filled with soda-lime. The 25 c.c. burette *D* is filled by applying suction at *H* while the tap *I* is opened partially. A glass shield is provided for the end of the burette; it is fitted with a stopper of cotton wool *G* between two aluminium discs *F*, and is suspended from the tap by the copper wire *E*. Three such pieces of apparatus are required, one for 0.1 *N* acid, one for 0.1 *N* alkali solution, and one for water.

W. P. S.

Fallacy of the Test for Lactose Fermenters as an Indicator of Faecal Pollution of Waters. O. Schöbl and J. Ramirez. (*Philippine J. Sci.*, 1925, 27, 317-324.)—Owing to the relatively limited distribution of true *B. coli* outside the animal body, the presence of this organism serves as an indication of faecal pollution. Other micro-organisms which ferment lactose, although frequently

present in human and animal faeces, are also of wide occurrence in nature and appear in places where faecal contamination is excluded. True *B. coli* may be differentiated fairly readily from the other members of the *coli* group, since these give, on eosin-methylene-blue lactose agar plates, large moist cupolated colonies with more or less pronounced black centres, often with a pinkish tinge. Attempts to arrive at a criterion for the differentiation of *B. coli* of human origin from that of animal origin proved unsuccessful. Under natural conditions the pollution of water by *B. coli* derived from the faeces of aquatic animals, such as fish, frogs, and insects, is unlikely.

T. H. P.

Micro-organisms in Decomposing Oysters. A. C. Hunter and B. A. Linden. (*J. Agric. Res.*, 1925, 30, 971-976.)—It has been shown that there is no definite relation between the number of bacteria present and the stage of decomposition of oysters, but this stage may be correlated with the P_H value. Initially the bacterial flora of oysters are the same as those of the sea water from which they are derived, but they may be materially altered by handling under unsanitary conditions. Their decomposition is primarily due to the following groups of organisms:—*Serratia* (water and soil bacteria producing red pigment), *Pseudomonas*, *Proteus*, *Clostridium*, aerobic spore-forming bacilli, *Escherichia* (*coli* group), aerogenes group, streptococci and lacto-bacilli.

H. E. C.

The Purity of Ice. O. v. Hubay. (*Zeitsch. Unters. Nahr. Genussm.*, 1925, 49, 370-373.)—Examination of the ice prepared in the city ice factory at Budapest, has shown that while some selective purification takes place as between the clear ice and that which is obviously cloudy, it is by no means complete. Numerous figures are given, of which the following are typical:—

Total solids		Mgrms. per litre.		Total bacteria per c.c.	
Cloudy.	Clear.	Cloudy.	Clear.	Cloudy.	Clear.
2000	400	142.7	48.2	7909	173
900	250	94.0	45.0	531	215
1000	680	106.2	65.6	1320	2501
Average ratio.					
3.08	: 1.0	2.54	: 1.0	1.43	1.0

H. E. C.

Bacterial Flora of Preserved Eggs. H. Popp. (*Zeitsch. Unters. Nahr. Genussm.*, 1925, 50, 139-142.)—Dried eggs and liquid eggs preserved with either salt, boric or benzoic acids, or mixtures thereof, were found to contain large numbers of bacteria. These are mainly derived from the shell and include large numbers of *B. coli*. The commonest types found were *B. subtilis*, *B. ramosis*, *B. coli* and *sarcinæ*. *B. Gaertner* or *B. suispestifer* were not found, and pathogenic bacteria are rarely, if ever, present. Preserved liquid eggs contain very much larger

numbers of bacteria than does dried egg prepared either by the spray or the roller process. On account of the heavy bacterial contamination the use of such eggs for the preparation of mayonnaise, etc., is attended with risk. H. E. C.

Paratyphoid Fever traced to Ice-Cream. G. P. Kinloch. (*Lancet*, 1925, 209, 823.)—During the months of July and August 23 cases of paratyphoid fever associated with Aberdeen were reported. Enquiry showed that the one common article of food consumed by all the patients (2 of whom had returned to Glasgow from a holiday in Aberdeen) was ice-cream obtained from a particular shop on July 20th, so that the incubation period of the disease could be put at about 15 days. After that length of time it was not possible to ascertain how the ice-cream had been handled on the day of sale. Full bacteriological investigation of the workers in the shop was made. Both the shopkeeper and her mother had suffered from typhoid fever, a long time ago, and their blood agglutinated to *B. typhosus*, but not to *B. paratyphosus*. The shopkeeper's son had agglutinins both to *B. typhosus* and *B. paratyphosus*, but he had been inoculated to both varieties in the army in 1917. Samples of blood from the three employees contained no agglutinins and the urine and faeces from all six persons engaged in the shop gave negative results. There was no evidence that the milk from which the ice-cream was made was infected. It is estimated that 360 customers might be supplied daily with ice-cream from this shop, but, so far as is known, only 23 cases of infection occurred. There were no deaths, but some attacks were severe.

Toxicological and Forensic.

Toxicity of Iron Cacodylate. P. Musucci and G. A. Slothower. (*Amer. J. Pharm.*, 1925, 97, 587-588.)—Iron cacodylate in the various market brands produces more or less abnormal irritation and pain at the point of injection, sometimes accompanied by flushing and vomiting. This was found to be independent of the acidity (between P_H 4.5 and 6.5), but due to the ionic state of the iron. If the salt is hydrolysed and the iron converted into the colloidal form, the toxicity (in animals) is halved, and the drug is then quite suitable for intravenous injection. D. G. H.

Water Analysis.

Determination of Dissolved Oxygen by the Winkler Method. E. J. Theriault. (*U.S.A. Public Health Bull.*, 1925, No. 151.)—A critical survey has been made of Winkler's original procedure and the various modifications proposed from time to time, together with detailed experimental work on the effect of varying the period of contact with the precipitated manganous hydroxide; the possible loss of iodine through volatilisation during the manipulations and the effect upon this loss of temperature; interference by oxalates, the magnitude of the error, the mechanism of the interference and methods for its elimination; the efficacy of the permanganate treatment in counteracting the effect of organic

matter, and the effect of iron salts and the methods available in the examination of iron-bearing waters. Whilst the unmodified Winkler method is subject to relatively few sources of error, its practical application is restricted to comparatively pure waters, and, if appreciable amounts of nitrites or iron salts are present, the Rideal-Stewart modification should be used. In the absence of iron salts the most important source of error in the permanganate modification is the use of an undue amount of oxalate, and if slight excess of oxalate is present the admixture of the reagents after the final acidification should be prompt, enough acid used, and a liberal excess of iodide be present. In the presence of iron salts decolorisation should proceed in the dark; the samples should be practically colourless when the Winkler reagents are added, and the titration should not be delayed after final acidification, unless phosphoric acid be substituted for sulphuric. It should be noted that in the case of stale sewage the rate of oxidation is not sufficient to prevent simultaneous absorption of oxygen, but this, however, can be computed, since the samples themselves are nearly always practically devoid of dissolved oxygen. Incubation of the samples at 20° C. for 24 hours appears to eliminate this source of error. As a result of the investigation the following procedure is put forward, which is essentially the Rideal-Stewart modification of the Winkler process:—

All reagents, except the sulphuric acid, are added beneath the surface of the liquid. Not more than 0.7 c.c. of concentrated sulphuric acid (sp. gr. 1.84) is run into the sample down the neck of a 300 c.c. bottle. With sewage or sewage effluents 1 c.c. (or 2 c.c. if necessary) of 0.2 *N* potassium permanganate solution are added, but the minimum proportion should be aimed at. After standing for 20 minutes, 0.5 c.c. (or less if possible) of 2 per cent. potassium oxalate solution ($N/4.6$ $(\text{COOK})_2\text{H}_2\text{O}$) is added, and, if the colour of the permanganate persists after a few minutes, another 0.5 c.c. The delay in decolorisation caused by the presence of iron salts may be overcome by adding 2 c.c. of 40 per cent. potassium fluoride ($\text{KF}\cdot 2\text{H}_2\text{O}$) at any stage of the preliminary treatment, and decolorisation should then proceed in the dark. When it is accomplished the Winkler reagents are added, *viz.* first 1 c.c. of manganous sulphate (480 grms. of $\text{MnSO}_4\cdot 4\text{H}_2\text{O}$, or 400 grms. of $\text{MnSO}_4\cdot 2\text{H}_2\text{O}$, dissolved in distilled water, filtered, and made up to 1 litre) and then 3 c.c. of the alkaline iodide reagent [(500 grms. of NaOH, 700 of KOH, and 135 grms. of NaI (150 of KI) in 1 litre, free from carbonates, nitrites, iodates and iron)]. After uniform distribution of the precipitate by shaking, it is allowed to settle to the lower half of the bottle, the bottle again shaken, and the process repeated until the supernatant layer is clear. Two c.c. of concentrated sulphuric acid are then run in, and the sample shaken as soon as possible, the liberated iodine being uniformly distributed before withdrawing the sample for titration, which should be carried out immediately in the presence of appreciable amounts of iron salts, but interference by these salts may be eliminated by substituting phosphoric acid (4 c.c. of 85 per cent. H_3PO_4) for sulphuric acid. If the preliminary treatment has been used, 101.9 c.c. of the sample are measured out for titration, it being assumed that the 0.7 c.c. of sulphuric acid, 1 c.c. of

0.2 *N* KMnO_4 , 3 c.c. of alkaline iodide solution and 1 c.c. of manganous sulphate added to a 300 c.c. bottle were entirely devoid of oxygen; if the preliminary treatment has been omitted 101.3 c.c. should be used, although 100 c.c. usually give sufficiently accurate results. The greatest accuracy is obtained if the titration is made in the bottle itself, and when 0.4 *N* sodium thiosulphate solution is used. One to two c.c. of starch solution (about 0.5 per cent.) are added when the colour is pale straw. If the amount titrated is equivalent to 100 c.c. of the original sample, the dissolved oxygen (in parts per million) is twice the number of c.c. of 0.4 *N* thiosulphate solution used.

D. G. H.

Organic Analysis.

Analysis of Acetic Anhydride. W. S. Calcott, F. L. English and O. C. Wilbur. (*Ind. Eng. Chem.*, 1925, 17, 942-944.)—The acetic anhydride is determined by acetylation in glacial acetic acid with 2, 4-dichloroaniline dissolved, and titration of the excess of dichloroaniline with sodium nitrite solution. Two grms. of 2, 4-dichloroaniline and 25 c.c. of glacial acetic acid are placed in a 300 c.c. flask, and a weighed quantity of the sample, corresponding with 0.6 to 0.7 gm. of pure anhydride, is added. The mixture is kept at 25° C. for one hour, then treated with 150 c.c. of water containing 25 c.c. of 35 per cent. hydrochloric acid, the mixture is cooled to 20° C., and titrated with 0.1 *N* sodium nitrite solution, potassium iodide-starch paper being used as indicator (*M*). One gm. of 2, 4-dichloroaniline is treated in the same way (but without the addition of anhydride) and titrated (*L*). The amount (*O*) of sodium nitrite solution required to give a reaction for nitrite in the volume of solution mentioned is also determined. Then, $(L - O) \times 2$ grms. of dichloroaniline/1 gm. of dichloroaniline = c.c. of 0.1 *N* nitrite solution equivalent to the total dichloroaniline used in the first titration = *P*, and $P - (M - O) \times N \times 10.21$ /weight of anhydride taken = percentage of acetic anhydride.

W. P. S.

Preparation of Organic Thiocyanogen Substitution Products. H. P. Kaufmann. (*Chem. Zeit.*, 1925, 49, 864.)—The solution, containing the compound to be converted into a thiocyanogen derivative (*e.g.* phenol), and a large excess both of free acid and thiocyanate, is treated with bromine while being cooled. The following reactions may occur: (a) $2\text{NaSCN} + \text{Br}_2 = 2\text{NaBr} + (\text{SCN})_2$; (b) $\text{C}_6\text{H}_5\text{OH} + \text{Br}_2 = \text{HBr} + \text{C}_6\text{H}_4\text{BrOH}$; (c) $3(\text{SCN})_2 + 4\text{H}_2\text{O} = 5\text{HSCN} + \text{H}_2\text{SO}_4 + \text{HCN}$; (d) $\text{C}_6\text{H}_5\text{OH} + (\text{SCN})_2 = \text{C}_6\text{H}_4(\text{SCN})\text{OH} + \text{HSCN}$. Reaction (a) is very rapid, whilst (b) does not take place if the thiocyanate is in excess. Hydrolysis after (c) is very slow in acid solution, hence (d) is allowed to proceed to a considerable extent. Numerous compounds, including polysubstitution products, were thus prepared (*cf.* ANALYST, 1925, 577).

W. R. S.

Application of Thallium Compounds in Organic Chemistry: Titrations. G. H. Christie and R. C. Menzies. (*J. Chem. Soc.*, 1925, 27, 2369-2373.)—Thallos salts of organic acids are obtained by titration of the acids with

standardised thalious hydroxide solution and phenolphthalein, the accuracy being the same as for sodium hydroxide. The following salts were prepared and analysed: fumarate (sparingly soluble in water), maleate (readily soluble), succinate, phthalate, and normal tartrate. Tetrathallium tartrate, $C_4H_2O_6Tl_4$, is deposited when a solution containing tartaric acid and thallium is made alkaline. The solution of this salt is decomposed by carbon dioxide, with formation of normal tartrate. β -Diketones and phenols give thallium salts which can be easily prepared in the pure state, and are hydrolysed by water, the thallium equivalent being accurately determinable by alkalimetry. Salts of the following compounds were thus analysed: ethyl acetoacetate, benzoylacetone, acetylacetone, acetonedi-carboxylic ester, phenol, the cresols, resorcinol monomethyl ester, guaiacol, α -naphthol, and vanillin.

W. R. S.

Some Plant Gums of the South Western United States. E. Anderson, L. Sands and N. Sturgis. (*Amer. J. Pharm.*, 1925, 97, 589-592.)—*Cholla Gum*, found on occasional plants of the white cholla cactus, *Opuntia fulgida*, varies in colour from the pale yellowish white of the new lumps to the quite dark colour of old lumps, the density also varying with age from 1.34 for the soft stage to 1.58 for the old hard gum. The gum swells up with 10 times its weight of water, and in 50 times its weight 40 per cent. of the gum dissolves, and, on boiling for 10 hours, about 50 per cent. It is almost insoluble in the ordinary organic solvents. A sample of dried gum had the following percentage composition:—Moisture, 8.65; ash, 5.0; nitrogen 0.4; total reducing sugars as glucose (after hydrolysis with 4 per cent. sulphuric acid), 67; galactose, 14; and ethereal extract, 0.45 per cent. Both 95 per cent. alcohol and solid ammonium sulphate, but not ferric chloride or lead acetate, precipitate the gum from aqueous solution. Little or no starch is present. Crystalline *l*-arabinose was isolated from the products of hydrolysis, and solutions of the gum in water, ammonium hydroxide or sodium hydroxide do not precipitate Fehling's solution. The water and ammonia solutions are faintly lævo-rotatory.

Mesquite Gum is found on the mesquite tree, *Prosopis juliflora* and other species, exuding from the stem and branches; light amber at first and darkening with age. The density is approximately 1.5, and the gum is completely soluble in cold water, to form an acid solution (P_H , 5) which becomes cloudy on heating, and is much less viscous than a similar solution of gum arabic. The gum had the following composition:—Moisture, 11.0; ash, 2.13; nitrogen, 0.7; pentoses, 60; galactose, 11.0 per cent. Specific rotation in a 6.38 per cent. solution was + 62, and in a 10 per cent. solution + 59. The gum is precipitated by 95 per cent. alcohol, but not by ferric chloride or lead acetate solutions. Crystalline *l*-arabinose was isolated (36.5 per cent.) from the products of hydrolysis. *Analysis of Ashes*:—(a) Cholla gum, (b) mesquite gum:— SiO_2 , 3.59, 4.52; unburned carbon, 3.75, 6.23; CO_2 , 27.57, 29.0; SO_4 , 2.97, 1.42; Cl, 4.67, 4.51; P_2O_5 , 0.94, 0.35; CaO, 36.71, 40.88; MgO, 8.7, 6.71; Fe_2O_3 and Al_2O_3 , 0.40, 0.93. Cholla gum also contained 0.40 of Mn_3O_4 .

D. G. H.

Determination of Chlorine in Benzaldehyde and Cinnamic Aldehyde.

T. H. Faust and T. Spängler. (*Chem. Zeit.*, 1925, 103, 724.)—Five c.c. of fuming nitric acid and 25 c.c. of sulphuric acid are mixed in a retort. To this mixture 25 grms. of the benzaldehyde are slowly added through a drop funnel, and the sulphurous and hydrochloric acid gases evolved are absorbed in silver nitrate solution. Toward the end of the reaction the retort is heated till no more hydrogen chloride passes over, after which the silver sulphite is dissolved in nitric acid, and the silver chloride determined gravimetrically. If the benzaldehyde contained 0.02 per cent. of chlorine, the weight of silver chloride is 0.016 gm., which is quite enough to enable an accurate determination to be made. The method is particularly suitable for the examination of benzaldehyde from toluol and cinnamic aldehyde.

R. F. I.

Inorganic Analysis.**Absorption of Oxygen by Alkaline Pyrogallol Solutions. T. J. Drakely**

and H. Nicol. (*J. Soc. Chem. Ind.*, 1925, 44, 457 T.)—The efficiency of seven alkaline pyrogallol solutions mentioned in the literature was tested, with special reference to the absorption of oxygen and the production of carbon monoxide in the residual gas. The gas taken for the test examination was cylinder oxygen, of which 95 to 100 c.c. were introduced into a Hempel pipette which could be shaken if desired. (Shaking was found to be advantageous, since less carbon monoxide was produced.) The residual mixture of carbon monoxide, nitrogen and argon was transferred to a Bone and Wheeler apparatus, any remaining oxygen removed, and the carbon monoxide absorbed by ammoniacal cuprous chloride. The type of pyrogallol solution used (references are given), the per cent. of carbon monoxide produced with the fresh solution, and the approximate specific absorption for each are as follows:—

Type of solution.	Carbon monoxide produced. Per Cent.	Specific absorption.
1. Wheeler	0.2 (shaken)	10-12
2. Clowes	0.21 (not shaken)	5
3. Shipley's No. 3	0.26 " "	9
4. Shipley's No. 9	0.68 " "	— (solution apt to crystallise in pipette.)
5. Weyland Zeitler	3.48 (shaken)	—
6. Anderson's "best"	0.04 " "	25
7. Hempel	0.35	— (absorption very slow.)

No. 6 is thus shown to be the best.

Details are then given of the various factors studied, and the following conclusions are drawn:—It is necessary to have a high concentration of alkali and pyrogallol. Potash is preferable to soda, because the latter tends to form crystalline deposits in high concentrations. The pipette should be shaken during absorption. Therefore the Hempel pipette is preferred to the Orsatt. The solution should not

be used after it has absorbed 4 to 5 times its own volume of oxygen, as the amount of carbon monoxide formed increases as the solution is used up. More carbon monoxide is produced if the oxygen under examination is of high purity than if it is in the form of air. Anderson's solution, which fulfils these conditions, is prepared by adding 15 grms. of pyrogallol to 100 c.c. of potassium hydroxide solution (sp. gr. = 1.55).
R. F. I.

Detection and Determination of Small Quantities of Fluorine. R. J. Meyer and W. Schulz. (*Zeitsch. angew. Chem.*, 1925, 38, 203-206.)—An excess of a 1 per cent. solution of lanthanum acetate is added to the solution of the fluoride after concentration and acidification with acetic acid. An excess of solid ammonium acetate is then added and, on now heating the liquid, a flocculent precipitate, becoming granular on standing or heating, will be obtained after a short time in the presence of fluorine. For a quantitative determination the precipitate is heated with acetic acid and ammonium acetate solution until it becomes granular, and is then washed, dried and weighed. It consists of a mixture of lanthanum fluoride and adsorbed acetate, and is therefore gently heated, to convert the lanthanum acetate into oxide, and again weighed, the amount of acetate being calculated from the difference between the two weighings.

Separation of Zirconium from Iron. P. Wenger and M. Müller. (*Helv. Chim. Acta*, 1925, 8, 512-513.)—When fused with sodium carbonate, zirconium oxide forms sodium zirconate in amount depending on the temperature, the duration of the fusion, the state of division of the oxide, etc. By suitable adjustment of these conditions, the proportion of the zirconate formed is reducible to 0.5 per cent., so that the sodium carbonate method for the separation of zirconium from iron may be employed when absolutely accurate results are not required and when the proportion of zirconium is small in comparison with that of the iron. The mixed oxides, together with six times their weight of sodium carbonate, are fused for 2 hours in an uncovered platinum crucible, the cooled mass being afterwards dissolved in hot water. The residue, containing iron, zirconium oxide and sodium zirconate, is separated by means of a hardened filter-paper, washed with dilute ammonium nitrate solution, ashed and calcined strongly in a blow-pipe flame, and treated for 2 hours with concentrated hydrochloric acid on a water-bath. The zirconium oxide, which remains unattacked, is filtered off, washed with dilute hydrochloric acid until it becomes perfectly white, calcined strongly, and weighed.
T. H. P.

Solubilities of the Phosphates of Zirconium and Hafnium. G. Hevesy and K. Kimura. (*J. Amer. Chem. Soc.*, 1925, 46, 2540-2544.)—The phosphates of zirconium and hafnium are the only ones insoluble in strong mineral acids (except hydrofluoric acid), and a precipitate under these circumstances will almost invariably indicate the presence of either zirconium or hafnium and zirconium (since hafnium is not found free from zirconium in nature). Each metal may be

quantitatively determined in the same way, and, if both are present, the composition of the phosphate may be calculated from the ratio $\text{ZrO}(\text{PO}_3)_2 + \text{HfO}(\text{PO}_3)_2 : \text{P}_2\text{O}_5$, or of that of the phosphates and oxides. Lundell and Knowles (*J. Amer. Chem. Soc.*, 1919, **41**, 1801) use about 200 c.c. of solution containing 20 per cent. of sulphuric acid by weight for 0.1 grm. of zirconium dioxide, but, in order to prevent error from the slight solubility of the phosphates of zirconium and hafnium, a great excess of phosphate is necessary for precipitation, and the solution should be kept cold. The solubility of zirconium phosphate ($\text{ZrO}(\text{H}_2\text{PO}_4)_2$) in 6 *N* hydrochloric acid is 0.00012 molecular equivalents, and that of hafnium phosphate ($\text{HfO}(\text{H}_2\text{PO}_4)_2$) 0.00009 mol. equivalents; and the solubility in 10 *N* hydrochloric acid is 0.00023 and 0.00012 respectively. D. G. H.

Sensitive Differential Reaction of Cerium. L. Fernandes. (*Gazz. Chim. Ital.*, 1925, **55**, 616-618.)—By means of the coloration it yields with pyrocatechol, cerium present in the proportion of 1 part to 400,000 parts of solution is readily detectable. When the solution contains only rare earth elements, it is rendered almost neutral by addition of ammonia, and a small portion of the liquid then shaken with a crystal of sodium thiosulphate and about 1 grm. of pyrocatechol until these are completely dissolved; if necessary, the liquid is diluted. Addition of excess of ammonia solution then produces a more or less intense violet coloration if cerium is present. If very small traces of cerium are to be detected, a blank test is made for comparison. When relatively large quantities of the rare earth elements are present, the addition of ammonia gives a white precipitate, which must be allowed to settle before the colour of the liquid is observable. If the rare earth elements have been precipitated as oxalate, this may be treated directly with the pyrocatechol in presence of ammonia. The reaction may be disturbed by the presence of other elements forming highly coloured complexes with pyrocatechol. In this case the elements of the first two analytical groups must first be eliminated in the usual way, and any iron removed by shaking the solution with ether in presence of ammonium thiocyanate and hydrochloric acid until the red coloration formed disappears. T. H. P.

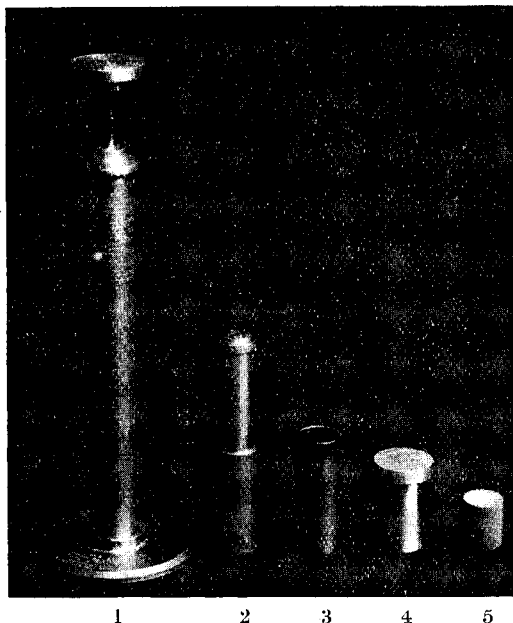
Physical Methods, Apparatus, etc.

Method of Testing the "Permeability-to-Gas" of Sands. A. L. Curtis. (*Iron and Steel Inst., Carnegie Scholarship Memoirs*, 1925, 43-68.)—For testing the permeabilities of steel moulding sands a modification of the apparatus of the American Foundrymen's Association has been devised in which the sizes of the orifices are more suitable for this purpose. The degree of permeability is calculated by means of the formula—

$$P = \frac{\text{cm}^3 \text{ of air} \times \text{height of test piece in cm.}}{\text{pressure of manometer in grms.} \times \text{area of face of test-piece in cm.}} \div \text{time in minutes.}$$

Only 1000 c.c. of air are forced through a 25 grm. test-piece of the sand, the air

being driven from a displacement bottle by means of water flowing at the rate of 1000 c.c. per 30 seconds from an overhead supply tank. The pressure is recorded on a manometer with a range of 25 cm., and any test-piece likely to exceed this



1. Moulding, Sand Ramming Instrument (capacity 5 to 75 lbs. per square inch. 2. Plunger of Instrument. 3. Brass container for holding Moulding Sand during ramming, and for connecting with Permeability Apparatus. 4. Plunger for use with Container. 5. Moulding Sand Test Piece.

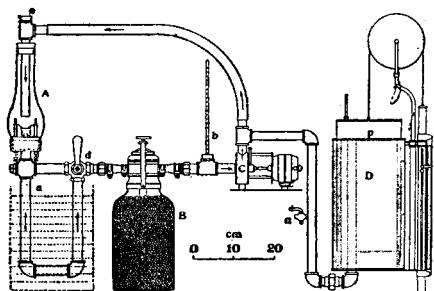
pressure is mixed with standard silica sand to bring it within the permeability range. With a test piece of 25 grms. the operations of adding water, mixing 200 times wet in the mortar, ramming to a given pressure, and testing for permeability only take about 15 minutes. The American method of ramming by means of a drop sand-rammer (*Report Joint Committee on Moulding Sand Research*, American Foundrymen's Assoc., 1924, p. 44) has been abandoned in favour of a more simple apparatus (see Figure) in which 25 grms. of moistened sand are compressed in a brass container (3 in. \times 0.995 in. inside diameter) to any desired pressure (5 to 75 lbs. per sq. in.). The brass container is then connected with the permeability testing apparatus by a rubber tube. A pressure of 10 lbs. per sq. in. was found to give a good ramming pressure for all test-pieces. A series of parallel tests has shown that there is no apparent relationship between the value for P and the crushing strength of air-dried test-pieces. Steel facing sand mixtures of various origin gave values for P ranging from 29.5 to 134.6—a very large margin of difference possibly responsible for some of the troubles occurring in the steel foundry. Varying the proportion of water

between 6 and 9 per cent. had little effect on the value of P , but any water added in excess of 6 per cent. made the sand too wet for use as steel facing sand. The maximum cohesiveness was obtained with 6 per cent. of water. No relationship exists between the permeability and the average size of the grains of a sand, as was shown by the following results *inter alia* :—

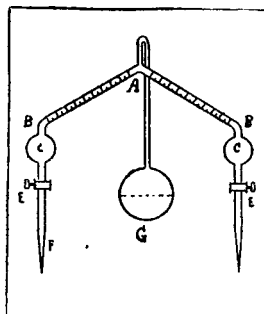
	P .
Cornish sand, average grain size, 0.01344 in.	65.83
U.S.A. No. 4 Facing Sand, average grain size, 0.01345 in.	104.8

The Oxy-calorimeter for the Determination of the Energy Values of Fuels, Foods, etc. F. G. Benedict and E. L. Fox. (*Ind. Eng. Chem.*, 1925, 17, 912–918.)—The apparatus consists of a glass combustion chamber A connected at its lower end with a cooling tube a and a 3-way tap d for regulating the flow of oxygen to the combustion chamber. The material is placed in a nickel crucible which is supported at the bottom of A , and is ignited electrically, the carbon dioxide produced being absorbed in the soda-lime chamber B . The expansion or contraction chamber D also serves for the measurement of the volume of oxygen used for the combustion. At the commencement of the operation, the whole apparatus is filled with oxygen through the tap n while the stopper e is removed, and an electric blower C circulates the oxygen through the apparatus during the combustion. The apparatus is standardised with pure substances such as sucrose, lactose, etc.

W. P. S.



The Oxy-calorimeter for the Determination of the Energy Values of Fuels, Foods, etc.



New Method for the Determination of Molecular Weights.

New Method for the Determination of Molecular Weights. G. Rastelli. (*Gazz. Chim. Ital.*, 1925, 55, 552–554.)—If equally concentrated solutions of two different substances in one and the same solvent are prepared, the molecular weights of the solutes are proportional to the vapour pressures of the solutions. This principle may be utilised for the determination of molecular weights by means of the apparatus shown in the accompanying sketch. Two calibrated glass tubes of 2 mm. bore are fused together at A and connected at their other ends with the bulbs C , the taps E and the drawn-out tubes F . The other tube connected with A serves for the application of suction to draw equal volumes of the solutions through F into the two graduated tubes. After this has been done, a bulb G

containing a substance which absorbs the vapour of the solvent is joined to A. If a and b are the respective quantities of solvent evaporated in a given time from the two solutions, the molecular weights of the solutes are in the ratio $a:b$, so that if one molecular weight is known, the other may be calculated. The values 142, 219 (and 250), 141, and 204 were obtained in this way for the molecular weights of acetanilide, triphenylmethane, azobenzene, and benzoin, the true values being 135, 244, 182, and 212.

T. H. P.

X-ray Method of following the Oxidation of Unsaturated Fatty Acids.

J. J. Tillat. (*Compt. Rend.*, 1925, **181**, 504-506.)—The author has been able, by the application of X-rays, to observe the mechanism of the oxidation or drying of oleic, linolic and linolenic acids. The method consists in observing under the influence of X-rays a thin film of the acid on lead. There is formed a lead salt which acts as catalyst. The oxidation takes place by successive additions of a definite quantity of oxygen accompanied by an elongation of the molecule (of the order of 6 to 7 Å.) which can be directly observed and measured. This is the first example of the direct observation of the mechanism of a reaction.

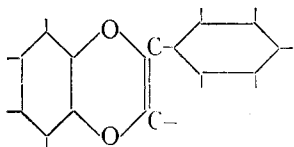
H. E. C.

Fluorescence of Vegetable Colours. L. Meunier and A. Bonnet.

(*Compt. Rend.*, 1925, **181**, 465-467.)—The application of Wood's light to yellow tinctures or vegetable extracts, such as those of quebracho, fustic or berbery, enables them to be easily differentiated from other vegetable colours. This is by reason of the fact that morin, quercitrin, rhamnetin, luteolin and fisetin contain a characteristic grouping which, under

the influence of these rays, causes them to exhibit a yellow fluorescence. Turmeric, annatto, logwood, saffron and other similar colours do not exhibit this fluorescence (cf. *ANALYST*, 1925, 256, 361).

H. E. C.



Reviews.

LES NOTIONS FONDAMENTALES D'ÉLÉMENT CHIMIQUE ET D'ATOME. G. URBAIN.

Pp. 171. Paris: Gauthier-Villars et Cie. 1925. Price 10 fr.

This little book, by the President of the International Commission on Chemical Elements, is one of the series "Science and Civilisation," in which it is attempted to set out a comprehensive but exact view of the results of modern researches. It is intensely interesting. This must be so when a competent authority commences to write on the definition of an element (Chap. I.), and traces the notion from the earth, air, fire and water of Empedocles, touching on the work of all the great masters and ending with the "definition" adopted by the Commission in 1923. This latter is only provisional as, indeed, it must be in the present state

of knowledge. Subsequent chapters deal with the radio-active elements, the constituents of the atom, the structure of the atom, a discussion of properties in relation to constitution, and, lastly, isotopes. Altogether it is a most interesting little book which will be appreciated by philosophic chemists.

One could wish that the publishers had thought it worth while to give the volume cloth covers; the paper covers so common on the Continent do not appeal to English readers, who are accustomed to something better. The book is worthy of a better binding, and an index would add to its value.

H. E. COX.

LE PRINCIPE DE SYMÉTRIE ET SES APPLICATIONS. Par F. M. JAEGER. Pp. 417. Paris: Gauthier-Villars et Cie. 1925. Price 55 fr.

This work was published in 1917 at Amsterdam in English and dedicated to Sir William Pope. It received an appreciative review in *Nature*, but does not seem to have attracted much attention in this country or in France. Prof. Ch. Moureu, who contributes a preface to this new French translation by M. M. Pierre Gérald and Jean Chevier, describes the work as treating "un des sujets les plus vastes et les plus profonds parmi tous ceux que nous offre la contemplation et l'étude des phénomènes naturels." The author, who will be remembered by those who assisted at the Benzene Centenary as a man of culture as well as a chemist, heads his opening chapter with a quotation from the *Republic* of Plato to the effect that "the knowledge at which geometry aims is knowledge of the eternal." In seven chapters carefully annotated with references to original papers, he discusses the geometrical theory of symmetry applying it to symmetry, as actually seen in living beings, in natural minerals and in chemical compounds. "Il est curieux de remarquer que presque tous les êtres vivants supérieurs (hommes, quadrupèdes, oiseaux, insectes, etc.) présentent la symétrie du groupe S ("bilateral") ayant un simple plan de réflexion comme élément de symétrie. Les animaux inférieurs (Blastoidea, Coralla, Radiolariae, Discomedusiae, Ascidiae, etc.), au contraire présentent souvent une symétrie plus complexe, caractérisée par des axes dont le nombre périodique est supérieur à 2 ($n=3, 4, 5, 6 \dots$) et par la présence de plusieurs plans de symétrie." It is certainly very remarkable that morphological evolution proceeds in the direction of simplicity.

The eighth and ninth chapters are of most direct interest to chemists; in them the author introduces us to the "knowledge of that aristocracy of chemical compounds which possess in addition to all the commonplace and vulgar physical attributes, the distinctive seal of nobleness: optical activity" (Percy Frankland, 1881).

Pasteur's experimental work on optical activity and its relation to mirror image asymmetry led him, in 1860, to the following speculation: "Doit on considérer les atomes du composé droit comme groupes sur les spirales successives d'une hélice dextrogyre ou certains groupes d'atomes comme placés aux sommets d'un tétraèdre irrégulier?" Fourteen years afterwards the answer came from Holland and from France in the conception of the asymmetric carbon atom. To Van't Hoff

and Lebel is due the credit of lifting chemical formulæ from the two dimensional regions of paper to the three dimensional world in which things really exist. On comparing the two last chapters of this book with Van't Hoff's *Chemistry in Space* (English edition of Marsh, 1891) the extraordinary fertility of this conception and the results of its extension to other atoms than carbon fill one with respectful amazement.

It is remarkable that, so far, no optically active compound has been completely synthesised, although by the aid of agencies of vital origin one or other of the active components of artificially prepared racemic compounds has in many cases been separated from its enantiomorph.

The author speculates on the origin of optical activity and the reasons for the great prevalence of active rather than racemic compounds in nature. He ends with a note of hope that the dynamics of asymmetric syntheses will become as accessible to us as those of our ordinary laboratory operations.

The book is profusely illustrated with figures of structures found in nature, and also with many diagrams.

J. H. COSTE.

A MANUAL OF CHEMISTRY FOR MEDICAL STUDENTS. By ARTHUR P. LUFF, M.D., B.Sc. (Lond.), F.R.C.P., F.I.C., and HUGH C. H. CANDY, B.A., B.Sc. (Lond.), F.I.C. Seventh Edition, Vol. I. Introduction and Inorganic Chemistry. London: Cassell & Co., Ltd. 1925. Price 11s.

Since its first issue in 1892 this work has been of the greatest service to medical and dental students throughout the country, and has been the means of conveying to many minds that are at first inclined to deprecate the need of chemistry in the everyday requirements of their profession, the idea that after all this science may be of real use to them. This statement is confirmed by the fact that edition after edition has been called for. Each has been revised and enlarged to keep pace with modern developments, the present edition being issued in two volumes. The first, now under review, deals with Inorganic Chemistry only, and is to be followed shortly by a second volume devoted to Organic Chemistry.

Although primarily intended to assist the student working for the pre-medical examination of the Conjoint Board, the syllabus of this examination is in no sense slavishly adhered to, the subject being treated much more widely, and Mr. Candy, who is responsible for this edition, shows his thorough knowledge and actual experience of the requirements of the present-day student.

Part I., an introduction to the study of chemistry, has been largely revised, and includes concise descriptions of many of the new theories and recently-discovered facts in reference to the atom and the chemical constitution of matter.

Parts II. and III. deal mainly with non-metallic and metallic elements and their compounds, and the subject matter has been brought well up to date.

In Part IV. the preparation of salts is given at some length, and this is followed by the theory and practice of simple qualitative and quantitative analysis, many exercises for the student being worked out in detail. The treatment of this section

is on scientific lines, is very clearly given, and fully covers the requirements of the various elementary examinations in practical chemistry.

The book is well printed, contains fifty-seven diagrams and illustrations in the letterpress, and can be recommended as one of the best of its kind.

P. A. ELLIS RICHARDS.

WIRE DRAWING AND THE COLD WORKING OF STEEL. ALASTAIR T. ADAM, A.R.T.C.
Pp. 212. London: H. F. & G. Witherby. Price 40s. net.

Books on the technical application of metallurgical knowledge in the general sense are many, but really valuable contributions to specialised branches of metal working are rarely found, hence this book is one to be praised and treasured.

From the commencement it is clearly indicated that the processes of wire-drawing and cold-rolling are selected for consideration in studying the mechanism of cold flow in metals, and of these two processes wire-drawing has been accorded the greater prominence.

It is obvious that the making of the book has been to a careful and well thought out plan; as an early evidence of this the division of cold working into two classes might have mention, for the author clearly distinguishes between cold working for shape only, and cold working for the physical properties which accrue.

A thoughtful plea for greater care in the manufacture of steel for finer work should give cause for reflection and will be approved by all who have to deal with cold worked material in the final stages of manufacture.

A considered statement that "with a more uniform distribution of impurities in steel, higher limits of tolerance in respect to impurities could be allowed with safety" cannot be considered to be at all ill-timed.

In turn the author deals with: Wire-drawing, cold-rolling, heat treatment, the effect of cold work on the physical properties of metals, the effect of heat treatment after cold work and the application of cold work to non-ferrous metals and alloy steels.

Additional chapters are separately devoted to theories of plastic flow in cold worked metals and the pathological aspect of cold working operations.

In these the intrinsic value of the author's wide knowledge of his subject has been enriched by a careful selection of references to the most recent work of others, and—with wisdom—where personal knowledge is being put forward, this is vouched for as such.

The account of the nature of flow in drawing, merits special mention, as also does the concise summary of the various theories of plastic flow in cold worked metals: in fact, the work as a whole is distinguished by its clear expression and ordered sequence and can be thoroughly recommended, not only to those interested directly in cold-worked metals, but also to all students of metallography.

The illustrations, reproductions and printing are also equally worthy of the matter.

G. RUDD THOMPSON.