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Liverpool Section.

Meeting held on Wednesday, November 28th, 1900.

MR. C. LONGUET HIGGINS IN THE CHAIR.

EXPERIMENTS ON FRACTIONAL DISTILLATION.

BY SYDNEY YOUNG, D.SC., F.R.S.

THE close connection between pure and applied science is very well illustrated by the history of fractional distillation. The ordinary process of distillation was, no doubt, known to the alchemists, but no great improvements seem to have been introduced until the want was felt of a more rapid and economical method of separation of alcohol from the dilute solutions obtained by fermentation. The progress then made was very great; and for the treatment of large quantities of liquid, some of the stills, such as the Coffey still, seem to me to leave little to be desired. Most of the still-heads in use in the laboratory are, in fact, constructed on the same principles as those previously used on the large scale, and, certainly, I can claim no novelty in the principle of the first one (Chem. News, 1895, **71**, 177) which I devised, in conjunction with Mr. G. L. Thomas, B.Sc., for laboratory purposes. Like an earlier one devised by F. D. Brown (Trans. Chem. Soc. 1880, 49), it might almost be described as a laboratory Coffey still. At the Bristol meeting of the British Association in 1898, I described a somewhat improved form of this still-head, which I have called the Young and Thomas dephlegmator, and I was asked by Prof. Armstrong whether I had made experiments to compare its efficiency with that of the still-heads in most common use, such as the Glinsky or Le Bel-Henninger.

I had not then made such a comparison, but I did so soon afterwards, and various points of interest having arisen, I found it desirable to extend the investigation to still-heads in general, and was thus led to devise the new forms which have been described in the Trans. Chem. Soc. 1899, **75**, 679, and a full account of which has been given in the Journal of this Society (1899, **18**, 859). In making such a comparison, great care is necessary to keep the conditions as nearly as possible the same in all cases, not only as regards the composition of the mixture distilled, but also as regards the rate at which the distillation is conducted, for this has a very great influence on the extent of the separation, as may be seen from Table I.

TABLE I.

Temperature Range.	Number of Drops of Distillate per Minute.		
	30.	60.	120.
	Percentage Weight of Distillate.		
80·2— 83·2	0·8	0·6	0·6
83·2— 86·3	29·6	21·8	10·8
86·3— 89·4	9·8	14·3	20·2
89·4— 92·5	5·6	7·8	12·6
92·5— 95·6	3·8	5·0	7·0
95·6— 98·7	3·0	4·7	5·4
98·7—101·8	2·8	4·0	5·0
101·8—104·8	3·0	3·6	5·0
104·8—107·9	4·3	5·2	5·6
107·9—110·3	6·2	7·3	9·2
110·3—110·9	11·6	9·8	11·0
Pure toluene by difference.	19·5	15·9	7·6
	100·0	100·0	100·0

Equal weights of pure benzene and toluene (generally 50 grms. of the mixture) were always taken, and the distillate was collected at the rate of one drop per second. A seconds pendulum was made to swing behind the receiver, so that the drops could be easily watched and regulated.

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In order that a still-head may be efficient, it is necessary that there should be good contact between the ascending vapour and the condensed liquid. This is not the case with the plain vertical still-head, but the efficiency, poor always, varies considerably with the width, diminishing from the smallest diameter to about 12 or 15 mm. and then increasing again. But as the weight of vapour and condensed liquid is much smaller in a very narrow than in a very wide still-head, the former is certainly to be preferred.

Any alteration in the form of the still-head which brings about better contact between vapour and liquid—sloping the tube, bending it into a spiral, and so on—improves its efficiency, and a study of the effects produced by such alterations led to the construction of the "Rod and Disc," the "Pear," and the "Evaporator" still-head.

[The different forms of still-head were exhibited at the meeting, and distillations carried on with some of them; the relative efficiency of other forms—such as the "regulated temperature" still-head, and the Glinsky, the Le Bel-Henninger, and the Young and Thomas dephlegmators—was discussed and illustrated by tables; the effect of increasing the number of sections in a still-head was also considered.]

In carrying out the systematic fractional distillation of a mixture, it is important that the results should be tabulated in a convenient form for reference and comparison. The fractions should always be weighed, and the observed boiling points should be corrected for deviations of the barometric pressure from 760 mm. Lastly, it is very convenient to calculate the ratio of the weight of each fraction to its temperature range, for this may throw much light on the progress of the separation. The purer the fraction, the higher will be this ratio $\frac{w}{\Delta t}$.

Or, instead of calculating the ratios $\frac{w}{\Delta t}$, a graphical method may be employed, the total weight of distillate being mapped against the temperature. As an illustration I may refer to the separation of normal and isopentane from American petroleum carried out by Mr. G. L. Thomas and myself in 1895 with a combined Young and Thomas dephlegmator and regulated temperature still-head.

The curve representing the results of the first distillation (figure, Curve I.) seems to indicate that a single substance boiling at about 33° is being separated from others boiling considerably lower (butanes) and higher (hexanes); but, if that were so, the curves for subsequent fractionations should become more horizontal (indicating increased purity) at about that temperature. Instead of this they become less horizontal, and the next curve in the figure (fourth fractionation) approximates to a straight line between about 30° and 37°. This change is a sure sign that there are at least two substances present with boiling points not very far apart, but little or no light is thrown on the actual boiling points.

Curve VII. is fairly straight from about 28·5° to 35·5°, but then becomes much more horizontal, terminating at 36·4°. This seems to indicate that the least volatile component boils at a temperature not far from 36°.

Curve X. is distinctly most vertical in the middle; it becomes nearly horizontal above, and terminates at 36·3°, showing that the higher boiling point is a little above 36°. As the curve is more horizontal below than No. VII., there is evidence that the second component must boil not far from 28°.

The upper extremity of Curve XIII. is perfectly horizontal at 36·3°, showing that a pure substance (normal pentane) is being separated, and the form of the curve below indicates that the boiling point of the more volatile component must be very close to 28°, and further fractionation showed that it was really 27·95°.

It may be of interest to show how the presence of hexamethylene was recognised in American petroleum. The material used was petroleum ether, consisting chiefly of hexanes, but containing also pentanes and heptanes. The fifth fractionation, with a 12-column Young and Thomas dephlegmator, gave high values of $\frac{w}{\Delta t}$ from 61·5° to 70° with a maximum at 67°—68°. Above 70° the ratios fell to a minimum at 78°—84°, and then rose again, as will be seen from Table II.

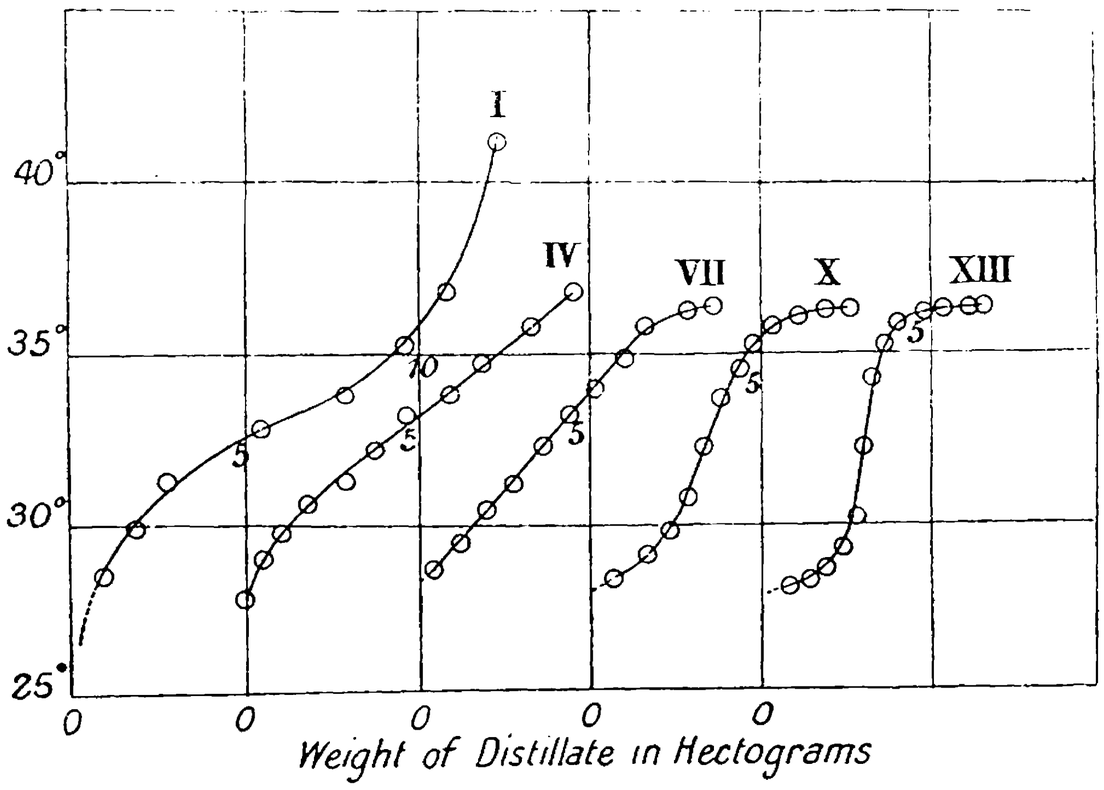


TABLE II.

V.			VI.			VII.			XII.		
Δt	w	$\frac{w}{\Delta t}$	Δt	w	$\frac{w}{\Delta t}$	Δt	w	$\frac{w}{\Delta t}$	Δt	w	$\frac{w}{\Delta t}$
66—67	85·9	85·9	66—67	74·9	74·9	66·0—66·9	49·8	55·3	74·0—78·8	12·7	2·7
67—68	94·1	94·1	67—68	82·6	82·6	66·9—67·7	62·3	77·9	78·8—80·0	16·4	13·7
68—69	81·1	81·1	68—69	103·0	103·0	67·7—68·4	70·0	100·0	80·0—80·5	24·3	48·6
69—70	73·3	73·3	69—70	78·3	78·3	68·4—69·0	68·8	114·7	80·5—81·1	12·1	20·2
70—72	64·6	32·3	70—71·5	52·2	34·8	69·0—69·8	81·9	102·4	81·1—83·0	11·5	6·1
72—78	81·4	13·6	71·5—76·0	69·7	15·5	69·8—71·0	46·9	39·1	83·0—85·0	7·1	3·5
78—84	62·5	10·4	76—82	64·8	10·8	71·0—72·5	45·4	30·3	..	..	..
84—89	66·0	13·2	82—87	58·9	11·8	72·5—76·0	20·5	5·9	..	..	..
89—91	39·9	20·0	87—90	35·3	11·8	76·0—79·5	38·1	10·9	..	..	..
..	..	..	..	..	..	79·5—85·0	72·9	13·3	..	..	..
..	..	..	..	..	..	85·0—88·0	23·4	7·8	..	..	..

Now, if there were no substance present between the hexanes and heptanes, the ratio $\frac{w}{\Delta t}$ would become smaller each time at the intermediate temperatures, notably about 80°; but it will be seen that in the next fractionation the ratio was slightly higher, instead of lower. (At the same time the maximum was higher and at a somewhat higher temperature, 68°—69°.) It was therefore thought advisable to increase the number of fractions about 80° and in the seventh fractionation a maximum value of $\frac{w}{\Delta t}$ was observed at about this temperature, in addition to that due to normal hexane near 69°.

Further fractionation of the distillates coming over between 72° and 88° showed that there was really a substance present boiling not far from 80°, as will be seen from

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No. XII. It might be supposed that this substance was benzene (b. pt. 80·2°); but that could not have been the case, for a 10 or 20 per cent. solution of benzene in hexane boils nearly constantly at a temperature very little higher than that of hexane alone, and in American petroleum almost the whole of the benzene comes over below 70°, mostly from about 63° to 68°. Moreover, the aromatic hydrocarbons in this case had been removed by treatment with a mixture of nitric and sulphuric acids.

The quantity of liquid was insufficient to complete the purification, though further improvement was effected; and later on a large quantity of Galician petroleum was very carefully fractionated by Miss E. C. Fortey, B.Sc., who obtained a considerable amount of liquid boiling quite constantly at 80·8°. Derivatives of hexamethylene were obtained from this, and it was believed to be quite pure until it was found that it could be partially but not completely frozen. Finally by fractional crystallisation the hexamethylene was obtained quite pure, and was found to have almost exactly the same boiling point (80·85°), but a somewhat higher specific gravity.

It is evident that these is another hydrocarbon present, no doubt a heptane, boiling at so nearly the same temperature as hexamethylene that it cannot be separated from it by fractional distillation.

Determination of Composition of Mixtures.

In the comparison of the various forms of still-head, a large number of distillations of mixtures of equal weights of benzene and toluene were carried out, and it was noticed that whenever an efficient still-head was used, and when not less than 50 grms. of the mixture was distilled, the weight of distillate that came over below the middle temperature, 95·55°, was always near to 50 per cent., the extreme variations being from 47·9 to 52·0 in 25 cases, and the mean of all 49·9 per cent.

It occurred to me, while looking through my notes for this paper, that it might perhaps be possible to estimate the composition of a mixture, at any rate of two homologues or isomers, by fractionating it, two or three times if necessary, and finding the weight of distillate coming over below the middle temperature.

The data available are not very extensive, but in one case they refer to a mixture of three liquids, methyl, ethyl, and propyl acetates, and in another to two isomeric paraffins mixed with lower and higher homologues, and the results seem satisfactory.

In the case of the esters the mixture consisted of 200 c.c. of methyl acetate, 250 c.c. of ethyl acetate, and 200 c.c. of propyl acetate, or by weight 31·7, 38·2, and 30·1 per cent. respectively. The boiling points are 57·1°, 77·15°, and 101·55°, and the two middle points 67·1° and 89·35°. A long, plain, vertical still-head was employed for this fractionation.

Table III.

——	A.—Below 67·1.	B.—Below 89·35.
1	11·5	86·0
2	22·5	68·0
3	28·5	70·0
4	32·5	69·0
5	31·0	69·5
6	30·0	69·5
7	31·5	70·0
8	30·0	69·0
9	29·0	69·0
10	31·0	70·0
11	31·0	68·7
12	30·5	68·8
Mean of last ten	30·5	69·3

——	Percentage Composition.	
	Taken.	Found.
Methyl acetate	31·7	30·5
Ethyl acetate.....	38·2	38·8
Propyl acetate.....	30·1	30·7
	100·0	100·0

It will be seen from Table III. that the percentage weight of distillate below 67·1° was considerably below the percentage of methyl acetate in the mixture in the first two fractionations, somewhat irregular in the next two, and then remained practically constant in the next eight at 30·5 per cent. instead of 31·7. The percentage weight below 89·35° was much too high in the first distillation, a little too low in the second, and then remained practically constant at 69·3. This should represent the sum of the weights of the methyl and ethyl acetates, which was in reality 69·9 per cent. The difference, 69·3 − 30·5 = 38·8, should give the weight of ethyl acetate, and it was actually 38·2 per cent. Lastly, 100 − 69·3 = 30·7 should be the weight of propyl acetate; the percentage weight taken was 30·1.

Thus a fairly accurate estimate of the composition of the mixture could be obtained from the results, at any rate, of the third fractionation long before any pure methyl acetate could be separated, and when the range of temperature for the fractions richest in ethyl acetate was over six degrees. No doubt if a more efficient still-head had been employed the weights would have become constant after the first or second fractionation.

Again, in the separation of normal and isopentane already referred to (b. pts. 27·95° and 36·3°; middle temperature, 32·15°), from a mixture containing also butanes, hexanes, and a little pentamethylene, if we take the weight of distillate between 27·95° and 36·3° as 100 in each case, the percentage coming over between 27·95° and 32·15° became roughly constant after the first distillation. The variation was greater in this case than with the esters (40 to 46, mean 42 per cent. in 12 fractionations) but the differences of boiling point is only 8·35°, as against 20·15° and 24·4°.

It would appear, then, that in American petroleum, of the two paraffins, normal and isopentane, about 42 per cent. consists of isopentane and 58 per cent. of normal.

At the end of the fractionations 101 grms. of pure isopentane and 175 grms. of pure normal pentane were obtained, or 36·6 per cent. of the iso-paraffin; but the loss by evaporation is greater, and there is always greater difficulty in the separation of the more volatile component of a mixture.

In the cases considered the components were present in not very far from equal quantities, and it still remained doubtful whether the method suggested would be applicable to mixtures in which one component was present in relatively small quantity. In order to test this point I have distilled mixtures of benzene and toluene containing respectively 90 and 10 per cent. of benzene.

Since the higher boiling constituent of a mixture is more easily separated than the lower, it was to be expected that the determination of the composition of a mixture poor in toluene would be simpler than that of one poor in benzene, and that was, in fact, found to be the case.

When 100 parts of a mixture containing 10 per cent. of toluene was distilled once through a three-column evaporation still-head, it was found that 89·6 grms. came over below the middle temperature, the percentage composition being thus at once ascertained with an error of only 0·4.

A single distillation of 100 grms. of a mixture containing 10 per cent. of benzene with the same still-head was, however, quite insufficient, very little coming over below 95·55°. Moreover, the quantity was too small to admit of the systematic fractional distillation of the more volatile portions. Two more distillations, however, without fractionation brought up the quantity coming over below 95·55 to 9·0 grms. A series of fractional distillations of 250 grms. of the mixture, containing 10 per cent. of benzene, with a 12-bulb "Pear" still-head, gave the results shown in the table on next page.

Thus the percentage weight of distillate below 95·55° was 0, 6·5, 8·4, 9·1, and 9·3 respectively, the limit being apparently about 9·5 instead of 10·0. The deficiency is certainly in part due to evaporation and loss by transference

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——	I.	II.	III.	IV.	V.
1. Below 95·55	0	16·2	21·1	22·7	23·2
2. 95·55 to 105·0	43·7	21·0	10·9	6·4	3·5
3. 105·0 to 110·7.....	76·0	39·4	19·4	9·6	6·3
	119·7	76·6	51·4	38·7	33·0

from flask to distillation bulb.* By employing a very efficient still-head the number of distillations required is greatly reduced and the losses are to a large extent avoided. Thus, on distilling 300 grms. of the mixture with an 18-column Young and Thomas dephlegmator, the first distillation gave 21·4 grms., or 7·1 per cent., below the middle temperature, and 54·7 grms. from 95·55° to 110·8°; and on mixing the two fractions together and redistilling, 29·2 grms., or 9·7 per cent., came over below 95·55°. Thus, with a very efficient still-head, two distillations, without separation into fractions, gave the composition to within 0·3 per cent.; so that, besides great saving of time, considerably increased accuracy is secured by using such a still-head.

In making these determinations it is essential that the rate of distillation be kept fairly constant, and it is convenient to make the rate about one drop of distillate per second.

It is obvious that this method would not be applicable to such pairs of liquids as propyl alcohol and water, or benzene and hexane, for we may have mixtures boiling at a perfectly constant temperature at or below the boiling point of the more volatile component; and since up to the present time it is only mixtures of homologous substances that have been examined, it is not yet safe to say that the method could be extended to any others.

London Section.

Meeting held on Monday, December 3rd, 1900.

MR. OTTO HEHNER IN THE CHAIR.

Before the reading of the paper, the Chairman stated that Mr. Tyrer, jun., had been good enough to put on the table that evening a collection of condensers. The members would have an opportunity of inspecting them at the close of the meeting.

COAL-GAS: EFFECT OF QUALITY ON CONSUMPTION.

BY W. J. DIBDIN, F.I.C., F.C.S., ETC.

THE importance of a clear comprehension of the effect of variations in the quality of coal-gas upon the quantity of light obtainable therefrom is of no little moment. It is a curious fact that in the minds of many of those who discuss the question there appears to be a vague notion that all coal gas is more or less of the same lighting value, and that the only point for discussion is the price to be paid for a given quantity.

The use of coal-gas purely as a heating agent raises another point entirely apart from that of the illuminating effect when the gas is burnt in those burners commonly employed. The question is also complicated by the recent introduction of the incandescent gas burners, or "mantles," which materially affect the question so far as the number employed bears any ratio to the total number of burners of all kinds in general use.

If none but incandescent burners were employed, then it might be granted at once that the old idea of "illuminating power" of coal-gas must be very largely and seriously modified—so much so that the expression "heating power" might safely be used in its place. As long, however, as the great proportion of the gas is consumed in ordinary luminous flame burners, it must be admitted that there is no excuse for neglecting the effect of variations in quality upon the quantity of gas required to give normal or "unit" illumination. If the quantity of gas required to be burnt to afford any desired degree of illumination be a variable factor, in consequence of fluctuation in quality, and the gas so employed be charged for at a uniform rate for each cubic foot used, the actual cost of that degree of illumination must vary with the quantity. Thus, a gas of higher price, but of higher quality, may be far cheaper to the consumer than is a gas of lower price but lower quality. These two factors must be taken together, and, in order to obtain a proper estimate of their ratios, the conditions under which the gas is to be consumed must first be determined, as these conditions will materially affect the problem. Taking the extremes, for instance, the value may depend upon quantity only if the basis be that of the incandescent burner, but even then the heating value of the gas should be taken into account. On the other hand,

Diagram A.

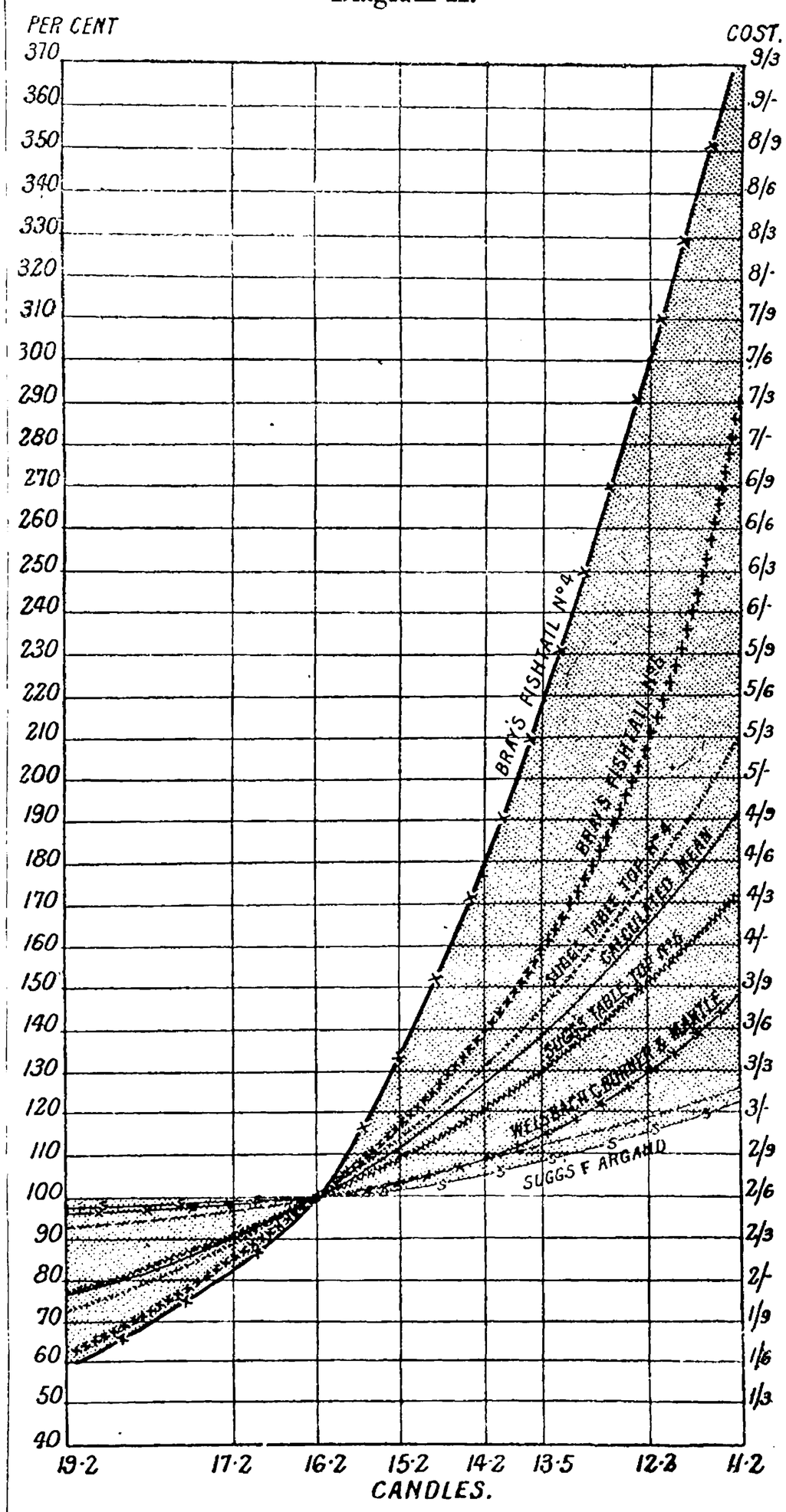


Diagram showing the percentage variation in the quantity of gas consumed to yield unit light for each burner when varying qualities of gas are used.

* In the case of the three esters the loss by evaporation, &c., was allowed for, the percentages being calculated, not on the total weight of mixture originally taken, but on the total amount remaining after each fractional distillation. In the 12 fractionations this total fell from 576·8 to 529·2 grms.

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TABLE 1.—WIDNES SERIES.

Table showing the Variation in Quantity of Gas consumed to yield Unit Light for each Burner when varying Qualities of Gas are used.

No.		Illuminating Power.	Consumption of Gas per Hour with							
			11·2	12·2	13·5	14·2	15·2	16·2	17·2	19·2
			Candle Gas.							
1	Standard Argand	16·0	6·25	6·0	5·7	5·4	5·15	4·95	5·0	4·7
2	Sugg's table top, No. 4	14·4	11·2	9·7	7·75	6·4	6·1	5·3	4·5	3·9
3	„ „ No. 5	15·3	9·5	7·8	6·2	5·7	5·5	5·35	4·6	4·15
4	„ „ No. 6	17·0	10·4	8·9	7·3	6·9	6·3	5·65	4·8	4·5
5	„ „ No. 7	24·6	13·1	11·4	9·2	9·4	8·6	7·75	6·7	6·5
6	Sugg's slit union, No. 4	11·7	12·1	9·8	6·2	5·9	5·15	4·5	3·5	3·2
7	„ „ No. 5	15·3	9·8	8·8	7·1	6·7	6·0	5·35	4·4	4·1
8	„ „ No. 6	20·0	11·4	9·6	8·5	8·0	7·3	6·35	5·8	5·2
9	„ „ No. 7	18·5	10·6*	8·9	7·4	6·9	6·35	6·0	5·2	4·85
10	Sugg's fishtail, No. 6	14·3	11·2*	9·2*	7·5	6·4	5·8	5·1	4·4	4·0
11	„ No. 7	10·5	11·4*	10·7*	6·0	5·6	4·95	4·2	3·4	2·8
12	Bray's fishtail, No. 4	8·6	15·5*	13·4*	10·5	9·0	5·6	4·3	3·1	2·6
13	„ No. 5	11·8	14·0*	10·6*	9·8	6·8	5·9	5·05	4·0	3·2
14	„ No. 6	12·4	12·6*	10·7*	8·3	6·6	5·8	5·0	4·1	3·4
15	„ No. 7.	14·0	9·8*	9·1	8·0	6·0	5·6	5·1	4·15	3·6
16	Bray's batswing, No. 6	16·6	11·6	10·0	9·3	7·0	6·7	5·7	5·1	4·3
17	Bray's union, with Codac economiser	14·6	6·8	6·3	7·1	5·4	5·0	4·95	4·6	4·2
18	Mint's batswing, No. 6	19·0	12·1	10·8	9·2	8·0	7·35	6·6	5·7	4·8
19	„ No. 7	16·8	9·8	9·0	8·3	6·9	6·25	5·55	5·1	4·4
20	Iron fishtail	3·3	(out of range)				5·8*	3·0	1·7	1·4
21	Butcher's burner	26·5	13·7	12·0	11·5	10·5	9·3	8·4	7·9	7·4
22	Imitation Bronner, No. 4	10·1	5·5	4·8	4·5	4·3	3·8	3·5	3·15	2·9
23	Peebles, No. 4	9·0	6·3*	6·2*	5·0*	4·6*	4·05*	3·6	3·1	2·4
24	„ No. 5	13·0	7·4*	6·6*	5·6*	5·5*	4·8	4·55	4·1	3·6
25	„ No. 6	15·1	8·2*	7·5*	6·6*	6·1*	5·3	5·0	4·6	4·25
26	Sugg's F Argand	20·5	7·7	7·4	7·2	6·6	6·35	6·3	6·15*	6·15*
27	Welsbach C burner and mantle	Max. intensity	4·9	5·4	4·0	3·7	3·5	3·5	4·2	3·4
28	Sunlight	„	5·9	5·8	5·0	5·0	5·0	5·1	5·0	4·6

if the basis be that of a flat-flame burner, then the value must depend upon illuminative effect as well as on the quantity required to be consumed.

These considerations have rendered it necessary that the effect of consuming gases of different qualities in those burners commonly employed, as well as in the standard Argand and incandescent burners, should be clearly established. To assist in this the author has conducted a number of tests with various burners and different qualities of gas in regard to the quantity required to yield the maximum or "normal" light from any given burner when burning 16·0 candle gas under the most suitable conditions.

After a preliminary series of experiments of a necessarily limited character, the author arranged six series of photometrical tests. The first of these was made with coal-gas at Widnes; the second with gas supplied by the Gas Light and Coke Company; the third with gas supplied by the South Metropolitan Gas Company; and the fourth, fifth, and sixth with coal- and water-gases in various proportions.

For the purpose of the first series of experiments, Mr. Carr, the manager of the Widnes Corporation Gas Works, kindly prepared different qualities of gas from time to time and stored them in an experimental 100-ft. holder, which was connected to the author's photometer. The procedure was to first carefully test the quality of the gas when burnt at the rate of 5 cb. ft. per hour in a No. 1 London Argand burner, or what is commonly called its "illuminating power," and then to burn it in various gas burners in succession, making photometrical determinations of the light and estimations of the quantity of gas consumed.

The first series of tests was made with gas which had an illuminating power of 16·2 candles when burnt at the rate of 5 cb. ft. per hour in the standard Argand burner. This value was ascertained by independent tests by different observers using two photometers, *viz.*, the closed Evans photometer on the works, using candles as a standard, and the author's portable bar photometer, using the Dibdin's 10-candle pentane Argand standard, as recommended by the Board of Trade Committee. The value of the gas being thus ascertained, the standard London Argand burner on the portable photometer was removed and a Sugg's "table-top" burner No. 4 placed in position, and the gas adjusted until a fair and even-burning flame was obtained, which was found to be equal to 14·4 candles. The quantity of gas consumed was then ascertained by means of the experimental meter, which was found to indicate a rate of 5·3 cb. ft. per hour.

In like manner 28 burners were tested in succession with the same gas, and the results recorded in the attached table No. 1, in the ninth column, headed "16·2 candles," which refers to the quality of the gas employed in the experiments in question.

On the completion of the tests of all the burners with 16·2 candle gas, the gas unused in the experimental 100-ft. holder was again examined to make certain that no change in the illuminating power of the gas had taken place, the remainder displaced and the holder filled up with gas of another quality, when the tests were repeated in a precisely similar manner, the greatest care being taken to ensure that as far as possible the experiments were strictly comparable.

In this way it was ascertained that the flat-flame burner first tested, *viz.*, Sugg's table-top No. 4, which gave 14·4 candles of light with 5·3 cb. ft. per hour of 16·2 candle gas, required, to produce the same illumination, 6·1 cb. ft. per hour when the illuminating power of the gas was reduced to 15·2 candles; 6·4 cb. ft. with 14·2 candle gas; 7·75 cb. ft. with 13·5 candle gas; 9·7 cb. ft. per hour with 12·2 candle gas; and 11·2 cb. ft. per hour with 11·2 candle gas; whilst when the quality of the gas was raised to 17·2 candles the consumption required to yield the same unit or normal lighting power of 14·4 candles was reduced to 4·5 cb. ft. per hour; and with 19·2 candle gas the consumption was only 3·9 cb. ft. per hour.

In like manner the whole of the burners were tested and the results tabulated as shown. From this table another (Table 2) was prepared, in which all the results are reduced to terms of percentage quantity of gas consumed, on the basis that the 16·2 candle gas was normal, and therefore taken at 100. By this method of comparison the extra quantity of gas required to compensate for defective quality is at once seen, and, in like manner, the reduction in the quantity required to produce unit light as the quality increases.

In certain instances with low-grade gas the burners could not properly consume sufficient gas to give the amount of

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light afforded when the 16·2 candle gas was employed, and corrections had therefore to be applied. Where this was done the fact is indicated in the tables by an asterisk. Thus, in the case of Sugg's table top burner No. 7, 24·6 candles of light were obtained with gases down to 12·2 candles, but when 11·2 candle gas was used, only 20·2 candles could be obtained instead of 24·6. As the consumption of gas was 10·8 cb. ft. per hour, 13·1 cb. ft. would have been necessary to yield the 24·6 candles of light. These corrections more particularly apply to burners adapted for very rich gases when employed with low-grade gases. On the basis of a sufficient number of burners being employed to burn the total quantity of gas of a given quality to yield the volume of light required, this method of approximation would probably give slightly too low a result.

The diagram, "A" (see page 1075, *ante*), shows the effect of any alteration in the quality upon the actual cost of the gas required to produce unit light with certain representative burners.

On the left-hand side of the diagram, the volume of gas is indicated in terms of percentage for the various abscissæ, and on the right-hand side the corresponding increase or decrease in the cost is shown, on the basis that 16·0 candle gas costs 2*s.* 6*d.* per 1,000 cubic feet. The ordinates indicate the candle power of gas supplied. The curves represent unit or normal intensity of the light yielded by the respective burners when burning 16·2 candle gas with a consumption most suited to them, as shown in the third column of Table No. 2.

TABLE 2.—WIDNES SERIES.

Table showing the Percentage Variation in the Quantity of Gas consumed to yield Unit Light for each Burner when varying Qualities of Gas are used.

(100 per cent. = that required with 16·2 Candle Gas.)

No.	Burners.	Illuminating Power.	Percentage Consumption of Gas with 11·2 Candle Gas.	12·2	13·5	14·2	15·2	16·2	17·2	19·2
1	Standard Argand	16·0	125	120	114	108	103	100	100	94
2	Sugg's table top, No. 4	14·4	210	183	146	121	115	100	85	73
3	„ „ No. 5	15·3	178	146	116	107	103	100	86	77
4	„ „ No. 6	17·0	184	157	129	122	111	100	85	80
5	„ „ No. 7	24·6	169	147	119	121	116	100	87	84
6	Sugg's slit union, No. 4	11·7	269	218	148	131	114	100	78	71
7	„ „ No. 5	15·3	183	164	133	125	112	100	82	77
8	„ „ No. 6	20·0	180	151	134	126	115	100	91	82
9	„ „ No. 7	18·5	177*	148	123	115	106	100	87	81
10	Sugg's fishtail, No. 6	14·3	220*	180*	147	125	114	100	86	78
11	„ No. 7	10·5	272*	255*	143	121	118	100	81	67
12	Bray's fishtail, No. 4	8·6	361*	312*	244	209	130	100	72	60
13	„ No. 5	11·8	277*	210*	194	135	117	100	79	63
14	„ No. 6	12·4	252*	214*	166	132	116	100	82	64
15	„ No. 7	14·0	192*	178	157	118	110	100	81	70
16	Bray's batswing, No. 6	16·6	204	175	163	123	117	100	89	75
17	Bray's union, with Codac economiser	14·6	137	127	143	110	101	100	93	85
18	Mint's batswing, No. 6	19·0	183	164	139	121	111	100	86	73
19	„ No. 7	16·8	177	162	150	124	113	100	92	79
20	Iron fishtail	3·3	(out of range)				193*	100	57	47
21	Butcher's burner	26·5	168	143	137	125	111	100	94	88
22	Imitation Bronner, No. 4	10·1	157	137	128	123	108	100	90	83
23	Peebles, No. 4	9·0	175*	172*	139*	128*	113*	100	86	67
24	„ No. 5	13·0	163*	145*	123*	121*	105	100	90	79
25	„ No. 6	15·1	164*	150*	132*	122*	106	100	92	85
26	Sugg's F Argand	20·5	122	117	114	105	101	100	98*	98*
27	Welsbach C burner and mantle	Max. intensity	140	154	114	106	100	100	120	97
28	Sunlight	„	116	114	98	98	98	100	98	90

The bottom curve on the left-hand side of the diagrams cuts the ordinate for 19·2 candle gas on the abscissa, representing 60 per cent. of the quantity of gas required when 16·2 candle gas is employed. This curve then proceeds upwards until it crosses the ordinate representing 17·2 candle gas, which cuts the abscissa for 83 per cent. of normal value. The curve then crosses the ordinate for 16·2 candle gas on the abscissa for 100 or normal volume. The curve then proceeds until it cuts the ordinate for 15·2 candle gas on the abscissa for 134 per cent.; and in like manner the ordinate for 14·2 candle gas at 180 per cent.; 13·5 candle gas at 220 per cent.; 12·2 candle gas at 305 per cent.; and the ordinate of 11·2 candle gas at about 380 per cent.

By interpreting the variations in consumption of gas into relative cost, as indicated on the right-hand side of the diagram, it will be seen that in order to obtain equal degrees of illumination with varying qualities of gas, in the case of a No. 4 Bray's burner, the actual cost of the gas to the consumer, on the basis of *light for money*, will be as shown in the preceding table.

As it may be thought that No. 4 Bray is an exceptional burner, we may take No. 5 Bray, which may reasonably be looked upon as an average burner generally employed, and ascertain in the above manner the cost of equal light intensity for different qualities of gas, *viz.*:—

Illuminating Power of Gas.	Quantity required to give Light equal to 1,000 cb. ft. of 16·0 candle Gas.	Actual Cost of Gas at 2*s.* 6*d.* per 1,000 cb. ft.
	Cb. Ft.	*s.* *d.*
19·0	600	1 6
18·0	700	1 9
17 0	820	2 1
16·0	1,000	2 6
15·0	1,340	3 4
14·0	1,800	4 6
13·0	2,400	6 1
12·0	3,040	7 9
11·0	3,750	9 6

Illuminating Power of Gas.	Cost of Gas per 1,000 cb. ft.
	s. *d.*
19·0	1 7
18·0	1 10
17·0	2 1
16·0	2 6
15·0	3 0
14·0	3 7
13·0	4 3
12·0	5 4
11·0	7 1

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On this basis it is seen that any variation in price per 1,000 cb. ft. for each candle alteration in the illuminating power of the gas should be greater than has hitherto been supposed. On the other hand, these facts explain the common complaint as to the otherwise apparently inexplicable rise in the amount of the gas bills—a fall of 2 candles in quality causing a rise, in the case of Bray No. 5 burner, of 44 per cent. on the gas bill; whilst, when the gas is down to 12·6 candles, the amount of the gas bill is doubled. From these facts it will be at once seen that any discussion of the cost of gas per 1,000 cb. ft. is valueless in the absence of an equal recognition of its *quality*.

In the case of the Welsbach and the best Argand burners, which, however, are used to only a very limited extent as compared with the flat-flame burners, the results are less disproportionate, and a moderate reduction in price for each candle power would not be unreasonable; but, unfortunately, in order to obtain a problematical advantage to the users of gas for heating purposes, the vast majority of those who employ the gas for illuminating purposes in the burners commonly used would be mulcted to a most unjust and injurious extent.

As the foregoing results were obtained with specially prepared gas, it was deemed advisable to repeat the experiments with gas actually supplied to consumers. For this purpose a second series of tests was made in the author's laboratory at Westminster with gas supplied by the Gas Light and Coke Company. In order to obtain gas of very low illuminating power, the ordinary supply was stripped by passing it through a coke scrubber, the coke being moistened with linseed oil. The richer gases were obtained by the addition of petroleum to the ordinary supply and allowing the mixture of petroleum vapour and coal gas to stand for some hours in a holder before making the tests. The results are set out in Diagram "B."

A third series was next made with gas supplied by the South Metropolitan Gas Company to the Southwark gas meter testing station of the London County Council, the poor and rich gases being obtained in the same way. The results are set out in Diagram "C."

The results confirmed those first arrived at.

For the purpose of ascertaining the effect of the use of water-gas, the author conducted a similar series of tests three in number, *viz.*, first with a mixture of lower power coal-gas and water-gas in varying ratios; second with mixtures of high-power coal-gas and water-gas; and the third with high power water-gas and coal-gas.

The results are set out in Diagrams "D" and "E," and Tables 3 and 4.

Diagram B.

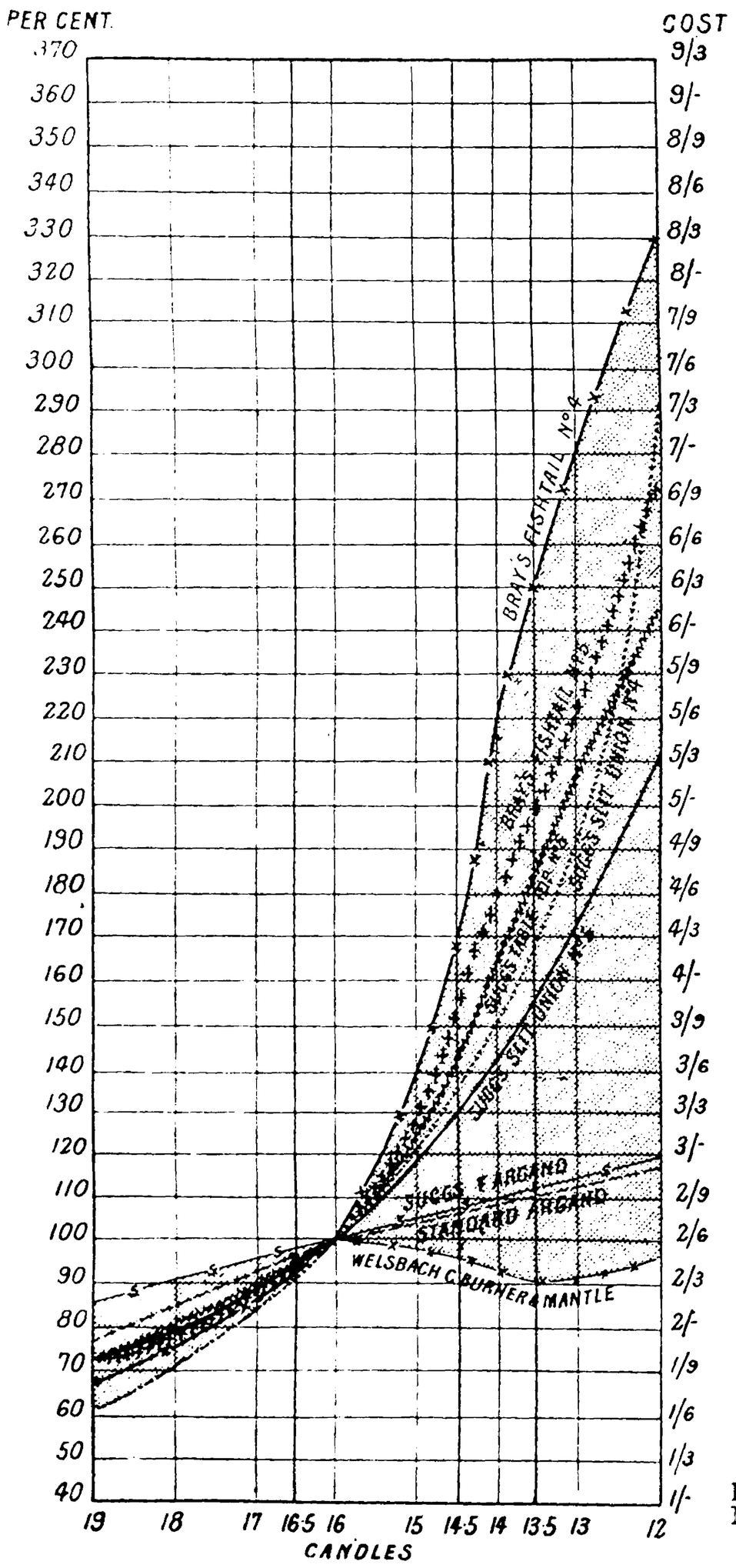


Diagram showing the percentage variation in the quantity of gas consumed to yield unit light for each burner when varying qualities of gas are used. Gas Light and Coke Co.'s Gas. 100 per cent. = that required with 16·0 candle gas.

Diagram C.

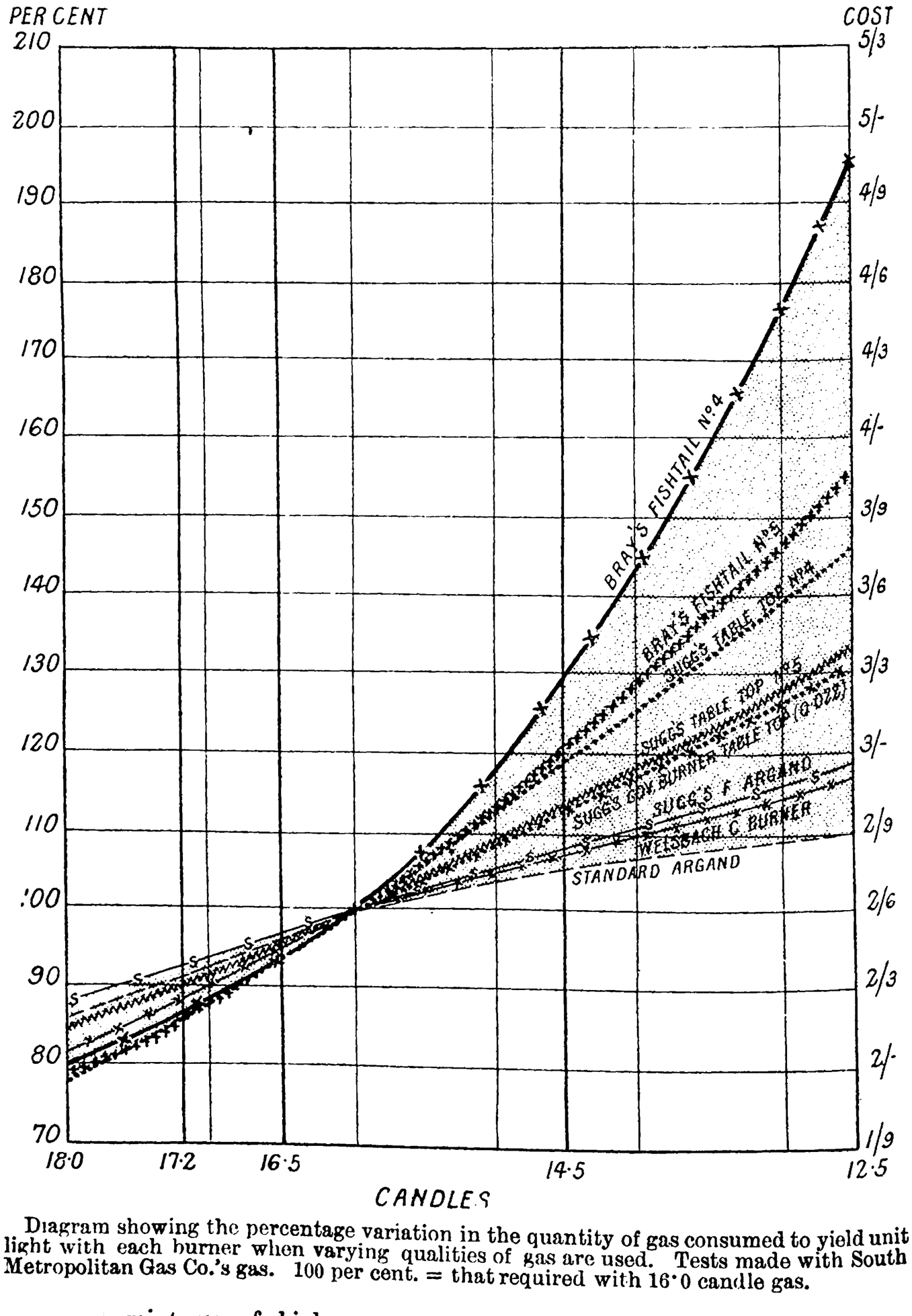


Diagram showing the percentage variation in the quantity of gas consumed to yield unit light with each burner when varying qualities of gas are used. Tests made with South Metropolitan Gas Co.'s gas. 100 per cent. = that required with 16·0 candle gas.

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Diagram D.

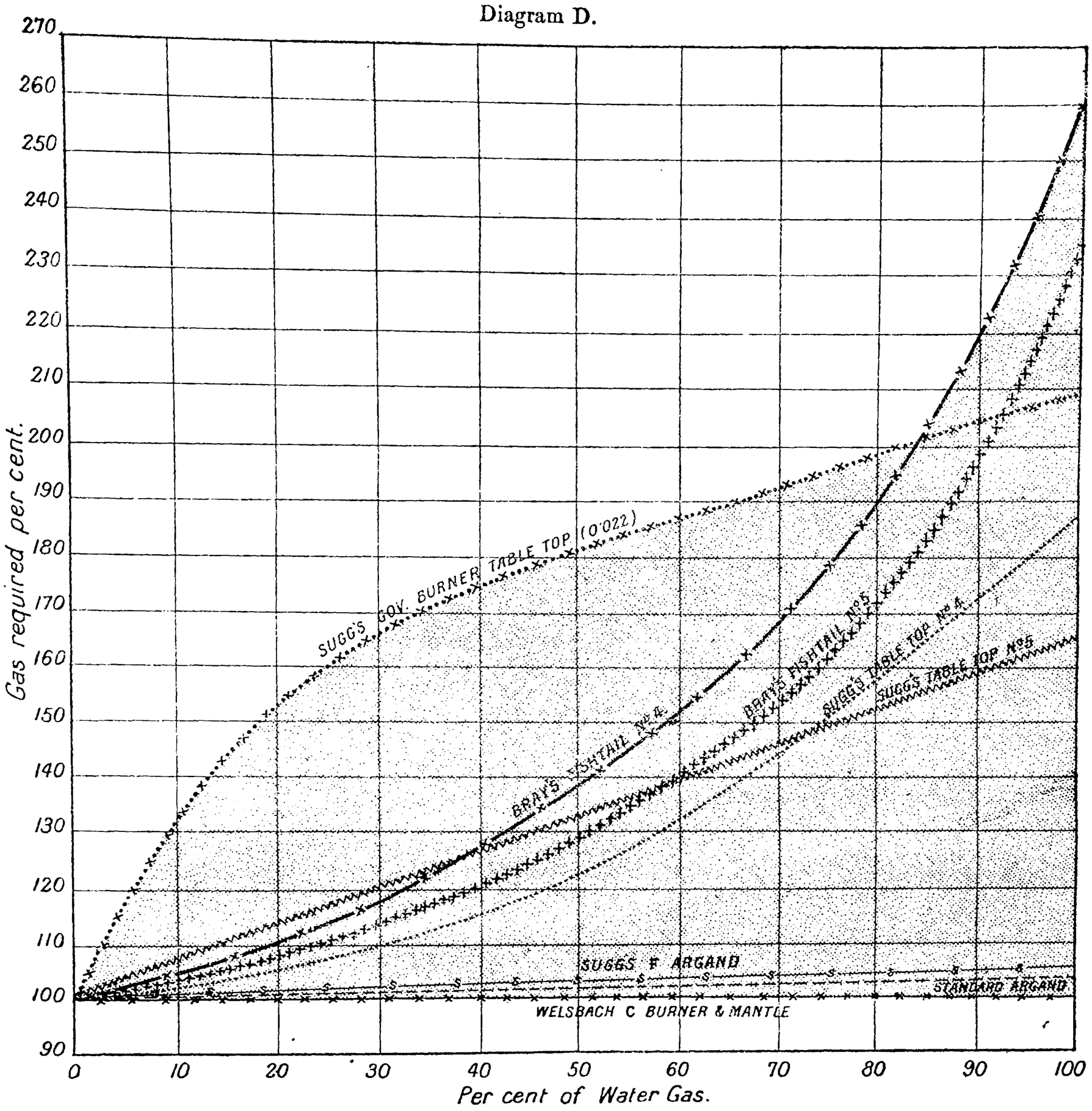


Diagram showing the percentage variation in the quantity of gas consumed in each of a series of burners to yield unit light with a mixture of low-power coal- and water-gases in varying ratios. Illuminating power of both coal- and water-gas = 14·5 candles.

TABLE 3.

Table showing the Variation in the Quantity of Gas consumed in each of a Series of Burners to yield Unit Light when varying Quantities of High-Power Water-Gas are mixed with Low-Power Coal-Gas, the High-Power Water-Gas being used as an Enriching Agent.

No.	Burners.	Illuminating Power.	Consumption of Gas per Hour with 16·0 — Candle-Power Gas containing: Pure Coal-Gas.	Consumption of Gas per Hour with 16·0 — Candle-Power Gas containing: 27 per Cent. Water-Gas.	Consumption of Gas per Hour with 16·0 — Candle-Power Gas containing: 50 per Cent. Water-Gas.
1	Standard Argand	16·0	5·0	4·7	4·6
2	Sugg's table top, No. 4....	14·0	5 4	5·7	5·0
3	„ „ No. 5....	15·0	5·4	4·9	4·9
4	„ „ No. 6....	17·0	5·7	5·7	5·7
5	„ „ No. 7....	24·0	7·8	5·4	7·4
6	Sugg's slit union, No. 4 ...	12·0	4·6	5·4	5·3
7	„ „ No. 5 ...	15·0	5·4	6·0	5·4
8	„ „ No. 6 ...	20·0	6·4	6·4	6·4
9	„ „ No. 7 ...	18·0	6·1	5·9	5·5
10	Sugg's fishtail, No. 6.....	14·0	5·2	5·9	5·3

Table 3—*cont.*

No.	Burners.	Illuminating Power.	Consumption of Gas per Hour with 16·0 — Candle-Power Gas containing: Pure Coal-Gas.	Consumption of Gas per Hour with 16·0 — Candle-Power Gas containing: 27 per Cent. Water-Gas.	Consumption of Gas per Hour with 16·0 — Candle-Power Gas containing: 50 per Cent. Water-Gas.
11	Sugg's fishtail No. 7.....	10·0	4·2	4·8	4·3
12	Bray's fishtail, No. 4.....	8·6	4·4	6·4	5·4
13	„ „ No. 5.....	12·8	5·1	5·0	4·8
14	„ „ No. 6.....	12·4	5·1	5·4	5·4
15	„ „ No. 7.....	14·0	5·2	5·2	5·2
16	Pray's batswing, No. 6.....	17·0	5·8	6·6	6·2
17	Brays union, with Codac economiser	15·0	5·0	4·7	4·6
18	Munt's batswing, No. 6 ...	19·0	6·7	6·8	6·4
19	„ „ No. 7 ...	17·0	5·6	5·7	5·7
21	Butcher's burner	26·0	8·5	8·8	8·0
22	Imitation Bronner, No. 4..	10·0	3·5	3·5	3·4
23	Peebles, No. 4.....	9·0	3·6	4·4	4·1
24	„ No. 5.....	13·0	4·6	4·9	4·2
25	„ No. 6.....	15·0	5·1	5·2	4·8
26	Sugg's F Argand.....	20·0	6·4	6·2	6·2
27	Welsbach C burner and mantle.	60·0	3·5	5·7	4·0

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From Diagram "D" it will be seen that with increased percentages of water-gas the quantity of gas required to give unit light with a Bray's No. 4 burner rose to as much as 160 per cent., whilst with the standard Argand burner the increase was only 6 per cent., and with the Welsbach mantle it was *nil*.

Diagram E.

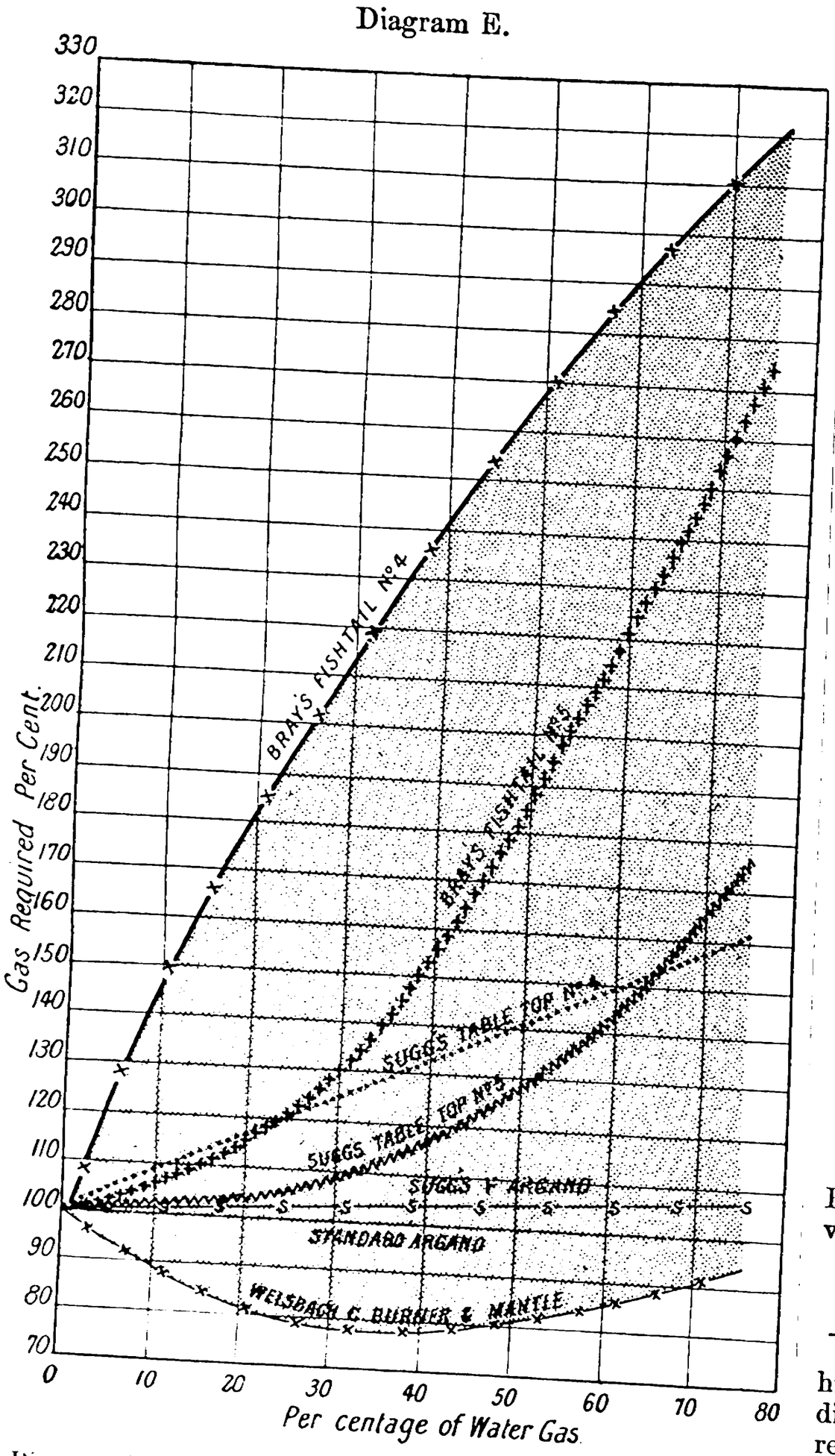


Diagram showing the percentage variation in the quantity of gas consumed in each of a series of burners to yield unit light when varying quantities of high-power water-gas are mixed with high-power coal-gas. Illuminating power of both water- and coal-gas = 17·2 candles.

In the tests with high-power coal- and water-gas (Diagram "E"), with Bray's No. 4 fishtail burner, the increase in consumption was 250 per cent. with 75 per cent. water-gas, but with the standard Argand there was no increase, whilst with the Welsbach mantle there was an actual decrease in the consumption of 7 per cent.

Briefly stated, the results of the water-gas series are that dilution of coal-gas with equal power water-gas has the same effect in many burners as that produced by a reduction of the illuminating power of the gas, *i.e.*, a larger quantity of gas has to be consumed in order to obtain the same illumination, whilst the use of excessive quantities of high-power water-gas as an enriching agent is without the commensurate advantages that might have been anticipated, *viz.*, such as are obtained from the use of benzol, cannel, &c.

These facts are of so much public interest that the author has no hesitation in responding to the invitation of your chairman to place them before the Society for the purpose of full discussion, and in order that their bearing upon the commercial interests of the community should be fully understood.

Table 4.

Table showing the Percentage Variation in the Quantity of Gas consumed in each of a Series of Burners to yield Unit Light when varying Quantities of High-Power (20·0 candle) Water-Gas are mixed with Low-Power Coal-Gas, the High-Power Water-Gas being used as an Enriching Agent.

No.	Burners.	Consumption of Gas per Hour with 16·0 Candle-Power Gas containing Pure Coal-Gas.	Consumption of Gas per Hour with 17·2 Candle-Power Gas containing 27 per Cent. Water-Gas.	Consumption of Gas per Hour with 18·0 Candle-Power Gas containing 50 per Cent. Water-Gas.
1	Standard Argand	100	94	92
2	Sugg's table top, No. 4	100	105	93
3	" " No. 5	100	91	91
4	" " No. 6	100	100	100
5	" " No. 7	100	95	95
6	Sugg's slit union, No. 4	100	117	115
7	" " No. 5	100	111	100
8	" " No. 6	100	100	100
9	" " No. 7	100	97	90
10	Sugg's fishtail, No. 6	100	114	102
11	" " No. 7	100	113	101
12	Bray's fishtail, No. 4	100	145	123
13	" " No. 5	100	98	94
14	" " No. 6	100	106	106
15	" " No. 7	100	100	100
16	Bray's batswing, No. 6	100	114	107
17	Bray's union, with Codac economiser	100	94	92
18	Munt's batswing, No. 6	100	102	95
19	" " No. 7	100	102	102
21	Butcher's burner	100	104	94
22	Imitation Bronner, No. 4	100	100	97
23	Peebles, No. 4	100	122	114
24	" No. 5	100	107	91
25	" No. 6	100	102	94
26	Sugg's F Argand	100	97	97
27	Welsbach C burner and mantle	100	94	114

The author has to acknowledge his indebtedness to Mr. R. G. Grimwood, F.I.C., and to Mr. E. W. Cox, for their valuable assistance during the investigation.

Discussion.

The Chairman said that Mr. Dibdin had so clearly stated his case that nothing was needed on his part to open the discussion. It was quite evident that there was no direct relation between the nominal illuminating power and the real illuminating power of coal-gas as ordinarily burnt by the consumer; that the most economical appliance to use was the Welsbach burner, and that those who did not use incandescent mantles should use Argand burners and eschew flat flames altogether. The subject treated by Mr. Dibdin touched a chemical industry in which many millions of capital were involved. If 16-candle-power gas was supplied they got a gas of a certain value. Mr. Dibdin had shown that it was entirely fallacious to assume that if the illuminating power were reduced to 14-candle-power, it was an adequate compensation to the public to diminish the payment by two-sixteenths.

Prof. Percy Frankland said he was sure the members would consider it a great privilege to have heard the results of Mr. Dibdin's exhaustive experiments. There was probably no one living who had had so much practical experience of the illuminating power of gas, how it was developed, and on what principle burners should be constructed. Those experiments had led to conclusions which could be summarised in one sentence—that a gas of higher price and higher quality might be far cheaper to the consumer than a gas of lower price and poorer quality. That was, however, a fact which had long been known. He had known it from his earliest days. His father, who had always been very eloquent on this point, had distinctly enunciated the fact as far back as 1876, or even before.

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Previous to that time two kinds of gas were circulated in the London mains; one consisted of coal-gas of 16-candle power, and the other cannel-gas of 27-candle power. The results of his father's experiments had distinctly shown that the cannel-gas, although of higher price per 1,000 cb. ft., was far cheaper for the consumer than the coal-gas of lower price. The nominal illuminating value of the coal-gas at that time was 16-candle power; it was also nominally 16-candle power at the present day. In 1851, he believed, the gas was nominally 14-candle gas, and so the general population of London was under the impression that between 1851 and 1876 a very important increase in the illuminating power of the gas had been made by the companies. But in 1876 the London gas was tested with the same burner that had been used in 1851 for the official testing of the gas, and it was found that the later gas had no greater power than the earlier. The increase in the nominal illuminating power was due to the improvement in the testing burner. In 1876 the gas was tested with an Argand burner, and it was that burner which led to the apparent proof of improvement in the London gas supply. It was now seen that the standard Argand burner developed a large amount of illuminating power out of a poor gas which the burner used in 1851 was incapable of developing. That was an important point in connection with the question of gas and its illuminating power—the use of such a burner as would develop the maximum amount of light out of the gas supplied. The materials from which Mr. Dibdin's conclusions were drawn were so abundant that it was difficult at first to fully grasp their significance, but with extraordinary ingenuity Mr. Dibdin had been able to bring to a focus, so to speak, the whole of his results on a single diagram, which to him seemed a masterpiece of lucidity. Those experiments had involved an enormous amount of trouble in their performance. It was very easy to experiment on a number of different burners with the gas as supplied from the main, but Mr. Dibdin's experiments had been made not only with a large number of burners, but also with gases of very widely different illuminating power, and consequently a very valuable and comprehensive series of results had been collected. He considered the members were particularly indebted to Mr. Dibdin for the thoroughness with which he had made those experiments, and for calling public attention to the difference between the illuminating value of gas and its nominal illuminating power. If incandescent mantles were universally employed, it would be a matter of little importance what was the intrinsic illuminating power of the gas supplied, and, indeed, from Mr. Dibdin's interesting latter experiments it appeared that the non-luminous gas, composed for the most part of water-gas, had some advantages in the development of light in Welsbach mantles. He felt bound to confess, however, that from his past experience with Welsbach mantles he would like to have as little to do with them as possible. They were distinctly troublesome to keep in order; the mantle was rarely giving its full light when wanted, and but for their great advantage in not polluting the air so much as the flat-flame burner, he would not use them at all. Even in the streets of London the Welsbach burners were comparatively seldom used, the flat-flame burner being generally employed. Nothing could be more striking than the way in which the volume of gas had to be increased in order to produce a given amount of light with flat-flame burners when the illuminating power of the gas was diminished. In actual practice, when the light supplied from one burner proved insufficient, it was usual to light a second burner, and, if the illuminating power of the gas supplied fell further, more burners would be used to produce the amount of light required. It would be seen from Mr. Dibdin's figures what that meant if the illuminating power of the gas was diminished from 16·2 to 14·2 candles; one would pay not a little more but enormously more for the gas; in fact, with a small diminution in illuminating power the gas bill might be doubled. Under those circumstances, and bearing in mind that the flat-flame burners were still in vogue, any diminution in the illuminating power of the gas was a distinctly retrograde movement. It did not mean merely that they were going back to the time of 1851, before the 16-standard gas was in use, because if the 1851 gas had been examined with the modern Argand burner it would have been 16-candle-power gas, although it was only supposed to be 14-candle gas, owing to the flat-flame testing burner then in use; therefore, to reduce the power now would be to employ a gas inferior to that used in 1851. It was also important that the gas should be of constant illuminating power, because each burner was adapted to gas of a particular illuminating power. It was now to be permitted that the illuminating power of the gas should vary, so that it was impossible for any burner except the Welsbach to continuously develop the full illuminating power of the gas supplied. Perhaps the facts which Mr. Dibdin had brought out in connection with water-gas were the most instructive and novel of all. On thinking over Mr. Dibdin's novel and remarkable results obtained with illuminating gas containing water-gas, it appeared to him that they were of a similar character to those which he obtained a number of years ago* in his investigation of the relative value of carbonic oxide, hydrogen, and marsh-gas as diluents for ethylene. In these experiments he found that marsh gas was by far the most advantageous, and carbonic oxide the most prejudicial, of these three diluents, hydrogen occupying an intermediate position in this respect. Thus a mixture of 80 per cent. carbonic oxide and 20 per cent. ethylene actually burnt with a non-luminous flame in the standard Argand, whilst with hydrogen the proportion had to be increased to 90 per cent. (hydrogen, 90 per cent.; ethylene, 10 per cent.) before the luminosity was destroyed. On the other hand, all mixtures of marsh-gas and ethylene burnt with a luminous flame in the standard Argand, for in this burner even pure marsh-gas itself had a small illuminating value. It appeared to him probable, therefore, that the prejudicial effect of water-gas on the illuminating power, when tested in ordinary burners, was due to the suppression of marsh-gas as a diluent.

Mr. T. Fairley expressed the hope that friends on the other side would state the views of the gas companies, and thereby promote discussion. Prof. Frankland had gone into points which he might himself have touched on, and there was little left for him to add, as the special work he had done in connection with gas testing was more applicable to its heating power. But there were one or two points which might be summarised. The flat-flame burners were better throughout for gas above 16-candle power, and the Argand burners of various kinds and the Welsbach burners were best with low-quality gas, below 16-candle power. In trying to estimate the value of the gas one must think, however difficult it might be, of a definite quantity of light, and one would want so many cubic feet of gas of a certain lighting power, at a certain price. Those three items must all be taken into account; to omit any one would be misleading. In respect to the heating power of the gas, he had not found the same differences as Mr. Dibdin had in using different burners; in fact, the relation of heating power to lighting power might be put into an algebraic formula; that was to say, one had in all gas a certain proportion of non-luminous gas that might give somewhere about half its heating power, and the rest was due to its lighting constituents. That part was certainly a multiple of the candle power, and one could find the factor which would give the total thermal units from the lighting power. Some people tried to show that the heating power of a gas went down in proportion as the lighting power went up, but that was only apparently so. The result of his own work might be stated thus:—B.T.U. = m(c.p.) + C, in which m was a multiple of the candle power by a certain factor and C a constant representing the heat due to the combustion of the non-illuminating constituents which formed a large part of coal-gas. In the gases he had tested m was, approximately, = 23·5 and C = 275, so that the formula became—

$$\text{B.T.U.} = 23{\cdot}5\ (\text{c.p.}) + 275.$$

In some cases the heating power of gas had been expressed in heat units per candle, by dividing the observed heating power by the candle power of the gas, and certain inferences drawn from the fact that as the candle power rose

* "The Composition and Illuminating Power of Coal-Gas." Percy F. Frankland, Soc. Chem. Ind. 1884, 275.

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the heat units per candle diminished. Carrying out this division in the formula:—

$$\frac{\text{B.T.U.}}{\text{c.p.}} = \frac{23{\cdot}5\ (\text{c.p.}) + 275}{\text{c.p.}} = \frac{23{\cdot}5\ (\text{c.p.})}{\text{c.p.}} + \frac{275}{\text{c.p.}}$$

it was obvious that as candle power increased the quotient $\frac{275}{\text{c.p.}}$ must diminish. In other words, the heat due to the combustion of the non-illuminating constituents of the gas could not increase with the lighting power. The apparent diminution was no argument in favour of the use of any particular low-lighting gas for heating purposes. A high lighting-power gas gave a proportionate increase in the heating power.

Dr. P. Dvorkovitch said that the question which Mr. Dibdin had raised was of very great importance. The South Metropolitan Gas Company had applied to Parliament for power to distribute to consumers 14-candle-power gas in lieu of the 16-power gas previously supplied. Thanks to the previous experiments of Mr. Dibdin, steps had been taken to oppose the reduction of power. Mr. Dibdin's experiments in the past had proved that although the company professed to supply 16-power gas the consumer never received more than 14-candle power, and from that it was argued that as the consumer had only received 14-candle power previously, they should continue to receive it by Act of Parliament. It was of the utmost importance that it should be widely known that the higher the illuminating power, the cheaper was the illuminant to the consumer. It was quite true that there were some burners which were used for testing purposes, *viz.*, the Argand and the Welsbach, which did produce a fairly equal result, whether rich or poor gas were used; but, after all, as Mr. Dibdin had explained, most of the consumers in the United Kingdom were not using standard Argand burners, and a very small percentage of the consumers were using Welsbach burners. At the same time, it had been shown that with the ordinary flat-flame burners, if a rich gas were supplied, the consumer was able to obtain full value for his money. He was sure it was not to the interests of the gas companies to reduce the power, but rather the reverse. He would like to ask Mr. Dibdin as to the manner in which he had used water-gas enriched by petroleum vapour. He hoped Mr. Dibdin would continue his experiments with carburetted water-gas, as he believed he would find the results quite different. His own experiments with water-gas gave different results to those of Mr. Dibdin, and if that gentleman would make experiments with water-gas as now produced by various systems in different gasworks, *i.e.*, water-gas of 18- to 24-candle power, he would get results different from those he had already obtained. Petroleum gas contained a large quantity of aromatic hydrocarbons which produced a high illuminating power, whereas petroleum vapours did not contain them, and in combustion produced a different result altogether. Nevertheless, the results as they stood were very instructive, and the diagram showed distinctly what the consumer would gain if the companies were to raise instead of to reduce the candle power. Gas engineers had stated that the cost of increasing the power would not be more than one halfpenny per candle, and if by expending a penny halfpenny the companies would give us 19-candle gas, and produce the results which Mr. Dibdin had shown, it would be to their interests to do so.

Mr. R. G. Grimwood said that one of the most interesting points brought out by Mr. Dibdin's paper was the peculiar influence which water-gas exerted on the relation between the illuminating value and the quantity of gas consumed, which was a most important point, because every day the quantity of water-gas introduced into gas supplies was gradually increasing. On looking down Mr. Dibdin's tables, one would notice on table 7, diagram D, where coal-gas and water-gas of equal illuminating power were mixed together in varying proportions, that the mere addition of 20 per cent. of water-gas involved an increased consumption of 10 per cent. to obtain the mean normal illuminating value of the burners employed; or if the most commonly employed burner, Bray's No. 5 fishtail, were used, an increased consumption of no less than 16 per cent. was entailed. The water-gas employed was made on the most modern principle, and was the water-gas supplied from the very best plant to be obtained. It was quite normal water-gas, and was not enriched after being made. On looking at table 11, where water-gas was employed in the manner in which it was ordinarily used, as an enriching agent, it would be seen that a mixture containing 27 per cent. of water-gas, by means of which the original coal-gas was enriched from 16 to 17·2 candles, necessitated the use, to obtain the mean normal illuminating value for that series of burners, of 5·6 cb. ft. per hour. On reference to table 1 it would be seen that for 17·2-candle-power coal-gas, or gas enriched by petroleum, the mean normal illuminating power only required 4·6 cb. ft.; thus the mere addition of 27 per cent. of water-gas entailed an increase in consumption of over 20 per cent. There was another way of looking at the question. A 17·2-candle-power gas containing 27 per cent. of water-gas gave no more illuminating value than 15·8 coal-gas, or coal-gas enriched with petroleum. That was a point which required very careful consideration, since no restriction was placed on the companies as to the amount of water-gas they might introduce into their supplies. It would be very interesting to know what would be the effect of, say, 10 per cent. of 40-candle-power water-gas added to an ordinary make of 14-candle coal-gas giving a 16·6-candle gas. It did not quite seem as if it were the luminous portion which influenced its peculiar effect, but the water-gas itself, and although it might be argued that 27 per cent. was high, it was certainly not more than was used by many companies in England. Another point Mr. Dibdin had brought prominently forward was the uselessness of making any comparison of the prices of gas without taking into account the illuminating value of the gas supplied. Being interested in the matter, he had looked up the London County Council reports on the illuminating power of the gas supplied to London outside the gas-testing stations, and he found, on taking the mean of the year, that the Gas Light and Coke Company's gas was 15·7 candles, whereas the South Metropolitan Gas Company's gas was 14·6 candles. On looking through diagram A it would be found that 1·1 candle power represented a difference of 5*d.* in illuminating value. Therefore, before making any comparison of price between the South Metropolitan and the Gas Light and Coke Companies' prices, one had to add 5*d.* to the price charged in South London. The paper had brought forward many new points which required very careful consideration. This year so many points in regard to the gas supply had come to light and the fact that no restriction was put on the gas companies as to the amount of water-gas they might put into their supplies, an addition which was acknowledged to be detrimental both to health and pocket, demands that some impartial body should hold an enquiry and settle the many points in dispute in connection with gas supplies.

Mr. I. Carr, of the Corporation Gas and Water Works, Widnes, wrote that, having assisted the author in the experimental research work at Widnes, mentioned in the paper, he was in accord with his conclusions adduced as to the lighting value of coal-gas of varying quality, when consumed in the ordinary flat-flame burners common to the consumers of to-day. The difference of 9*d.* per thousand in the selling price of gas by the two great London gas companies was, at the present time, the subject of much dissatisfaction and discussion; and while there was no denying, in one sense, the hardship of the position of the consumers of the Gas Light and Coke Company, who were paying 3*s.* 5*d.* per 1,000, as compared with that of 2*s.* 9*d.* of the South Metropolitan, yet the important fact that the former price was for 16-candle gas and the latter for 14, did, in a great measure, appear to be lost sight of. The writer had found that the light-giving value of 14-candle gas in the best type of flat-flame burner required 32 per cent. increase in consumption to give the same light as 16-candle gas; this, with gas at 2*s.* 9*d.*, amounted to 10*d.* per 1,000. He had stated that the position of the consumers on the north side of the river was hard, as compared with that of the consumers on the south, and he did so on the grounds that the cost of enrichment to the company did not bear a proportionate relation to the loss sustained by the consumer in the reduction in quality; *i.e.*,

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while the company might keep up the quality from 14 to 16 candles for ordinary lighting purposes at the additional outside cost of a penny per candle per 1,000, the loss to the consumer by reducing the quality from 16 to 14 candles for ordinary lighting purposes was 5*d*. per candle per 1,000. At the same time the consumer on the south side was paying dearly for his so-called cheap gas when the loss of lighting efficiency was taken into consideration. The economic standard of burner duty with gas of varying quality had an important bearing on this matter from the consumer's point of view. With the best ordinary batswing and fishtail burners and 20-candle gas, the consumer obtained four candles per cubic foot; yet the batswing burner of the most suitable kind, Bray's No. 6 special, when consuming the London 16-candle gas, yielded but 2·66 candles per cubic foot, or a falling off of 33·5 per cent. in effective duty. The highest economic duty the writer had obtained with 14-candle gas and a Bray No. 6 special batswing burner was 1·9 candles per cb. ft., or a further falling off of 32 per cent. He did not, however, agree with the author in describing the use of incandescent lighting as limited. On the contrary, this system of lighting was becoming very general, and, with the recent reductions in the price of both burners and mantles, it was highly probable that the amount of incandescent lighting would, in a few years' time, exceed that of the flat flame. Until, however, the flat-flame burner was entirely superseded by incandescent lighting, the serious loss in lighting efficiency inflicted on users of flat burners by low-grade gas must continue. Low-grade gas also affected adversely every type of burner, such as the incandescent, gas for heating, cooking, and motive power purposes, on account of the reduced calorific value, although the proportion of falling off was very much less than in the case of the flat-flame burner. For these purposes he found that for each candle the gas was reduced in illuminating power, and about 3 per cent. increase in consumption was required.

Mr. D. A. Sutherland said that he was in favour of a higher illuminating power, not necessarily as high as the former standard in Glasgow, some 25 candles, with which he had gained his first experience in gas testing. It surprised him very much that in London regulator burners were not more generally used; he had investigated several on which he had been able to report very satisfactorily. In reference to Prof. Frankland's remarks, he wished to say that he used Welsbach indandescent burners in his house, and also found them very useful for the purposes of titration in his laboratory. He would recommend Prof. Frankland to see that the air-holes in the burner were clear; they might require blowing through. The mantles would not last for ever, and he made it a rule to change them if they were injured and the light was not good. He believed that where there was much vibration, or handling, as in the case of a standard burner, it would pay to change them even, if necessary, once a month, although with care they would last for a very long time. It surprised him that any chemist should not prefer incandescent burners. In reference to the use of petroleum vapour, he was not able to follow how Mr. Dibdin secured its mixture with the gas. Unless permanent petroleum gas were used, petroleum vapour merely mechanically mixed might be affected by extremes of temperature between the periods of control. All the results had, no doubt, been corrected for temperature and pressure, as usual, but it would be interesting to know if there had been any variation in the temperature at which the tests were made.

Mr. Clayton Beadle understood that the great objection to the Welsbach light was the rapid destruction of the mantle. He noticed that Prof. Lewes had recently described a new mantle made of artificial silk, in place of the ordinary cotton mantle. Such a mantle was said to have lasted 3,000 hours, as against 600 hours of the ordinary mantle. If such mantles made of Lehner silk proved in practice as good as they had done in experiment, it would go a long way to make the Welsbach mantle a practical success.

Mr. R. Watson asked at what point Mr. Dibdin had introduced the air, in order to obtain the lower qualities of gas—11·2-candle, 12·2-candle gas, and so on. Since air was admitted he felt that it must oxidise the gas to a certain extent, as with the result that a certain percentage of the gas would furnish no heat, thus falsifying the actual consumption of gas which would be required. It seemed to him that the true moral of the figures brought forward by Mr. Dibdin was, that the consumer should be educated to use the correct burner, and not to use any burner that might happen to take his fancy, so far as appearance or popular opinion was concerned. There seemed very little variation between the 14- and 16-candle gas when the Argand, or still less the Welsbach, burner was used, and the question of price, as between 4·9 ft. of 16·2-candle gas and 14·2 gas with 5·4 cb. ft. to produce unit light, was a comparatively small one, not more than 10 per cent. of the actual value.

Mr. W. J. Dibdin, in reply, said that he felt in considerable difficulty, owing to the lack of criticism of his paper. He had expected to have to submit to a thorough pulverising—to be told that his conclusions were as foolish as the enquiry was nonsensical; but from the tone of the discussion that had taken place he was tempted to believe that he was not very far from the track, and that track was a very important and serious one. He had hoped to have heard some justification for the statement that had recently been made, that it was an economical thing to the consumer to be supplied with a low-grade gas, and that if he used a good burner he could get better results than with a higher grade gas; and he regretted extremely that the makers of such statements were not present that night to justify them. To the best of his ability everybody concerned in the question had been supplied with a copy of the paper, and had received an invitation to attend and discuss it; if they declined to avail themselves of the opportunity, no more was to be said, and the question must be left to the judgment of the public at large when they had the whole of the facts before them. He did not say this because he wished to establish any one particular point. There had been a controversy, and all honest men would wish to have it settled on the lines of truth, and truth alone. There was a question as to the character of the water-gas supplied. The water-gas was enriched in the process of its manufacture; that was to say, the charge of oil was placed in the retort, the oil cracked in the usual way, and a permanently enriched water-gas was produced at once, and not a gas that was enriched after manufacture. Mr. Carr had referred to the question of London gas. Of course that was a very important question; but he must again emphasise the fact that he did not care an iota about any particular case. He had put forward these facts as scientific truths, obtained with patience and care; whether they applied to London or Kamschatka did not influence him at all. Mr. Carr appeared to think that incandescent lighting had no limits. But the question of limitation was a relative one. No doubt a great many of those lights were now in use, and their numbers would increase; probably in the future they might be the only burners employed. But while they might hope that in the future something would be done, it would not be wise to neglect the existing position of the question. Go where one would, one saw the common flat-flame burners; one saw enormous factories all illuminated with them, also schools and streets; but how many incandescent burners would one see? Flat-flame burners would be found in many ordinary rooms where Welsbach burners might be used; but there were many places where the present form of Welsbach burner could not be used because of vibration, &c. He himself had been compelled to discontinue them in some places on that account. He felt perfectly justified in saying that at present, throughout the country at large, the use of the incandescent mantle was very small in relation to the total quantity of gas consumed for illuminating purposes. With regard to the admixture of petroleum introduced to increase the illuminating power, the method was to admit the spirit while the holder was filling. In every case a sufficient time was allowed for it to diffuse throughout the holder. In an hour or so the petroleum vapour was found to be thoroughly diffused. That was the way in which Harcourt proposed to produce his standard pentane gas for his standard burner. As to the temperature, he thought it would be taken for granted that it was carefully noted, and corrections made, not only for the volumes of the gases

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used, but for the illuminating effect. Exceptionally favourable circumstances were experienced. For instance, the experiments made at Southwark were in a room kept always at about 60° F. for the testing of meters; and the same applied to the experiments made in his own laboratory, all the conditions being carefully noted. With regard to the possibility of a new type of burner coming into use, that was very interesting, and he for one would be delighted to hear that the expectations of it were realised; but that fact would not affect the statements put forward in the paper. If a new mantle were produced which would take the place of the ordinary flat-flame burners, he would consider any man foolish who used any other form of gas-lighting than the incandescent mantle; but with the present form of mantle only available, it was often wiser to employ a flat flame burner. Everyone should use the burner that best suited his requirements; and that being so, the facts given in the paper had a special bearing on that point. As to the method of introducing air, there was only one instance, *viz.*, at Widnes. In that case a small side-cock was opened and a little air drawn in. In all other cases the gas was passed through a coke scrubber moistened with oil. In the case of the South Metropolitan supply there was no occasion to strip the gas at all.

The CHAIRMAN said that he thought all would agree that Mr. Dibdin had put a matter of the highest public importance in an exceedingly fair manner. He regretted much that the managers of gas companies had not thought it convenient to attend that evening, especially of that great company which had recently obtained permission by Act of Parliament to lower the illuminating power of their gas from 16 to 14 candles. No doubt, by the use of Welsbach mantles the alteration in the standard would not be felt, but all those who had tried mantles must have come to the conclusion that they were not altogether so admirable as was often stated. In the dusty London atmosphere they deteriorated rapidly, and had to be very frequently renewed, such renewal adding materially to the price of the illumination. The mantles as now used, whether those made by the Welsbach Company or those referred to in the discussion, were so exceedingly fragile, that he felt sure that further developments in this mode of illumination would have to take place before the incandescent light would come into more general use. He was convinced that in a few years a mantle of the present type would be as much of a curiosity as the 1885 mantle was at present. The greatest disadvantage under which the public laboured was, that in England the Welsbach Company had a monopoly of this type of illumination till the expiry of their 1893 patent. On the Continent, where the patent law was different, the price of mantles, owing to competition, was so low that they were within reach of all. He hoped that the time would not be far distant when the more or less accidental illuminating power of coal-gas, as due to carbon, would be entirely superseded by incandescent illumination.

Manchester Section.

Meeting held on Friday, December 7th, 1900.

DR. J. GROSSMANN IN THE CHAIR.

THE CHANGES IN THE PHYSICAL PROPERTIES OF CLAYS DURING DRYING.

BY W. JACKSON, A.R.C.S., AND E. M. RICH, B.SC.

IN view of the great importance of the physical properties of clays and clayey mixtures in the manufacture of ceramic bodies, it is very necessary to have the fullest possible knowledge of how these properties vary during the time the body is passing from the plastic or wet condition to the dry. This paper embodies the results of observations on the contraction, porosity, and tensile strength of clays at arious stages of dryness.

The clay employed was a china clay of very good quality, which on analysis yielded the following results:—

Ultimate Analysis.

SiO_2	45·72
Al_2O_5	38·56
Fe_2O_3	0·61
CaO	0·24
MgO	0·22
Alkali	2·11
Water	12·70
	100·16

Proximate Analysis.

Clay substance	97·44
Quartz	0·19
Felspar	2·52

Clay Substance.

SiO_2	44·95
Al_2O_3	39·07
Fe_2O_3	0·62
CaO	0·25
MgO	0·22
Alkali	1·87
Water	13·04
	100·02

By elutriation in Schone's apparatus the clay was divided into the following portions:—

Clay substance (so-called)	50·93
Silt	47·68
Sand dust	1·00
Fine sand	0·35
Coarse sand	0·04

The tensile strength was the first property examined.

The clay was made into a paste with water, poured on a plaster slab, and allowed to remain until stiff enough for working—that is until it just failed to stick to the fingers. It was then carefully "wedged" in order to render it as free as possible from air bells, flattened out into a sheet about 1 in. thick, and stamped into a number of pieces of a shape approaching the figure 8. Each piece was numbered and weighed, and two pairs of fine marks 50 mm. apart were impressed on the wider portions. They were then allowed to remain on plaster slabs exposed to the ordinary air of the laboratory, and after different lengths of time were re-weighed, re-measured, and broken in the small tensile-strength apparatus as made by Frühling, Michaelis, and Co., and described in Böckmann Untersuchungs Methoden, Vol. I., p. 721. After breaking, the area of fracture was measured and the tensile strength in kilos. per square centimetre calculated. Finally the two portions were either both completely dried at 120° C., or one dried and the other used for determination of the porosity. The object of drying was to determine the water contents at time of breaking, and to supply other data for the computation of porosity.

Before proceeding to give the results of these experiments it is necessary to describe the methods adopted to determine the porosity, both of the plastic and partially and completely dry clay.

A.—*Porosity of Plastic Clay.*—As it appeared to us unlikely that every trace of air would be removed from the clay by wedging, we devised the following method for investigating the matter.

A piece of the plastic clay, when placed in petroleum, was found to liberate no air bubbles, and did not alter in size. This, however, we could not accept as proof positive of the absence of all porosity.

Further experiment showed the existence of an appreciable porosity even in the most carefully and thoroughly wedged clay; in no case was it less than 1·8 per cent. The method was as follows:—the volume of the whole plastic lump was determined by weighing the lump in air and again when suspended in petroleum. The piece was then thoroughly dried, and the contents of water and the

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volume of the clay were thus determined, the specific gravity of the clay having been previously found. The volume of the whole lump, less the sum of the volume of water and clay, gave evidently the empty space—that is, porosity.

The following table embraces a series of results :—

Specimen.	Vol. of Plastic Lump.	Vol. of Water.	Vol. of Dry Clay.	Sum of Water + Clay Vols.	Air Spaces.	Per Cent. Porosity.
	C.c.	C.c.	C.c.	C.c.	C.c.	
*C. clay.....	21·78	11·36	9·83	21·19	21·78—21·19	2·7
*C. clay.....	19·33	10·19	8·71	18·90	19·83—18·9	2·2
*C. clay.....	16·11	8·32	7·50	15·82	16·11—15·82	1·8
H.&Co.'s body (pugged).	16·13	6·86	8·77	15·63	16·13—15·63	3·1
„ „	20·18	8·63	10·97	19·60	20·18—19·60	2·9
*Ball clay...	27·38	13·41	13·46	26·87	27·38—26·87	1·9

* Average of wedged specimens, 2·0 per cent.

Having thus determined the initial porosity, we passed on to the determination of—

B.—*Porosity of partially and completely dry Clay*—

1. By calculation from contraction and water contents.
2. By weight of petroleum absorbed.
3. By difference of vol. of whole lump and vol. of clay + water, as in case of original porosity.

Let C = wt. of dry clay in grms.
G = sp. gr. „ „
W = wt. of water (in grms.) in wet clay.
W_l = „ „ „ clay at time of experiment.
V = per cent. cubical contraction of clay from the plastic condition to time of experiment.
p = per cent. original porosity.
P = final porosity.

Now vol. of original piece = vol. of clay + water + pores—

$$= \frac{C}{G} + W + \frac{p}{100 - p}\left(\frac{C}{G} + W\right)$$

$$= \frac{100}{100 - p}\left(\frac{C}{G} + W\right)$$

Vol. of piece at time of experiment—

$$= \frac{100 - V}{100}\left\{\frac{100}{100 - p}\left(\frac{C}{G} + W\right)\right\}$$

This is also equal to—

Vol. of clay + remaining water + porosity

$$= \frac{C}{G} + W_l + P$$

$$\therefore \frac{C}{G} + W_l + P = \frac{100 - V}{100}\left\{\frac{100}{100 - p}\left(\frac{C}{G} + W\right)\right\}$$

$$P = \frac{100 - V}{100}\left\{\frac{100}{100 - p}\left(\frac{C}{G} + W\right)\right\} - \left(\frac{C}{G} + W_l\right)$$

$$\text{Per cent. porosity} = 100\left[1 - \frac{100\,(C + GW_l)}{\frac{100}{100 - p}\,(C + GW)\,(100 - V)}\right]$$

2. By weight of petroleum absorbed.

The broken piece of clay was weighed in air, and then allowed to lie in petroleum with one face exposed until constant in weight. The increase in weight was quickly determined, and the piece immediately weighed in petroleum. We thus obtained the volume of the whole piece, and the volume of the pores, from which the percentage porosity was determined.

3. Same as plastic method.

Below follows a series of results, showing the porosity of china clay, containing 13·4 per cent. of moisture, as determined by the three methods:—

	Porosity.
Method 1.....	16·9
Method 2.....	17·5
Method 3.....	18·6

from which it is seen that they agree fairly well.

These results were deduced from the following experiments :—Weight of piece of plastic clay, 76·3 grms. This was allowed to dry until its weight became 62·23, and the average linear contraction was 6·19 per cent., which is equivalent to a cubical contraction of 17·5 per cent. The water still present amounted to 8·92 grms. The porosity obtained from the formula utilising these figures is 16·9 per cent.

The piece was next divided into two portions—

A, weighing 15·09 grms.
B, weighing 44·12 grms.

A was soaked in petroleum (sp. gr. 0·824) and assumed a constant weight, 16·35, increase 1·26 grms.

$\therefore$ Vol. of petroleum soaked up = 1·52 c.c.

Weight of A suspended in petroleum, 9·2 grms.

Loss of weight, 7·15 grms.

$$\therefore \text{ Vol. of piece} = \frac{7{\cdot}15}{0{\cdot}824} = 8{\cdot}68 \text{ c.c.}$$

$$\text{Porosity} = \frac{1{\cdot}52}{8{\cdot}68} \times 100 = 17{\cdot}5 \text{ per cent.}$$

Piece B was completely dried, and then weighed 37·73 grms.

Vol. of clay is $\frac{37{\cdot}73}{2{\cdot}65} = 14{\cdot}24$ c.c. (sp. gr. of clay, 2·65).

The vol. of water in B was 6·39 c.c.

Total vol. of B before drying was obtained by proportion from the volume of A.

$$\frac{8{\cdot}68 \times 44{\cdot}12}{15{\cdot}09} = 25{\cdot}35 \text{ c.c.}$$

$$\therefore \text{ pores} = 25{\cdot}35 - [14{\cdot}24 + 6{\cdot}39] = 4{\cdot}72 \text{ c.c.} = 18{\cdot}6 \text{ per cent.}$$

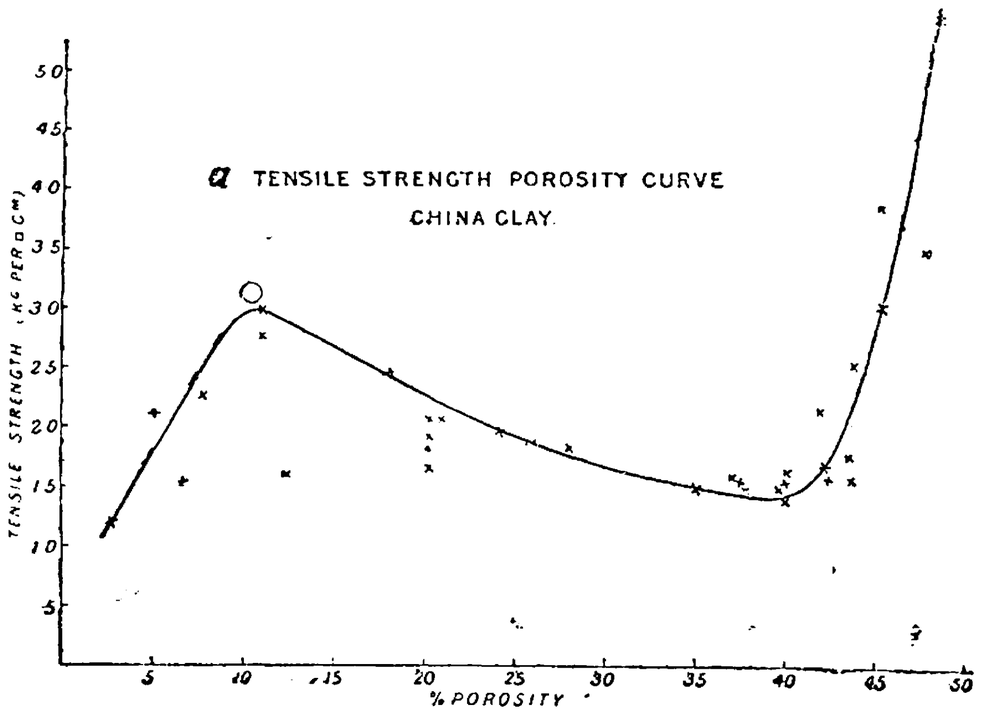
We now come to the results of determination of tensile strength.

The table on next page gives the results of experiments carried out to determine the tensile strength of a china clay at various stages of dryness, and shows, for comparison, the contraction and porosity determined by calculation from formula mentioned previously.

These results we have plotted as curves :—

a. Between tensile strength and porosity.
b. „ „ „ „ moisture.

In plotting the curves, greater value is attached to the higher numbers where several results are obtained in the same region, because, apart from errors of observation, these values must be the correct ones. The lower values may be accounted for by supposing the existence of flaws or lines of weakness in the clay. In fact, it is no very easy matter to obtain complete homogeneity and continuity in a clay, and especially so if the clay is very plastic.

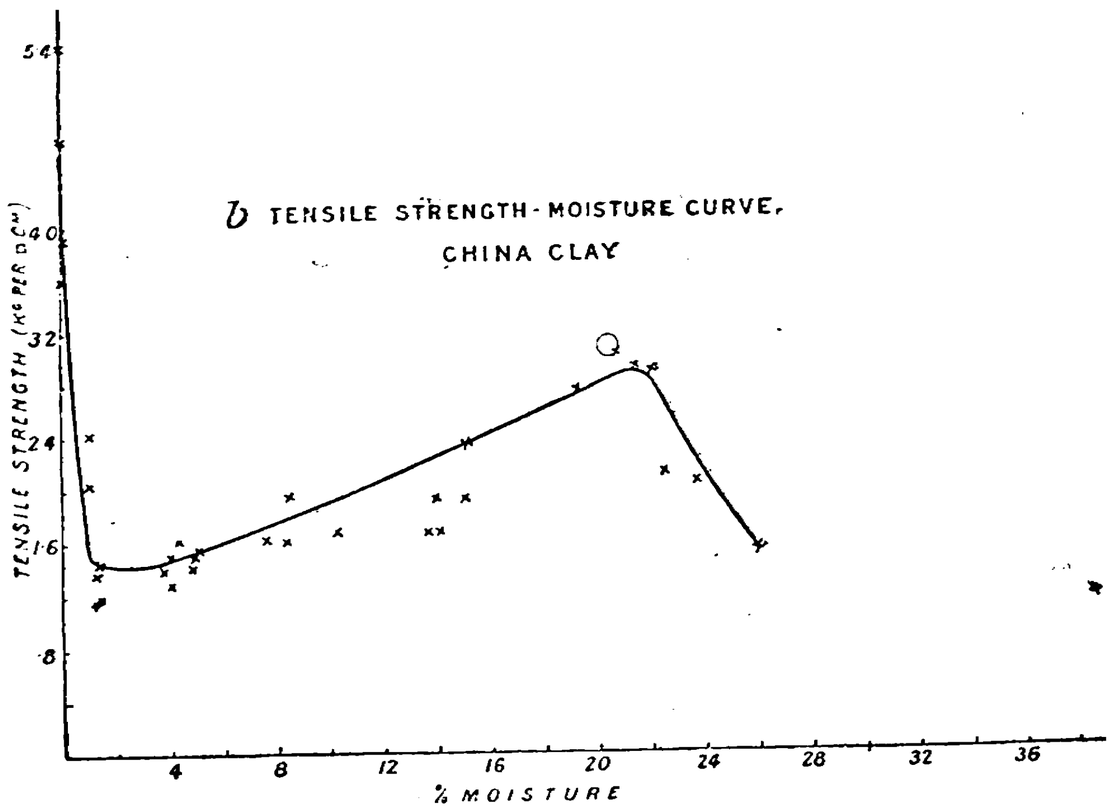


It will be seen that the tensile strength varies in a remarkable manner with the porosity—gradually rises to a first maximum at 10 per cent. porosity, falls to a minimum at 40 per cent.; and then again reaches another maximum as the porosity increases to its limit, 45—47 per cent.

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Original Weight.	Weight when broken.	Weight when Dry.	Linear Contraction.	Vol. Contraction.	Breaking Weight.	Area broken.	Tensile Strength.	Porosity.	Moisture.
Grms.	Grms.	Grms.	Per Cent.	Per Cent.	Grms.	Sq. Cm.	Kilos.perSq.Cm.	Per Cent.	Per Cent.
94·8	68 35	65·35	6	16·96	94·7	13·5 × 27·5	1·28	39·95	3·9
158·0	148 07	109·66	3	8·80	157·95	22·6 × 27·8	1·24	3·14	38·5
116·3	84·05	80·50	6	16·96	135·0	16·5 × 27·5	1·5	39·59	4·2
175·65	131·79	120·84	7	19·52	229	24·5 × 27·5	1·7	12·75	8·3
144·4	133·42	98·99	3	8·80	178·5	20·75 × 28	1·53	6·46	25·8
137·15	102·02	95·3	5	14·24	187	20 × 27·5	1·7	19·73	7·5
133·5	91·2	91·2	6	16·96	533	17·75 × 27·5	5·4	47·2	0
161·3	110·55	110·55	6·75	18·92	372	22·75 × 26·87	3·05	45·3	0
105·85	73·4	73·4	6·2	17·49	423	32·75 × 14·5	3·88	45·3	0
121·53	98·15	85·04	5·5	15·62	179	17·25 × 27·5	1·88	23·43	13·36
113·37	92·95	79·23	6	16·96	191	30 × 15·75	2·03	19·82	14·80
138·0	127·1	97 1	4	11·5	220·5	27·5 × 19·2	2·09	4·80	23·6
145·13	130·8	101·42	4·5	12·9	250·5	27·5 × 20·5	2·22	7·13	22·46
117·64	82·0	82·0	6·2	17·49	481	30·5 × 16·5	4·78	44·03	0
110·15	78·34	76·5	6·0	16·96	126·5	26·7 × 15·5	1·52	42·0	1·86
141·72	102·73	98·99	6·2	17·49	142·7	27·5 × 18·5	1·4	39·1	3·64
115·15	81·93	80·77	6·2	17·49	204	28·7 × 16·5	2·15	42·05	1·41
129·25	92·3	90·62	6·0	16·96	171	28·5 × 17·7	1·69	41·87	1·82
148·4	133·72	104·6	4·0	11·5	302	26·5 × 20	2·85	8·78	21·77
148 73	132·2	104·8	4·2	12·1	293	25 × 19·5	3·00	10·6	20·67
138·5	116·9	96·91	5·5	15·62	161·4	25 × 17·75	1·82	14·2	17·1
138·2	114·77	97·67	4·5	12·9	215	24·75 × 18·5	2·35	17·88	14·9
128·85	105·3	90·66	6·2	17·49	167	24 × 18·5	1·88	19·86	13·91
116·52	91·5	82·03	5·5	15·62	136	24·75 × 14·75	1·82	28·24	10·35
97·8	72·15	68·67	6	16·96	105	24 × 14	1·56	37	4·82
140·84	121·28	97·96	6	16·96	265	24 × 20	2·76	10·83	19·23
110·52	80·60	76·74	6·5	18·27	110	15·5 × 24	1·48	37·24	4·79
102·64	75·40	71·89	6·0	16·96	103	14·5 × 24·5	1·45	37 53	4·65
125·45	91·98	87·93	7	19·57	146	17·0 × 26	1·65	35·91	4·29
137·32	106·13	96·78	9	24·66	183	22·7 × 19·5	2·06	22·56	8·8
184·62	149·65	129·95	6·7	18·79	245	24·5 × 24·25	2·06	20·03	13·2
116·76	81·96	81·89	5	14·24	349	33·5 × 14·5	3·39	46·89	0·1
125·3	89·01	87·86	6	16·96	210	26·5 × 16	2·48	43·45	1·3
125·32	88·17	87·92	6	16·96	299	28·5 × 16·2	3·23	..	0·28

A somewhat similar curve is seen between moisture and tensile strength. A maximum is reached with the absolutely dry clay, then a quick fall to a first minimum at about 5·—2 per cent. moisture, followed by a rise to another maximum at 20 per cent. moisture. More moisture causes a softening of the clay, with another rapid fall in the tenacity to zero.



Before we can clearly see the reason for these regular changes in the tensile strength of the clay, it is necessary to consider the question of the contraction which has taken place during the drying of the clay, and examine the connection between contraction, loss of water, and porosity.

It has been shown by Aron that the drying of a clay may be considered to take place in three stages :—

1st. The stage when the cubical contraction is equal to the volume of water lost; or, in other words, when the whole of the space vacated by the water is taken up by clay;

2nd. The stage in which the cubical contraction is *less* than the volume of water lost; or when a portion of the space vacated by the water is reoccupied by clay and the remainder continues vacant; and

3rd. When the whole space vacated by the water remains vacant.

These points were re-examined by us with reference to our particular clay, and we found the observations of Aron were correct.

We proceeded as follows :—

A prism of clay about 120 mm. long and section 20 mm. square was prepared from well-wedged clay. This was placed on a glass plate slightly smeared with oil, and the whole was weighed. Marks were made on the clay near the ends, on one of the four sides, and the distance between them measured by a Vernier microscope. The clay was allowed to dry at the ordinary temperature of the laboratory, and from time to time the loss of water and the contraction were determined. The results are shown in the accompanying table, the porosity being calculated from the formula before given.

Weight of Plate and Clay.	Weight of Clay.	Length between Marks.	Contraction.	Linear Contraction.	Cub. Contraction.	Moisture.	Porosity.
Grms.	Grms.	Grms.	Grm.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
353·35	141·67	9·075	..	..	..	30·25	2·0 (Assumed.)
348·32	136·64	8·87	0·265	2·26	6·6	27·7	1·63
347·80	136·12	8·845	0·23	2·537	7·37	27·4	1·47
346·82	135·14	8·805	0·27	2·98	8·66	26·85	1·47
345·49	133·81	8·765	0·31	3·41	9·9	26·20	1·90
344·65	132·97	8·750	0·325	3·58	10·34	25·7	2·5
341·75	130·07	8·630	0·445	4·91	14·0	23·9	2·5
340·94	129·26	8·615	0·460	5·07	14·4	23·58	3·17
340·09	128·41	8·575	0·50	5·50	15·7	23·05	3·0
338·77	127·09	8·555	0·520	5·72	16·3	22·23	4·3
334·55	122·87	8·465	0·610	6·72	18·8	19·63	7·7
[329·18	117·50	8·43	0·645	7·10	20·0	16·75	13·0]
324·93	113·25	8·46	0·615	6·77	19·0	12·67	22·2
..	98·8 Abs. dry.	..	..	..	..	..	..

The following embodies these results: (*a*) as moisture-contraction curve; (*b*) moisture-porosity curve.

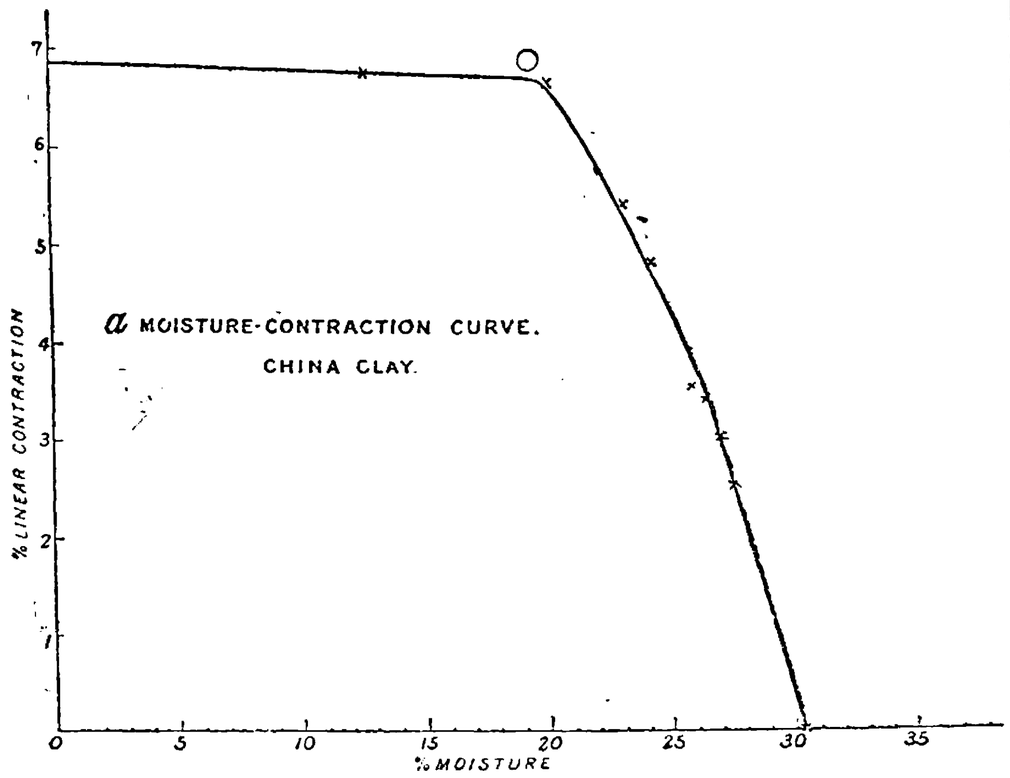
In (*a*) it is seen that the contraction during loss of moisture can be divided into stages—

1. That in which cubical contraction is equal to volume of water lost.

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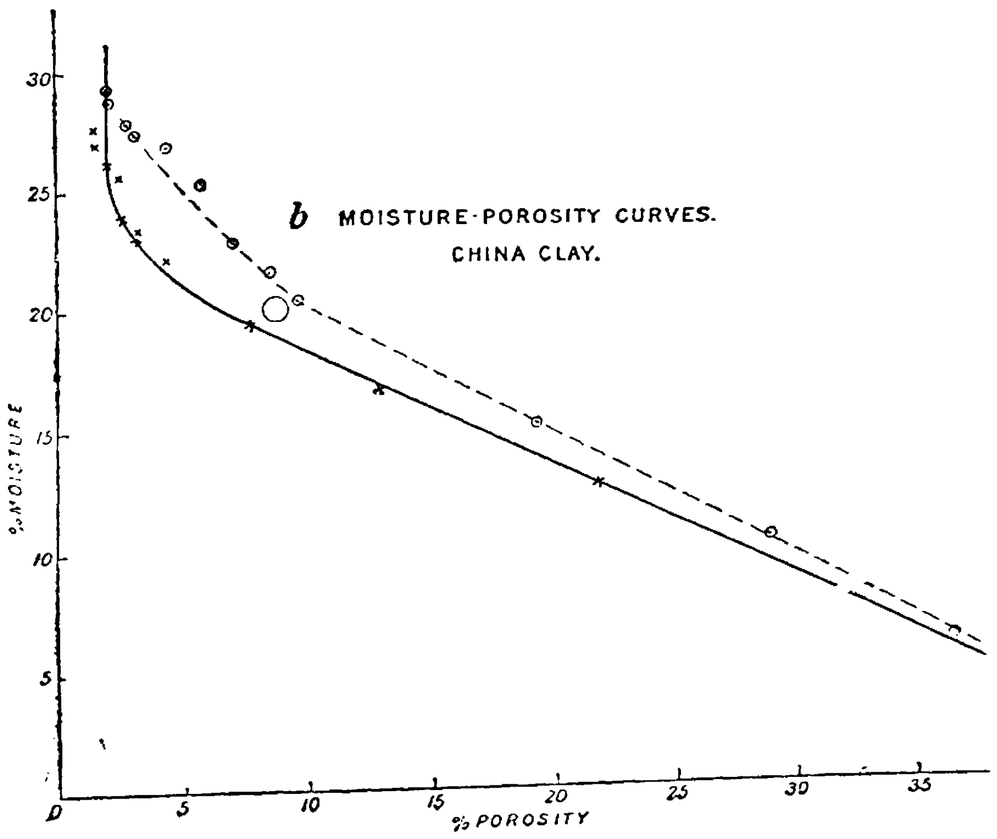
2. That in which cubical contraction is less than volume of water lost.
3. That in which the contraction ceases altogether.

That is to say, in the first stage of drying the whole space vacated by the water is reoccupied by clay; in the third stage the whole space is left vacant; while in the second stage the space is part filled by clay, and part left vacant. In the case of china clay, the second stage is not very well defined. The third stage appears to commence at about 20 per cent. moisture. Evidently as the contraction has taken place until this point of dryness has been reached, this must be the point at which the maximum of clay



particles per unit area is reached, and this remains constant to the end of the drying.

At the commencement of the second stage of drying, an increase in the porosity must set in, on account of the fact that a portion of the space vacated by the water remains vacant; and during the third stage the increase in the porosity is a maximum, and is equal to the water lost.



These deductions are borne out by the porosity-moisture curve, which shows very clearly that at about 20 per cent. moisture the increase in the porosity is equal to water lost, the curve becoming a straight line. It is also seen that until the moisture has diminished to 25 per cent., there is no increase in porosity, which clearly shows that the space vacated by the water is occupied by clay.

Now on reference to the tenacity-moisture curve, it is seen that this point of 20 per cent. moisture is the point of maximum tensile strength, which reaches 3 kilos. per sq. cm. With increase of moisture the tenacity falls regularly until the point is reached at which the clay becomes ductile. On the other hand, if the clay is dried beyond this point of 20 per cent. moisture, the tensile strength regularly falls to a minimum at about 5—2 per cent. moisture, after which an exceedingly rapid rise takes place, until, when completely dried at 120° C., the tensile strength is again a maximum, in one case being 5·4 kilos. per sq. cm.

An explanation of the first maximum may be derived from the fact already mentioned, *viz.*, that at this point—20 per cent.—there exists a maximum number of clay particles per unit area, and that consequently at this point the cohesion of maximum number of clay particles has to be overcome before the clay can be fractured. After this point is passed, and the clay becomes drier, there is no alteration in the number of clay particles per unit area. The fall in the tensile strength is probably due to the loss of the layer of water from between the clay particles, for, as is well known, the presence of a water layer between the surfaces of solids increases their cohesion.

The minimum reached at about 5—2 per cent. is followed by a most marked increase. This we consider may be due to the almost absolute withdrawal of the water layer, which might lead to a felting action between the particles, which would be sufficient to account for the increased tenacity.

It is interesting, in this connection, to note that the operative potter is in the habit of removing his unfired wares from the moulds and carrying them from place to place at the period of drying when they begin to show whiteness. This corresponds to the point indicated in the curves by a small circle, where rapid increase in porosity sets in, and is the point of the first maximum tensile strength as determined in these experiments.

THE PROXIMATE ANALYSIS OF CLAYS.

BY W. JACKSON, A.R.C.Sc., AND E. M. RICH, B.SC.

The idea of the proximate analysis of clays is to separate them into their mineral constituents, which have been taken to comprise clay substance, felspar, and quartz. This separation is attained by utilising the action of hot sulphuric acid on hydrated silicate of alumina (clay), which brings about the solution of the alumina as sulphate, and the silica remains in the amorphous condition, to be subsequently taken up with dilute alkali.

Seger, who has worked largely with the method, affirms that the felspar is to all intents and purposes unaffected by the action of the hot sulphuric acid. Experiments carried out by him show that 2·24 per cent. of the felspar dissolved, and this he attributes to a slight weathering of the felspar used. (Seger, Gesammelte Schriften, p. 42.)

On the other hand, Langenbeck quotes experiments showing that in one case 18·56 per cent., and in another 16·05 per cent., of the felspar was dissolved when treated in the same manner as clay. (Langenbeck, Chemistry of Pottery, p. 9.) He then concluded that the action of sulphuric acid on felspar is not negligible. On account of these differences between the two observers we examined the matter, with the results sets set out in this note.

A clear crystal of orthoclase felspar was obtained and finely ground in an agate mortar; 0·5 grm. was weighed and digested with dilute sulphuric acid, which was evaporated until almost all the sulphuric acid disappeared. The mass was extracted with water and a few drops of sulphuric acid, filtered, and washed. The filtrate was evaporated to dryness, and ignited till no further fumes were observed. The weight of the extract was found to be 9·2 mgrms. This was dissolved in dilute hydrochloric acid and the alumina precipitated. Its weight was 2·0 mgrms. The remainder (7·2 mgrms.) comprised residue from sulphuric acid (= 3 mgrms.) and the potash as sulphate (= 4·2 mgrms.). This contains 2·1 mgrms. potassium oxide. It will be noticed that the alumina and potassium oxide in solution are in the same proportion as in the felspar. The residue from the extraction yielded 7 mgrms. silica to 50 c.c. of a 1 per cent. caustic soda solution just raised to the boiling point. This, again, is in the required proportion to the bases. It may therefore be concluded that, treated with sulphuric acid in the manner prescribed in the proximate analysis of clay, felspar is slightly dissolved as a whole, and the amount found, curiously enough, is the exact amount found by Seger, *viz.*, 2·24 per cent.

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Whether the felspar, thus rid of its siliceous coating by the action of the soda is again open to attack by sulphuric acid in the same manner as a fresh portion, is a point we propose to examine further.

Again, no mention is made, either by Seger, Böckmann, or Langenbeck, as to the strength of the alkali to be employed in the proximate analysis, nor of the length of time the action is to proceed. We found that, warming (not boiling) for one hour with 5 per cent. caustic soda, 2·4 per cent. of silica and 1 per cent. of alumina were extracted from felspar, and on a second treatment 1·4 per cent. and 0·4 per cent. respectively. It therefore appears that 5 per cent. caustic soda would not only dissolve the silica separated by the sulphuric acid, but would even attack the felspar. Hence, perhaps, may be accounted for the high results of Langenbeck.

Considering the manner of formation of beds of china clay and of plastic clay, one would naturally expect a higher degree of fineness of the mineral fragments in the latter than in the former. Hence the proximate analysis might be more inaccurate in the case of a plastic clay than in a china clay, seeing that a larger surface of felspar would be exposed to the decomposing action of the reagents.

A sample of ground felspar was elutriated, and the very finest portion was collected and dried. This was mixed with a plastic clay which on a proximate analysis had shown no contents of felspar, 0·5 grm. clay, 0·5 grm. felspar being used. This mixture was submitted to the proximate analysis. The alkali used was 1 per cent. caustic soda, and it was boiled for seme minutes. The felspar which passed into solution after three treatments with acid and alkali was 21 per cent., and no end point was reached; that is, the last extraction with hydrochloric contained appreciable quantities of alumina.

Other experiments, using variable proportions of clay and felspar, gave 30 per cent. and 35·66 per cent. soluble felspar.

It therefore appears plain that in the case of plastic clays —or secondary clays in general—altogether unreliable results may be expected by the proximate method, even if the greatest care be exercised.

The following table comprises a list of the alkaline contents of the clay substance in a series of china and plastic clays possessing the same ultimate percentage of alkali:—

Ultimate per Cent. Alkali in		Per Cent. Alkali in Clay Substance.	
Ball Clay.	China Clay.	Ball Clay.	China Clay.
Per Cent.	Per Cent.	Per Cent.	Per Cent.
0·78	0·75	0·56	0·02)
1·08	1·18	1·24	0·21 |
1·55	1·60	2·36	0·99 }*
2·11	2·26	3·85	1·84 |
0·48	0·51	0·45	0·53)
3·44	3·39	4·22	2·75 (Langenbeck, p. 10.)

* Seger, Gesammelte Schriften, pp. 50—58.

It is clearly seen that in the corresponding clays the clay substance from the plastic clay is much richer in alkalis than that from the china clay, the proportion being doubled. This may be due not to an intrinsic difference between the clay substances, but rather to the finer state of division of the felspathic contents of the plastic clay; whereby, more surface being exposed to the action of the reagents, greater solubility of the felspar would result.

Our thanks are due to the Technical Instruction Committee of Staffordshire County Council, in whose Pottery Laboratory the work involved in this paper has been carried out.

THE PATENT LAWS.

BY C. D. ABEL.

In the April issue of the Journal of the Society of Chemical Industry there appears a paper by Mr. Ivan Levinstein on "The Patent Laws," in which the author tries to set aside, as "altogether fallacious and misleading," certain figures published by me in a paper read before the Congress of the International Association for the Protection of Industrial Property, in 1898.

The figures in question must be repeated here:—

Patents in the Year 1896.

——	Patents granted.	Patents litigated.	Patents wholly or partially invalidated.
Great Britain.....	14,105	29	13
Germany.....	5,410	102	43

It is evident that these figures, showing as they do how illusory is the beneficial effect of the German system, are little to Mr. Levinstein's liking. Had he been less anxious to set them aside he would probably have studied them more carefully, when he would have seen that he had overlooked the main point of my argument, which is not that a smaller number of English patents were the subject of litigation in 1896, and declared void, than was the case with German patents, but that the proportion of litigated patents to annulled patents was practically *the same* in both countries:—German, 102 : 43; English, 29 : 13.

It will be noted that this result does not in any way depend upon the numbers of patents that are granted or litigated; in other words, it shows clearly that my assertion, to the effect that German patents have no greater security than English ones, notwithstanding the severe test as to novelty and utility which the former have to undergo, was justified.

Mr. Levinstein then undertakes to show the fallacy underlying my figures. He, however, does nothing of the kind; he endeavours to explain away undoubted facts and the conclusion derived therefrom without bringing forward a single counter-fact. Thus his four "reasons" why my figures should be disregarded are suggestions why there should be a larger number of patents litigated in Germany than in this country—a fact which is certainly a subject for interesting speculation, but has absolutely no relation to my main argument.

Having said this much I should feel disposed to leave Mr. Levinstein alone, were it not for the fact that out of a lifelong experience in German patent law I may be able to contribute some information to show that the system is by no means so perfect as its supporters would have us believe.

Mr. Levinstein says: "Probably half the patents granted in any year in this country are not worth the paper on which they are printed, and most certainly are not worth fighting." This is a mere assertion, and had its author any experience as an agent for obtaining patents in Germany I think he would probably make the same remark with regard to that country.

Turning to the question of the relative cost of patent litigation in the two countries, which is more *ad rem*, I assert that English litigation is expensive (and wisely so, I think) but very reliable, while German litigation is cheap and nasty. In the first place, when a patent action is commenced in the Landsgericht (county court) where the patentee is domiciled, both parties to the suit are obliged to employ a barrister appointed to that particular court and no other. From this, miscarriage of justice frequently occurs, resulting in endless appeals, the total cost of which I should venture to say is nearly or quite equal to that of an English patent case. Another feature of German litigation which tends to its inefficiency is, that only written evidence can be produced in court, and the assessors and lawyers, reports have to be in writing, the payment for such reports being at the rate of 2*s*. per hour occupied. What can be expected for such a rate of remuneration?

I may here mention an illustration of the German method of litigation. Some two or three years ago, an engineer of the name of Schlick was granted a German patent in connection with the propeller shafts of that class in which the cranks, together with compensating radial arms, are so arranged round the shaft as to produce an approximately uniform rotary motion. Mr. Schlick's invention being such

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that, by arranging the cranks in peculiar relative position, he obtained a practically perfectly uniform motion. A patent having been granted for this invention, the owner of the patent brought an action for infringement against a manufacturing firm, which in its turn brought an action for annulment on the ground of want of novelty. This action was, as prescribed by law, brought in the Patent Office, which eventually decreed the annulment of the patent *it had previously granted.*

Here we have positive evidence of the absence of security of a German patent.

But this is not all, the patentee then appealed against this decision, which appeal was heard before the Reichsgericht, with the result that the decision of the court below was quashed, whereupon the patentee doubtless proceeded again against the infringers, and it is quite possible that two or three subsidiary actions followed. Hence it will be seen that no fewer than five, and probably more, actions were brought in respect of this patent; and it would be interesting to ascertain whether the cost of all these actions would not have been equal to an effective single action fought out by a heavily paid English patent barrister, by means of oral evidence and cross-examination, instead of by long reports paid at the rate of 2*s.* per hour.

Mr. Levinstein refers to the short average duration of the English patents. He must remember that this is due in a large measure to the number of patent applications dropped before completion; if these are deducted from the total number of patents completed, the average life of an English patent would be increased.

From facts given to me by a reliable German patent agent, and also assertions made by German clients, I have come to the conclusion that it is much easier in Germany to obtain a patent for an unimportant invention than for an invention that is of importance to a large trade. As a proof of this, it may be mentioned that the greatest proportion of patents granted to those applied for in any trade is almost always in the class of basket-making, where, in 1896, the proportion granted was 61·9 per cent. of those applied for. Now, as the trade in these small things is much greater at the commencement of the term of years as compared with a higher class of invention, and as the capital required for starting such a trade would be infinitely smaller than that, say, for a steam-engine factory, it will be evident that a very large proportion of the German patents will be able to start with a lucrative manufacture, and the taxes will be paid thereon for a long term, while only the smaller number of high-class patents involving large expenditure are liable to be dropped at an earlier stage. With English patents, there being no such cause operating to increase the number and life of low-class invention, the average life will be smaller.

Mr. Levinstein regards with equanimity the fact that in carrying out the German system of examination, injustice may be done to some meritorious inventors; here I beg to differ entirely from him. It may be of incalculable detriment to the nation if, owing to the crochets or want of discernment in the examiner, a patent for a valuable invention is refused. An incident may be mentioned that happened many years ago, when a very clever German inventor applied for a Prussian patent for an invention which is now of world-wide importance. The application was refused on the ground that it had been previously used for a different purpose. The inventor, having heard of the more liberal laws of England, and having obtained a patent, came over and established himself here, carrying out his numerous important inventions in various fields of industry, to the great advantage of this country, and the great disadvantage of Germany. I say that a law which produces such a result as the above is a disastrous law.

If Mr. Levinstein will read to the end of my pamphlet from which he quotes, he will find that I insist upon the same new function of the Patent Office as he desires, namely, a complete search relative to the invention, but instead of letting the question of patentability rest with the Patent Office examiner, who may not grasp the nature and scope of the invention, that question should be left to the patentee or his advisers to decide.

Newcastle Section.

Meeting held in the Durham College of Science, on Thursday, Nov. 29th, 1900.

MR. N. H. MARTIN IN THE CHAIR.

The first business was the passing of a resolution expressing the high appreciation of the Section of the work done by the late Hon. Local Secretary, Mr. Saville Shaw. Mr. F. C. Garrett was then elected Hon. Local Secretary.

The following informal communications were read:—

"Note on the Discoloration of Silvered Brass;" by Harry Smith.

"Notes on the Bases contained in Shale Oil;" by F. C. Garrett and J. A. Smythe.

"Notes on the Action of Pyridine on Coal;" by Thomas Baker.

Nottingham Section.

Meeting held at the Municipal Technical College, Derby, on Wednesday, November 28th, 1900.

PROF. STANLEY F. KIPPING, F.R.S., IN THE CHAIR.

ZEISS' BUTYRO-REFRACTOMETER.

BY JOHN WHITE, F.I.C.

(*Abstract.*)

Mr. John White exhibited a Zeiss' butyro-refractometer, and described in detail the various uses of the instrument. In the course of the demonstration, Mr. White compared this refractometer with others, such as the Abbé, the Pulfrich, and the oleo-refractometer of Amagat and Jean. The results obtained by the examination of various fats and oils were stated, and many specimens were shown to the members present.

The very convenient heating apparatus supplied by Zeiss was shown in action, and Dr. Woolny's "arbitrary thermometer," for use in the examination of samples of butter and lard, was shown, and criticised by the speaker.

The following table gives the results obtained by Mr. White from known genuine samples of fats and oils:—

——	Scale Divisions. Temperature.		
	25° C.	40° C.	45° C.
Butter	50	42	40
Lard, English	58·2	50·2	47·9
„ American	58·3	50·3	47·7
Margarine	58·5	50·4	47·3
Olive oil	62	53·5	..
Rape oil	68·5	60·5	..
Cotton-seed oil (refined)	66·5	58	..
Sesame oil	67·5	59·5	..
Castor oil	78	69·5	..
Linseed oil (raw)	83	74·5	..
Sperm oil	54	46·2	..
Cod-liver oil	80	71	..
Mineral lubricating oil	..	95—100	..

To calculate the scale divisions at any observed temperature, up or down to any other temperature, a correction of $\pm$ 0·55 scale divisions should be made. This correction gives fairly approximate results.

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The "scale divisions" or "degrees" may be calculated to the actual refractive index, the range of the butyro-refractometer being as follows :—

Scale Divisions.	Refractive Index.
0	1·4220
100	1·4895

In conclusion, Mr. White expressed the opinion that the Zeiss' butyro-refractometer was capable of more extended use than was at present recognised. He believed that the application of this test to a sample of butter, together with the determination of the Reichert figure, gave more information as to the purity or otherwise of the sample than any other two tests that could be applied.

Discussion.

Mr. S. F. Burford said it seemed a matter for regret that an arbitrary scale had been adopted for the new instrument, whilst in the earlier oleo-refractometer the actual refractive indices were indicated. It must be a disadvantage to workers with the butyro-refractometer not to be able to readily compare their results with those made with the older instrument of which records were kept.

Mr. J. T. Wood remarked that the refractometer has been applied with beneficial results in comparing oils and fats used in leather manufacture.

Mr. L. Archbutt said that the reason that he had not used the oleo-refractometer in the analysis of lubricating oils was because it was simply the means of obtaining one additional factor that alone was of limited value. For instance, one could detect cotton-seed oil in olive oil, and the amount of it present, in several ways. But it would not follow that cotton-seed oil was present in a sample because the refractometer indicated any particular position of the critical line, and, even if it did, one would have to go through the other tests all the same. A mixture of oils could be made that, relying on the indications of this instrument alone, might pass for the genuine substance. The instrument simply confirmed the results of other tests. Of course it was an advantage that the method was very simple and the test quickly done. If they had an instrument enabling them to detect paraffin in beeswax with the facility of the butyro-refractometer it would be a great boon. But such difficult mixtures to analyse as American with Russian turpentine, or either one of these with resin spirit, he did not think that this instrument would enable one to detect. With regard to the "standard liquid" there seemed no reason why the instrument should not be standardised with glycerin.

Mr. White, replying, said that in many instances, in the examination of oils and fats, it was very useful to be able to apply such a ready test, even though the test be only confirmatory and not conclusive. After making the series of tests of the various oils shown in the table, for the purpose of illustration of this paper, he had formed a much better opinion of the value of the indications of the refractometer than was the case before, when his experience had been confined almost entirely to butter, lard, and margarine It was true that one could make mixtures that gave the indications of the genuine substances in this instrument, but so one could make them defeat the specific gravity test. It was not claimed that any one test should stand alone, but the refractometer test, together with the Reichert figure, gave more information as to the purity or otherwise of a sample of butter than any other two tests which could be applied. Mr. Burford asked whether fats are clarified for testing. This was not necessary; indeed, when taken for observation, very often the fat was distinctly turbid. As a matter of fact, the way in which a sample of butter melted—that was to say, whether it melted clear or turbid—afforded some indication of its character. He had never made any attempt to find out the secret of the fluid; he had taken it in good faith. In conclusion, he believed the buryro-refractometer would come into very general use. As a proof of the high opinion entertained of it by some chemists, he might mention that in a recent law case, involving a large sum of money, the analysts for the plaintiff relied on the indications of this instrument, coupled with the Reichert figure.

The Chairman said that another method could be adopted in place of having a certain head of water for the purpose of keeping a constant temperature in the water jacket, namely, a mercurial column which acted on the gas tap automatically as the temperature tended to vary. He thought the instrument a valuable one, as it was important to employ every available method to detect the tricks of the sophisticator.

Scottish Section.

Meeting held at Glasgow on Tuesday, Dec. 4th, 1900.

DR. J. CLARK IN THE CHAIR.

Mr. Geo. Lean, B.Sc., read a short historical paper, in which he briefly referred to the more important researches on the liquefaction of gases since the time of Faraday; and, in conjunction with Mr. Jas. Roberts, subsequently showed a number of interesting experiments with about 2 litres of liquid air which had been prepared by means of the Hampson apparatus.

Alcohol, carbon dioxide, and acetylene were solidified by immersion in the liquid air. A quantity of mercury, in which a wooden handle was supported, was frozen, and the mercury hammer thus produced was used to drive nails into a wooden board. The marked change in physical properties produced by the action of intense cold was demonstrated by immersing an india-rubber ball in liquid air, and showing that the material became so brittle that it could be readily powdered. To demonstrate the suspension of chemical action at low temperatures, a piece of metallic potassium was thrown on to ice which had been cooled in liquid air. The metal remained unchanged for some minutes, until the temperature had risen considerably, when vigorous chemical action set in, accompanied by ignition of the hydrogen which was evolved. The "spheroidal state" was illustrated by pouring a quantity of liquid air into water. Spherical drops of the liquid, protected from direct contact with the water by layers of air, were observed to fall through the water, and subsequently to be carried again to the surface by the gas evolved in the process of evaporation. In conclusion, a striking experiment, devised by Tripler, of New York, in which iron is burned in liquid air contained in a transparent cup made of ice, was successfully executed.

Erratum.

This Journal, 1900, page 990, col. 1, two lines from bottom : *for* "Galician" *read* "Roumanian."

Journal and Patent* Literature.

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* Any of these specifications may be obtained by post by remitting 8*d.*—the price now fixed for all specifications, postage included—to C. N. Dalton, Esq., Comptroller of the Patent Office, Southampton Buildings, Chancery Lane, London, W.C.

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I.—PLANT, APPARATUS, AND MACHINERY.

PATENTS.

Flow of Liquids, Steam, or Gases, through Tubes; Method of and Apparatus for Measuring Rate of ——; also for Mixing or Delivering them in given Proportions or Quantities. Dr. H. Rabe, St. Petersburg. Eng. Pat. 21,772, Oct. 31, 1899.

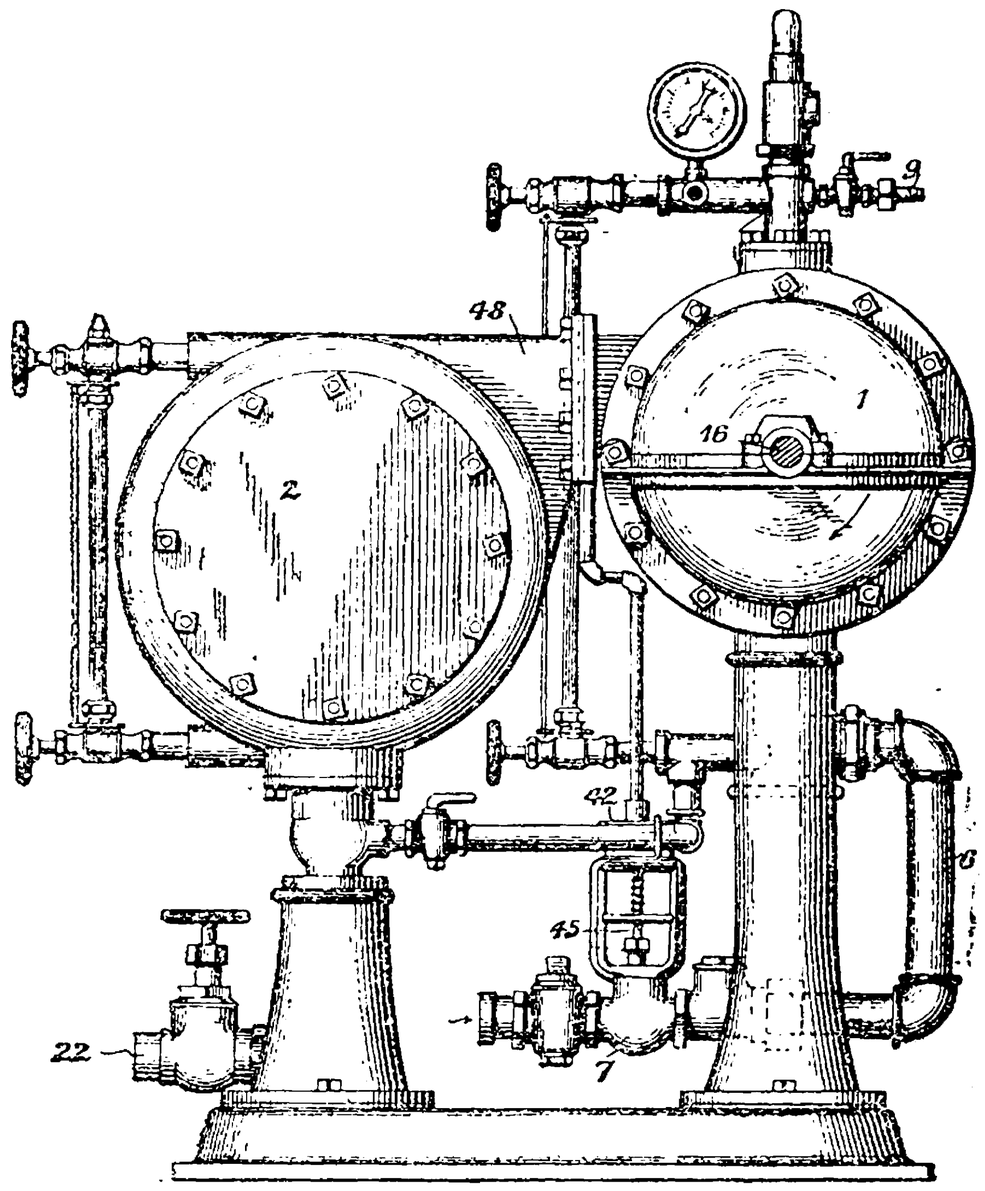
THE velocity or rate of flow of gases and liquids through pipes is measured by variably throttling the medium filling the pipe, without interrupting the passage, thereby producing a difference in pressure, from which, "by taking into account the friction of the specific gravity of the medium to be measured," the velocity may be calculated. The throttling is effected by a valve, cock, or the like, the amount of opening of which is indicated externally. The difference in pressure produced by the throttling device is measured by a manometer tube, the ends of which are connected to the main tube in front of and behind the cock, &c. Gaseous or liquid substances may be mixed in definite proportions, or separated into different volumes of definite proportions, by inserting in the mixing or separating vessel an adjustable device for varying the ratio of the resistances in the two branch tubes. An apparatus for mixing or separating media in this way is described, in which a three-way controlling cock is employed. This cock is formed so that, while one passage remains fully open, the ratio of the flows through the other two passages may be varied within very wide limits.—R. A.

Extraction of Soluble Matter, and otherwise Treating Materials by the continued Action of Liquids, Vapours or Gases; Apparatus for the ——. H. Hadfield, Furness Vale, Cheshire. Eng. Pat. 2455, Feb. 7, 1900.

THE apparatus comprises a series of superposed receptacles or chambers in the form of a tower, with means for admitting steam or other condensable vapour, and, when required, water or other liquid solvent. The chambers communicate with each other through perforated plates or gratings, and are closed at the front by suitable doors. The material to be treated, is packed in separate perforated boxes, baskets, or cages, such as cylindrical wire baskets, open at both ends, and these, when filled, are piled in the chambers of the tower. A number of such holders may be enclosed in a single large cage or holder, to facilitate their insertion into and removal from the chambers. In use, the steam, &c. admitted to the chambers condenses, and, with or without additional water, &c, percolates downwards through the material, the extract or solution of the soluble matters being collected in a receiver beneath. The solvent action may be aided, or the product modified, by introducing gases, such as ammonia, or sulphurous or carbonic acid gases.—R. A.

Carbonating Liquids; Apparatus for ——. C. B. van Horn, Detroit, Michigan, U.S.A. Eng. Pat. 22,392, Nov. 9, 1899.

THE liquid is supplied through the pipe 6 and the gas through the pipe 9 to the infusion chamber or cylinder 1, where they are mixed by rotating paddles mounted on the spindle 16. From the cylinder 1 the carbonated liquid passes through the opening 48 into the receptacle 2, from which it is delivered, against any desired counter pressure, through the pipe 22 to the storage tank. The opening 48 is formed in the cylinder 1 at the opposite end from the liquid inlet, and at a height sufficient to retain the liquid until it is thoroughly impregnated with the gas. In case of the influx of liquid to the receptacle 2 being greater than the quantity drawn off, a float in the receptacle rises, and an external arm on the float spindle opens an air-supply valve, which permits compressed air to actuate the piston 45, so as to close the valve 7 in the liquid-supply pipe. When the



liquid in the receptacle falls sufficiently, the valve 7 is opened automatically. A reducing valve in the gas-supply pipe 9 ensures a constant pressure in the cylinder 1. Any liquid may be carbonated, by regulating the gas pressure in the cylinder 1 in inverse proportion to the specific gravity of the liquid.—R. A.

Filter Presses. J. B. Alliott, Nottingham. Eng. Pat. 22,563, Nov. 11, 1899.

THE filter plates of the press are made interchangeable, only one pattern being used. Each plate is formed with four holes arranged symmetrically at the corners, and with a central or other feed hole. When several plates are put together in a press, the centre holes permit the passage of the material to the filtering chambers formed by and between the plates. Two of the corner holes are plain and the other two holes have channels, which lead to the filtering surface of the plate, opening into them. When the plates are all arranged the same way in the press, the longitudinal passages formed by the plain holes have no connection with the filtering chambers and are inoperative, while the passages formed from the other holes serve as conduits for the expressed liquid. When the press is to be employed as a washing press, &c., alternate filter plates are reversed, and certain of the cocks controlling the passages formed by the aforesaid holes are closed, so that the washing water, &c., fed through one of the passages, is forced to pass through the filtering material and filter cakes before it can escape through that passage which is left open. The movable intermediate plates and the movable end-plate are mounted on deep rectangular bars, which are supported at one end by the fixed end-plate, and at the other

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end by standards. The plates are adapted to be forced together, and against the fixed end-plate, by a screw or screws, and the movable end-plate is connected to the piston of a pneumatic or other fluid-pressure engine.

—R. A.

Concentrating, Distilling, and Elevating Liquids; Apparatus for ——. P. Kestner, Lille, France. Eng. Pat. 24,024, Dec. 2, 1899.

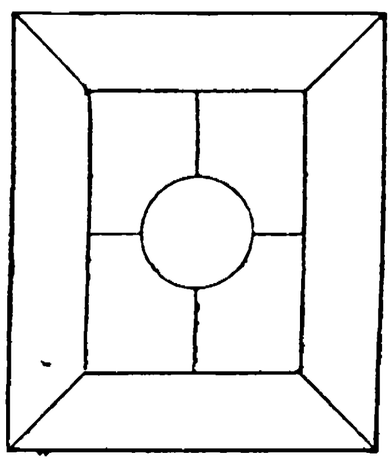
THE liquid is made to descend under a head or liquid pressure to a heater or evaporator, from which, by the emulsification or mixture of the liquid with the evolved vapour, it is caused to rise to a higher level, the ascending column of liquid and vapour being of lower specific gravity than the descending column of liquid. A continuous circulation is produced by returning the liquid raised in the ascending column to the descending column. A centrifugal separator may be employed to separate the vapour from the liquid raised in the ascending column.—R. A.

Packing Semi-Fluid Substances, such as Soft Soap and other Caustic Semi-Fluid Substances and the like, and Boxes therefor. C. Mason, London. Eng. Pat. 25,334, Dec. 21, 1899.

MATERIALS of the nature indicated in the title are packed in boxes which are made of pulp-board, paste-board, millboard, or the like, and provided with a metallic lining. The bottom and lid may be made entirely of metal.—R. A.

Pasteurising Liquids; Apparatus for ——. A. F. Gasquet, Castres, Tarn, France. Eng. Pat. 12,694, July 13, 1900.

A TANK, divided into an inner and an outer series of four or more separate compartments, surrounds a central furnace or stove, as shown (by circle) in plan in the figure. The compartments, which are all filled with water, communicate one with another through bent pipes so arranged that, by plugging some and opening others, a stream of cold water turned into any compartment may be caused to circulate through the whole or any number of the others in any desired order. The four inner compartments in contact with the stove contain a store of hot water. The bottles or vessels of liquid to be sterilised are placed in the outer compartments, which are used in rotation, the water being heated up gradually, maintained at the requisite temperature for any length of time, and cooled again gradually, by displacement of water in the compartment by hotter water from the inner compartments or colder water from the outside. Continuous working, gradual heating and cooling, and economy of heat, are some of the advantages claimed.—L. A.



II.—FUEL, GAS, AND LIGHT.

Calorific Power of Solid Fuels; Berthier's Method for the Determination of the ——. U. Antony and E. di Nola. Gaz. chim. ital. **30,** [2], 218. Chem. Centr. 1900, **2,** [16], 988.

AN alleged source of error in Berthier's method for determining the fuel value of a fuel is, that on fusion with litharge, volatile products escape, and thus do not enter into reaction. By experiments with different fuels and mixtures of fuels, the authors found that the temperature at which reduction of the litharge begins can be attained without the appearance of volatile products. This statement is based on the supposition that the heating is carried out gradually and in a suitable manner, with the apparatus previously described by the authors.

In Berthier's process, however, the litharge is reduced not only by the carbon contained in the fuel, but also by the available hydrogen, which is generally present only in small quantities. In order to determine the latter by Berthier's process, it is advantageous to use lead fluoride, which is reduced by the free hydrogen, but not by the carbon. The reduction is effected in the usual manner, except that a crucible of pure graphite must be used. By a combination of the two processes, the calorific power of a fuel can be more accurately calculated, the formula used being :—

$$P = \frac{p_C}{34{\cdot}5}\,0{\cdot}8083 + \frac{p^1{}_H}{103{\cdot}5}\,0{\cdot}29367 \text{ (cal.)}$$

where p_C is the lead obtained by reduction of the litharge and $p^1{}_H$ that obtained by reduction of the lead fluoride.

—A. S.

Liquid Fuel [Petroleum]. E. L. Orde. Petr. Ind. Tech. Rev. **3,** [89], 450—452.

FROM his investigations the author concludes that liquid fuel of good quality should, if properly handled, show a reduction in consumption of about 40 per cent. as compared with coal, in the boiler furnaces of steamers; also a reduction of about 15 per cent. in bunker space, weight for weight, and a reduction of about 50 per cent for the same radius of action.

As regards immunity from danger, a fuel oil flashing at 200° F. is safe, provided care be taken to keep the burners free from obstruction by dirt; hence the oil should always be filtered. The presence of water in the oil may lead to the extinction of the fire where the oil is burned as spray, unless carefully managed; but where the oil is vaporised before ignition, this risk is greatly diminished, the author having worked with as much as 5 parts of water to 3 of oil without any cessation of combustion.—C. S.

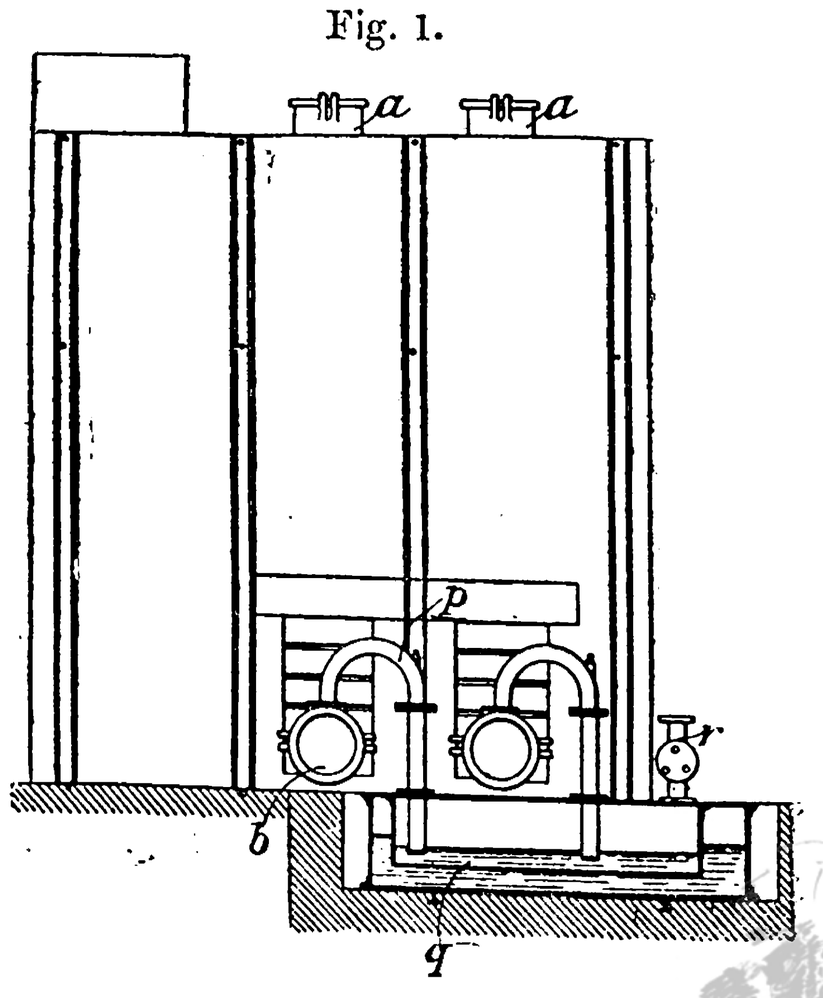
Wood; Rapid Transformation of ——, into a Substance similar to Lignite. G. Arth. Comptes Rend. **131,** [18], 719—720.

A BLOCK of lignum vitæ was used as a bearing for the revolving steel axle of a 12-h.p. water-turbine; it was never immersed in water, but always moist. After six months' use the apparatus was dismounted, when the upper part of the block was found to be converted into a black, fissured, brittle mass, with a fracture resembling that of certain mineral fuels. The analysis of this substance, and its calorific value, would place it between lignite proper and the more recent coals; and the short period required for the conversion of the original wood into it, under the influence of pressure, slight elevation of temperature, and moisture, is interesting, in view of the long geological periods which are commonly thought to have elapsed during the formation of coals and lignites.—J. T. D.

Wood Gas Process; The Riche ——. Eng. and Mining J. 1900, **70,** [16], 460.

A DESCRIPTION is given of the Riche process for making gas from wood. The process, which has recently been patented in the United States (Amer. Pat. 658,589, Sept. 25, 1900), depends upon the well-known principle of downward

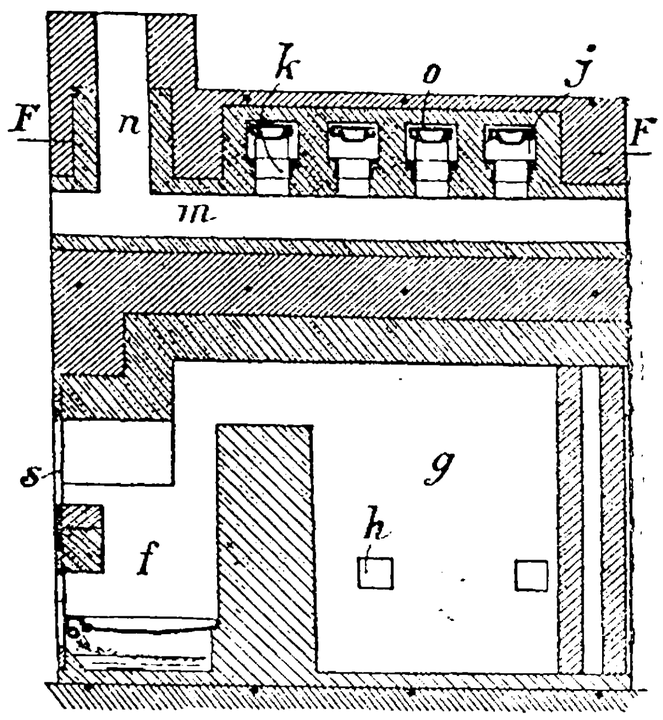
Fig. 1.



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distillation, but improvements have been effected, relating chiefly to arrangements by which the products of distillation are purified, before leaving the retort, by being caused to pass through a thick layer of incandescent carbon residues resulting from a great number of previous distillations. These residues are steadily renewed by the residues of

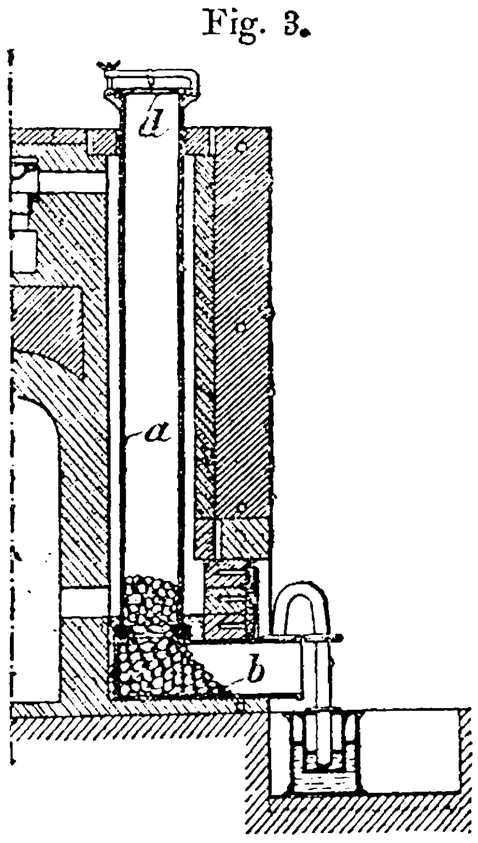
Fig. 2.



the successive charges. Fig. 1 represents a side elevation of the furnace. Fig. 2 is a vertical section of the same through the axis of the heating chamber. Fig. 3 represents a transverse axial section of the furnace through one of the retorts.

The apparatus consists of a gas furnace with vertical retorts, which are heated from outside to redness—say 800°—900° C.—by the flames of a furnace with heating chamber in the central part of the masonry. The retorts, *a*, of cast iron or other suitable material, bear upon a horizontal and cylindrical piece, *b*, the two being united by means of a rib-and-groove device, fitted on the cylinder, the joint being sealed by means of a refractory mastic compressed by the sole weight of the retort, which is allowed to expand freely upwards. The head of the retort is closed by a cover, *d*, and the cylinder, *b*, by a door. Behind the furnace, *f*, is arranged the central heating chamber, *g*, in the lower part of which openings, *h*, are provided, leading to the vertical flues of fire-brick surrounding the retorts. The flues communicate by conduits, *k* and *j*, with a main conduit, *m*, leading to the chimney, *n*. The horizontal cylinders, *b*, are fitted with curved and diagonally arranged pipes, *p*, causing the products of distillation to cross the washing apparatus, *q*, from which they are discharged through the pipe, *r*.

Fig. 3.



The method of working is as follows:—The furnace, *f*, is lighted, whereupon the air passes across the fire grate and the fuel is converted into "Siemens gas," which, after mixing with the air entering through the door, *s*, is burned in the form of long flames, in the central heating chamber, *g*. The burned gases pass through the openings, *h*, to the flues surrounding the retorts, rise along the said flues, and flow across the conduits, *k* and *j*, and the main conduit, *m*, to the chimney, *n*. When the retort has been brought to a sufficiently high temperature, a small quantity of coke or charcoal is introduced, so as to fill the rear part of the cylinder, *b*, and the lower part of the retort, as shown in Fig. 3. When the coke or charcoal has been raised to a red heat, the retort is charged with the wood to be distilled, and the cover, *d*, closed and tightened. The gaseous products of distillation are filtered by "passing through the incandescent column of coal in the lower end of the retort, and in the cylinder, *b*, where they are purified on one side by cementing the coal in destroying its tar vapours, and on the other side by converting into carbonic oxide all their proper oxygenised elements." It is stated that this method of working, results in a large increase in the volume and weight of gas produced, caused by addition of the gases formed from the condensable products of the simple distillation. The purifying material is automatically renewed by the succession of charges. The purified gas is collected at the front part of the cylinder, *b*, and conducted by means of the curved pipe, *p*, to the washing and cooling tank, *q*, and thence through the outlet pipe, *r*, to the gasholder or utilising apparatus.—A. S.

Incandescence Mantles [*Auer*]; *Theory of* ——. E. Bauer. Zeits. angew. Chem. 1900 [42], 1055—1057.

After enumerating and criticising the various theories suggested in explanation of the capacity for emitting light possessed by a definite mixture of thoria and ceria, the author states that, in his opinion, the key to the problem lies in the results of Le Chatelier and Boudouart, given in the subjoined table. These were obtained by determining the temperatures with each substance in the same zone of a Bunsen burner by means of a thermo-element, measuring the respective radiations in the red, green, and blue with the spectrum-photometer, and comparing them with that of melting platinum, which was taken as 100 for all the rays.

Substance.	Temperature.	Red.	Green.	Blue.
	° C.			
Thoria + ceria	1,380	7·0	12·5	12·5
Thoria.....	1,290	1·45	1·4	0·3
Ceria.....	1,110	1·9	0·7	0·15
Platinum.....	1,290	8·5	4·0	1·4
Magnetic iron oxide (Fe_3O_4)	1,080	1·5	0·48	0·1

From this it appears that a mixture of thoria and ceria is heated about 300° C. higher than is a "black" substance, which may approximately be represented by the magnetic iron oxide. The intensity of the radiations shows a strong decrease, in the normal manner, from red to blue in the case of the iron oxide, platinum, and ceria; in the case of the thoria the radiations are approximately the same throughout the spectrum; whilst the radiations increase from red to blue in the case of the mixture of thoria and ceria. The special illuminating power of the mixture is therefore to be attributed to its specific "colour"—colour in the sense of curve of radiations. There still remains the chemical question why the radiation curve of the mixture should deviate so widely from that of each of its components. As an analogous phenomenon the author mentions the case of iron being radically changed in its properties by the addition of small quantities of other substances. The conception of a "solid solution" has been formed by Drossbach (J. für Gasbeleuchtung, **41**, 253) to explain such phenomena (see this Journal, 1900, 444 and 445). This would account for the fact that the intensity of light emitted by a mixture of thoria and ceria reaches its maximum with a certain definite proportion of the latter (0·9 per cent., according to Drossbach). Any further addition of ceria may then, on this assumption, be regarded as being no longer in a "dissolved" condition, but only in a state of mechanical mixture or suspension, as it were, and on heating, it will emit ultra-red rays like any other foreign substance, and tend to prevent the mantle from acquiring the high temperature which it requires for the emission of its full quantity of light (*cf.* this Journal, 1896, 890; 1900, 230 and 814).—C. A. M.

PATENTS.

Electric [*Hearth*] *Furnaces.* R. Chavarria-Contardo, Sévres, France. Eng. Pat. 14,582, Aug. 14, 1900.

Objections are set out as against the surface of the arch and its inactivity in hearth furnaces, and it is proposed to

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replace it by a double sloping roof formed of slabs. These two slopes form the lower walls of two inclined flues which abut at the lower end against the upper edges of the inclined planes forming the sole or hearth, and form at the top a vertical shaft. The opening of this shaft is closed by a device similar to that used in blast furnaces, and a pipe is provided for carrying off the gases to a series of purifiers and condensers. The furnace is thus of the closed breast or reverberatory type. Included in the claims are also the following: a regulating gasholder, a gas motor for converting into energy the heat stored up in these gases, and means for converting into electrical energy, and supplying the same in the form of current to the electrodes of the arc or arcs heating the furnace; means for moving each electrode towards the interior of the furnace, through a stuffing gland cooled by a current of water circulating under pressure, and in a fixed friction contact sleeve; securing to the free end of one electrode another electrode in such a manner as to ensure simultaneously the tightness of the joint through which the electrode enters the furnace; the constancy of the electrical resistance, the continuity of the forward movement of the electrodes, their cooling and complete utilisation.—J. C. R.

Pulverised Fuel; Method of, and Apparatus for Burning ——. F. H. Lewis, Virginia, U.S.A. Eng. Pat. 16,608, Sept. 18, 1900.

THE method consists in using a moderate air blast to carry the finely divided fuel from the hopper to the rotary inclined cylinder where it is to be burned, and in employing a blast of air of small diameter, as compared with the feed blast, but of high pressure and a short distance to the rear of the delivery end of the nozzle, so as to supply sufficient air for perfect combustion, such air being drawn through the hot clinker bed below the furnace, and thus becoming heated before it reaches the kiln. The apparatus consists of a usual form of rotating inclined cylinder, having at its discharge end a hood, across which is an arch or partition. The nozzles pass into a central orifice in this partition, whilst the induced air comes up from the clinker bed below.—R. S.

Liquid Fuel; Burners for ——. Sir W. G. Armstrong, Whitworth and Co., Ltd., and E. L. Orde, Newcastle-on-Tyne. Eng Pat. 23,568, Nov. 25, 1899.

THIS burner for liquid fuel, arranged for commingling oil with steam and hot air, or either steam or air alone, consists of three tapered or conical nozzles, arranged telescopically and supplied respectively with oil, steam (which may be superheated, or replaced by hot compressed air), both under pressure, and hot air, the flow of oil being regulated or stopped by means of a spindle traversing a stuffing box. In order to provide an extra supply of hot air, an extra air chamber may be placed at the upper end of the burner, the spindle in such case being perforated and made hollow to conduct this extra air to the nozzle, and packed to keep the oil under pressure from entering the hot-air chamber. A diffuser may be placed in the mouthpiece of the burner if required.—C. S.

Burner for Heating or Lighting Purposes. E. Petreano and La Cie. Gén. d'Incandescence par la Pétrole et l'Alcool, Paris. Eng. Pat. 12,524, July 11, 1900.

A PETROLEUM or alcohol burner for heating or lighting by means of a blue flame, characterised by adding to the ordinary burner movable pieces consisting of "a mixing bell perforated on its circumference and bottom passing into the inner wick-holder tube and resting on the upper part of the said tube, said bell being provided with heating bar or not; a gasification socket surrounding and passing beyond the outer wick-holder, and a gallery for supporting the mantle." The gasification chamber is provided with apertures for the passage of an air current between the chamber and the "outer partition," and between the latter and the mantle gallery.—C. S.

Hydrocarbon Burners for Heating and Lighting. C. Périllat, Boston (Mass.), U.S.A. Eng. Pat. 13,684, July 31, 1900.

To obtain intense heat with a minimum consumption of fuel, the inventor provides a perforated jacket surrounding a vaporising tube or chamber, and communicating with a mixing chamber in which the vapour is mixed with air, the mixture descending into the perforated jacket and being consumed on the outside thereof.—C. S.

Hydrocarbon Burners. C. J. Search, Brooklyn (N.Y.), U.S.A. Eng. Pat. 15,316, Aug. 28, 1900.

THE claims include the combination—in a vapour burner—of a casing, a second casing without and spaced from the inner casing, a vaporiser within the inner casing, and located intermediate between the outlet-end of the casing and said burner nipple; means within the casing connecting the vaporiser with a liquid supply, the inner casing being reticulated near the outlet-end thereof, and provided with an air inlet so located that the air must pass for some distance in contact with the inner casing before entering the air inlets thereof. The casing has its bottom closed to form a cup, and its top so constructed that the auxiliary heating fluid may be poured in at the top, into said cup, the said casing (being) provided with air-inlet openings near the burner nipple, and means for closing and opening said openings so that they may be closed while the auxiliary heating fluid is being poured into the casing.—C. S.

Bunsen Burners. F. M. Brooks, New York. Eng. Pat. 15,682, Sept. 4, 1900.

THE inventor claims the combination of a burner tube, inlets for gas and air, an adjustable chamber at one end of the tube having a contracted mouth located within the central third of the tube, a cap at the upper end of the tube having perforations near its periphery, and a combined flame arrestor and heat transmitter, attached to the cap, the lower end of which is curved inwards so as to be automatically guided into the interior of the tube. The perforations in the cap are cut in such a manner that the turned-up inner edges act as deflectors, and direct the flame outwards against a mantle so that the contact between them takes place within the zone of highest incandescence, thus producing a light of great intensity.—C. S.

Purifying and Burning Smoke or the like by Means of Water under Pressure or Steam. E. Geist, Samaden, Switzerland. Eng. Pat. 15,418, Aug. 29, 1900.

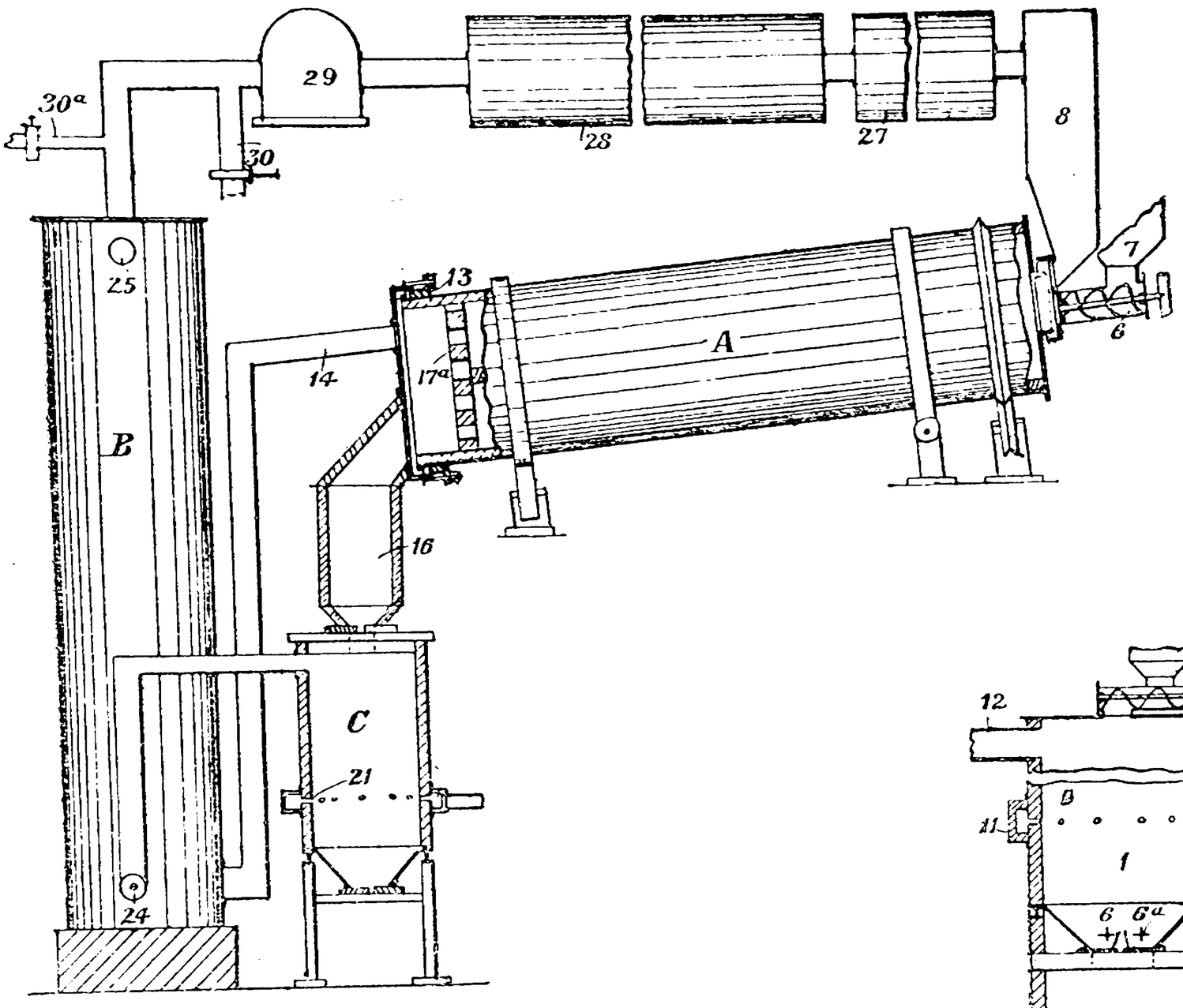
THE inventor introduces a jet of water or steam, under pressure, into a "boiler," where it sucks up the waste gases and smoke from the furnace through a pipe replacing the usual chimney, and draws them into a second "boiler, whereby the admixtures, such as soot, ashes, coal-dust, &c., are precipitated in water under pressure or condensed, the purified smoke gases being forced back into the furnace, where they are mixed with fresh combustible air and burnt.—C. S.

Gas and By-products; Method of and Apparatus for Producing ——. P. Naef, New York, U.S.A. Eng. Pat. 20,659, Oct. 14, 1899. (Date claimed under Inter. Con., March 14, 1899.)

THIS invention is for continuously producing water-gas from bituminous fuel and steam, and for recovering as ammonia the nitrogen in the fuel. A mixture of a combustible gas containing no nitrogen, such as water-gas, and steam is heated to a high temperature, and passed through a column of the fuel. Several forms of apparatus may be employed for the process, such as that described in the specifications of Eng. Pat. 7951, 1898 (this Journal, 1899, 570), 30,496, 1897 (this Journal, 1898, 762), whilst for heating the gases, heaters such as are described in Eng. Pat. 7952, 1898 (this Journal, 1899, 569), may be used. The plant shown consists of a rotary inclined furnace A, having internal lifting partitions, and fed (*a*) with fuel by a hopper 7 and conveyer 6; and (*b*) with residual dust from a chamber 8. Hot gas passes into the lower end of the furnace from a heater B through a tube 14, and is distributed within the furnace by a perforated wall 17*a*. The gases leave the furnace by the dust chamber 8, and thence pass through a cooler 27, washing plant 28, and blower 29. Some of the gas is withdrawn to the holder through a tube 30, while the remainder, mixed with steam

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introduced through the pipe 30*a* passes to the heater B for again passing through the furnace. The residue of the fuel in the furnace passes through a hopper 16 to a gas producer C, wherein air is introduced at ducts 21. The produced



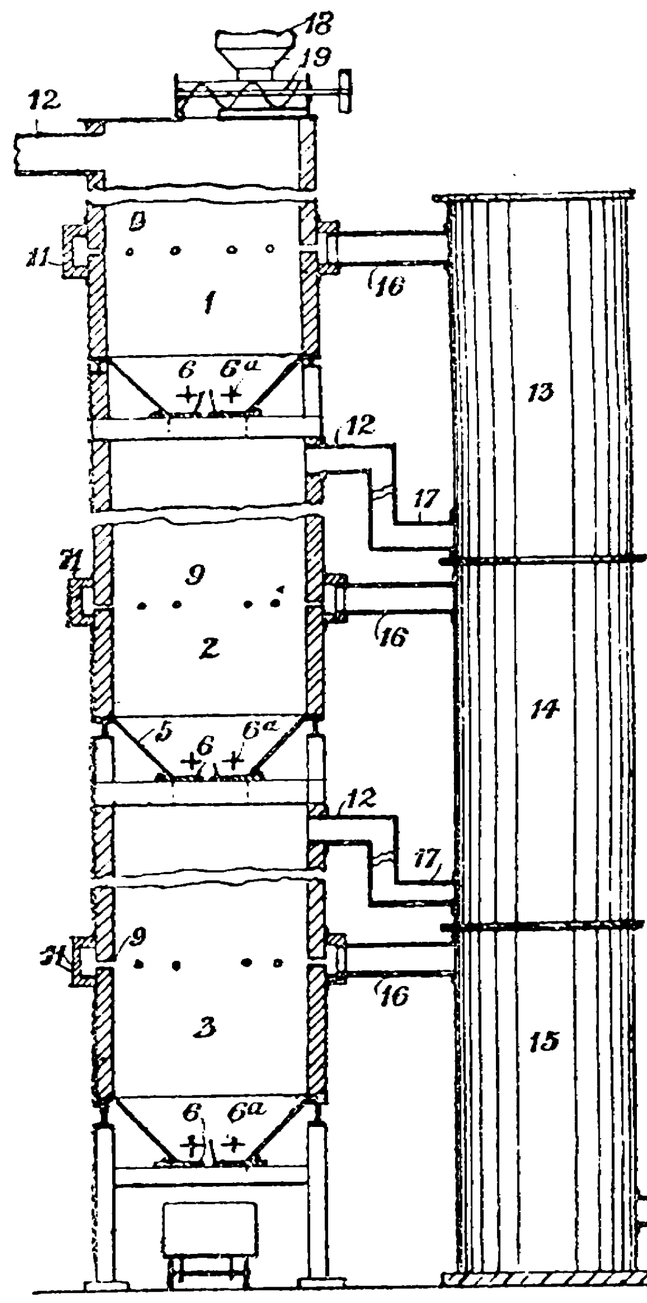
gas is passed to the heater to heat the gases passing therethrough, being burned by air introduced through the pipe 24. The burned gases escape by an outlet 25. Another form of apparatus is illustrated, having a stationary upright furnace; while several modifications in the methods of working are described. There are 45 claims.—R. S.

Coke, Gas, and By-products; Method of and Apparatus for Producing ——. P. Naef, New York, U.S.A. Eng. Pat. 20,658, Oct. 14, 1899. (Date claimed under Inter. Con., March 14, 1899.)

THE method consists in continuously passing and re-passing a comparatively small quantity of heated gas containing practically no nitrogen, such as water-gas, through the fuel, and reheating the said gas together with any gaseous products of distillation it may contain after each passage through the fuel. The circulating gas may be mixed with steam. The hot coke obtained is treated with steam to obtain water-gas and ammonia. The latter are mixed with the gas obtained by destructive distillation, and are afterwards washed to obtain by-products. The apparatus used may be such as are described in the following Eng. Pats., 30,497, 1897 (this Journal, 1898, 762); 7951, 1898 (this Journal, 1899, 570); 7952, 1898 (this Journal, 1899, 569); 7953, 1898 (this Journal, 1899, 569); 13,164, 1898 (this Journal, 1899, 819); 13,165, 1898 (this Journal, 1899, 820); 17,852, 1898.—R. S.

Gas and By-products; Method of and Apparatus for ——. P. Naef, New York, U.S.A. Eng. Pat. 20,660, Oct. 14. 1899. (Date claimed under Inter. Con., March 14, 1899.)

WATER gas and by-products are continuously obtained from fuel, by conducting heated steam through the fuel, withdrawing any remaining steam together with the reaction products after their temperature is reduced below the reaction temperature, re-heating them and again conducting them through the fuel, and repeating the re-heating and conducting through the fuel as often as required. The fuel is continuously passed through one or a series of generators or furnaces. The by-products may be recovered after each withdrawal of gases from the furnace, or only after the final withdrawal. Steam may be added to the reaction products before passing them back to the furnace, or steam may be passed through heated fuel in another generator. In the form of apparatus shown, there are three superposed generators 1, 2, 3, having a charging device 18, 19, and discharging devices consisting of sliding doors 6, and toothed revolving rollers 6*a*. Three gas heaters 13, 14, 15, are used, gas passing as follows: tube 17, heater 15, tube 16, annular channel 11, and radial inlets 9, outlet 12, inlet 17 to heater 14, and so on through generator 2, heater 13, generator 1, and outlet 12. A modified form of apparatus is illustrated in the specification.



—R. S.

Illuminating or like Gas; Process for Washing ——. R. Haddan, London. From Berlin-Anhaltische Maschinenbau-Actienges., Berlin. Eng. Pat. 14,569, Aug. 14, 1900.

CLAIM 1 is "A process for washing illuminating gas, consisting in washing the gas with an amine perfectly soluble in alcohol, as, for instance, with an alcoholic solution of aniline."

—R. S.

Gas Producers. W. H. Bradley, Pennsylvania, U.S.A. Eng. Pat. 15,393, Aug. 29, 1900.

EACH gas producer has at least three ridge-shaped grates extending radially from the centre of the producer, and is provided with (1) a water seal and trough, (2) free spaces for the descent of ashes between the ridge-shaped grates, (3) blowers directed into the space beneath the grates, (4) rake-out extensions in the water-sealing trough beneath each grate, and (5) slots at the inner meeting edges or

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ridges of the grates to allow air to pass up at these points, so as to prevent burning out at the junctions.—R. S.

Explosive Gas or Dust in the Atmosphere; Apparatus for Detecting ——. C. E. G. Simons. Eng. Pat.

See under XXIII., Apparatus, *page* 1144.

Acetylene Gas Lamps. J. H. Lancaster, New York. Eng. Pat. 21,804, Oct. 31, 1899.

A CARBIDE chamber, with lining and division walls specially planned to facilitate cleaning, is provided with water through a grooved cock by which also the generated gas escapes to the burner. The grooves on the plug of the cock are so arranged that, on turning it, gas stored in the apparatus first passes to the burner, while a further turn opens the water duct. When the apparatus is to be put out of action, turning the cock first closes the water duct, and a subsequent turn cuts off the gas supply to the burner. Safety valves permit surplus gas to pass to the burner. Forty claims are made.—J. A. B.

Acetylene Gas; Apparatus for the Production of ——. P. N. Lucas Girardville, Paris. Eng. Pat. 13,996, Aug. 3, 1900. (Under Internat. Convention.)

A CARBIDE receptacle alongside a gasholder is supported from the crown of the bell of the latter by means of a pipe, which serves also to convey the gas evolved to the gasholder. The end of this pipe is sealed in petroleum or glycerin contained in a receptacle attached to the inside of the crown of the bell. Water passes from the tank of the gasholder to the carbide receptacle through a flexible pipe, when the receptacle—following the movements of the bell—falls below a certain level.—J. A. B.

Acetylene Gas; Process of and Means for the Production of ——. E. S. Titus, Hempstead, State of New York, U.S.A. Eng. Pat. 15,292, Aug. 28, 1900.

CARBIDE is fed by means of a wheel actuated through a cog wheel attached to its spindle, by the bell of a gasholder, into a shoot which terminates at the base of a generating chamber containing water. The carbide receptacle and shoot are closed, and consequently at the start become filled with gas, so that thereafter the carbide does not come in contact with water until it reaches the bottom of the shoot, which is within the generating chamber. The gas evolved passes into the gasholder.—J. A. B.

Acetylene Gas; Generators for the Production of ——. W. P. Rees and G. R. Boundy, both of Abergavenny. Eng. Pat. 16,367, Sept. 14, 1900.

ATTACHED to the bell of a gasholder is a bent rod, on the free end of which is a hollow plate, which, when the bell descends to a given point, comes in contact with and depresses the ball of a ball-cock, and thereby causes water to flow from a supply pipe to a receptacle containing carbide, whence the gas evolved passes through a seal to the gasholder.—J. A. B.

Gas-ignition Pills; Manufacture of ——. A. Martini, Berlin. Eng. Pat. 24,392, Dec. 7, 1899.

REFERENCE is made to Eng. Pat. 22,901 of 1898 (this Journal, 1899, 904). The processes claimed in the present patent are:—

(1) The easily soluble parts of meerschaum are removed by treatment with dilute acids, or by cautious treatment with alkalis; the skeleton remaining, while still wet, is impregnated with a solution of salts of the rare earths, preferably thorium nitrate; the salts are reduced to oxides, a high temperature being avoided; the skeleton is thoroughly lixiviated and impregnated with a solution of platinum salt, which is then reduced to spongy platinum.

(2) The meerschaum, having been extracted and impregnated with rare-earth salts, is dried so as not to reduce the salts to oxides; it is then impregnated with platinum salts, which are next reduced to the spongy state without using high temperatures; and, finally, the soluble rare-earth salts are washed out by hot water or steam.—H. B.

Lighters for Gases or Vapours. W. P. Thompson, Liverpool. From A. Simonini, Brooklyn, U.S.A. Eng. Pat. 11,874, June 30, 1900.

THE improved lighter consists of (1) a preliminary heater in the form of a pellet composed mainly of platinum black, which will glow when placed in a stream of air and gas; (2) an intermediate heater, which will glow in the stream of gases when it is heated, and which is prepared by impregnating a thread, into which is secured a platinum wire, with a solution of thorium nitrate and platinum chloride in proportions varying from 75—90 per cent. of thorium nitrate and from 25—10 per cent. of platinum chloride; (3) a second intermediate heater, prepared by impregnating threads, embodying platinum wires, with a solution of platinum chloride alone; and (4) an igniter prepared by impregnating a thread with a solution consisting substantially of 98 per cent. of thorium nitrate, 1 per cent. of cerium nitrate, and 1 per cent. of platinum chloride. The various threads are arranged in contact with the pellet, and after ignition are ready for use. The igniter is itself incapable of glowing in a cold mixture of air and gas, but the preliminary heating effected by the other parts of the device raises it to activity.—H. B.

Self-igniting Gas Mediums; Manufacture of ——. D. J. Archer, Toronto. Eng. Pat. 11,517, June 25, 1900.

THE igniter consists of a piece of platinum wire, in connection with a heating pellet prepared by mixing into a paste with water two parts of platinum black and one part of bone ash, moulding the paste into a pellet, baking it and heating it in a flame.—H. B.

Incandescence Osmium Lamps; Process for Clearing the Bulbs of ——. C. Auer von Welsbach, Vienna. Eng. Pat. 25,273, Dec. 20, 1899.

IT is found that an exceedingly fine brownish film is deposited upon the inner surface of the bulb of a lamp containing an osmium filament. For removing such films, the process claimed consists in oxidising and gasifying them by introducing oxidising gases into the opened bulbs, which are heated to a temperature insufficient for attacking the "reguline osmium" of the filaments themselves, and afterwards rinsing out the osmic acid produced by non-reducing gases. A modification of the process consists in "also introducing into the warm bulb a small quantity of some diluted acid, for instance, nitric acid, and subsequently rinsing the bulb with water and drying it with pure dry air."—H. B.

Mantles for Incandescent Gas Light; Improved Construction of ——. J. Place, Beckenham, Kent. Eng. Pat. 3995, March 1, 1900.

"AN incandescent mantle constructed of separate, approximately vertical, straight rods or filaments of incandescent material, reposing in and held apart by an upper notched or perforated horizontal ring, and supported at their lower ends in a spaced ring or channel."—H. B.

Incandescent Mantles; Improved ——. E. Pikhart, Vienna. Eng. Pat. 16,473, Sept. 15, 1900.

To strengthen the upper part of the mantle, additional threads or seams, in zigzag or loop form, are worked into the corresponding part of the fabric.—H. B.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM.

Coal; Thermal Reactions in the Distillation of ——. M. Euchene. Communication to the Internat. Gas Congress, Paris. J. Gas Lighting, 1900, **76**, [1955], 1080—1084; [1956], 1141—1146.

THIS long communication is divided into two parts, the first of which treats of the thermal reactions in the manufacture of gas; and the second, the investigation of various matters in connection with the ground covered by the first part. The author points out that the practical gas maker

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regards the amount of heat needed for the distillation of the coal as that afforded by the fuel consumed in the furnace; this, however, varies with the type of furnace and apparatus employed, and is quite distinct from the heat of decomposition of the coal, as scientifically defined. The latter is constant for a particular variety of coal.

For every 100 parts by weight of coal carbonised, a certain quantity of fuel, which develops a certain number of heat units, has to be consumed. Suppose the heat developed by the fuel = A calories per 100 parts by weight of coal carbonised; the heat carried away by the volatile matters—*e.g.*, gas, water, tar, &c., D cals.; heat carried away by smoke in the flue = C; heat retained by the coke = E; heat lost by radiation = F; heat carried away by the ashes and clinker = H. Then, x, the heat needed for the decomposition of the coal is represented by—

$$(1)\ x = A - (C + D + E + F + H).$$

In attempting to elucidate the thermal reactions in the distillation of coal, the author has made use of St. Claire Deville's classification of gas coals. The five types are shown in the following table, in which the figures refer to the substance of the coal after ash and moisture have been deducted.

Type of Coal.	Volatile Matter.	Elementary Composition.			
		Carbon.	Hydrogen.	Oxygen.	Nitrogen.
	Per Cent.				
No. 1	29·48	88·38	5·06	5·56	1
„ 2	33·88	86·97	5·37	6·66	1
„ 3	36·42	85·89	5·40	7·71	1
„ 4	40·66	83·37	5·53	10·10	1
„ 5	43·99	81·66	5·64	11·70	1

These coals, as employed in gas-making, would contain ash and moisture; and a detailed description is given, with numerous tables, showing the products of distillation, with the quantities of heat liberated and absorbed, for these five types of coal and for peat. The more important figures are summarised in the following table:—

Type of Coal, &c.	Elementary Composition.							Volatile Matter obtained on Distillation. Percentage by Weight.			
	Moisture.	Ash.	Carbon.	Hydrogen.	Oxygen.	Nitrogen.	Sulphur.	Gas.	Tar.	Water.	Total.
No. 1	2·17	9·040	77·790	4·460	4·890	0·880	0·770	14·283	4·500	4·584	23·367
„ 2	2·70	7·060	77·560	4·790	5·940	0·890	1·060	15·361	5·070	5·567	25·998
„ 3	3·31	7·210	76·000	4·780	6·820	0·880	1·000	16·046	5·450	6·805	28·301
„ 4	4·34	8·180	72·080	4·780	8·730	0·870	1·020	17·258	6·300	8·616	32·174
„ 5	6·17	10·730	67·010	4·630	9·600	0·820	1·040	16·797	6·400	9·861	33·058
Peat	17·50	5·342	47·475	5·207	22·975	0·825	0·676	36·250	8·300	26·500	71·050

Type of Coal, &c.	Heat Liberated during Distillation.	Heat Absorbed during Distillation.	Percentage of Coke obtained from the Coal.*	Carbon Volatilised. Per Cent. of Total Carbon.	Fuel (Coke) Consumed. Per Cent. of Coal Distilled.
	Calories per 100 kilos.	Calories per 100 kilos.			
No. 1	23,718	1,976	75·661	15·50	..
„ 2	26,228	2,282	72·567	17·40	22·40
„ 3	29,243	2,547	70·243	18·80	21·00
„ 4	34,213	2,865	65·962	21·70	20·20
„ 5	32,017	2,832	64·016	22·80	..
Peat	76,564	4,333	27·304	55·00	..

* The nature of the coke was: No. 1, caked, dense, large; No. 2, caked, dense; No. 3, caked, medium size; No. 4, caked, friable, small; No. 5, caked, very friable, small; peat, not caked.

Remarks.—Distillation proceeded slowly in the cases of Nos. 1 and 2; rather quickly with No. 3; quickly with Nos. 4 and 5; and rapidly with peat.

The author then shows in equation (2) the heat exchanges. A = heat furnished by the fuel, and B = heat of formation of products formed. C, D, E, F, H have the same meaning as in (1). The second member comprises seven terms, *viz.*, the five terms included in the bracket in equation (1); G = heat of formation of the compounds of carbon which are formed with absorption of heat, and X = heat of decomposition of the coal.

$$(2),\ A + B = C + D + E + F + G + H + X.$$

$$\text{Hence } x = X - B + G.$$

The values of B and G are known from the foregoing table, and the author describes in detail the methods employed for determining the values of A, C, D, E, F, and H. The values obtained for coal No. 3, distilled in an ordinary setting of seven retorts, were:—

	Calories per 100 kilos.
Heat produced:	
A. Heat developed from 21·2 kilos. of coke	143,683
B. Heat of formation of volatile products	29,243
Heat consumed:	
C. Loss of heat through smoke at 975° C.	81,311
D. Loss of heat through volatile products at 650° C.	17,999
E. Loss by red-hot coke at 950° C.	24,585
F. Loss by radiation	22,114
Heat consumed—*cont.*	Calories per 100 kilos.
G. Heat of formation of carbon compounds	2,547
H. Loss through ash, &c. (15 per cent. of the coke)	1,272
X (by difference)	23,098

Thus the heat of decomposition—

$$x = 23{,}098 - 29{,}243 + 2{,}547 = -3{,}598 \text{ calories.}$$

In a similar manner, for coals Nos. 2 and 4, distilled in an ordinary setting, the value of x was found to be −1,239 and −6,351 calories respectively. It is apparent, therefore, that heat is liberated in the distillation of coal, and this confirms the conclusion drawn by Mahler from results obtained in 1893 by an entirely different method of research.

The author states that this fact affords an explanation of the phenomenon of the "heating" of coal, which is generally admitted to be due to oxidation. When the oxidation occurs in a small heap, the heat produced is dissipated, and "heating up" does not take place. If, on the other hand, the heap of coal exceeds a certain height, say, 13—18 feet—and especially when the lumps are large and the intervening air spaces considerable, the absorption of the enclosed air by the coal produces a small amount of heat, which favours oxidation of the coal. Then, in consequence of the feeble conductivity of the coal, distillation commences, and continues slowly until the volatile matter is completely separated.

From the results of his experiments and calculations the author concludes that, with the ordinary furnace and setting,

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as commonly used, improvement may be effected in the following directions:—

	Per Cent.	
On the excess of air in the chimney gases, an economy of	9·50	
On the water in the ash-pan, an economy of	4·90	
„ red-hot coke, an economy of	6·16	
„ losses by radiation, an economy of	3·20	
Total	23·76	of the heat furnished by the coke.

The author has also drawn up a heat-balance for coal No. 3, distilled in the Siemens setting of eight retorts, and discusses the relative efficiency of this form of setting in regard to the loss of heat through different channels, as compared with the ordinary setting. Full details are given of the determination and calculation of the values of the different terms of the equation for the Siemens setting. The chief difference between the types of setting appears to be the greater economy effected with the Siemens setting in the loss due to the smoke or chimney gases. The other losses appear higher with the Siemens setting, because, even though they are actually the same as with the ordinary setting, they are compared with a smaller consumption of fuel. The losses through radiation, however, are really greater with the Siemens setting, because of the producer and recuperator which are absent from the ordinary setting. From consideration of the results, the author considers it clearly proved that the Siemens regenerative setting possesses many distinct advantages over the ordinary setting, the slight disadvantage being the greater loss due to radiation. The heat of decomposition of coal No. 3 was found to be only −1,419 calories with the Siemens setting, as against −3,598 calories with the ordinary setting.—A. S.

Coumarone Homologues in Coal-Tar; Occurrence of ——. R. Stoermer and J. Boes. Ber. 1900, **33**, [16], 3013—3020.

The coal-tar fraction boiling at 185°—195° C. contains methyl-coumarones, which may be separated, in a resinous (polymerised) condition, together with some indene resin, by the action of sulphuric acid. When heated they partially decompose into the corresponding cresols, which serve as a means of identification.

2,400 grms. of tar oil, only a small quantity of which boiled above 195° C., were shaken in portions of 50-grms. each, with ice-cooled sulphuric acid for 10 minutes, the deep red-coloured mixture poured into water, and ether added until a viscous mass separated. Traces of hydrocarbons were removed from this by superheated steam, and the resulting brown and brittle solid was pulverised in water, strained and dried in the sun. Analysis indicated the presence of 25 per cent. of indene at this stage. 1,500 grms. of the mixed resin were then slowly distilled from an iron retort yielding about 500 grms. of an unpleasant smelling oil, from which 120 grms. of phenols were obtained by shaking with caustic soda; 600 grms. of pitch remained in the retort. The neutral oil (370 grms.) was distilled so as to yield the following fractions:—(1) b.p. 176°—185° C., chiefly hydrindene (compare Kraemer and Spilker, Ber. 1900, **33**, [14], 2257), no methylhydrindene being present; (2) b.p. 185°—190° C., hydrindene (25 per cent.) and methylcoumarone; (3) and (4) b.p. 190°—195°—200°, nearly pure methylcoumarone; (5) a portion boiling above 200°, which varied in amount and nature according to the condition of distilling the resin. Fractions 3 and 4 were completely purified by resinifying again, removing the hydrindene by steam distillation, and dry-distilling the purified resin. The different methylcoumarones could not be separated by fractional distillation, nor even by means of their picrates, the melting points of which lie close together; analysis and general properties decided the nature of the mixture.

The alkali soluble products of the dry distillation were then fractionated, the first fraction (190°—192° C.) proving to be chiefly *o*-cresol; the second (192°—200° C.), a mixture of *o*- and *m*- cresol, and the third, a mixture of *m*- and *p*-cresol. These were identified by methylation, oxidation to the methoxy-benzoic acids, then by heating in sealed tubes with HCl at 120° to 130° C., these were demethylated. The mixture of *m*- and *p*-oxybenzoic acids mixed with some salicylic acid, after being treated with superheated steam to remove salicylic acid, were then separated by means of their different solubilities in water at 0° C., as the usual method of converting to a urethane fails when applied to the separation of a mixture of cresols. The methyl-coumarones thus indicated were 6-methylcoumarone, 4-methylcoumarone, and 5- or 3-methylcoumarone, from each of which latter two, *m*-cresols might arise.

In a similar manner, 4·6-dimethylcoumarone, identified by the discovery of asymmetrical *m*-xylenol, was found to occur in a coal-tar fraction boiling at 215°—225° C.

—R. L. J.

Mineral Oils; The Geology of ——. Hans Höfer. Oesterr. Zeits. Berg. u. Huttenw. 1900, 48, 525; through Chem. Zeit. Rep. 1900, **24**, [86], 315.

In support of Angell's statement that productive oil springs occur in order and direction, and of the fact that old sand and pebble beaches already changed into sandstone and conglomerate were recognised by P. Carll in oil-bearing strata, the author finds that the Pennsylvanian oil lines run parallel with the anticlinals of the Chestnut and Laurent ridges, themselves representing anticlinal planes. Old beach lines are to be seen in Alsace at Pechelbronn, in the large sand beds there, which measure 1 kilo. in length and 50 meters in breadth and depth. The mineral pitch and tar obtained by mining, show that these are primitive oil beds. At still greater depths mineral pitch becomes tar, and finally oil. Andrae found in the marine oligocene beds of Pechelbronn no vegetable, only animal, remains. The oil is therefore of animal origin. Peckham assigns a similar origin to Californian oil, which contains 1·11 per cent. of nitrogen, but not to Pennsylvanian, because organic nitrogen is absent. The author now points out that the nitrogen of mineral oils may exist in a gaseous form, being found in the mineral gas of Pennsylvania to the extent of 27·87 per cent. Since oil beds are to a large extent lost under diluvial formations, it is important to discover the overlying folds of the oil-bearing Tertiaries.—R. L. J.

Petroleum Products; Alleged Spontaneous Inflammability of ——. R. Zaloziecki. Chem. Zeit. Rep. 1900, **24**, [34], 295; through Nafta, 1900, **8**, 33.

These phenomena are: the ignition of benzine in chemical cleansing processes; the ignition of natural gases in pipe-mains, explosions in reservoirs of volatile mineral oils, and the ignition of petroleum wells. The first-named has been traced by Richter to electric discharges. The ignition of natural gases in pipes has been shown by a specially appointed American Commission to be due to a spontaneously inflammable, amorphous, brown, spongy incrustation formed by the action of the natural gas on the iron of the pipes; such pipes should be frequently cleansed. The explosions of volatile petroleum products in reservoirs, agitators, wells, &c., are attributable either to such causes as electrical short-circuits or sparks caused by friction of hard surfaces, or to the flow of heavy hydrocarbon vapours in the direction of a neighbouring flame. Neither the gases from, nor the vapours of, petroleum have yet been shown to be spontaneously inflammable.—W. G. M.

Petroleum; Organic Bases in Russian ——. G. W. Chlopin. Ber. 1900, **33**, [15], 2837—2841.

The presence of organic bases, containing nitrogen, in crude petroleum and its distillation products has only recently been proved.

As a result of his investigation on the subject, the author comes to the following conclusions:—

1. Caucasian crude petroleum and Masut contain 0·005—0·006 per cent. of pyridine bases.

2. The six different pyridine bases isolated by the author in the form of the platinum chloride double salts had molecular weights varying from 104 to 308.

3. The "naphtha bases" have the general formula, $C_nH_{2n-15}N$.

4. The naphtha bases are poisonous to fish, but having regard to the small proportion contained in the naphtha,

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this fact cannot be accepted as an explanation of the poisonous action exerted on fish by crude petroleum and its products.

5. The bases are not injurious to small animals.

6. The bases have no special disinfecting properties. —A. S.

Scottish Shale Oil; the Bases contained in ——. F. C. Garrett and J. A. Smythe. Proc. Chem. Soc. **16**, [228]. 190—191.

THOUGH many investigators have examined the bases contained in coal-tar, but little attention has been paid to those present in shale oil. The authors have therefore undertaken the examination of those obtained from the Broxburn oil. The shale, on distillation, yields gas, ammonia water, and "crude oil;" this "crude oil" is again distilled, giving "green naphtha," "green oil," and still "coke," the temperature towards the end of the operation rising to a red heat. A quantity of the "green naphtha" was washed with 1 per cent. of sulphuric acid (diluted to about 15 per cent.). Steam was blown through the reddish-brown liquid so obtained for several hours to free it from a small quantity (about 0·1 per cent.) of an oily liquid possessing a peculiarly disgusting smell. When this had been removed, sodium hydroxide solution (17½ per cent.) was added, and superheated steam blown through until all the volatile bases had been driven over. The soluble bases in the distillate were thrown out by the addition of solid sodium hydroxide; the mixed bases were then dried by solid potash and fractionally distilled. Each litre of the crude acid liquor yields about 120 grms. of the dry bases, of which about 25 per cent. boil below 170°, and 46 per cent. between 170°—205° C.

The basic oil thus obtained was then repeatedly refractionated, and an attempt made to isolate the various bases in the lower fractions by precipitation with mercuric chloride and fractional crystallisation of the salts so obtained. The portion boiling below 125° C. (about 10 grms.) was examined for pyridine by precipitation with potassium ferrocyanide, but none was found, the base being chiefly *a*-picoline (b.p. 128°); from the other fractions below 160°, the symmetrical collidine ($\alpha\gamma\alpha'$-trimethyl pyridine) and two other bases, which appear to be the hitherto undescribed lutidines ($\alpha\beta$- and $\alpha\beta'$-dimethyl pyridine). The first of these boils at about 160° and yields a platinichloride melting with decomposition at 208°, whilst the second boils at about 140°, and although no platinum compound was isolated, it yielded a gold compound melting at 73°. In each case, however, the amount of base obtained was very small.

PATENTS.

Metacresol and Paracresol; Separation of ——. F. Raschig, Ludwigshafen, Germany. Eng. Pat. 25,269, Dec. 20, 1899.

THE process consists in sulphonating a mixture of the two cresols and subjecting the product to the action of superheated steam at a temperature of 120°—130° C., which causes the decomposition of the metacresol sulphonic acid, the result being sulphuric acid and metacresol, which distils off, whilst the paracresol sulphonic acid remains undecomposed. The latter may then be also decomposed by superheated steam, but at a higher temperature, *viz.* 140°—160° C.—D. B.

Anthracene or other Substance; Apparatus for Pressing Cakes of ——. Burt, Boulton, and Haywood, London, and T. S. Standfast, Southampton. Eng. Pat. 15,519, Aug. 31, 1900.

THE apparatus consists of two perforated discs, between which a spiral spring is placed, which, when the pressure is relieved, raises the upper disc. The latter having been removed, the substance to be pressed is piled upon the lower disc. The upper disc is then replaced and the whole is subjected to pressure until the upper disc and spring are pressed quite down. The claim is for "Apparatus for pressing cakes of anthracene or other substance, constructed and operating substantially as described."—D. B.

Charcoal having great Decolorising Power; Manufacture of ——. R. Ostrejko, Satkuny, Kowno, Russia. Eng. Pat. 14,224, Aug. 8, 1900.

ACCORDING to the first claim, the process is "characterised by treating substances containing carbon with aqueous solutions of chloride of calcium, or chloride of magnesium, or other compounds containing chlorine and their combinations, and then submitting it to dry distillation without access of air and washing the charcoal thus obtained with water, treating it with an acid solution (for instance, hydrochloric acid), and then again washing it repeatedly with water, and finally drying it or heating to a red heat a second time without access of air; the hydrochloric or other acid and chlorides being capable of being used over and over again for fresh quantities of charcoal." The charcoal thus obtained is claimed for decolorising acids, as well as for ordinary industrial applications. It is stated that charcoal obtained as described from birch wood is from 10—12 times more efficient than ordinary bone charcoal, and from 50—60 times better than birchwood charcoal as usually prepared.—E. S.

IV.—COLOURING MATTERS AND DYESTUFFS.

Natural Dyestuffs; Function of Soluble Ferments in the Formation of ——. N. Nicolle. Rev. Gén. des Mat. Col. 1900, **4**, [44], 253—259.

MOST vegetable colouring matters exist in the plants in which they are produced, in the form of glucosides, contained in certain cells. Other cells, more or less distant from these, produce enzymes which are endowed with the property of hydrolysing the glucosides.

It was formerly assumed that in the production of colouring matters, the glucosides underwent fermentations which were brought about by the action of microbes. It is now, however, recognised that the normal changes are induced by purely diastasic actions, although the enzymes generated by microbes are capable of effecting them.

Persian Berries; Fermentation of ——. C. and G. Tanret have shown that these contain a glucoside, xanthorhamnin, which is resolvable into Rhamnetin and rhamninose by the action of an enzyme rhamninase. Rhamninose is a dextro-rotatory sugar of the empirical formula, $C_{18}H_{32}O_{24}$, which dilute acids convert into rhamnose (2 mols.), and galactose (1 mol.). The enzyme present in the berries was at one time supposed to accomplish the change of the glucoside into the latter substances and Rhamnetin; hence the name, "rhamnase," which was then assigned to it. The colouring matter, Rhamnetin, separates as a greenish yellow precipitate after 72—24 hours, when a solution of xanthorhamnin is heated at a temperature of 45°—70° C.

Indigo; Fermentation of ——. According to Bréaudat, and also Molisch, the manufacture of Indigo from the plant is based upon diastasic actions, two enzymes successively operating. No Indigo is formed from leaves which have been boiled, when these are macerated in water during 18 hours at a temperature of 37° C., while the plant leaves which have not been heated yield the dyestuff after 45 minutes' maceration in water saturated with chloroform. This proves that microbes have no essential function in the action, this being effected by enzymes which are destroyed by heat. After the leaves have been exhausted with alcohol, they give up to water saturated with chloroform an enzyme which has the power of converting indican into indiglucin and Indigotin (it also hydrolyses amygdalin), as well as an oxydase which, in the presence of alkalis, transforms Indigo white into Indigotin. Bréaudat's researches extend over the following plants:—*Isatis alpina, Isatis tinctoria, Indigofera anil, Indigofera tinctoria.*

Rubianic Acid; Fermentation of ——. The glucoside present in Madder-root is changed by a diastase, erythrozym, into glucose and Alizarin.

It is probable that most vegetable colouring matters, during their separation from the plants in which they are formed, undergo similar enzymotic reactions.—E. B.

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Indigo; Natural v. *Artificial* ——. C. Rawson. Indian Gardening and Planting, July 19, 1900; through J. Soc. Dyers and Colourists, **16**, [11], 252.

Owing to the introduction of artificial Indigo, the price of natural Indigo has greatly diminished.

However, the author states that the cost of production of the natural product can be materially reduced, so that the difference in cost between the natural and the dearer artificial product will, in all probability, be increased.

After two or three years' study of the production of natural Indigo in India, he is convinced that in a short time there will be not only a greater yield of plant per acre, but that a plant will be obtained containing a higher percentage of colour-yielding principle.

By conducting Indigo cultivation and manufacture on more scientific lines, the author believes that it will be a profitable undertaking for many years, especially in combination with sugar production.—J. E. H.

Indican; Our Knowledge of ——. S. Hoogewerff and H. ter Meulen. Rec. trav. Chim. des Pays-Bas; through Chem. Zeit. Rep. 1900, **24**, [86], 312.

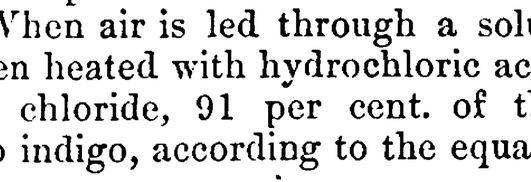
The authors have obtained crystallised indican from *Polygonum tinctorium* by plunging the leaves of this plant in boiling water for a few minutes, extracting them with lime water, treating the filtered decoction with baryta water, filtering, removing the excess of barium with carbon dioxide, again filtering and evaporating to dryness; then extracting the crude residue with methyl alcohol, precipitating the last traces of foreign substances by the addition of a double volume of ether to the extract, filtering and distilling off these solvents, dissolving the final residue in water, evaporating once more and ultimately allowing the solution, placed inside a desiccator containing sulphuric acid, to deposit the glucoside. It separated as almost colourless needle-shaped crystals having a composition represented by the formula $C_{14}H_{17}NO_6$, $3H_2O$, and melting at 51° C., but, after removal of the water of crystallisation by standing in a vacuous desiccator over sulphuric acid, at 100°—102° C. Indican is moderately soluble in water, acetone, or ethyl and methyl alcohols, only slightly soluble in ether, benzene, or chloroform, does not reduce Fehling's solution, has a lævorotatory action on polarised light, and, when heated in a test-tube, emits a purple vapour which condenses as a blue-coloured sublimate. When air is led through a solution of indican which has been heated with hydrochloric acid, and contains a little ferric chloride, 91 per cent. of the glucoside is converted into indigo, according to the equations—

$$\text{I. } C_{14}H_{17}NO_6 + H_2O = C_6H_{12}O_6 + C_8H_7NO;$$
$$\text{II. } 2C_8H_7NO + O_2 = C_{16}H_{10}N_2O_2 + 2H_2O.$$

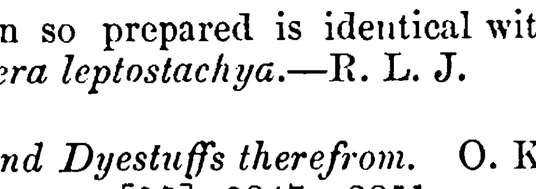
The indican so prepared is identical with that obtained from *Indigofera leptostachya*.—R. L. J.

Benzazols, and Dyestuffs therefrom. O. Kym. Ber. **33**, [15], 2847—2851.

The author, in continuation of his previous work (Ber. **32**, 3532) on the effect of different positions of the azo group in the benzazols on the colour and affinity for cotton of dyestuffs derived therefrom, has prepared two more derivatives of the series, *α-p*-amidophenylbenzoxazol—



by careful reduction of *p*-nitrobenzoic acid *o*-nitrophenylester $C_6H_4(NO_2)OCO.C_6H_4.NO_2$, and *α-p*-amidophenylbenzimidazol—



from *p*-nitrobenzoyl-*o*-nitraniline. The amidobenzazols were diazotised and combined with *β*-naphtholdisulphonic acid and with *α*-naphthol. The comparative dye tests were made by immersing the cotton for about half an hour in a 1 per cent. faintly alkaline solution of the dyestuff. After washing with water, the dye tests were treated for half an hour each in hot 1 per cent. soap solution and hot 10 per cent. sodium carbonate solution. The paper contains a table giving the behaviour of the different dyestuffs, which may be summed up as follows. The position of the azo group in the benzazols has little effect on the affinity of the dyestuff for the fibre, although those combined in the *α*-phenyl ring dye cotton somewhat heavier shades than their isomerides. An azo group attached to the *α*-phenyl ring gives heavier and bluer shades than one attached to the benzazol ring. If both the *α*-phenyl and the benzazol rings provide each an azo group, the shade and also the affinity for cotton are very considerably increased. The shades produced by the oxazols and thiazols are almost identical, whilst the corresponding imidazol derivatives give much deeper and bluer shades.—T. A. L.

Bismarck Brown III. E. Täuber and F. Walder. Ber. **33**, [15], 2897—2899.

Continuing their previous work (Ber. **30**, 2899; this Journal, 1898, 40), the authors have further investigated the composition of different Vesuvins, and the dyeing properties of the different constituents. The brown in the form of base is extracted in a Soxhlet apparatus with benzene, and the solutions obtained are allowed to crystallise. Triamidoazobenzene as most easily soluble, dissolves first and separates in large crystals, which can be mechanically removed from the phenylene-disazo-*m*-phenylene diamine. Subsequently, this latter only, in pure form, goes into solution. The residue, which cakes together after some time, was powdered, and again extracted, and finally dissolved as far as possible in hydrochloric acid, reprecipitated with sodium carbonate, dried, and again extracted with benzene, when an insoluble residue still remained. The crude brown therefore contains, in addition to triamidoazobenzene and phenylenedisazo-*m*-phenylene diamine, a basic substance and non-basic or very slightly basic substance, both insoluble in benzene. The latter appears to be soluble in solutions of the dyestuff itself. The following table gives the analyses of some good commercial Bismarck Browns in percentages of the amount taken:—

Triamidoazobenzene.....	..	8·0	..	..	..
Phenylenedisazo-*m*-phenylene diamine.	70·5	65·3	63·6	67·4	68·4
Base insoluble in benzene.....	15·4	17·3	19·7	19·6	19·0
Insoluble and tarry residues	..	7·0	..	5·5	7·0

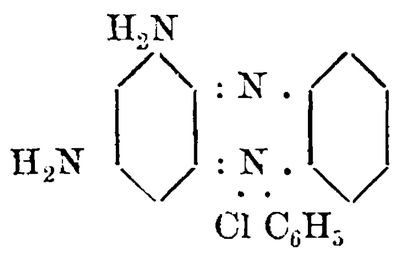
The blanks in the above table represent small unweighable amounts. A laboratory preparation of Bismarck Brown made from 3 molecular proportions of *m*-phenylene diamine, 4 of hydrochloric acid, and the amount of sodium nitrite necessary for the complete conversion of the *m*-phenylene diamine into dyestuff, gave 2 per cent. of triamidoazobenzene, 74 per cent. of phenylenedisazo-*m*-phenylene diamine, 10·5 per cent. of base insoluble in benzene, and 6·7 per cent. of residue insoluble in acid. By employing *m*-phenylene diamine dihydrochloride in the manufacture of Bismarck Brown, a dyestuff is obtained containing no triamidoazobenzene. The yield of dyestuff is an inferior one, and much nitrogen is evolved. It has already been pointed out (Ber. **33**, 2116; this Journal, 1900, 728) that the Bismarck Brown reaction depends very largely upon the working conditions. An excess of acid leads in a high degree to by-reactions, and a sudden addition of the nitrite solution causes the formation of nitroso-*m*-phenylene diamine from one-fourth of the *m*-phenylene diamine employed. Another impurity frequently present is azimidobenzene, due to the presence of *o*-phenylene diamine in commercial *m*-phenylene diamine. It is, of course, well known that the dinitration of benzene yields, not only the *m*-product, but also small quantities of its isomerides, which can only be removed at a prohibitive cost. For the dyeing tests, the three basic constituents of Bismarck Brown were converted into their hydrochlorides and dyed on unmordanted cotton and on cotton mordanted with tannin and tartar emetic. Triamidoazobenzene scarcely dyes unmordanted cotton, and gives yellowish-brown shades on the mordant; the two other products dye unmordanted cotton dark brown and mordanted

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cotton, reddish-brown. Phenylenedisazo-*m*-phenylene-diamine gives much brighter shades than the dyestuff containing the base insoluble in benzene, but otherwise these two dyestuffs show much similarity. All these facts tend to show that phenylenedisazo-*m*-phenylene diamine, owing to its great affinity for cotton, and the brightness and purity of the shades produced, is the most valuable constituent of Bismarck Brown.—T. A. L.

Iso-Phenosafranine; Preparation and Conversions of ——. F. Kehrmann and O. Kramer. Ber. **33**, [16], 3074—3081.

THE isomeride of phenosafranine, described shortly in Ber. **32**, 2608 (this Journal, 1899, 1115), is obtained from picrylphenyl-*o*-phenylene diamine by suspending 12 grms. of this product in 100 c.c. of alcohol, adding 100 c.c. of hydrochloric acid (20 per cent.), and the theoretical amount of stannous chloride. The whole is then heated on the water-bath until the solution turns dark red and the nitro compound has almost entirely disappeared. After standing 12 hours the greater part of the iso-phenosafranine separates as tin double salt, and is purified by boiling with water, when the tin is precipitated, and the iso-phenosafranine hydrochloride crystallises out in blackish-green needles on adding brine to the filtrate. It can be recrystallised from a little water containing a few drops of hydrochloric acid, and then forms blackish-green steely prisms, giving a yield of over 60 per cent. of the theoretical. The product has the formula—



On heating an aqueous solution of iso-safranine with sulphuric acid for some hours under a reflux condenser, the solution, at first green, turns finally mauve-red. The new chloride is precipitated by salt, and, after a further purification, is recrystallised from alcohol, forming shining brown needles readily soluble in alcohol to a magenta-coloured solution. The base separates from water in blackish-brown needles and melts between 310° and 315° C. It is at present impossible to decide which of the two amido groups has been replaced by hydroxyl by the action of dilute acids, but the iso-safraninone obtained is isomeric with the safraninone already known (Ber. **28**, 274; this Journal, 1895, 564). On treating the chloride with acetic anhydride and sodium acetate, it yields an orange-yellow acetyl compound, which undergoes an unexplained change on attempting to purify it by crystallisation. If picrylphenyl-*o*-phenylene diamine be reduced with an excess of stannous chloride, it is converted into leuco-iso-phenosafranine, which, on treatment with sodium acetate and acetic anhydride, and subsequent oxidation with ferric chloride, yields the chloride of a monacetyliso-phenosafranine, which, by further treatment with sodium acetate and acetic anhydride, gives a diacetyl derivative. Both these acetyl compounds, on warming with 50 per cent. sulphuric acid for a short time, are hydrolysed to iso-phenosafranine. On raising to the boil the reddish-yellow aqueous solution of the leuco tin double salt with sodium carbonate, ammonia, or aniline, the liquid turns a magenta colour, forming Aposafranine, and this method can be employed for the preparation of pure Aposafranine.

Since it has already been shown (Ber. **30**, 1565; this Journal, 1897, 793) that Aposafranine can be converted into Phenosafranine, it is now possible, starting from picryl chloride and *o*-amidodiphenylamine, to completely synthesise Phenosafranine.—T. A. L.

Gallinek's Amidomethyl Naphthimidazole; Note on ——. R. Meldola and F. W. Streatfield. Proc. Chem. Soc. **16**, [227], 183. (See this Journal, 1900, 1006.)

WITH regard to Gallinek's paper (Ber. 1900, **33**, 2315; this Journal, 1900, 1006), the authors point to his unjustified assumption that the base he has been dealing with is the same as that described by them (Trans. Chem. Soc. 1887, **51**, 691). Gallinek considers that the authors' failure to separate the base in the free state was due to their having had impure dinitro-*a*-acetnaphthalide as their raw material. The authors now desire to point out "that Gallinek is completely in error in his original assumption," and that the base he describes is *isomeric*, and not *identical* with that described by them in 1887. In fact the authors are at present engaged in the investigation of the nature of this isomerism. (See also Meldola and Eynon, Trans. Chem. Soc. 1900, **77**, 1159.)

Luteolin, III. A. G. Perkin and L. H. Horsfall. Proc. Chem. Soc. **16**, [227], 181—182.

ON methylation, luteolin (from weld) yields two ethers insoluble in alkali, (*a*), m. pt. 191—192° (this Journal, 1896, 444), and a more soluble compound (*b*), newly isolated, m. pt. 161—163°. The latter, $C_{15}H_7O_3(OCH_3)_3$, is the true *luteolin trimethyl ether*. Weld contains a trace of another colouring matter, $C_{15}H_{10}O_5$, which, on decomposition with alkali, yielded p-*hydroxybenzoic acid*, a trace of protocatechuic acid, *phloroglucinol*, and p-*hydroxyacetophenone*. By further reactions it was identified as *apigenin*. By the gentle action of alkali, morin, a colouring matter of *Morus tinctoria*, yields, in addition to β-resorcylic acid and phloroglucinol (Trans. 1896, **69**, 697) previously found, some quantity of *β-resorcylic aldehyde*.

Genistein, II. A. G. Perkin and L. H. Horsfall. Proc. Chem. Soc. **16**, [227], 182.

THE results obtained are in harmony with the constitution of a *trihydroxyphenylketocamaran* for genistein. Genistein from *Genista tinctoria* melts at 291°—293° C.

PATENTS.

Indigo White Compounds (with Formaldehyde, Phosgene, &c.); Manufacture and Production of ——. J. Y. Johnson, London. From The Badische Anilin und Soda Fabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 23,396, Nov. 23, 1899. [Second Edition.]

THIS invention consists in the production of new compounds of Indigo White which are stable in the air, but which can be readily converted into Indigo White or its salts. The new compounds can be, therefore, employed in the production of Indigo on the fibre, and are especially suitable for use in printing. They are obtained by treating Indigo White, under appropriate conditions, with formaldehyde, the chlorides of carbonic acid, and the esters of chlorocarbonic acid. Thus, the formaldehyde compound is produced by suspending about 26½ parts of Indigo White in 200 parts of water, adding about 30 parts of formaldehyde solution (40 per cent.), and agitating the mixture, at the ordinary temperature, until the Indigo White has been completely transformed. The product, which separates as a greenish powder, is filtered off, washed with water, and may be dried in the usual way, in the presence of air. It is soluble with difficulty in water and cold alcohol, almost insoluble in ether and benzene, but readily soluble in acetone and in hot acetic acid. It can be crystallised from hot alcohol in greenish-yellow plates. When treated at the ordinary temperature with caustic alkalis, or the carbonates of alkalis or of alkaline earths, or when boiled with water, it is decomposed into a salt of Indigo White or into Indigo White itself. The product from phosgene is insoluble, or nearly so, in the ordinary solvents, but is moderately soluble in boiling acetone. From the ethyl ester of chlorocarbonic acid two compounds are formed. One of these, which dissolves readily in most solvents, may also be obtained by treating with phosgene the sodium compound of Indigo White dissolved in ethyl alcohol.—E. B.

Anthraquinone Dyestuffs [Red, Greenish-Blue]; Manufacture or Production of New ——. H. E. Newton, London. From The Farbenfabriken vorm. F. Bayer and Co., Elberfeld, Germany. Eng. Pat. 23,968, Dec. 1, 1899.

THE amido- and amidoxy-anthraquinones and their sulphonic acids react with formic aldehyde and sulphites, yielding acid dyestuffs giving red to greenish-blue shades on wool from

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an acid bath. For example, a mixture of 100 kilos. of a 10 per cent. paste of 1.4′-diamidoanthraquinone, 300 litres of water, 10 kilos. of a 40 per cent. formic aldehyde solution, 20 kilos. of a 40 per cent. sodium bisulphite solution, and 40 kilos. of hydrochloric acid (33 per cent.) is heated with constant agitation at 50°—60° C. until the diamido-anthraquinone has dissolved almost entirely with a red colour. After filtering, the new dyestuff is salted out, filter-pressed and dried. It forms a brownish-red powder readily soluble in water to a red solution, and gives bluish-red shades on unmordanted wool from an acid bath fast to alkalis. It dissolves in concentrated sulphuric acid with an intense blue colour, and on heating with strong mineral acids it regenerates 1.4′-diamidoanthraquinone, which dissolves to a yellow solution in sulphuric acid. Analysis shows that the substance has the formula—

$$C_{14}H_6O_2(NHCH_2SO_3Na)_2 + 2H_2O.$$

In a similar manner, diamidoanthrarufin disulphonic acid (Eng. Pat. 12,011 of 1897; this Journal, 1898, 572) yields a dark blue powder, readily soluble in cold water and giving greenish-blue shades on unmordanted wool from an acid bath. The product dissolves in concentrated sulphuric acid with a yellow colour, which turns greenish-blue on adding boric acid. The absorption spectrum of this latter solution is identical with that of the boric ester of the diamido-anthrarufin disulphonic acid. The new dyestuff, when heated with a 15 per cent. hydrochloric acid is decomposed, yielding diamidoanthrarufin disulphonic acid.—T. A. L.

Azo Dyestuffs [Red, Blue Violet] for Cotton; Manufacture or Production of New ——. H. E. Newton, London. From The Farbenfabriken vorm. F. Bayer and Co., Elberfeld, Germany. Eng. Pat. 24,296, Dec. 6, 1899.

The patentees combine one or two diazo compounds with the disulphonic acid of dihydroxydinaphthylamine of the formula—

1.3.3′.HO.SO_3H.$C_{10}H_5$.NH.$C_{10}H_5$.SO_3H.OH.3′.3.1

obtained by heating 1.4′.2′-amidonaphthol sulphonic acid with sulphurous acid or salts thereof. The diazo solution from 9·3 kilos. of aniline is run into a concentrated solution of 46·1 kilos. together with some sodium acetate and acetic acid to make the solution slightly acid. The dyestuff forms at once, and after about 12 hours' agitation the whole is heated, and the dyestuff is salted out, filter-pressed, and dried. It gives red shades on cotton from a slightly alkaline bath. When two diazo compounds are combined with the dihydroxydinaphthylamine disulphonic acid, the reaction takes place preferably in presence of sodium carbonate, so that the solution remains alkaline throughout the operation. For instance, the diazo solution from 18·6 kilos. of aniline is run into a concentrated aqueous solution of 46·1 kilos. of dihydroxydinaphthylamine disulphonic acid and sufficient sodium carbonate to maintain the solution alkaline throughout the reaction. The formation of the dyestuff is complete in about 12 hours. The mixture is then heated, and the dyestuff salted out, filter-pressed and dried. It gives bright bluish red shades on unmordanted cotton. When different diazo compounds are employed, the first is combined in a solution acid with acetic acid, and the second in presence of sodium carbonate. For instance, with aniline and α-naphthylamine, a dyestuff is obtained which gives reddish-violet shades on unmordanted cotton.

—T. A. L.

Phthaleïn Dyestuffs [Red]; Manufacture of ——. O. Imray, London. From The Farbwerke vorm. Meister, Lucius und Brüning, Hoechst a/Main, Germany. Eng. Pat. 24,953, Dec. 15, 1899.

By condensing alkylamidohydroxybenzoylbenzoic acids with alphylated *m*-amidophenols, such as *m*-hydroxydiphenylamine or *m*-hydroxyphenyl-*p*-tolylamine, the patentees obtain a new series of phthaleïns differing from the rhodamines, which only contain alkyl groups. The new products are less basic and dye bluer shades than the alkyl rhodamines. On sulphonation they give sulphonic acids which dye wool from an acid bath very fast magenta to violet-red shades, similar to the Violamines, which they closely resemble in their properties. For example, 3 kilos. of dimethylamidohydroxybenzoylbenzoic acid, 2·84 kilos. of *m*-hydroxydiphenylamine, and 10 kilos. of zinc chloride are heated together in an enamelled vessel with constant agitation, with access of air for 5—6 hours at 160°—170° C. After cooling, the melt is powdered, washed with dilute hydrochloric acid to remove zinc chloride, filtered and dried. It forms a dark violet powder insoluble in water. The reddish-violet alcoholic solution dyes tannined cotton violet. In order to obtain the sulphonic acid of the product, 3 kilos. of dimethylamidohydroxybenzoylbenzoic acid and 2·84 kilos. of *m*-hydroxydiphenylamine are dissolved in 30 kilos. of sulphuric acid (66° B.), and heated on the water-bath for 1 hour, when the deep brownish-red solution is poured into ice water, filtered, well washed, and dried. The sulphonic acid so obtained has a metallic lustre, and is sparingly soluble in water. It dissolves to a deep reddish-violet solution in alcohol, and gives magenta-red shades on wool from an acid bath very fast to alkalis.—T. A. L.

Colouring Matters [Red, Violet, Brown] of the Anthracene Series; Manufacture and Production of New —— J. Y. Johnson, London. From the Badische Anilin und Sodafabrik, Ludwigshafen-on-Rhine, Germany. Eng. Pat. 25,080, Dec. 18, 1899. [Second Edition].

According to Claus (Ber. **15**, 1514) anthraquinone sulphonic acid, on nitration, yields an α-nitroanthraquinone sulphonic acid sparingly soluble in water, and an easily soluble isomeric β-acid. On heating these nitro-sulphonic acids, or either of them, with primary aromatic amines, they are converted into new dyestuffs which dye unmordanted and chrome-mordanted wool red, violet, and brown shades. About 100 kilos. of *p*-toluidine and 10 kilos. of β-nitroanthraquinone sulphonic acid are boiled in a vessel provided with an agitator, and the temperature is maintained until the melt has become cherry-red, and the colour no longer increases in intensity. It is then cooled to 80° C., mixed with 150 kilos. of alcohol, further cooled and filtered. The filtrate is mixed with twice its volume of ether, which precipitates the new dyestuff as a brownish-violet crystalline powder. It gives bluish Bordeaux-red shades on unmordanted or chrome mordanted wool. The patentees state that other methods (not specified) can be employed for isolating the dyestuff from the melt.—T. A. L.

Black Substantive Colouring Matters; Manufacture of New ——. J. Imray, London. From La Société Anonyme des Matières Colorantes et Produits Chimiques de St. Denis, Paris. Eng. Pat. 1150, Jan. 18, 1900.

The patentees heat together sulphur chloride with aniline, phenol, or cresols, and cause the products so obtained to react with a mixture of aromatic nitro-derivatives and complex polyamido or amidohydroxy aromatic compounds. A mixture of 5—6 kilos. of sulphur chloride and 3 kilos. of aniline hydrochloride is heated to 130°—150°C. for two hours. There are then added to the product 3 kilos. of *p*-phenylene diamine and 2 kilos. of *p*-nitraniline, the temperature being raised and kept for six hours at 190° C. After cooling slightly, 25—30 kilos. of sodium sulphite crystals are added to the melt, and the temperature is kept at 150°—175° C. for eight hours with constant agitation. The product so obtained solidifies on cooling, and dissolves readily in hot water to a deep bluish-black solution, which dyes unmordanted cotton an intense black. The addition of the *p*-nitraniline exercises an important effect. Its presence sensibly increases the amount of product obtained from a given weight of *p*-phenylene diamine, compared with similar processes in which it is absent.—T. A. L.

V.—TEXTILES: COTTON, WOOL, SILK, Etc.

Oxycelluloses from Cotton, Flax, Hemp, and Deadnettle L. Vignon. Comptes Rend. **131**, [14], 558—560.

The celluloses from these four plants give, on oxidation by hydrochloric acid and potassium chlorate, the same oxycellulose. This was shown by the analysis of the osazone, by the reducing power of the product, and by its action in removing dyestuffs from solution. The variations in the

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results were not greater than might arise from differences in the physical condition of the different celluloses, or in their molecular weights.—J. T. D.

Cellulose and Oxycellulose; Acetylated Derivatives of ——. L. Vignon and F. Gerin. Comptes Rend. **131**, [15], 585—590.

OXYCELLULOSE must be looked on as an aldehyde of cellulose. By the action of nitric acid on cellulose, a trinitro-derivative (calculated on C_6) is the highest obtainable, but at the same time the molecule is rendered aldehydic. To determine whether the aldehydic group is formed from a CH_2OH group (and thus whether the cellulose molecule contains four alcoholic groups), the authors acetylated cellulose and oxycellulose, using acetic anhydride and zinc chloride. The acetylation of cellulose was also repeated with glacial acetic acid and zinc chloride. The analysis of the products showed that each was a tetra-acetyl derivative; but, as that from oxycellulose retained its aldehydic character, the suggestion that cellulose contains four alcoholic hydroxyls, one of which is rendered aldehydic on nitration, is not proved.

—J. T. D.

Cellulose; Mercerised Cellulose; Precipitated Cellulose; Hydrocellulose. L. Vignon. Comptes Rend. **131**, [18], 708—709.

A COMPARISON of these substances as to reducing power, speed of saccharification, and heat of combustion.

None of the substances has any reducing effect on Fehling's solution. They are thus all sharply distinguished from oxycellulose.

The following figures were yielded by the treatment of 2 grms. of each of the substances for six hours on the water-bath with 50 c.c. of hydrochloric acid (1·125) and 200 c.c. of water.

100 grms. of—	Gave of Glucose, Grms.
Purified cotton	3·29
Hydrocellulose	9·70
Cellulose mercerised (soda, 1·26 sp. gr.)	4·39
„ „ („ 1·38 „)	3·51
„ precipitated by Schweitzer's reagent	4·39
Oxycellulose	14·70
Starch	98·60

The heats of combustion of 1 grm., determined in a calorimetric bomb, were as follows:—

Purified cotton (dried at 110° C.)	4223
Hydrocellulose (dried *in vacuo* over H_2SO_4)	4003
Mercerised cellulose (dried *in vacuo* over H_2SO_4)	3980
Precipitated cellulose (dried *in vacuo* over H_2SO_4)	3982

The effect, then, of weak acids or of cold alkalis is, possibly, to hydrate and depolymerise cellulose, but without altering its chemical functions. The resulting substances are quite different from starch on the one hand, and oxycellulose on the other. Oxycellulose cannot exist in contact with strong solutions of alkalis, but breaks up into cellulose and a soluble acid.—J. T. D.

Wool and other Albuminoids; Relations of ——, *to Sulphuric Acid and Caustic Potash.* N. A. Stepanow. Rev. Gén. des Mat. Col. 1900, **4**, [44], 246—251.

LIDOW found the coefficients of acidity (mgrms. of KOH : 1 grm. of substance) to potassium carbonate of the following albuminoids to be:—Albumin, 20·9; gelatin, 28·4; wool, 57·0; globulin, 101·5; silk, 143·0.

The author has experimented with a larger number of the compounds of the same class, and has determined their acidity and alkalinity, as measured by the amounts of caustic potash and sulphuric acid respectively neutralised or absorbed. In the case of wool and silk the apparatus employed for this purpose consisted of a modified form of Soxhlet extraction tube, into which a weighed quantity of the substance was introduced along with the solution of the acid or alkali. The apparatus was then sealed. After some time the solution was withdrawn, and the fibrous material washed until the washings were free from the reagent employed.

The results obtained vary. They are influenced by the masses in action, the time during which, and the temperature at which, the compounds react, and the nature of the solvent for the reagent used. The coefficients of acidity (grm. of KOH:1 grm. of substance), estimated by means of an alcoholic solution of the alkali, at a temperature of 18°, and during periods of time varying from 24—336 hours, are, approximately: vittelin, 0·2; globulin, 0·17 hemialbumin, 0·2; caseïn, 0·14; keratin, 0·26; legumin 0·11; spongin, 0·3; fibrin, 0·15; silk (24 hours), 0·04 (216 hours, and with a more dilute solution of the reagent), 0·025; wool (24 hours), 0·033 (120 hours and the reagent solution more dilute), 0·06.

With wool the amounts of alkali and acid absorbed (the coefficient of absorption being C_l) increase directly with the increase in concentration of the reagent solution applied. The coefficients of distribution $\left(\frac{C_l}{C_v}\right)$ of the alkali and acid between 1 grm. of the fibre (C_l) and 1 c.c. of the reagent solution (C_v) decrease as the concentration of the latter increases, and when the solution is very concentrated they approach 0.

Number of Experiment.	Wool.	KOH or H_2SO_4.	Volume of Solution (Alcohol).	(C_l) KOH or H_2SO_4 absorbed by 1 grm. of Wool.	(C_v) KOH or H_2SO_4 left in 1 c.c. of Solution.	$\frac{C_l}{C_v}$	Time.	Temperature.	$\frac{\sqrt{C_v}}{C_l}$
	Grm.	Grm. (KOH)	C.c.	Grm. (KOH)	Grm. (KOH)		Hours.	° C.	
1	1	0·154233	100	0·126471	0·000277	456	96	20	0·13
10	1	1·542330	100	0·264766	0·012776	20	96	20	0·43
		(H_2SO_4)		(H_2SO_4)	(H_2SO_4)				
1	1	0·126185	150	0·054007	0·000507	106	48	20	0·41
10	1	1·261850	150	0·090853	0·007806	12	48	20	0·97
		(KOH)		(KOH)	(KOH)				
1	0·3140	1·54233	150	0·383126	0·009487	40·4	72	20	0·25
10	3·1053	1·54233	150	0·141750	0·007348	19	72	20	0·57
		(H_2SO_4)		(H_2SO_4)	(H_2SO_4)				
1	0·2850	0·630925	150	1·098033	0·002119	518	48	20	0·04
10	2·7196	0·630925	150	0·142907	0·001615	88	48	20	0·28
		(KOH)		(KOH)	(KOH)				
1	1	1·54223	150	0·070947	0·014714	4·7	2	− 10	1·76
7	1	1·54223	150	0·216640	0·0132589	16·3	2	80	0·42
		(H_2SO_4)		(H_2SO_4)	(H_2SO_4)				
1	1	0·504740	100	0·010350	0·004944	2	2	− 10	6·79
7	1	0·504740	100	0·074750	0·0042999	17	2	80	0·87
		(KOH)		(KOH)	(KOH)				
1	1	0·771165	100	0·120816	0·006503	18	1	20	..
9	1	0·771165	100	0·210785	0·005038	37	384	20	..
10	1	0·771165	100	0·210785	0·0056038	37	768	20	..

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Alkalis are absorbed and not neutralised by wool. This was proved by taking two portions of wool, each weighing 1 grm., and treating them separately with the same quantity of alcoholic potash solution, the alcohol being allowed to evaporate to half its volume in the one case, and being prevented from evaporating in the other. After a time (312 hours) the solutions were withdrawn and the wool washed with alcohol. In the first case the wool absorbed 1·0423 grm., in the second case 0·2031 grm., of KOH.

The results obtained with wool which had been bleached with sulphurous acid, and which contained a small quantity of this, are given in the table on page 1103.

Analogous relations exist between caustic potash, sulphuric acid, and the other albuminoid substances.

The results support the theory of dyeing advanced by O.N. Witt (this Journal, 1891, 42).—E. B.

Artificial Silks. C. Hassac. Oesterr. Chem. Zeit. 1900, **3**, 235, 267, and 297; through Analyst, 1900, **25**, 275.

Six materials were examined: three samples of Chardonnet silk (made from collodion), 1. From Pris de Vaux near Besançon, 2. From Fismes, in North France, 3. From Walston, England; 4. a collodion silk made by Lehner's process at Glattbrugg, near Zurich, 5. a cellulose silk made by Pauly's ammoniacal copper oxide process at Oberbruch, near Aachen, 6. Hammel's gelatin silk.

Physical Properties.—In appearance 1, 2, and 4 are very similar; they are more lustrous than real silk, but are stiffer, and do not possess the characteristic feel. 3 feels rough and appears hairy, resembling mohair rather than silk. 5 has the appearance of 1 and 2; its lustre is still better, and when made up it has the characteristic feel of true silk. Under the microscope (× 150, and swollen by immersion in water) 1, 3, and 2 are very similar; the last being more deeply grooved. In cross section they are distinguishable, 1 giving the most symmetrical outlines, and 2 the least. 4 is characterised by deep longitudinal grooves, and by small air bubbles; its cross section is highly irregular. 5 exhibits fine longitudinal grooves, and minute transverse lines in the centre of the fibres; its cross section is regular, approaching a circle or ellipse. 6 is almost circular in outline, and is free from grooves or bubbles. The fracture is even and the thickness constant. In polarised light 6 is singly refracting, the others doubly so. 5 shows uniform interference colours over considerable lengths of fibre; in 1, 2, 3, and 4 the colours vary greatly, owing to the irregular thickness of the fibres.

Action of Reagents.—As the collodion silks always contain some nitro compound, they give a blue colour with diphenylamine and sulphuric acid. In water all the artificial silks expand, alcohol or glycerin causes them to contract again. In strong sulphuric acid the collodion silks swell rapidly and dissolve; cellulose silk gradually becomes thinner and dissolves; gelatin silk only dissolves on heating strongly. Strong cold hydrochloric acid has little action; on warming, it rapidly dissolves gelatin silk. Acetic acid causes a slight swelling; but gelatin silk dissolves almost entirely if boiled therein. Chromic acid (a half-saturated solution) dissolves all artificial silks quickly in the cold; real silk dissolves more slowly; cotton, flax, and other vegetable fibres are unaffected.

Caustic potash (40 per cent.) dissolves gelatin silk rapidly; collodion and cellulose silks swell, but do not dissolve even on boiling—the liquid becomes yellow. True (white) silk is dissolved by boiling, but the liquid remains colourless. Ammoniacal copper oxide (Schweitzer's reagent) causes collodion silk to swell quickly and then to dissolve; cellulose silk swells less rapidly; gelatin silk is insoluble, but stains the liquid a bright violet. Alkaline copper glycerin solution dissolves real silk immediately at 80°; Tussah and gelatin silk dissolve when boiled for one minute; the others are untouched. Solution of iodine and potassium iodide colours artificial silks an intense red or reddish-brown. The colour vanishes on washing with water, leaving collodion silks a transient greyish-blue. Cellulose silk does not exhibit this blue. Iodine and sulphuric acid (von Höhmel's paper reagent) stains true silk yellow, gelatin silk yellowish- to reddish-brown, collodion silks deep blue (violet shade), cellulose silk pure blue. Solution of zinc chloride and iodine colours collodion silks bluish-violet, cellulose silk greyish-blue to greyish-violet; gelatin silk and real silk become yellow and disintegrate.

In burning, gelatin silk resembles true silk; the other artificial silks suggest cotton. The accompanying table gives various mechanical and physical data respecting these products. The specific gravity was determined in benzene, removing air bubbles *in vacuo*. The fifth column gives the number of single fibres per square millimetre after soaking n water, as measured microscopically. The sixth column was obtained by calculation. The tensile strengths were determined by means of Teclu's machine.

Variety of Silk.	Moisture.		Specific Gravity.	Number of Fibres per 1 sq. mm.		Tensile Strength. Kilos. per sq. mm.		Extension.
	Air-dry.	Saturated.		Wet.	Dry.	Wet.	Dry.	
	Per Cent.	Per Cent.						Per Cent.
Real Silk	8·71	20·11	1·36	9,710	9,710	37·0	37·0	21·6
Chardonnet	11·11	27·46	1·52	640	1,135	2·2	12·0	8·0
Fismes	10·92	27·12	1·52	370	656	1·6	7·8	11·6
Walston	11·32	28·94	1·53	683	1,620	1·0	22·3	7·9
Lehner	10·45	26·45	1·51	413	1,180	1·5	16·9	7·5
Cellulose	9·20	23·08	1·50	742	1,550	3·2	19·1	12·5
Gelatin	13·98	45·56	1·37	265	945	Nil	6·6	3·8

—F. H. L.

PATENTS.

Silk, Wool, and like Fibres; Preparation or Treatment of ——. C. Henry, Paris. Eng. Pat. 20,092, Oct. 6, 1899.

Silk is treated with a solution of 1 part of guncotton in 100 parts of Hoffman's ether, or 1 part of tetracetate of soda in 100 parts of nitrobenzene. The material is dried and prepared in the usual way. It is claimed that this treatment renders silk more hygienic as a clothing material; that is to say, it maintains the body at a more even temperature than ordinary silk.—C. M.

Artificial Silk; Manufacture of ——. W. E. Heys, Manchester. From A. Petit, Paris. Eng. Pat. 15,343. Aug. 29, 1900.

100 lb. of dry nitro-cellulose, 7 lb. of india-rubber solution, and 5 lb. of stannous chloride are intimately mixed together, and sufficient benzene added to give the mixture a working consistence.

The product is filtered and then squirted through dies by pressure, as in the existing methods of manufacture of artificial silks of the same type. It is claimed that this silk is not so inflammable as others made in similar ways.

—C. M.

Threads and Fabrics for the Purpose of rendering Fabrics Puncture-proof; Process for Preparing ——. A. Boyeux, L. F. Humbert, and A. Laulaville, Lyons. Eng. Pat. 21,162, Oct. 23, 1899.

This process is chiefly applicable to cloth used for covering pneumatic tyres of bicycles, &c. Cotton fibre is woven very closely and then mercerised, washed, and treated with a solution of 200 grms. of acetate of lead in 1 litre of

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boiling water. It is then placed in a 1 per cent. solution of sulphuric or other acid. After washing and drying, it is brushed over with a solution of caoutchouc (80—100 grms. in 2 litres of benzine), this solution having about 800 grms. of oxide of lead or zinc added to it. It is then spread over with powdered sulphate of baryta or the like and passed through a roller, so that all the interstices are filled.

If silk is used, the mercerisation is dispensed with, and the silk impregnated with stannic chloride.

For tussah silk and wool the stannic chloride is not required.—C. M.

Cellulose Threads, Films, and the like; Washing of ——. M. Fremery and J. Urban, Aachen, Germany. Eng. Pat. 24,101, Dec. 4, 1899.

In precipitating cellulose in the form of threads from its solution, by water, alcohol, or other precipitant, a certain part of the cellulose remains in combination with the metal or metallic compounds used to dissolve it. The authors find that the best way to remove this compound is to wash the threads with very dilute acid or salt solutions, and to use as little washing liquid as possible, in order to avoid forming insoluble basic salts. The washing liquid may consist of, say, 1,000 parts by weight of water and 1 part of sulphuric acid, or a 5 per cent. salt solution. If sulphuric acid and salt are used together, then the proportions are 1,000 parts of water, 1 part of acid, and 50 parts of salt.

The process is carried out in the same manner as described in Eng. Pat. 6641, Mar. 28, 1899, where only water was used as the washing agent.—C. M.

Cotton or like Vegetable Fibres in the Operations of Boiling, Purifying, or Extracting, and Bleaching and Mercerising; Treatment of ——. J. F. Copley, Newmill, near Huddersfield. Eng. Pat. 24,163, Dec. 5, 1899.

This invention is for combining the processes of purifying, bleaching, and mercerising. For purifying and bleaching, 100 lb. of yarn are worked in a solution containing, for every 450 galls. of water (at 40°—50° C.), 2 galls. of Turkey-red oil and 2 galls. of a solution of sodium hypochlorite containing 15 per cent. of available chlorine. The process is continued for about 30 minutes, and the yarn then left exposed to the air to drain.

For bleaching and mercerising where the cotton has already been purified, 5 per cent. of sodium hypochlorite (of the above strength) is added to the caustic soda-bath, and the mercerisation continued for about 15—30 minutes. The fibres may be purified and partly bleached in one operation, and then immediately mercerised and completely bleached in a second. The ordinary precautions as to tension, &c. during mercerisation should be taken.—C. M.

Antiseptic Fabrics. C. Geiringer, Vienna. Eng. Pat. 24,766, Dec. 13, 1899.

The fabric is saturated with a solution containing a salicylate, and a chloride of hygroscopic character; it is then wrung out.—L. A.

Peat; Treatment of ——. H. H. Lake, London. From La Société Paté Burke et Cie., Paris. Eng. Pat. 14,937, Aug. 21, 1900.

Peat is first beaten to free it as much as possible from earthy matter, stalks, roots, &c., and then digested in a 2 per cent. alkali solution. The solution is run off and the peat washed two or three times with water. It is now digested under pressure with a 2—3 per cent. solution of sulphuric acid for from ½—2 hours. The next process is to digest with a solution of oxalic, hydrochloric, or sulphuric acid of 45° B., and gradually heat to a suitable temperature, which does not destroy the fibrous material. The mass is now washed in a fulling trough with dilute alkali to render it soapy, and finally beaten and carded to render it fleecy. It is then washed well and dried.—C. M.

VI.—DYEING, CALICO PRINTING, PAPER STAINING, AND BLEACHING.

Rosaniline in Amyl Alcohol [Theory of Dyeing]; Solution of ——. P. Sisley. Rev. Gén. des Mat. Col. 1900, **4**, [44], 251—252.

Prud'homme ascribes the coloration of amyl alcohol by a hot slightly alkaline aqueous solution of colourless Rosaniline base to the presence of sodium valerate, which he considers to be capable of producing the change (this Journal, 1900, 734, 735, 736). The true explanation is, that the colourless form reverts to the coloured form when it is boiled with water. In the solution employed in the author's experiments, it is prevented from doing so by the caustic soda present. On being removed from the influence of the latter by the amyl alcohol, it is free to change. A similar phenomenon is witnessed in the case of the colour-base of Crystal Violet, which in its colourless form is more sensitive to alkalis than the colourless Rosaniline base. With this the change is still more striking. The change may be produced by alcohols other than amyl alcohol; for instance, ethyl alcohol. Amyl alcohol was chosen because of its affording in its non-miscibility with water, an illustration of the analogy existing between its action and that of a textile fibre—for example, silk—upon an aqueous solution of a pseudo-colour base.

The atmospheric carbon dioxide has no influence on the coloration of the amyl alcohol, nor have the constituents of the glass or porcelain vessel in which the change occurs, since it takes place equally well in a platinum vessel. That free acid does not cause it, is proved by its occurrence when pure aniline is substituted for the amyl alcohol.

Georgievics (this Journal, 1894, 807), Homolka (Nietzki, Chem. der org. Farbstoffe, 119), and Hantzsch (this Journal, 1900, 432), have already shown that the phenomena of dyeing can be satisfactorily explained without assuming them to be cases of salt-formation reactions.—E. B.

Wool Dyeing; Theory of ——. C. Gillet. Rev. Gén. des Mat. Col. 1900, **4**, [46], 305—307.

Objection is taken to the "salicylic acid" and "acetanilide reagents," employed by Prud'homme in an attempt to construct "an artificial fibre" (this Journal, 1900, 734), on the ground of the ready solubility of these compounds in water. The author describes some experiments he has made in the same direction. After trying amidopalmitic acid, without definite result, he turned his attention to naphthalene derivatives, with which he was more successful.

A solution of β-naphthol (5 per cent.) in amyl alcohol has no action upon aqueous solutions of strongly basic dyestuffs, such as Magenta, Methyl Violet, and Safranine, the phenol being too weak an acid to displace those with which the colour-bases of these dyestuffs are combined. In its behaviour towards these dyestuffs, the solution resembles cotton more than wool. It extracts, however, the free colour-bases from their aqueous solution, and is coloured by them. The phenol is, therefore, sufficiently energetic to form salts with these bases. Less strongly basic dyestuffs (for instance, Rhodamine B) give less stable combinations. The dyestuff named dissolves in amyl alcohol with an orange-yellow colour and a fluorescence. On the addition to this solution of β-naphthol, the fluorescence disappears and the colour becomes a bluish-pink like that which the dyestuff gives upon wool. Water removes the dyestuff from its solution in pure amyl alcohol, but not from the solution containing β-naphthol. Dyestuffs of weak basicity, as Carmine Blue G, Acid Violet 7 B, Magenta (? Acid Magenta), are extracted more completely from aqueous solution, and better retained against the action of water by an amyl alcoholic solution of the naphthol, than by the alcohol alone. The manner in which they thus combine with β-naphthol may be taken as an indication of how they react with stronger acids (for example, with wool which has been treated with sulphuric acid), with which they form compounds insoluble in water.

The results obtained with β-naphthylamine are of less importance. Although this compound is a stronger base

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than wool, it is incapable of forming compounds of great stability with acid dyestuffs. Its solution in amyl alcohol exhausts the aqueous solutions of the latter, of some more rapidly than of others, according to the value of their acidic functions; thus, it extracts Carmine Blue less rapidly than does a solution of β-naphthol in the same alcohol. The solvent action of water upon the amyl alcoholic β-naphthylamine solution of the dyestuffs is also related to their acidic energy, to which it is inversely proportional. Unlike wool, an amyl alcoholic solution of β-naphthylamine extracts the free colour-acids from aqueous solution.

A mixed solution of β-naphthol and β-naphthylamine in amyl alcohol retains the dyestuffs it extracts from aqueous solution more strongly than do the separate solutions of the two compounds. It presents little analogy with wool however, inasmuch as the phenol present in it is, on the one hand, less, and the base, on the other hand, more energetic than that fibre.

The author is investigating the action in this connection of various amido- and imido-naphthol compounds.

The acidity of wool is distinctly stronger than its basicity. In the case of the wool-substantive dyestuffs, the opposite would appear to be true. Still, it is necessary to point out that the conclusions arrived at are deduced from observations made with water as the dyestuff-solvent, and that the action of this has not been taken into account. If dyeing reactions take place through the medium of sulphonic acid groups, as Prud'homme supposes, strongly acid dyestuffs, as Alizarin S and Acid Alizarin Blue BB, should dye wool very rapidly and give colours fast to water, which they do not. The non-dyeing of wool with the free colour-acids can be explained by assuming that these are really feebly basic compounds, and that the presence of acid in the wool is required to produce a reaction. As Knecht has shown (this Journal, 1888, 623), wool which has been treated with sulphuric acid and been afterwards well washed in hot water still retains a certain quantity of acid in combination with it. This compound is dyed very rapidly by the colour-acids, more rapidly, indeed, than when the sulphuric acid is merely present in the dye-bath. Support is given to the assumption by the fact that the dyestuffs which contain fewer dye more rapidly than those which contain more acid groups of the same nature, for if the dyeing power of wool-substantive dyestuffs were a function of their acidity, the opposite should be the case.—E. B.

Wool-Dyeing; Influence of Acids, &c. in ——. C. Gillet. Rev. Gén. des Mat. Col. 1900, **4**, [47], 337—342.

Mineral Acids.—Sulphuric acid impedes the dyeing of wool by highly basic dyestuffs, such as Magenta, Methylene Blue, Safranine, &c., while it promotes the absorption of slightly basic dyestuffs, such as Light Green SF, Acid Magenta, and Crystal Ponceau. With the latter its action is greatest when it is applied in the proportion of 1·5—6 per cent. of the weight of the wool. Hydrochloric acid acts similarly. It may be stated generally that the favourable action of an acid upon the absorption of a dyestuff by wool is inversely proportional to the basicity of the dyestuff.

Sulphurous acid, prepared from pure sodium bisulphite and sulphuric acid, has no effect upon the dyeing properties of wool. The action ascribed to this acid by Prud'homme (this Journal, 1898, 663) is, therefore, it would seem, due to the presence of mpurities in the sodium bisulphite of commerce.

Hydrogen Peroxide.—Treatment of wool, under ordinary conditions, with commercial hydrogen peroxide, has no influence upon the dyeing property of that fibre with regard to slightly basic dyestuffs. On the other hand, the attraction of the fibre for highly basic dyestuffs is much increased. The change is not produced by pure hydrogen peroxide. It is, therefore, no doubt, to be ascribed to the presence of impurities, probably silica, in the commercial product, which is found to contain, in addition to that substance, magnesia, alumina, and fluorine.

Alkalis.—Dilute (1 per cent.) solutions of these, at a temperature of 70° C., have no permanent effect upon the dyeing properties of the active substance of the wool fibre, although they neutralise the acidic group in the molecule $COOH - A - NH_2$. The compounds thus formed behave differently towards different dyestuffs. The sodium compound attracts highly basic and repels slightly basic dyestuffs more powerfully than does the free acid (wool). The compounds resemble the salts of the higher fatty acids, inasmuch as water dissociates the ammonium compound very readily, the sodium compound less readily, and the calcium, magnesium, and aluminium compounds with difficulty.

The changes produced in the fibre by the action of alkalis and acids, although only temporary, have an important bearing upon the dyeing of wool. The modifications in the dyeing properties of this fibre, observed by Prud'homme, are in part to be referred to such changes.

Chlorine.—When wool is treated with chlorine for the purpose of increasing its dyeing powers, an important alteration in its permeability to water takes place. While ordinary scoured wool requires a prolonged immersion in water completely to wet it, the wool so treated, when put into water, is saturated almost immediately. This is the principal change which is effected in the process of "chloring" wool.—E. B.

Grey and Black Colours [Nigrisines] upon the Fibre; Production of ——. J. Brandt. Rev. Gén. des Mat. Col. 1900, **4**, [44], 241—242.

The dyestuff Nigrisine (this Journal, 1890, 611) is formed and simultaneously fixed upon the fibre, when the following mixture is printed upon a cotton tissue and steamed for about three minutes:—100 grms. of nitrosodimethylaniline hydrochloride, 1 litre of warm water, 1¼ litre of starch paste thickening, 1¼ litre of gum tragacanth paste (6 : 100), and a solution of 200 grms. of tannic acid in 1 litre of water. The drying of the printed tissue is performed at a low temperature. After it has been steamed, the tissue is passed through a solution of tartar emetic, before it is washed and soaped. When the mixture is acidified with an organic acid, such as tartaric or oxalic acid, a bluer shade of grey is produced, but the tenacity of the fibre is endangered. With 20 grms. of tartaric acid per litre, a colour is obtained which, when reduced, still shows a bluish tone. This colour develops well only upon unprepared tissues; upon tissues prepared with Turkey-red oil, the result is unsatisfactory. A mixture containing 10—20 grms. of oxalic acid per litre gives a full bluish shade of grey upon oil-prepared tissues, but it is liable to attack the fibre.

Reserves can be produced upon tissues which have been padded with a mixture such as the above, and have been dried at a low temperature, by means of potassium sulphite or stannous chloride. A mixture suitable for padding is composed of 200 grms. of nitrosodimethylaniline hydrochloride, 19 litres of cold water, 200 grms. of tartaric acid, and 400 grms. of tannic acid. The tissues impregnated with this are printed with the reserve colours, preferably those containing potassium sulphite. They are then steamed for three minutes and are afterwards treated with tartar emetic, washed, and lightly soaped. No acid vapours should be present in the steam.

Nitrosodiethylaniline yields a grey which is less bluish than that obtained from nitrosodimethylaniline. Nitrosoethylbenzylaniline and nitrosodibenzylaniline give dull colours of no interest. A colour of some technical value is produced from nitrosoethyl-*o*-toluidine:—200 grms. of this base, 2,000 grms. of dilute hydrochloric acid (60 grms. per litre), 5 litres of starch and gum tragacanth thickening, 400 grms. of tannic acid, and 200 grms. of tartaric acid dissolved in 2 litres of water, give a dark purplish grey. With the addition of 100—120 grms. of Magenta, the shade of the colour is changed to a chocolate, which is fast to soap.

The grey colour-mixtures, when sufficiently concentrated, give blacks. The best results are obtained by adding oxalic acid to the mixtures and preparing the tissue with a dilute solution of sodium carbonate to protect it against the action of the acid. The following is an example of a black colour-mixture: — 200 grms. of nitrosodimethylaniline base (50 per cent.), 80 grms. of hydrochloric acid (19° B.), 400 grms. of gum tragacanth paste (6 : 100), 1 kilo. of starch paste, 100 grms. of tannic acid dissolved in 100 c.c. of water, 20 grms. of resorcinol dissolved in 100 c.c. of water, 20—30 grms. of oxalic acid. This is

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printed upon a tissue prepared with Turkey-red oil, with the addition of 20—40 grms. of crystallised sodium carbonate per litre. The colour is developed by eight minutes' steaming, although it may be steamed for an hour without injury to the shade. The tissue is then passed through a solution of tartar emetic and soaped. The colour is very suitable for fine patterns, in cases where Aniline Black cannot be employed; for instance, in association with Alizarin Red upon tissues prepared with Turkey-red oil.

—E. B.

Nitrosodimethylaniline and Diethyl - m - *amidophenol; Direct Production upon the Fibre of Dyestuffs from* ——. C. Kurz. Rev. Gén. des. Mat. Col. 1900, **4**, [47], 342—344.

At the instance of H. Koechlin, the author, in 1894, made experiments in connection with the production upon textile fibres of dyestuffs of the oxazine class, with the object of obtaining a dark blue dyestuff of greater fastness than many of the dyestuffs then used in dyeing and printing that colour. These attempts were only partially successful. Later, the author resumed the research, and obtained a fast *black*, which has, since that time, been satisfactorily produced on the large scale. The mixture employed in its production consists of $\frac{1}{4}$ litre of acetic acid, $\frac{3}{4}$ litre of water, 25 grms. of resorcinol, 50 grms. of nitrosodimethylaniline hydrochloride, and 20 grms. of tannic acid. The tissue padded with this is dried with hot air, steamed for two minutes, and passed for one minute into a solution of 10 grms. of tartar emetic and 25 grms. of ferrous sulphate per litre of water, then it is washed, soaped at the boil, rinsed, and dried. The colour can be resisted by the same means as Nitroso Blue, and can be discharged with aluminium chlorate. Its shade may be modified, if desired, by the addition to the colour mixture of Methylene Blue, Methyl Violet, &c.

A *dark blue* is formed, according to the method indicated by The Hoechst Farbwerke (Eng. Pat. 6056 of 1898; this Journal, 1899, 270) from a mixture of 6,000 grms. of starch and gum tragacanth paste, 2,000 (? 200) grms. of glycerin, 260 grms. of "nitroso paste M." (50 per cent.), 74 c.c. of hydrochloric acid (22° B.), 200 grms. of resorcinol, 1,500 grms. of water, 60 grms. of oxalic acid, 600 grms of water, 600 grms. of tannic acid solution (10 : 10), 400 c.c. of a solution of sodium phosphate (2 : 10). This is printed on unprepared cotton tissues, which are then steamed for three minutes, and afterwards passed for one minute into a bath containing per litre 5 grms. of tartar emetic and 10 grms. of chalk. By adding 25 grms. of ferrous sulphate per litre to the bath, the colour is converted into a *blue-black*.

When the resorcinol in a mixture similar to the above is replaced by diethyl-*m*-amidophenol, fast colours are formed of shades varying from a bright pale *green* to a deep *myrtle green*, according to the proportions employed and the procedure adopted. The darkest colour is transformed by the action of ferrous sulphate to a greenish-black. The colours can be resisted by the same reagents as Nitroso Blue, the white obtained being very clear. They are of interest as being the first green dyestuffs directly produced upon the fibre.—E. B.

Mordanting Compound ["*Antimonin*"]; *New* ——. F. Düring. Färber-Zeit. **11**, [20], 319—321.

The great defect of the antimony salts which have been previously used as mordants, *i.e.*, the difficulty in extracting all the antimony, was overcome to a considerable extent by the introduction of potassium antimony oxalate. The same results were obtained with the latter salt, which contains only some 25 per cent. of antimony oxide (Sb_2O_3), as with tartar emetic containing 43 per cent. But from the experimental results given by the author, it is shown that the best tannin-fixing mordant yet discovered is the double salt of lactic acid with antimony and calcium, *i.e.*, antimony calcium lactate. This salt bears the trade-name of "Antimonin."

Antimony calcium lactate is readily decomposed by the tannic acid into antimony oxide and calcium lactate.

It is further shown that the acid lactate of lime has no action either on the cotton fibre itself or on the antimony tannate fixed upon the fibre.

Four hanks of cotton were treated with 5 per cent. tannic acid, fixed respectively with 2·5 per cent. tartar emetic, antimony salt, antimony potassium oxalate, and antimonin, and then dyed with several of the basic dyestuffs, such as Methylene Blue, Solid Green, Auramine, Safranine, and Methyl Violet. In every case the shades dyed on the antimonin mordant were the richest and fastest, showing that this new salt, containing only 15 per cent. of antimony oxide (Sb_2O_3), gives better results than other salts containing a much higher percentage.

The analysis of the mordanting bath, after the passage of the goods, shows that in three experiments 76·7, 84·0, and 77·8 per cent, of the antimony oxide respectively were withdrawn; and the author considers that even from 93—100 per cent. of the valuable Sb_2O_3 may be utilised.—D. P.

Photographic Pictures on Textile Fibres; Production of ——, *by means of Mordants and Dyestuffs*. F. Dommer. Chem. Zeit. 1900, **24**, 953—954.

In order to produce from a negative a picture on silk, woollen, or linen fabric, the material is spread on a glass plate, painted in the dark with an aqueous solution of nitroprusside of sodium (30 grms. per litre), and dried by means of hot air. The fabric so prepared is stretched in a frame and exposed for a quarter of an hour under the negative to the direct rays of the sun. The iron mordant should then have developed, and its presence would be recognised by the appearance of the picture in a greenish-blue shade. The unaltered nitroprusside is removed by a thorough washing in water, and the colouring of the picture is effected by the use of such alizarin dyes as are fixed by an iron mordant, as, for example, Alizarin S X (B. A. S. F.), Anthracene-Brown S W, Cœrulein S W, Alizarin Orange, Alizarin Blue, or Gambine. For the colouring bath is used 1—2 grms. of the dyestuff in the form of a 20 per cent. paste and 5—6 drops of acetic acid per litre. When the fabric is dyed, it is drawn through a boiling soap-bath, and is then thoroughly washed with water.—W. G. M.

Copper Rollers in Alsace; Manufacture of Calico Printers' ——. E. Jaquet. Bull. Soc. Ind. Mulhouse, 1900, July—Aug., 199—200.

About 300,000 kilos. of copper rollers are annually imported into the Mulhouse district from England and France. A manufactory was successfully established at Niederbruck in 1894, and has since been enlarged. The proprietors of this have been awarded a medal of honour by the Industrial Society of Mulhouse for the introduction of a new industry into Alsace.

The process of manufacturing the rollers comprises the operations of fusing the metal in reverberatory furnaces, forcing it under pressure into moulds, hot rolling, cold rolling, and hammering.—E. B.

Colour Resists and Discharges; Use of Tungstic Acid in Producing ——. P. Bielher. Rev. Gén. des Mat. Col. 1900, **4**, [46], 313.

Tungstic acid, which has recently been proposed as a mordant for basic dyestuffs, is not only applicable in this connection in the Aniline Black resist style, as has been described (this Journal, 1900, 740), but it can also be employed in the production of resist effects upon Paranitraniline Red and of discharge effects upon Indigo-dyed tissues.

In producing discharges upon indigo, the tissue dyed with this colouring matter is padded in a solution of sodium tungstate, dried, and printed with a steam-discharge mixture containing barium chlorate, potassium ferrocyanide, and a basic dyestuff capable of withstanding the oxidising action. Rhodamine 6 G, for instance, gives a pink. Pigments such as Ultramarin and Chrome Yellow may also be used. The colours are rendered faster by the addition to the mixture of albumin, along with an alkali citrate or tartrate.

Resists are obtained, in the Paranitraniline Red style, by adding sodium tungstate to the sodium β-naphtholate "prepare." The printing mixture is a thickened solution of barium sulphocyanide, tartaric acid, and a basic dyestuff. The process of developing, &c. is the same as usual. Albumin may, in this case also, be employed to increase the fastness of the colours. When it is employed, the tartaric

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acid is omitted from the printing mixture and the proportion of barium sulphocyanide in this is increased. After washing and drying the tissue, a passage through a steam ageing machine may be given to further fix the colours.

—E. B.

Colour Matching; Improved Light for ——. A. Dufton and W. M. Gardner. J. Soc. Dyers and Colourists, **16**, [11], 238—242.

An examination of all known dyestuffs shows that they are all characterised by a greater or less transparency for red light. The difficulties of colour matching are due largely to this cause. As a substitute for ordinary daylight, the authors employed the electric arc light (with pure carbons), because of its general adaptability.

However, as the arc light is too rich in red and violet, compared with the light of a north sky, it is essential that the proportion of red which it contains should be accurately adjusted, to bring it into accord with daylight.

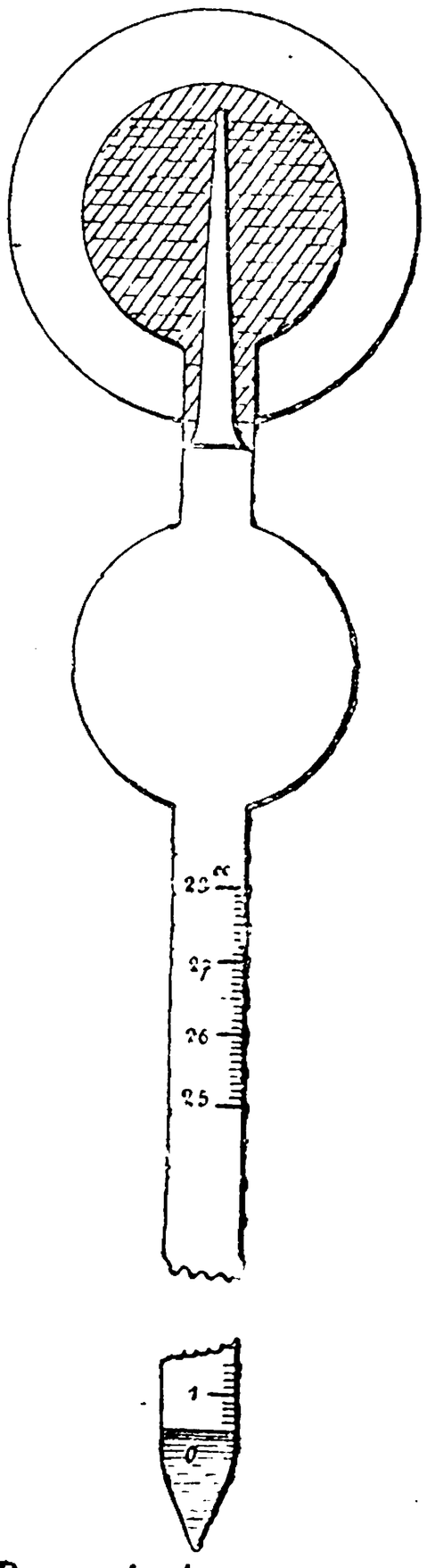
The authors found that a dilute solution of copper sulphate was capable of absorbing the red down to the yellow-green, and possessed great transparency for blue and violet. (No blue or green dyestuff was suitable.)

In this way the exact shade of blue required for a certain lamp was ascertained, and by making use of this property of copper salts, the authors constructed an arc light surrounded by a globe made of the proper tint of blue copper glass, and found that it gave a light of exactly the same character as daylight for colour matching.

The authors state, after an examination of a large variety of patterns, that no difference is discernible in the appearance of the latter under the new light and daylight.

—J. E. H.

Light; Method of Determining and Expressing the Fastness of Colours to ——. P. Dosne. Bull Soc. Ind. Mulhouse, 1900, July—Aug., 207—248.



Bellani's Actinometer.

With a view of determining absolutely and expressing with precision the degrees of resistance of colours to light, the author proposes to measure the insolation which they are capable of withstanding up to the time when their fading may be said definitely to commence, by means of the vaporisation actinometer of Bellani, as modified by Descroix (see figure).

This consists of a bulb of dark blue glass, about 0.045 m. in diameter, attached to a graduated, colourless glass tube, upon which is blown a second bulb of the same size as the first. The coloured bulb is filled to the extent of two-thirds of its capacity with ethyl alcohol (90°) and is enclosed in a clear glass bulb, a vacuum being produced in the intervening space. The air is exhausted from the interior of the apparatus, which is thus completely filled with the alcohol and its vapour.

The samples of colours, the fastness of which is to be ascertained, are exposed to light under the same conditions, side by side with this apparatus. The quantity of alcohol which is vaporised during the exposure is noted daily, the apparatus being inverted, after the reading has been taken, in order to replace the alcohol in the coloured bulb and so reset the apparatus for use. This is continued until the colours commence to fade. The amount of alcohol which distils over during this time is expressed in terms of units of thermo-actinicity, as measured by the apparatus, which it is proposed to name *photes*, a phote being the quantity of radiant heat required to maintain during one hour's time a difference of 17° C. between the two thermometers in Arago's actinometric apparatus, this difference being found, by calculations based upon observations, to be the total effect of the sun's radiation outside the terrestrial atmosphere.

Each degree C. of difference between the temperatures shown by these two thermometers corresponds, in spring and summer, with 0·145—0·146, and in autumn and winter with 0·140, c.c. of distillate received in the vaporisation apparatus. In practice it is recommended to use a *decaphote* as a convenient measure.

When a prolonged insolation of a colour is required, the degree of fastness of this, or the number of photes needed to cause it to begin to change, may be approximately ascertained from the tables of actinicity compiled by Descroix. These give the mean actinometric degrees, for several days in each month in the year, between the latitudes 42° N. and 51° N. in clear weather. The results obtained by means of the actinometer may in most cases be controlled by means of them.

Paper-rag; Electrical Bleaching of ——.

See under XIX., *page* 1131.

Lactic Acid; Valuation of Commercial ——. F. Jean.

See under XXIII., *page* 1152.

Alkaline Earth Peroxides; their Manufacture and Application to Bleaching. G. F. Jaubert. Eng. Pat.

See under VII., *page* 1111.

PATENTS.

Coloured Drawings; Reproducing on Paper, Fabrics, &c., Facsimiles of ——. T. Truchelut, Paris, and A. A. Rochereau, Suresnes, France. Eng. Pat. 23,826, Nov. 29, 1899.

The picture or design which is to be reproduced is prepared with suitable pigments of the three colours, yellow, blue, and red, and mixtures of these. The pigments chosen must be substances which, under chemical treatment, can be one by one removed or rendered photographically inactive; thus, mercuric iodide, for red; silver ferrocyanide, for yellow; and Aniline Blue-lake or Prussian blue, to which lead sulphate is added, for blue, are suitable, each being finely ground and admixed with fish glue, and employed in the form of a block, crayon, or liquid paint. Three photographs of the same size are taken in succession from the drawing thus coloured. The first of these is taken after the drawing has been treated with barium chloride (along with formaldehyde to render the gelatin insoluble) for the purpose of converting the silver ferrocyanide into silver chloride. As the blue is inactive, only the parts coloured red are photographed. Then the yellow is restored, in the form of silver iodide, and the red is at the same time removed, by treating the drawing with potassium iodide. A second photograph now taken shows only the parts of the drawing which are coloured yellow. Finally, by means of potassium cyanide, the silver salt is removed, and the lead sulphate is then changed into lead sulphide, by the action of sodium sulphide, and a photograph of the parts which were originally coloured blue is then obtained. From the photographs thus produced, process blocks are prepared, which give a reproduction of the original drawing when the impressions from them in the corresponding colours are superimposed.

Methods are also described of taking lithographic or zincographic transfers directly from suitably prepared drawings and for producing photographic prints directly upon stones or metal plates, suitably sensitised, from drawings made upon a transparent ground, such as celluloid, &c.

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The process offers advantages in rapidity of execution, economy, enables retouching to be suppressed, and gives accurate replicas of the original drawings.—E. B.

Bleaching Vegetable Textile Materials. C. F. Cross, London, and G. A. Parkes, Muckmore. Eng. Pat. 25,076, Dec. 18, 1899.

VEGETABLE textile materials, chiefly those made of cotton and linen, are scoured and partly bleached, by the aid of steam, with alkalis and certain reagents which act upon the constituents of the fibres it is desired to remove. For example, linen tissues are treated with a mixture such as the following:—1·75 lb. of soap (potash-fish oil or soft soap), 14 lb. of sodium silicate solution (of the composition $Na_2O.3SiO_2$ and containing 30 per cent. of SiO_2), 1·5 lb. of caustic soda, 1·75 lb. of oil (generally a heavy petroleum oil, but in some cases a fatty oil or a mixture of a fatty with a mineral oil), and 10 galls. of water. The sodium silicate is added to increase the viscosity of the mixture, which, at a temperature of 30°—40° C., is gelatinous, and therefore does not run in the tissue and thus form uneven patches. The tissues to be bleached are passed at full width through the mixture and are squeezed as evenly as possible. They are then led into a chamber containing steam at atmospheric pressure, where they are wound into a roll. The latter is next steamed for 1—4 hours under a pressure of 4 lb. per sq. in., after which it is washed with water. It is then ready for treatment with bleaching powder, &c. The operations of steaming and washing may advantageously be effected in the apparatus described in Eng. Pat. 16,730 of 1899 (W. Mather, this Journal, 1899, 1015).

Warp yarns may be bleached by saturating them in continuous length, as in the case of tissues, with the above mixture, but in impregnating yarns in the form of hanks, it is preferable to immerse them in the mixture, to wring them as usual, to leave them for a while to drain, and then to free them from the excess of the mixture by means of squeezing rollers or by centrifugal action before they are placed in a cage and steamed, &c.—E. B.

Dyeing Yarns. A. R. Donisthorpe, G. White, and C. E. Ellis, Leicester. Eng. Pat. 25,610, Dec. 28, 1899.

WITH the object of obtaining by means of single threads of yarn, certain kinds of knitted fabrics which are at present manufactured with two or more threads of different colours, a part, for instance, one- or two-thirds of a hank of yarn, is dyed a "spot" colour, for example, red, and after portions of the dyed part have been "tied" or "clipped" at equal intervals, to preserve them from becoming further dyed, the rest of the dyed part is dyed a "ground" colour. The remainder of the hank, still undyed, is finally dyed another colour, for example, green. The "spot" coloured portions may, as an alternative, be "tied" and the remainder of the hank dyed another colour.—E. B.

VII.—ACIDS, ALKALIS, AND SALTS.

Sulphuric Acid Industry. L. Pierron. (Discourse at Internat. Congress of Applied Chem., Paris, July 25, 1901.) From Chem. Ind. **23**, [19], 377—387.

THIS is a review of recent progress in the industry. The subject is naturally divided into: *a*. Modifications in the chamber process; *b*. Processes involving the use of contact substances.

a. Chamber Process.

Production.—In Germany, the production has risen from 358,000 tons of sp. gr. 1·71 in 1882 to 846,000 tons of sp. gr. 1·84 in 1897. France produces annually 800,000 tons of sp. gr. 1·56, Belgium, 210,000 tons of sp. gr. 1·71.

Raw Material.—Of the German acid, 137,000 tons were made from blende, 651,000 from pyrites, 58,000 from other materials; of the Belgian, 130,000 from blende and 80,000 from pyrites. The amount of sulphur used for acid-making is diminishing; the amount of blende used is rapidly increasing. In England, Germany, and Belgium, cupriferous pyrites forms a continually increasing fraction of the whole of the pyrites used.

Kilns.—For dust, kilns of the Perret-Malétra type are used, of very various dimensions. For blende, the Rhenania kilns are used, often built in groups to deal with six or eight tons daily, with a fuel consumption of about 18, and in some cases, of 15 per cent. The Société de la Vieille Montagne use mechanical kilns; these are coming rapidly into use in America, and will no doubt extend here as the difficulty of obtaining manual labour is felt more acutely.

Glover Towers.—Are now always built cylindrical, about 10 feet diameter, 34 feet high, and are usually filled with stoneware grids, hollow bricks, or cylinders. Niedenführ's example has been followed in many new installations of using two Glovers in parallel, each half the height of the usual single tower. The equal division of the gases between the two is successfully effected by an apparatus devised by Rabe.

Lead Chambers.—Wide differences of opinion still exist as to the number and dimensions of chambers in a set. Good results have been obtained by the tangential system of Meyer. The same is the case with the concentric chambers of Delplace, in which the gases from the Glover pass though an additional "nitrifying tower," and then into a large annular chamber, within which are large siphons, intended to aid in the mixture of the gases in the upper and lower parts of the chamber. The second chamber is a cylinder encircled by the first, so that room is economised and variations of temperature are reduced in range. Another original system is Benker's. In addition to the usual chambers there are two towers—one interpolated between two of the chambers, the other, in which the gases are freed from dust by a filtering layer, between the Glover and the first chamber. A fan is used to produce draught. Excellent results have been obtained by the use of towers, whether of the Lunge-Rohrmann type, or filled like a Glover, between the chambers; the amount of acid formed in these is enormously greater than corresponds to their capacity, and the yield of the system per cubic foot is greatly increased by their use. Cooling columns—lead cylinders of five or six feet diameter, open to the air top and bottom—have in some instances been erected in the chambers, but their use has not become general.

Pumping up the Acids.—For lifting the acids, the use of some form of pulsometer with constant feed is extending. Two *Gay-Lussacs* in series are now frequently used instead of one; the nitre used varies according to circumstances from 0·7 to 1·12 per cent. of the acid made, with pyrites, and is about 1·0 per cent. with blende.

Concentration.—For 93 per cent. acid, platinum apparatus, for 98 per cent. acid, platinum-gold, is most satisfactory and cheapest in working. Where there is less capital at command, platinised cast iron can be used, and in some cases cast-iron vessels have been employed, though they deteriorate very rapidly. The porcelain apparatus of Benker, and the apparatus of Kessler, give good results, and their use is rapidly extending. Petroleum has been used in America as fuel in the concentration.

b. Contact Processes.

A historical account of the subject is given, from Phillips, who, in 1831, first caused sulphur dioxide and oxygen to combine, to Winkler, whose exhaustive memoir in 1875 showed that, of all the contact substances which had been proposed to effect this combination, the best was finely divided platinum spread over asbestos. In England, in the same year, W. S. Squire and R. Messel, incependently of Winkler, started experiments with platinised pumice to the same end, and Messel was the first to embody the principle in an industrial process. An account is given of the most important patents dealing with the subject. Many plans have been proposed for the preparation of the contact substance; for the most part they fall into one of two classes—either the previously prepared (by heating or reducing a platinum salt) platinum black is mixed with powdered asbestos, a combustible substance, and a cementing material, or else fibrous asbestos is impregnated with the platinum solution, and then heated, with or without previous immersion in a solution of some reducing salt. The contact processes chiefly in use in Germany and France

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are those of the Badische Anilin u. Soda Fabrik, Meister, Lucius und Brüning, Verein Chemischer Fabriken in Mannheim, Actiengesellschaft f. Zinkindustrie, Dr. Rabe, Sébillot, Société L'Anhydride, Patente Raynaud-Pierron. In general, it may be said of them that for the production of concentrated acid, the cost of erection is 30—40 per cent. and that of working some 15 per cent. below the corresponding figures for the chamber process. The contact process is also economical of room, it needs no nitric acid, and concentration is done away with. The process has not as yet, however, been very widely adopted; partly because of the caution or conservatism of many manufacturers; partly because many experimented with it in early times and on too small a scale, and were deterred by the poor results from pursuing the matter further; partly, too, because in the production of a less concentrated acid, it cannot compete economically with the chamber process. The amount of acid made by the new process is not yet sufficient to affect the markets; but it continues to grow, and if the makers by the chamber process are to hold their own, they will have to devote all their energies to improvements in the conditions of the process.—J. T. D.

Gay-Lussac Towers; Packing ——. Chem. Trade J. **27**, 262—263.

Messrs. Peter Spence and Sons communicate replies to a circular letter they sent out to 11 vitriol makers, asking for their opinions as to the relative merits of coke and brick as packing for Gay-Lussac towers. They express their own view that coke has but little cellular surface, and is soon filled by deposition of lead sulphate, that it readily disintegrates and blocks the draught, and that a brick packing, though it might cost more, could easily be made equally effective as an absorber, and ought to last much longer in good working order.

Of the replies, six are strongly in favour of coke; the remaining five have all used coke, but admit its disadvantages. Of these five, four have no experience of brick packing; the fifth has two Gay-Lussacs, both of which were formerly packed with coke. One of these has been repacked with bricks and ring tiles; it is now at work, but the loss of nitre is high, and it is proposed therefore to work it in series with the second, which is being similarly packed, but is to have 15 ft. of coke at the top, for more thorough scrubbing. Of the six makers favourable to coke, four have no experience of brick packing. The fifth has had a brick-packed tower working for many years with fairly satisfactory results. The sixth repacked with brick a tower formerly packed with coke, to ensure better draught; the loss of nitre was so considerable, however, and there was such a want of steadiness in the working of the tower, that first 25 ft., and ultimately the whole, of the brick packing was taken out again and replaced by coke, with quite satisfactory results.

Among the suggestions and points of interest in the replies may be mentioned: (i) the general opinion that the cellular surface of coke is considerably greater than can be secured by brick packing, save with much larger towers; (ii) Good quality of coke and careful packing, with avoidance of small pieces, are essential to the proper working of the towers; (iii) the deposition of lead and ferric sulphates occurs near the top of the towers, and might, if the acid were cooled longer in the tanks, be caused to take place there rather than in the towers; (iv) The enormous amount of acid absorbed by the coke and contained in the tower at any one time makes the tower a huge reserve store of nitrous vitriol, and gives a control of the process in the chambers, and a consequent steadiness of working, which can never be attained with a non-absorbent packing material; (v) One maker has found brick packing to be greatly inferior to flints in the Glover tower, and infers that it would similarly be inferior to coke in the Gay-Lussac.

Messrs. Spence have decided on re-packing their tower with bricks, on an improved system, and they promise to communicate in due time the results of its working.

—J. T. D.

Ferric Oxide and Ferric Acid; The Soluble Alkali Salts of ——. F. Haber. Zeits. für Elektrochem. 1900, **7**, [17], 215—221.

After giving a historical account of the subject, the author shows that alkali ferrate is easily produced when an iron plate is used as anode during the electrolysis of a solution of alkali hydroxide. The formation of ferrate proceeds slowly at the ordinary temperature, and more rapidly at or above 70° C. The production of ferrate is greater when caustic soda is used, owing to the greater solubility of sodium ferrate. The current yield was highest when the anode consisted of cast iron, and least when the anode was of wrought or pure iron; steel occupied an intermediate position.

A red solution is usually formed in the first instance, but this, under certain circumstances, generally becomes green. This was traced to the presence of manganese in the caustic alkali.

Ferric hydrate dissolves in alkali hydroxide, forming a solution of alkali ferrite. At the anode the ferrite is transformed into ferrate, and this, on boiling, is again converted into ferrite. A ferrite solution with alkali or ammonium sulphide gives a beautiful red coloration, which accounts for the "Red liquors" of the Leblanc soda manufacture. It is decomposed by much water. Sodium ferrite solutions on standing for a day or two deposit white crystals, which rapidly turn brown when exposed to the atmosphere, or when water is added.—J. S.

Sodium Bichromate; Preparation of ——. — Goldschmidt. Rev. Prod. Chim. **3**, [17], 260.

Sodium sulphate being insoluble in a solution of the bichromate of sp. gr. 1·795 (at 15° C.), this circumstance may be utilised to eliminate that impurity from the bichromate prepared in the ordinary way. The purification may be effected during the process of manufacture, either by concentrating the mono-chromate solution to such a degree that, on adding the sulphuric acid, the liquor will have the required density, or by concentrating the bichromate liquor after the addition of the acid. To purify the crystals they need only be taken up with sufficient boiling water or steam to form a solution of the requisite strength. In all cases the precipitated sodium sulphate is removed by filtration.

—C. S.

Acetic Acid in France; Denaturing of ——. E. Blondel.

See under XXIV., *page* 1153.

Acid Salts; Taste and Ionisation of ——. L. Kahlenberg.

See under XXIV., *page* 1153.

Persulphates; their Determination and Uses in Analysis and Industry. R. Namias.

See under XXIII., *page* 1149.

PATENTS.

Concentrated Sulphuric Acid and Anhydrous Sulphuric Acid; Process for the Production of ——, *from Sulphur, or Substances containing Sulphur, by the Contact Process.* P. Babatz, Rheingonheim, Germany. Eng. Pat. 1216, Jan. 19, 1900.

The process, as described in the first claim, is "for producing sulphuric acid and anhydrous sulphuric acid by the contact process without the assistance of machinery. The distinguishing feature is the heating of the purified gases which enter the contact apparatus by the unpurified gases coming from the roasting grate, the heat of which is further utilised by converting weak sulphuric acid, contained in leaden pans, into concentrated sulphuric acid and the washing fluid into vapour by passing over its surface, so that the gases are mixed with steam and flow against the refrigerating pipes of a refrigerating apparatus, and are thereby purified before they enter the contact apparatus, in which firm solid or hollow bodies, made of asbestos and

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impregnated with substances which are effective and capable of contact, are placed as contact material."

The contact apparatus is placed over the roasting furnace, between which exit and inlet flues are provided for the impure and purified gases respectively, the latter being further heated in the contact chamber by zigzag movement amongst the pipes or other enclosures for the contact materials before actually traversing these. Refrigerating pipes formed as ribbed bodies, against which the gases impinge, regulate the temperature of the contact chamber. Platinised asbestos, moulded into solid or hollow forms as stated, constitutes the contact material. A tower for washing the gases is used, which recovers sulphurous acid, afterwards utilised for purifying and enriching the gases coming from the refrigerator.—E. S.

Chlorine and Caustic Soda, or other Alkaline Hydrate; the Production of ——, and Apparatus therefor. H. H. Lake, London. From H. K. Moore, Lynn, Mass., E. A. Allen, Rumford Falls, Maine, G. W. Ridlon, West Paris, Maine, and J. Quincy, Boston, U.S.A. Eng. Pat. 4269, Mar. 6, 1900.

THE cell is so constructed that the caustic alkali may be formed at its point of discharge so as not to be diffused through the electrolyte, but pass away in fluid form to a receptacle; and also that "the saline solution may percolate through the diaphragm and be subjected to continued electrolysis before the solution of caustic soda, salt, and water reaches the receptacle provided for it." The cell has two end wooden walls, joined by side bars, leaving the longitudinal sides open, to be closed by asbestos diaphragms, outside which is placed the cathode, consisting of wire sponge, steel wool, or the like, and which is capable of taking up a considerable quantity of liquid by capillary attraction. The cathode is bent partly under the cell below, in contact with a lead plate which conveys the current. The cell is charged with the electrolyte (saline solution) to a little above the height of the upper edge of the diaphragm, which is cased in. The anode consists of a number of pieces of carbon cast in (and so suspended from) a lead plate, and is immersed in the cell. As the saline solution soaks through the asbestos paper diaphragm, and is absorbed by the cathode, it is decomposed by the current passed, and the caustic alkali formed drains out through a suitable aperture, there being no passage for the electrolyte except through the diaphragm into the cathode, and thence into the receptacle provided. The cell is arranged to contain lengthwise a series of anodes, and is slightly tilted to permit of flow from the receiving trough for the caustic alkali into its receptacle. A glass dome surmounts the cell, through which the chlorine produced passes, which permits observation of the progress of the electrolysis from the colour of the gas. The diaphragm is preferably made to permit the percolation in one hour of 3 litres of liquid per square metre, regulated by varying the height of the liquid in the cell.
—E. S.

Caustic Lyes and Ammonia, and Earth Alkaline Hydroxides; Process for Directly Obtaining by Electrolysis. C. Luckow, junr., Cöln, Germany. Eng. Pat. 20,925, Oct. 19, 1899.

THE scope of the invention is defined in the claim as follows:—"A process for obtaining (*a*) the lyes of the alkaline hydroxides; (*b*) of ammonia; and (*c*) of the earthy alkaline hydroxides, directly electrically out of an electrolyte consisting of solutions of their salts, in which:—

(1.) As regards the electrode, the anode lies below, and the cathode above.

(2.) The electrolytes are solutions of the salts of the alkaline metals, including ammonia, and the earthy alkaline metals, it being indifferent whether these be simple or double salts, or salt mixtures, either intermixed or mixed with other metallic salts, or compounds or mixtures with alien matters as are found widely diffused throughout nature as raw salts, or as they are produced more or less alloyed as bye and waste products of manufacturers, or as employed in more or less pure condition in all industries.

(3.) The electrolytes are more or less concentrated or saturated, and more or less warm.

(4.) The anions (acidulators) are driven out of the solution by their forming insoluble or hardly soluble salts with the anode metals, or are decomposed by electrolysis or are destroyed.

(5.) The anode metals first dissolve (ionise), and then incorporate with the insoluble or hardly soluble salts as bases.

(6.) The insoluble or hardly soluble salts are formed in more or less proximity to the anode surfaces, from which they fall as powder, or often as flakes to the bottom of the bath, where they collect as a continually increasing sediment.

(7.) A suitable filter arranged between the two electrodes keeps the insoluble or hardly soluble substances as much as possible away from the cathode chamber of the vessel for the electrolysis.

(8.) The cations (metals) are primarily deposited on the cathode surfaces, and then immediately actively decompose the medium of the solution, so that the solutions form their hydroxides in the cathode chamber, whilst hydrogen is simultaneously generated in the form of bubbles on the cathode surface, the ammonia partly settles there, and is caught in a suitable manner, and partly redissolves in the solution medium.

(9.) At the end of the first stage of the electrolysis, the caustic lyes are gradually let out from the upper part of the cathode chamber, the anode chamber being correspondingly fed with fresh salt solutions.

(10.) The metals of the anode body entering as bases into the insoluble or hardly soluble salts are from time to time renewed."—E. S.

Alkaline Earth Peroxides; their Manufacture and Application to Bleaching. G. F. Jaubert, Paris. Eng. Pat. 10,630, June 11, 1900.

SLAKED lime mixed with slightly more than its own weight of sodium dioxide, and the mixture exposed to moist air free from CO_2, yields a product from which caustic soda may be washed out, the residue consisting of calcium dioxide hydrate. Or milk of lime may be stirred with solution of sodium dioxide to obtain the same products. The process may be used with other alkaline earth hydrates to obtain the corresponding hydrated peroxides; or the alkaline earth hydrates may be replaced by the chlorides, oxychlorides, sucrates, or other soluble salts of the same. "The hydrates of the alkaline earth peroxides, and especially the hydrate of calcium dioxide, may be employed with advantage for bleaching wool, feathers, and other matters, and for oxidising processes in general."
—E. S.

Common Salt (Chloride of Sodium); Vacuum Apparatus for Separating ——, from Solutions, especially from Brine. G. N. Vis, Schweizerhalle, near Basel, Switzerland. Eng. Pat. 16,738, Aug. 17, 1899.

THREE connected vacuum boilers are shown, each with a lower conical end, communicating by a pipe with an open brine reservoir of limited size, supplied from a main reservoir. The pipe connecting the boiler to the reservoir is shortest in the first boiler of the series, and successively longer in the succeeding boilers, and the last boiler is connected to a condenser. Heating pipes are set horizontally in each boiler, below the surface of the brine, and the steam from the first boiler passes into the heater of the second, and the steam from that into the heater of the third boiler. Each boiler is provided with an air cock, which is opened at intervals, sufficiently to cause the brine to sink about 20 centimetres, crusts of salt being thus detached so as to fall into the reservoir; the action of the pump then brings the brine to its former height. A pipe is adapted to each boiler, starting from a point above the heating system, and descending into the reservoir to dip a short distance into the brine to maintain a constant level of brine in the boiler. Connected to each of these pipes by a three-way cock is another pipe entering a reservoir containing fresh brine, the object of which is to charge the boiler, at intervals of about 12 hours, with such brine, in order to remove incrustations of salt from the tubular heating system. As a substitute for this arrangement, a V-shaped tube is claimed, having

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one of its legs under the prolongation of the boiler, the other leg being supplied with fresh brine by a feeding tube. —E. S.

ERRATUM.

This Journal, 1900, p. 1014, col. 2, in title, 15 lines from bottom: *for* "T. J. Ireland" *read* "T. J. I. Craig."

VIII.—GLASS, POTTERY, ENAMELS.

Glass; Connection between the Electrical Properties and the Chemical Composition of Different Kinds of ——. A. Gray and J. J. Dobbie. Proc. Royal Soc. **67** [437], 197—207.

Resistance Experiments.—The results showed that of the glasses experimented with, the lead-potash glasses possessed much higher specific resistances than the lead-soda glasses. Barium-potash glass had a very low resistance in comparison with either lead-potash glass or Jena barium glass without potash, but the latter contained both boron trioxide and alumina, which were not present in the former.

Annealing.—"The results show that the effect of annealing glass is very greatly to increase its specific resistance." "In the case of the lead-soda glasses, the specific resistance has been raised to three times its former value." "Annealed glass is therefore a much better insulator than unannealed glass."

Variation of Resistance with Time.—Resistance tests were made at intervals of about six months, but no variation was apparent.

Capacity Experiments.—The specific inductive capacity of a lead-soda glass was found to be lower than that of a corresponding lead-potash glass. Dielectric polarisation effects were experienced in the latter case, but not in the former.

Imperfections in Torsional Elasticity.—An attempt was made to measure such defect by twisting glass fibres and noting the residual twist after release. The glass fibre was suspended in a vertical position, being fastened securely to a support at its upper end. Its lower end was then turned once round (360°), and kept in this position for 30 seconds, after which it was slowly released without jerking. After 15 seconds, the residual twist was measured. It was found to be very low in the lead-potash glasses, as well as in Jena barium glass, but very high in two ordinary glasses. —H. H. B. S.

Kaolin; Levigated ——, *and Ground Kaolin Sand for Pottery.* Sprechsaal, **33**, [25], 819.

ACCORDING to the analyses of J. Göthe, the levigated kaolin from Seilitz-Meissen contains:—Silica, 56·49 per cent.; alumina, 30·66 per cent.; iron oxide, 0·57 per cent.; lime, 0·25 per cent.; magnesia, 0·30 per cent.; and alkalis, 0·96; with 10·84 per cent. loss on calcination, a composition equivalent to:—Clay, 80·93 per cent.; quartz, 15·85 per cent.; and felspar residue, 3·22 per cent.

The composition of the ground kaolin sand is:—Silica, 88·75 per cent.; alumina, 7·04 per cent.; iron oxide, 0·27 per cent.; lime, 0·16 per cent.; magnesia, 0·11 per cent.; and alkalis, 1·10 per cent.; the loss on calcination being 2·53 per cent. This corresponds to:—Clay, 12·58 per cent.; quartz, 79·31 per cent.; felspar residue, 8·11 per cent.

Both materials bake very white and are regarded as suitable for high-class pottery ware, especially for chemical apparatus.—C. S.

Enamel; Opaque Turquoise ——. J. Salt. Monit. Céram.; Sprechsaal, **33**, [35], 1171.

THE fritt is prepared of pure quartz sand, 550 parts; tin oxide, 520; sodium carbonate, 260; calcined borax, 135; and potassium carbonate, 100 parts, sifted together, moistened, mixed with cuprous oxide (17 parts), and fired in the coolest part of the finishing oven. Of this fritt, 1,530 parts are mixed with lead carbonate, 275 parts; quartz sand, 100; potassium borate (prepared by fusing boric acid, 100 parts, and potassium carbonate, 60 parts), 150; flux, 115; felspar, 55; and kaolin, 45 parts; all fritted together, sifted, and washed.

The flux is composed of quartz sand, 37 parts; potassium carbonate, 21; boric acid, 12; sodium carbonate, 6; and minium, 24 parts; fused together and ground in water.

The enamel is suitable for architectural decorations and facing best white bricks. The best firing temperature is that of Seger cone, 0·5, *i.e.*, 1,030°—1,050° C. If greater heat be employed the enamel comes out green in colour, as is also the case when the firing temperature is too low, *e.g.*, 920° C. (= Seger cone, 0·11), even though this heat is sufficient to melt it.—C. S.

Enamels; Employment of Borocalcite for ——. J. Salt. Monit. Céram. **31**, [31], 97—98.

BESIDES boric anhydride, of which borocalcite contains 47 per cent., it also contains certain other constituents: *viz.*, lime, water of hydration, carbon dioxide, sodium carbonate, silica, and alumina, which are useful in enamels, whilst, according to the author, the small proportions of sulphuric acid, and iron oxide, as well as the magnesia and insoluble matters, are without any injurious action.

A successful transparent, white enamel for fine faïence can be prepared from a fritt containing: powdered borax, 3,340 parts; Fontainebleau sand, 1,600; calcium carbonate, 1,600; felspar, 2,460; and kaolin, 1,000 parts (loss on fusing, 21·30 per cent.), of which material, 63·50 parts are mixed with: felspar, 1,400; silica, 1,000; and lead carbonate, 1,250 parts. Equally good results can be obtained at lower cost by substituting borocalcite for the borax, as follows:—Fritt: borocalcite, 1,850 parts; Fontainebleau sand, 2,050; calcium carbonate, 1,350; felspar, 3,150; kaolin, 1,600 parts (loss on fusion, 6·65 per cent.). Enamel:—Fritt, 6,350 parts; felspar, 1,400; silica, 1,000; lead carbonate, 1,050 parts.

The modified enamel does not crack or scale, the coefficient of expansion being the same as that of the original type.—C. S.

Ultramarine Pigment for Enamel Painting ——. J. Salt.

See under XIII. A., *page* 1122.

PATENTS.

Glass with Nickel Steel; Combining ——. La Société Anonyme de Commentry-Fourchambault, Paris. Under International Convention. Eng. Pat. 20,661, Oct. 14, 1899.

NICKEL steels, containing either from 28 to 30 per cent. or from 42 to 46 per cent. of nickel are to be used in place of platinum in cases where it is required to form a stable connection between glass and a metal. As the coefficient of expansion of these alloys is the same as that of glass, such combinations are not liable to fracture with alteration of temperature.—H. H. B. S.

Glass Furnaces. F. J. Swoboda, Kreibitz, Bohemia. Eng. Pat. 10,832, June 14, 1900.

THE furnace is of the kind in which the glass is contained in covered crucibles. The combustion chamber is provided with a rim, by means of which, in the event of a crucible breaking, the molten metal, instead of running into the fire-box, is caused to flow down vertical channels, into troughs constructed to receive it. A hot-air chamber is also provided, by means of which the escaping products of combustion are caused to heat the air as it enters the combustion chamber.—H. H. B. S.

Glass; Improved Manufacture of ——, *by Electrical Heating, and Apparatus therefor.* A. Voelker, Ehrenfeld, Germany. Eng. Pat. 12,672, July 13, 1900.

THE fusion of the raw materials to glass is accomplished by the heat of the electric arc, and the clearing by the heat of electrical resistance. The mass having been melted in the arc furnace is allowed to flow into a tank provided with side chambers, separated by perforated partitions from the main chamber, but also containing molten glass. By means of electrodes in connection with the side chambers, an electric current is caused to pass through the molten mass sufficient to maintain it in a state of fusion during the process of clearing. Provision is also made for mechanically conveying the raw materials to the arc furnace.—H. H. B. S.

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Glass; Improved Manufacture of ——, *by Electrical Heating.* A. Voelker, Ehrenfeld, Germany. Eng. Pat. 12,673, July 13, 1900.

THE heat of electrical resistance is used instead of the heat of the electric arc for fusing the raw materials to glass. The materials are mixed with powdered graphite, charcoal, or similar conducting substance, and made to form part of a circuit between electrodes.—H. H. B. S.

Enamelling [*Inside*] *Metal Utensils or Vessels; Process for* ——. J. S. Kaufmann, Frankfort-on-Maine, Germany. Eng. Pat. 22,184, Nov. 6, 1899.

IN the first place, a vessel of enamel, porcelain, or similar material, glazed on the inside, but rough on the outside, is produced. A coating of metal powder is then applied to the outside, and burnt on, and upon this is deposited a thick metallic covering by electrolysis.—H. H. B. S.

IX.—BUILDING MATERIALS, CLAYS, MORTARS AND CEMENTS.

Normal Sand [*Cement Testing*]; *Influence of a Small Percentage of Lignitic Impurities on* ——. —Wegener. Thonind. Zeit. **24**, [88 Suppl.], 1289—1291.

SAMPLES of normal sand from Freienwalde were impregnated with solutions of lignite, paraffin, and ichthyol from bituminous shale, so as to contain 0·1 per cent. of one or other of these products. When made up into cement (1 cement : 3 sand) with 8 per cent. of water, the following results were obtained:—

Tested after	Sample.	Tensile Strength.	Diff.	Compression Strength.	Diff.
		Kilos.	Kilos.	Kilos.	Kilos.
7 days	Pure sand	14·6	..	..	..
	Sand containing paraffin.	12·92	−1·7	..	..
	Sand containing ichthyol.	12·34	−2·26	..	..
21 days	Pure sand	18·15	..	191·6	..
	Sand containing paraffin.	16·24	−1·91	168·6	−23·0
	Sand containing ichthyol.	17·6	−0·55	179·3	−12·3

showing that the bad results as to tensile strength occasionally obtained with normal sands cannot be attributed to the presence of small quantities of oily or tarry impurities like the above.

One of the strata of the Freienwalde deposit consists of lignitic sand, and is dark brown in colour, but becomes paler when heated, vapours smelling of lignite being evolved. Treated with water, this sand furnishes a dark brown, turbid, though still translucent, liquid. Extraction with boiling hydrochloric acid furnishes a deep yellow solution; sulphuric acid browns the sand, the acid itself assuming a similar coloration when heated—as does also alkali under similar treatment. On adding potassium bichromate to the acid extract the latter becomes clear red brown, and a considerable evolution of gas occurs. Benzene (or petroleum spirit), extraction gives a colourless solution, leaving a slight fatty residue on evaporation (0·04 grm. per kilo.). In the course of the discussion, Gary pointed out that, according to his experiments with this sand, only about one-seventh part of the sand in the drying kilns is exposed to such a temperature that the contained lignite can furnish a fatty oil capable of impregnating the sand. Furthermore, that the sand contains only 0·007 per cent. of matter extractible by benzene and ether, or 0·004 per cent. more than is obtained from admittedly good normal sand; and stated that the tensile strength tests made by him showed practically no difference between the good sand and that contaminated by lignite products.—C. S.

Marble; Experimental Investigation into the Flow of ——. F. D. Adams and J. T. Nicolson. Proc. Roy. Soc. 1900, **67**, [438], 228—234.

THE authors arrive at the following conclusions:—

By submitting limestone or marble to differential pressures exceeding the elastic limit of the rock, permanent deformation can be produced. This deformation, when carried out at ordinary temperatures, is due partly to a cataclastic structure and partly to twinning and gliding movements in the individual crystals of the rock. Both of these structures are seen in contorted limestones and marbles in nature. When the deformation is carried out at 300° C., or better, at 400° C., the cataclastic structure is not developed, and the whole movement is due to changes in the shape of the component calcite crystals by twinning and gliding. This latter movement is identical with that produced in metals by squeezing or hammering, in which case also it is facilitated by increase of temperature. There is therefore a flow of marble, just as there is a flow of metals, under suitable conditions of pressure. The movement is also identical with that seen in glacial ice, although in the latter case the movement may not be entirely of this character. In the above experiments the presence of water appeared to be without effect. Further experiments seem to show that similar movements can, to a certain extent at least, be induced in granite and other harder crystalline rocks.—J. F. B.

Silica in Lime Water; Swelling-up of ——. Wegener. Thonind. Zeit. **24**, [100, Suppl.] 1317—1319.

EXPERIMENTS made by the author with pure silicon hydroxide ($2SiO_2 + H_2O$), tridymite, normal sand, pumice, trass, chalk, diatomaceous earth, and aluminium hydroxide, showed that, except in the case of the two last substances, a swelling-up occurs on treatment with lime water. By increasing the quantity of reagent to from 300 to 330 c.c., the volume occupied by 2 grms. of trass (2 c.c.) was found to increase in 14 days from 2 c.c. to 32 c.c., *i.e.*, 16 times the original volume, and that of the same weight of pumice from 3 c.c. to 28 c.c. Gelatinous silica, treated for three months with lime water containing a lime cartridge, furnished a product which, on calcination, gave the composition $10SiO_2 + 1·2\ CaO$. Whether the structure of the product is crystalloid or colloid has not yet been determined. The author is of opinion that the increase in the volume of the silica is due not merely to arrangement but also to absorption.—C. S.

Silica, Swelling-up of —— *in Lime Water.* Michaëlis. Thonind. Zeit. **24**, [100], 1467—1468.

REPLYING to the objections of those who have either failed to confirm his results or attribute them to physical, rather than chemical, action, the author states that frequent agitation is necessary to induce the reaction, but that when the operation is properly performed, 5 grms. of silica will ultimately swell up to a volume of 80 c.c. By repeatedly renewing the lime water as it becomes exhausted, the (calcined) silica is converted into monocalcium hydrosilicate, and finally into $2SiO_2, 3CaO$, which latter appears to form the ultimate term of the reaction.

The non-physical nature of the phenomenon is also proved by the facts that a semi-saturated solution of lime will produce the same results, and that the product is more or less soluble in hydrochloric acid, according to the degree or treatment previously employed.

On the other hand, powdered quartz, basalt, basalt lava, &c., are not acted upon by lime at the ordinary temperature, but quartzose silica undergoes gradual conversion, the reaction being fairly rapid at 90° C. and progressively so at higher temperatures.—C. S.

Artificial Stone from Lime and Sand; Manufacture, without High Tension Steam, of ——. Swensitzky. Thonind. Zeit **24** [85], 1256.

THE freshly burned lime is reduced to powder and fed to an automatic rotary mixer, where it is incorporated with the requisite quantity of sand (69 bushels of sand to 6 cwt. of lime) and then delivered to a mixing cylinder

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about 10—13 ft. long and 30 ins. in diameter, fitted with stirrers. Here it is moistened with cold water, thoroughly mixed, and afterwards transferred to a silo where the mass heats spontaneously and acquires plasticity. The next stage is removal to the hot mixer, where it is thoroughly incorporated with hot water aided by steam, and where the slaking of the lime is completed. Pushed forward by the stirring apparatus the mass falls into the hopper of the press, where it is again mixed before being filled into the moulds and subjected to the heavy pressure employed. The hot blocks are piled up, in layers of 11—14 deep, in closed hardening chambers heated by steam pipes (waste from the engine) for 36 to 48 hours, by which time they will be ready for sale and use.

In favour of this method it is claimed that the expenses of installation of the hardening plant are only one-third those of a high-pressure steam plant; also that the former is free from the risks of boiler explosions, and that the working expenses are lower, waste steam alone being required for the hardening process, and the coal consumption is reduced to about one-half.—C. S.

Hydration; Reactions of ——. P. Rohland. Ber. **33**, [15], 2831—2834.

Reactions of hydration are distinguished from other reactions in which water plays a part, in that the water-molecule enters into the compound as a whole—not simply as a hydroxyl residue, as in the formation of basic salts, &c. All reactions of hydration will carry themselves on, and all have their speeds of reaction influenced by the addition of small amounts of certain substances, the catalytic action of which may be *primary* (the catalytic agent remaining apparently unchanged throughout) or *secondary* (the catalytic agent taking part in the reaction).

Instances of hydration reactions in organic chemistry are the inversion of cane-sugar or of salicin, or the conversion of acetamide into ammonium acetate, where the catalytic agent is found in the free hydrogen ions, to which the speed of reaction is very nearly proportional.

Among inorganic hydration reactions, the hydration of quicklime, of the calcium oxide in Portland cement, and of plaster of Paris are of especial interest. Candlot first showed that the speed of hydration of quicklime is accelerated by calcium chloride, and the author has shown that many substances influence this speed, as the following table shows. The influence of these substances on the speed of hydration of Portland cement is always the same in direction as on that of quicklime, though it usually differs in degree. This the author considers a direct proof of the existence of free calcium oxide in the cement before hydration; for, while the same catalytic agent often affects in different directions the speeds of hydration of different substances, it always behaves towards the same substances in the same way. In considering the hydration of plaster of Paris, if we regard the two molecules of water as constitutional rather than as water of crystallisation, the reaction is analogous to the hydration of lime; yet many catalytic reagents affect its speed in a different way, as is shown in the table, where an arrow pointing to the right signifies acceleration, one pointing to the left retardation, and a cipher no effect.

—	Quicklime.	Portland Cement.	Plaster of Paris.
NaCl	0	0	→
LiCl	0	0	· ·
$CaCl_2$	→	→	0
$AlCl_3$	→	→	→
$K_2Cr_2O_7$	←	←	→
$CaCrO_4$	←	←	→
$B(OH)_3$	←	←	←
$Na_2B_4O_7 10H_2O$	←	←	←
Na_2CO_3	→	→	←
N_2SO_4	←	←	→

The amount of the acceleration or retardation seems to be proportional (while the total amount of catalytic agent is small) to the amount of substance added, and a given amount of substance appears to produce more effect on the speed of a quick than of a slow reaction, but no satisfactory explanation of the effect can be offered in the present state of our knowledge.—J. T. D.

Fireclay from Knöba (Egerland). H. Seger and E. Cramer. Thonind. Zeit. **24**, [77], 1121.

A large deposit of white plastic clay has been discovered at Knöba, and the sample submitted to the authors for examination was found to exhibit the following composition:—Silica, 44·36 per cent.; alumina, 37·58; iron oxide, 1·40; alkalis, 1·18 per cent.; with a trace of lime and 15·50 per cent. loss on calcination. Burned at moderate temperatures, a white product was furnished, but at a kiln temperature corresponding to the fusing point of Seger cone 7, a grey mass was obtained. The fusing point of the clay is very high—between Seger cones 34 and 35. The composition and behaviour of the clay point to its suitability for making products capable of offering a high resistance to mechanical strain and chemical action.—C. S.

Portland Cement; Chemical Notes on ——. W. Michaëlis. Thonind. Zeit. **24**, [76], 113.

The author opposes the view put forward by Wormser, that an evolution of ammonia, occurring on the addition of dry ammonium chloride to dry cement, indicates the existence of free lime in the latter, having found that a similar phenomenon occurs on treating fused slag, powdered lime glass, or Carrara marble with the same reagent; and he ascribes the reaction rather to the 1 per cent., or thereabouts, of alkali in the cement.—C. S.

Portland Cement; The Ljamin Methods of Determining Free Calcium Hydroxide in Hardened ——. — Wegener. Thonind. Zeit. **24**, [97, Suppl.], 1312.

Both the experiments conducted by F. W. Fresenius, at the invitation of the German Association of Portland Cement Manufacturers, and by the author, lead to the conclusion that the Ljamin method (separation with methylene iodide and benzene) is unsuitable for the purpose in view.

With regard to the reabsorption of CO_2 by calcined cement as a means for determining the percentage of free lime, the author found that CO_2, though expelled at 1,000° C., is greedily absorbed at about 800° C., about a week being required for the attainment of constant weight. In this manner he determined the presence of 10·148—10·85 per cent. of CaO in freshly burnt clinker, and 13·37 per cent. in a hardened cement; but, owing to the paucity of the data, does not form any definite conclusions on the value of the method.—C. S.

Portland Cement and Trass Mortar; Influence of Carbon Dioxide and certain Dissolved Salts on ——. — Schiffner. Thonind. Zeit. **24**, [100, Suppl.], 1320—1321.

The results of the experiments conducted at the Bonn Waterworks lead the author to conclude that no calcareous cementing material is capable of permanently resisting the destructive action of running water containing free carbon dioxide, though in this respect Portland cement is about equal to Roman cement and superior to trass mortar, and even to compact marble. As regards protective coatings for cement-lined reservoirs, an experience of 33 months teaches that the fluorine preparations sold for this purpose give satisfactory results; and oxalic acid and ammonium oxalate (the latter being best) also considerably retard the corrosion. Similarly, asphaltum varnish preserves the cement from the influence of carbon dioxide.—C. S.

Slag Cement; Königshofer ——. A. Birk. Vierteljahrs. deutsch. polytech. Vereins in Böhmen; through Zeits. angew. Chem. 1900 [42], 1060—1061.

In Tetmaier's opinion, the granulation of blast furnace slag induces a partial dissociation, but this is denied by Zulkowski (see Lunge, this Journal, 1900, 827). In granulating the slag it must be made to solidify in the shortest possible time, for which certain conditions, such as a high initial temperature and low temperature of the water, are necessary. The Königshofer blast furnace slag, after

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granulation, had the following mean composition:—SiO_2, 26·29; CaO, 49·16; Al_2O_3, 18·71; MgO, 2·45; FeO, 1·80; and MnO, 0·24 per cent. The ratio of the three most important constituents was—

$$CaO : SiO_2 : Al_2 = 1 : 0·54 : 0·38.$$

It is powdered so finely that not more than 15 per cent. is retained by a sieve of 5,000 meshes to the square centimetre.

An analysis of the ignited lime used for the cement gave the following results:—SiO_2, 12·421; Fe_2O_3, 0·883; Al_2O_3, 2·620; CaO, 81·546; MgO, 1·751: Na_2O, 0·211; MnO, traces; CO_2, 0·194; and H_2O, 0·425 per cent.

The lime is mixed in a fine state of powder with the slag sand and incorporated in mills. The cement has the following composition:—SiO_2, 20·81; SO_3, 0·91; Al_2O_3, 10·50; Fe_2O_3, 1·90; MnO, 0·40; CaO, 55·90; MgO, 1·41; S as sulphide, 0·58; and loss on ignition, 3·50 per cent (Zulkowski). The following analysis is given by Tetmajer: — SiO_2, 21·23; Al_2O_3, 12·57; Fe_2O_3, 0·9; MnO, trace; CaO, 55·50; SO_3, 1·72; S, 0·70; MgO, 2·93; CO_2, 0·65; and H_2O, 2·41 per cent.

From the results of technical tests, the author has arrived at the conclusion that Königshofer slag cement is equal to the best Portland cement.—C. A. M.

PATENTS.

Slaking Lime or similar Material; Apparatus for ——. B. Willcox, London. From La Société J. et A. Pavin de Lafarge, Viviers, France. Eng. Pat. 25,512, Dec. 23, 1899.

The lime, mixed with a sufficiency of water, is fed into a hopper, from which it passes into a revolving steam-jacketed metal cylinder, fitted with blades, by means of which it is agitated and propelled from the end where it is fed in to the opposite end, at which it is discharged. Within the cylinder is a steam coil for maintaining the requisite temperature. A chamber, constructed with heat-retaining walls, is also used in connection with the apparatus for receiving and retaining the material on leaving the cylinder until the slaking is quite complete.—H. H. B. S.

Artificial Stone; Objects or Articles produced from ——, *and Process for the Manufacture of same.* L. Schreyer, Horrem, Germany. Eng. Pat. 10,778, June 13, 1900.

In moulding articles of artificial stone, in cases where the composition would be liable to act upon metal moulds, and where the design would cause moulds of glass to be too expensive, it is proposed to employ metal moulds coated with a lead silicate or other vitreous enamel.—H. H. B. S.

X.—METALLURGY.

Separating Plant [Ores] in Germany; A Wetherill ——. M. Smits. Eng. and Mining J. 1900, **70**, [16], 459.

The ore treated by the Lohmannsfeld Company at Kalk-am-Rhein, Germany, consists of galena, blende, and spathic iron ore (containing as much as 12 per cent. of manganese), the sterile portions being mainly quartz and quartzites. By ordinary mechanical separation there could only be obtained an impure spathic iron, containing 15 — 22 per cent. of zinc and about $2\frac{1}{2}$ per cent. of sterile material. From trials made with the Wetherill apparatus, however, it was found that with ore ground so as not to exceed a 3 mm. gauge blendes could be obtained "of 42 to 46 per cent. richness," and spathic iron containing only from 1 to 3 per cent. of zinc. The new ore to be treated in Wetherill separators of the types shown in Figs. 1 and 2, should be ground so as not to exceed a 3 mm. gauge, and should contain from 5 to 20 per cent. of water.

Fig. 1.

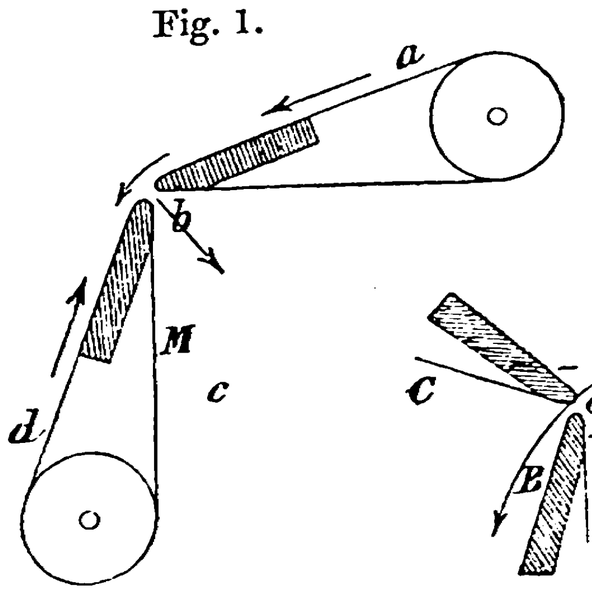
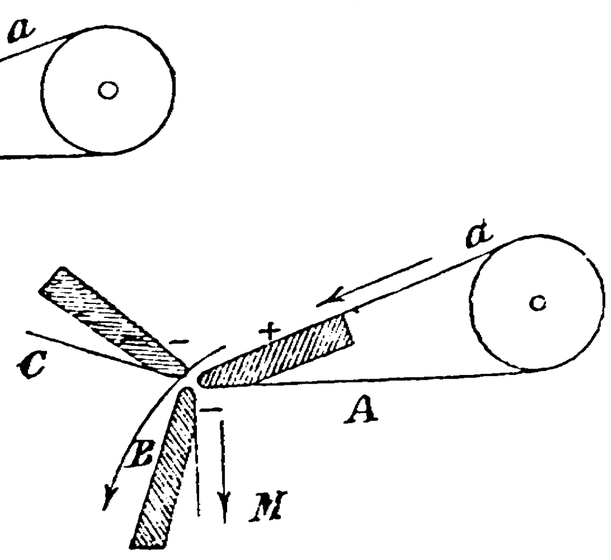


Fig. 2.



In the type shown in Fig. 1 the shaded portions represent the knife edges of the electro-magnetic poles; the arrows show the directions of the carrying belts, the ore being fed at *a*. The permeable portions receive at *b*, in the magnetic field, a slight change of direction, tending to carry them toward the point *c*. The diamagnetic portions pass off at *d*.

In the type shown in Fig. 2 there are three poles and only one carrying belt. In the upper portion of the apparatus the pure spathic iron is separated by light currents; the material, which passes as diamagnetic product, arrives at the lower part of the apparatus, where the intensity of the magnetic field is greater; here a mixed product (blende and spathic iron) is separated as paramagnetic product, whilst the pure blende passes as a diamagnetic product.

The knife edges of the poles are 34 cm. wide, and the speed of the carrying belt is 40 m. per second for the upper part and 25 m. for the lower. The tension of the current is 65 volts; and the upper part of the apparatus shown in Fig. 1 works with 12 ampères, and the lower part with 14—16 ampères, whilst for the type shown in Fig. 2 the corresponding figures are 5 and 8 ampères respectively.

The plant (three separators) is capable of treating 3—$3\frac{1}{2}$ tons of raw ore per hour, and the mean annual cost, excluding interest or depreciation, is 29 cents per ton of raw ore.—A. S.

Metals; Crystalline Structure of ——. Second Paper. J. A. Ewing and W. Rosenhain. Proc. Roy. Soc. **67**, [436], 112—117. (See this Journal, 1899, 834.)

The paper is divided into two sections. The first section describes an attempt to microscopically observe the crystalline changes taking place in iron at the time it is passing the arrest points, during heating and cooling. The changes took place in the specimens during the experiments, but they could not be seen, although all the difficulties of microscopic observation of the polished and etched crystalline surface whilst being heated were overcome. The iron specimen was electrically heated in a vessel with a thin glass or mica window. In one set of experiments the specimen was heated in hydrogen, but the crystalline surface was obliterated by tarnishing, although the uniform luminous surface developed dark patches, which, on slightly raising the temperature, spread over the entire field. No corresponding change took place during cooling, but it always occurred during heating, provided the metal had cooled below redness in the meantime. It did not occur in a vacuum, and the change is attributed to a chemical action between the hydrogen and the iron, possibly corresponding to Roberts-Austen's hydrogen arrest point. The specimens still became tarnished on prolonged heating in a vacuum; but, whilst the crystalline pattern remained visible up to a bright red heat, no change in it could be definitely observed, although some change of structure had taken place.

The second section deals with the changes observable in lead and other metals at comparatively low and even ordinary temperatures. Marked areas of surface were watched, with low magnification, for the changes during different times and treatment. It was necessary to etch the surface for each observation, for the reason just given. It is observed that a piece of cast lead, upon being severely strained by pressure, undergoes continuous change of structure at ordinary temperatures. The original large crystals, after being first flattened, are driven into and through one another, yielding a fine crystalline grain, which is only apparent at a magnification of 80 to 100 diameters. Changes were taking place throughout a period of six months, during which a large number of the small crystals were seen to grow larger at the expense of others. Increase

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of temperature facilitates the changes, 200° C. in some cases producing a complete alteration of crystalline pattern in five minutes. The rate of growth is a function of time and temperature, each degree of the latter yielding a state of equilibrium or stability which is upset by any increase.

A crystal grows, not in uniform layers all round it, but by the formation of arms and branches that invade the neighbouring crystals, the spaces between them filling up at a later stage. It is noticed that the more aggressive crystals are near the edges of the specimen. The growth only occurs in crystals subjected to severe plastic strain, since lead cast in chill moulds may have as minute a crystalline structure, which, however, remains unchanged at temperatures which produce rapid changes in the other.

Experiments with tin, zinc, and cadmium yielded analogous results when the crystalline structure had been modified by plastic strain. Tin, when melted and quenched in water, yields a small structure which is unchanged by heat up to the melting point. Commercial sheet zinc shows no large crystals, and is tough; but, after being heated to 200° C. for half an hour, it is crystalline, brittle, and when bent breaks along definite cleavage planes, and emits a "cry" like tin.

The explanation offered is, that the films of eutectic alloy between the crystals act under the influence of pressure or temperature as an electrolyte. Two crystals are forced into contact by pressure, and with the electrolyte film produce a low-resistance circuit, with the consequent growth of the positive at the expense of the negative crystal. Analogy in the case of crystals in the mother-liquor supports this, as well as the fact that the growth has not been observed except in strained crystals. Clean surfaces of lead were cold-welded and then annealed to produce the crystalline structure. It was found that the growth did not penetrate the boundary of the weld. On repeating the experiment with a preliminary sprinkling of a more fusible metal on the surface before welding, the crystalline growth frequently crossed the line. This shows that the eutectic is necessary, and goes far to confirm the above solution theory of crystalline growth in annealing.

—A. W.

Puddling; Chemical Phenomena of ——. Ironmonger, Dec. 8, 1900, 391.

Lieut.-Colonel L. Cubillo, of Asturias, Spain, in a paper read on Nov. 28, before the Staffordshire Iron and Steel Institute, discussed the chemical phenomena of the puddling process. All extraneous matters in the iron except carbon disappear almost completely during the first few minutes after fusion. Carbon vanishes more slowly. The origin of the oxygen for their oxidation has, however, always been a matter of some dispute, some holding that it comes from the air through the slag as a carrier, others thinking that the fettling is its sole source. The author, with a view of settling the question, appeals to the balance, and to calculation based on his analyses. In one heat 485 lb. of pig iron were charged in the furnace fettled with 399 lb. of ore. The weight of wrought iron yielded was 408 lb., while 364 lb. of cinder were tapped from the furnace and 54 lb. were squeezed out of the iron bloom. The weight of oxygen in the cinder or slag is 119 lb., and, assuming the carbon lost by the metal to be burnt to carbon monoxide, a further quantity of 17 lb. of oxygen was used. By subtracting the metallic iron lost from that existing in the slag, it is obvious that the rest came from the ore, and that therefore a certain quantity of ore was utilised. This amount of ore contained 128 lb. of oxygen. Consequently, the difference of 8 lb. probably came from the air or products of combustion passing through the furnace.

Pig Iron; Comparative Cost in U.S.A. and Great Britain. Sir Lowthian Bell. Ironmonger, Dec. 8, 1900, 393.

In the course of his presidential address to the Institution of Junior Engineers, on Nov. 30, Sir Lowthian Bell gave an interesting historical account of the development of the iron trade. In this development, he remarked, Great Britain stood out as almost the sole author of the various improvements which had raised the industry to its present high position. But of late years the mineral resources of Germany and the United States had enabled foreign owners of ironworks to advance concurrently with ourselves in an extended production, and the Americans, with their vast deposits of rich ores and abundance of excellent coal, together with their large home demand, had recently displaced the British from the foremost place they held for so many years. But he could not agree as to the ability of his friends on the other side of the Atlantic to sweep British makers out of existence. A personal knowledge of what could be done in both countries enabled him to offer an opinion on the question. Comparison between the United States and England involved two conditions—that imposed by nature, and that resulting from ignorance and consequent want of skill; the former was unavoidable, the other susceptible of remedy. Now, taking the Middlesbrough district in this country and Pittsburgh and its vicinity in America, a trifle over $5\frac{1}{4}$ tons of raw material were employed for the production of 1 ton of pig iron in the former, while in the latter something under $2\frac{3}{4}$ tons sufficed, or about one-half of that at the English works. The distances over which the materials had to be drawn from the mines to the Middlesbrough furnaces averaged about 22 miles, at a cost in ordinary times of 10*s*, on the ton of metal. The ore mines near the lake district were 1,100 miles from Pittsburgh, and the coke works at Connelsville were 130 miles from the blast furnaces, the cost of transport, on his information, being 16*s*. 6*d*. the ton of pig metal. The final cost of the minerals, mining and carriage included, consumed for each ton of pig iron at Pittsburgh and Middlesbrough, he thought, was almost identical. In reports which had been placed in his hands, the superiority of the American rolling mills was dwelt upon. Not having been in America since 1890 he was unable to speak from personal experience, but he was sceptical as to the extent of the advantages claimed for the Pittsburgh works, and submitted that they would not suffice by a long way to cover the large expense that would be incurred in transporting the product from the banks of the Monongahela—444 miles by land to New York and thence 2,500 miles by sea—to the Tees. The entire wages paid (not a bad criterion of relative expense) for producing a ton of steel rails in England would not suffice to transport the American article to the ship which had to convey it 2,500 miles across the Atlantic and German Oceans. If these facts were not true, the recent visits made to the United States by some leading British manufacturers had been undertaken to very little purpose.

Iron Silicide $SiFe_2$, and its Presence in Commercial Ferro-Silicons. P. Lebeau. Comptes Rend. **131,** [15], 583—586.

The authors have obtained this substance by heating copper silicide with excess of iron, and dissolving out from the fused product all that dilute nitric acid will extract. A felted mass of minute iron-grey crystals is left, which, after further purification by caustic soda, gives analytical figures agreeing with $SiFe_2$. The crystals are magnetic, insoluble in nitric, but soluble in hydrochloric, acid, and attacked only slowly by hot concentrated caustic soda solution. They are identical with the substance obtained by Moissan by the direct action in the electric furnace of iron on silicon. This silicide is contained in all commercial ferro-silicons containing 10—20 per cent. of silicon, and can be isolated as an insoluble residue when these substances are exhausted with nitric acid.—J. T. D.

Steel; Recalescence of ——. *The Lower Limit of the Critical Point Ar_2.* H. Kamps. Chem. Zeit. Rep. 1900, **24,** [35], 297. From Stahl und Eisen, 1900, **20,** 988.

Formerly, the lower limit of the Ar_2 point, marked by changes in the magnetic properties of the iron, was taken at about 700° C.; later work seems to point to this temperature being too high. Osmond has now endeavoured to bring into agreement the different determinations that have been made, *viz.*, by Roberts-Austen, 600°—550° C.; by Curie, about 550° C.; by Arnold, 525°—400° C.; by Morris, about 420° C.; and by Howe, below 260° C. Electrolytic iron gives the highest temperature for the lower limit of Ar_2. Hence it appears that the lower limit of the Ar_2 point varies greatly, but is much lower than was formerly supposed, while the region Ar_2 should rather be

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regarded as a zone than as a point. Taking 350° C. as the lower limit, at which all β-iron left on quenching must be reconverted into α-iron, it is evident that the annealing of dynamo plates must be effected between 350° and 700° C. (the upper limit of Ar_2), if it is to influence the magnetic qualities of the metal. Whilst Osmond assumes that the magnetic properties are chiefly dependent upon the relation between β- and α-iron, and that hardening carbon has only an indirect influence, the author holds that the hardening carbon, size of grain, and possibility of allotropy of other elements present, play a distinct part in the phenomenon.

—W. G. M.

Steel; Relation between Chemical Composition and Mechanical Properties of ——. H. v. Jüptner. Chem. Zeit. Rep. 1900, **24**, [84], 297. From Stahl und Eisen, 1900, **20**, 939.

Based on the view that the influence of the various impurities in the above respect is constant for the same number of atoms, and that equal effects would therefore be produced by $\frac{1}{12}$ carbon, $\frac{1}{28}$ silicon, and $\frac{1}{56}$ manganese, equations are given by aid of which it is possible to calculate the tensile strength (σ_B) and the percentage reduction of area (q) for any steel of known composition. With Neuberg Martin-steel A = 2·5 tons (presumably per sq. cm.), and B = 60 per cent. Then—

$$\sigma_B = A + \tfrac{20}{3} C + \tfrac{20}{7} Si + \tfrac{10}{7} Mn = A + \Sigma$$

$$q = B - 7\Sigma = B - \left(\tfrac{140}{3} C + \tfrac{20}{1} Si + \tfrac{10}{1} Mn\right)$$

$$= B - (47C + 20\,Si + 10\,Mn)$$

To include phosphorus the equation for tensile strength must have added to it + $\frac{10}{4}$ P. In both the above cases the numbers calculated agree well with those found in practice. The addition of + $\frac{10}{8}$ Cu and − $\frac{10}{4}$ S for copper and sulphur, did not, however, give numbers agreeing with Lipin's test of cupreous steels; the results were more nearly correct when the value for the copper was halved. The determination of the correctness of $\frac{10}{4}$ S and $\frac{10}{2}$ O for sulphur and oxygen respectively requires further experience.—W. G. M.

Gold in Solid Lead; Diffusion of ——, *at the ordinary Temperature.* W. Roberts-Austen. Proc. Roy. Soc. **67**, [436], 101—105.

It has already been shown that gold diffuses upwards into a column of molten lead heated to 492° C., or 166° above its melting point, and also into the same if heated only to 251° or 75° below its melting point, although, in the latter case, it diffuses very slowly. The present investigation shows that diffusion actually takes place in the cold, but with extreme slowness. The smooth bases of columns of pure lead, 0·88 cm. in diameter, were clamped to specially cleaned discs of pure gold and kept in this condition for four years at an approximately uniform temperature of 18° C. At the end of this time the gold was adherent to the lead. The lead column was cut into discs, the lowest being 0·75 mm. thick and the others 2·3 mm. thick, and each disc assayed. The lowest disc was found to contain 0·00005 grm. of gold, while the next three discs yielded quantities which were unweighable, but which could be approximately estimated by measurement under the microscope, and which were found to diminish with the distance from the base. The fifth disc and those above it were free from gold. The rate of diffusion is such that it is calculated it would take 1,000 years for the same amount of gold to diffuse into cold lead as would diffuse into the molten metal in one day, provided no more gold were supplied in either case than could be held in solution.

Cylinders are being prepared on the above lines for submission, after a sufficient lapse of time, to the National Physical Laboratory for examination. The author is also trying the influence of the electric current in promoting diffusion with these metals in the cold.—A. W.

Gold-Copper Series; Certain Properties of the Alloys of the ——. W. Roberts-Austen and T. K. Rose. Proc. Roy. Soc. **67**, [456], 105—112.

The authors have investigated the structure and freezing points of the gold-copper alloys. The results obtained show that a small proportion of copper in gold sets as a whole, forming a solid solution, and this goes on with increased amounts of copper until the saturation point, when the eutectic alloy commences to form and to show itself. The whole mass becomes the eutectic with about 82 per cent. of gold and 18 per cent. of copper, the freezing point of which is 905° C., or thereabouts. This disagrees with the eutectic of Charpy and Riche, which was 55 per cent. of gold and 45 per cent. of copper, with a melting point at 940°. Commencing with copper, a small amount of gold saturates it, and the eutectic alloy appears before the proportion of gold reaches 27 per cent.

The eutectic mixture, with 82 per cent. of gold, approximately corresponds to the composition of 60 atoms of gold and 40 atoms of copper, which is practically the same ratio of atoms as in the silver-copper eutectic, Ag_3Cu_2. The gold-copper and the silver-copper series of alloys resemble each other closely in the limited mutual solubility of the two component metals at either end of the series, in the liquation which attends the solidification, and in the brittleness of the eutectic. The main difference is that copper appears to be more soluble in gold than in silver, with the consequence that the characteristics of the gold-copper series are less marked and have been less easy to detect. It appears that in standard gold there is a tendency for the outside of the ingot to be richer in gold than the interior, whereas in standard silver the centre is the richer in silver, the enrichment being three or four times as great in the latter case as in the former.

The brittleness of the eutectics is in great contrast to the rule hitherto observed. The eutectics of lead and tin, of copper and tin, and of iron and carbon, are the strongest alloys of their respective series, and are not at all brittle. The eutectic of copper and zinc is more extensible than their other mixtures, and its tenacity is considerable. The gold-copper and silver-copper alloys are the first cases observed in which the eutectics show less tenacity and extensibility than the remaining alloys of their series.

—A. W.

Alloys; Heat of Formation of ——. J. B. Tayler. Phil. Mag. 1900, **50**, 37—43; Science Abstracts, 1900, **3**, [10], 810.

The author has determined the heats of formation of alloys, of lead with tin, bismuth and zinc, and of zinc with tin and

Alloy.	Heat of Formation per Grm. of Alloy in Calories.	Heat of Formation per Grm. Mol. Weight of Compound in Calories.	Volts corresponding thereto.	Observed Volta Effect in Volts.	Peltier E.M.F. in Volts.
Lead-zinc eutectic— Zinc, 1·6 per cent.	− 5·8	− 23,800	0·53	0·210 (Ayrton and Perry)	0·0008
Lead-zinc— Zinc, 23·9 per cent.	− 3·5	− 960	0·02	0·31 (Pellat)	
Lead-bismuth— Lead, 5·56 per cent.	+ 3·8	+ 1,400	0·03	.. .. ..	0·017
Tin-zinc eutectic— Zinc, 8·3 per cent.	+ 6·1	+ 4,800	0·10	0·281 (Ayrton and Perry) / 0·35 (Pellat)	0·0309
Lead-tin— Tin, 90·0 per cent.	+ 3·9	+ 8,100	0·18	0·099 (Ayrton and Perry)	0·6000
„ 61·8 „ (eutectic)	+ 1·9	+ 1,000	0·02	0·04	
„ 21·0 „	− 0·8	− 450	0·01	Scratched — Pellat by difference	
„ 5·0 „	− 1·1	− 2,600	0·06	0·10 — Pellat by difference	
„ 2·0 „	− 1·0	− 6,500	0·14	Clean — Pellat by difference	

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mercury. The values were obtained by measuring the heat of solution in mercury (*a*) of the alloy, and (*b*) of its constituents, and assuming that the products in the two cases are similar.

The results are given in tabular form in the original, some examples of which are given in the accompanying table (p. 1117).

From the figures in the second column, it appears that the alloys contain a small percentage of true compounds, whilst it may be noted that the eutectic alloys do not necessarily correspond to the greatest evolution of heat.—A. S.

Aluminium; Action of Caustic Alkalis on ——. E. T. Allen and H. F. Rogers. Amer. Chem. J. 1900, **24**, [4], 304—318.

With the exception of lithium aluminate, which is not directly formed in the wet way, the well-known aluminates may all be formed from the three aluminium hydroxides ($Al_2(OH)_6$, $Al_2H_4O_5$, and AlO_2H).

The alkalis form from the metal aluminates containing the least aluminium [*e.g.*, $K_2(AlO_2)_2$]. They are the most soluble and least stable, decomposing with water to form aluminium hydroxide, which is crystalline or amorphous according to the rapidity of its formation. Lithium aluminate ($Li_2Al_4O_7$), corresponding to the hypothetical oxide AlH_2O_7, is an acid salt which only dissolves with difficulty, and is quite stable.

Alkaline-Earth Hydroxides. — The type of aluminate formed by the action of these upon aluminium varies with the conditions. On heating, the compound $Ba_2Al_2O_5$ was obtained, but, in the cold, even with the greatest excess of base, only the aluminate $Ba(AlO_2)_2$ could be obtained. The compound $Sr_3(AlO_3)_2$ is formed when there is a sufficient excess of strontia, and $Sr(AlO_2)_2$ when the conditions are reversed. The action of lime water on metallic aluminium yields $Ca_2Al_2O_5$, whilst $Ca_3(AlO_3)_2$ may be precipitated from a hot solution. Speaking generally, the most soluble of the alkaline earths is the least inclined to produce the highest type of aluminate, but the stability of the respective aluminates appears to be considerably influenced by their physical condition.—C. A. M.

Pyrites; New Method for Determining Gold and Silver in ——. W. Buddëus.

See under XXIII., *page* 1147.

Metals; Passive Condition of the ——. W. Hittorf.

See under XXIV., *page* 1154.

Copper; Poisonous Action of ——. L. Lewin.

See under XXIV., *page* 1153.

Copper; Determination of Oxygen in ——. L. Archbutt.

See under XXIII., *page* 1148.

Lead; Defence of Hampe's Method for Determining ——. — Langer.

See under XXIII., *page* 1148.

Tungsten in Ores; Determination of ——. F. Bullnheimer.

See under XXIII., *page* 1147.

Glass with Nickel Steel; Combining ——. La Société Anonyme de Commentry-Fourchambault. Eng. Pat.

See under VIII., *page* 1112.

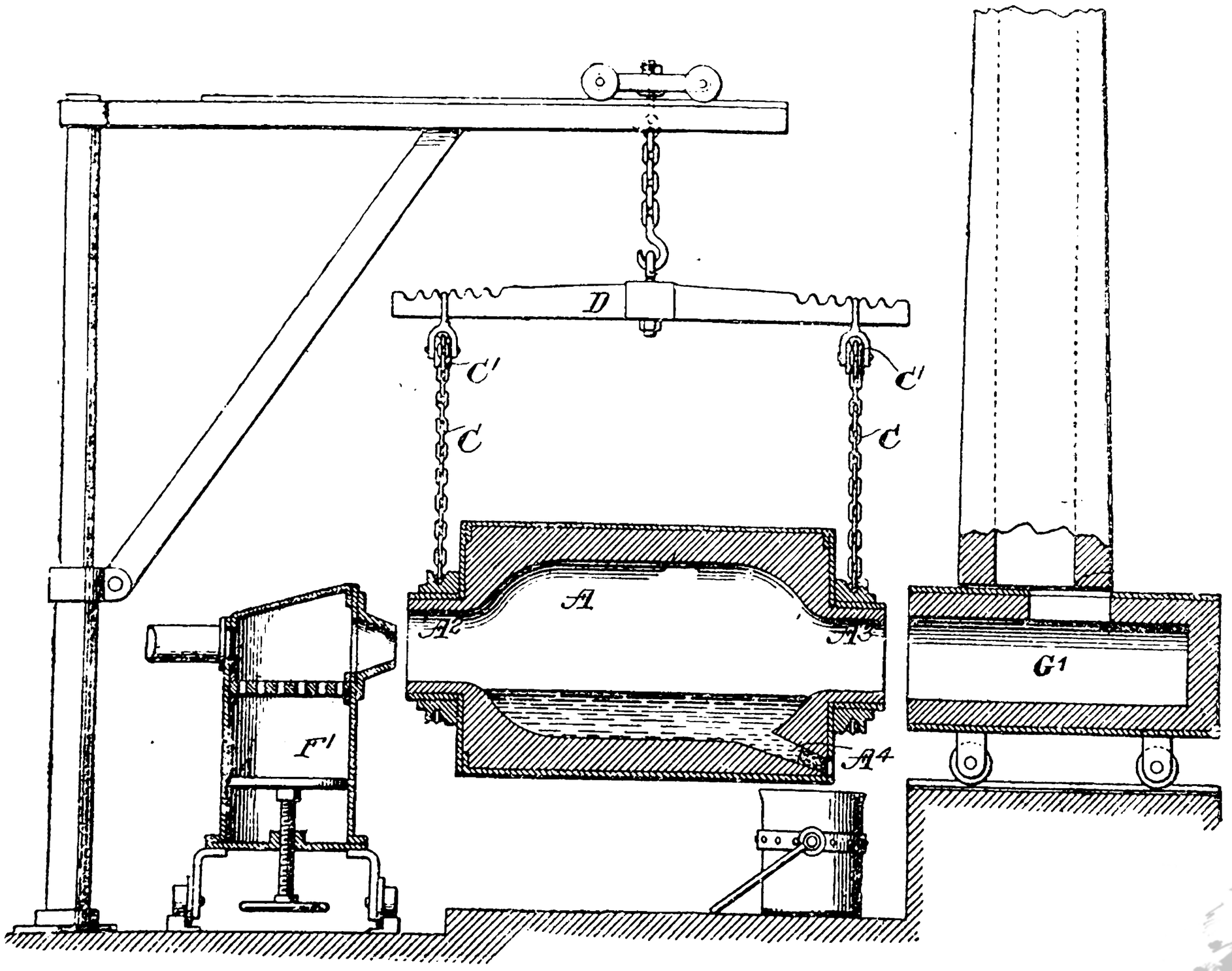
PATENTS.

Ores [*Pb, Ag, &c.*]; *Treatment of* ——. S. Ganelin, Philadelphia, U.S.A., and Berlin. Eng. Pat. 24,469, Dec. 8, 1899.

Ores containing metallic oxides, whether natural or artificially produced, especially oxide of lead or oxide of silver, or both, are introduced into a fused halogen metal salt, such as the double sodium-zinc chloride, in a manner similar to, and instead of, that for treating the sulphide ores described in Eng. Pat. 26,046, 1897 (this Journal, 1898, 159). The lead and silver are converted into oxy-chlorides or chlorides, which are taken up by the bath and completely separated from iron oxide, although the copper in this process is also dissolved.—A. W.

Melting Metals; Furnaces chiefly Designed for Use in ——. H. J. J. Charlier, Philadelphia, U.S.A. Eng. Pat. 5520, March 23, 1900.

The furnace A is cylindrical, with openings A^2 A^3 for the entrance of fuel and the exit of combustion products



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respectively, by means of adjustable supply and take-off arrangements F^1 and G^1 at the ends. The cylinder is supported on rotatable flexible loops or chains C C passing round at each end, and over pulleys C^1 C^1 attached to a pivoted beam D suspended from a crane. The whole is arranged so that the cylinder can be moved horizontally and placed in any position by the crane, tilted at either end by the beam D for discharge through the neck, if desired, instead of through the taphole A^4, and rotated horizontally on its own axis by the suspending chains CC partially from time to time, to bring the heated portions of the wall under the metal.—A. W.

Steel and Ingot Iron; Converters or Apparatus to be employed in the Manufacture of ——. J. E. Mitchell, Barnsley. Eng. Pat. 23,613, Nov. 27, 1899.

THE converter is arranged with a set of nearly horizontal tuyères in the same plane on one side only, so that the blast is forced on to the metal laterally in practically the same direction from all the tuyères. By increasing the blast pressure on one-half of the tuyères, nearest one end of the set, the metal is made to rotate to meet the weaker blast from the remainder of the tuyères. The molten metal is thereby made to gyrate, and to travel from the side to the centre at the surface. A converter built upon this principle, and in accordance with an accompanying diagram, is claimed. —A. W.

Steel and Iron; Process of Hardening ——. O. Gentsch, Magdeburg, Germany. Eng. Pat. 11,252, June 21, 1900.

THE piece of metal is heated to redness in a mixture of pounded charcoal, cornflour, slaked lime, and neats-foot oil, then cooled in water, with the addition of ammonium chloride and a layer of "eläin to exclude the air," and finally sunk into a "pap of lime, clay, or the like, contained on the bottom of the vessel, until the cooling is complete."—A. W.

Steel; Manufacture of Open-Hearth ——, *and Furnaces therefor.* J. W. Johnson, London. From The Wellman Seaver Engineering Company, Cleveland, U.S.A. Eng. Pat. 17,138, Sept. 26, 1900.

THE furnace is of the open-hearth type, with the usual heating appliances, but with an upwardly inclined pouring spout 2, communicating with a tubular structure 3, which consists of a refractory lined fore-hearth 4, with one or more openings towards its end normally closed with the plug 6, carried on a pivoted plate 7, hung underneath and held up by a key 8, on a forked retainer 9. The plug 6 is provided with a pouring hole 10, closed by a refractory stopper 11, worked from the top 13, by suitably arranged screw appliances attached to the outer sides of the structure 3. When casting, the furnace is tilted so that the metal and slag run on to 4; the metal, being underneath, is then tapped through the hole 10, the slag being retained and run back on to the working hearth, to be reheated previous to again being tilted on to the fore-hearth for final ejectment through the hole occupied by the plug 6, which is removed with the swinging plate 7, on removal of the key 8. In this combination of tipping or tilting open-hearth steel furnace and a projecting tapping fore-hearth structure, the latter is independent of the gas passages, and is above the furnace charge during its working on the bed.—A. W.

Lead Oxide; Manufacture of ——. A. G. Fell, New York, U.S.A. Eng. Pat. 14,985, Aug. 22, 1900.

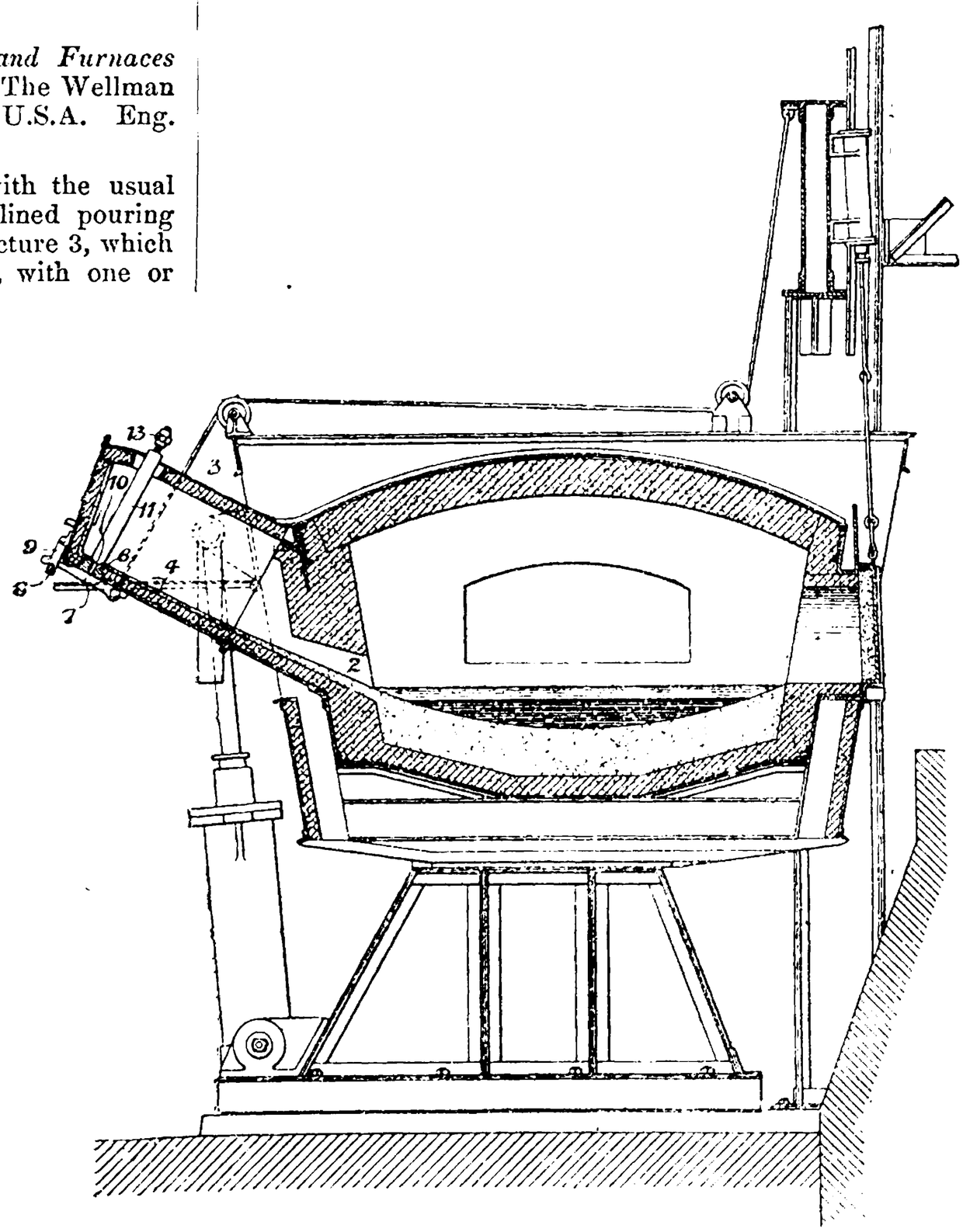
POWDERED galena is mixed with about an equal weight of impure lead oxide, occurring in a later stage of the process, and the mixture is roasted with access of oxygen, at a heat of 600° F. to 750° F. The basic lead sulphate thus produced is intimately mixed with powdered caustic soda in equivalent proportion, and the mixture is heated by means of steam, with stirring. The resultant mixture of lead oxide and sodium sulphate is lixiviated, and the crude lead oxide remaining is treated with a solution of 1 part of caustic soda in 2 parts by weight of water. The proportion of soda used should be three or four times that of the oxide. The mixture is steamed, and, after settling, the hot liquor is run off into a vessel containing spongy or finely divided lead, the action of which is to reduce any higher lead oxides that may be present to the lowest state of oxidation. The lead may be used as a filtering material in a steam-jacketed tank. The clear hot solution separated, deposits, on cooling, lead monoxide in crystals, and the soda solution is available for use over again.

The invention applies to lead ores in general, with such modifications as are obviously required.

Alkali Metals; Manufacture of Alloys of the ——. G. F. Jaubert, Paris. Eng. Pat. 17,459, Oct. 2, 1900.

POTASSIUM and caustic soda, or sodium and caustic potash, in the required proportions, are heated together *in vacuo* to about 2000° to 30° C. and afterwards allowed to cool, when an alloy of the two metals is found floating on the residual caustic. A separate claim is made for two alloys and their preparation from 4 parts of well-dried caustic soda and 12 parts of potassium, and from 8 parts of caustic potash and 5 parts of sodium, the former of which contains 77 per cent. K and 23 per cent. Na, corresponding to the formula NaK_2, and the latter 63 per cent. K and 37 per cent. Na, corresponding to NaK. Both alloys are liquid at ordinary temperatures, and are lighter than water or heavy petroleum. They are preserved "under petroleum."

—A. W.



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XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(*A.*)—ELECTRO-CHEMISTRY.

Electrolytic Reduction; Studies in ——. W. Löbb. Zeits. physik. Chem. 1900, **34**, 641; through Chem. Zeit. Rep. 1900, **24**, [86], 316.

When a current is led by mercury electrodes into a solution of alkali, containing no depolarising agent, a condition of equilibrium is set up between the formation of amalgam on the one hand, and of caustic alkali on the other, hydrogen being evolved later. If the liquid be stirred so as to maintain a supply of sodium ions around the cathode, the amount of amalgam formed may be increased twofold. As the addition of nitrobenzene, in sufficient quantity, prevents further formation, this substance is evidently a powerful depolariser. A rather high current density may be employed in a reducing system such as this, without prejudicially affecting its efficiency, but if the amount of depolariser is small, a low current density is required for economical working. Azobenzene and azoxybenzene act similarly as depolarising agents; here also part of the current energy is usually dissipated in forming amalgam, unless the liquid is energetically stirred and the amount of reducible substance is kept sufficiently high. This investigation has made clear the value of mercury electrodes in acid solution for the reduction of refractory substances.

—R. L. J.

Electrolysis; Secondary Reaction of ——. A. Brochet. Comptes Rend. 1900, **131**, [16], 616—618.

In the electrolysis of concentrated solutions of sodium hypochlorite, it is always found that the quantity of hypochlorite consumed does not correspond with the quantity calculated from the reduction to chloride at the cathode on the one hand, and from the oxidation to chlorate at the anode on the other hand.

Considerably more hypochlorite disappears and more chlorate is formed than the theoretical quantities; hence there is an apparent divergence from Faraday's law. The magnitude of this further reaction was, in one case, 25 per cent. during four hours, and in another case 54 per cent. during one hour, in excess of the theoretical quantity of hypochlorite decomposed. The accessory reaction increases with the concentration of the hypochlorite. It is not affected by the presence of chromate, and only slightly by the addition of alkali.

It is well known that concentrated solutions of hypochlorite in acid media rapidly decompose spontaneously, often with evolution of oxygen; the author has also shown that hypochlorous acid itself undergoes an auto-oxidation into chloric acid. This, then, is what occurs in the accessory reaction of electrolysis; the spontaneous decomposition and the auto-oxidation are set up because the liquid in the immediate neighbourhood of the anode is always in an acid state, even when there is excess of alkali present in the solution as a whole.

It is quite probable that the limits of concentration of active chlorine obtainable by the electrolysis of chlorides are due to this accessory reaction.—J. F. B.

Accumulators; Red Coloration of the Sulphuric Acid in ——. Zeits. Elektrotechnik und Maschinenbau. 1900, [17]; through Woch. für Brau. 1900, **17**, [40], 599.

The red coloration of the acid in accumulators is caused by manganese compounds, which are nearly always present in small quantities in commercial sulphuric acid. During the charging of the cell, the oxygen set free at the positive pole (PbO_2) oxidises the manganous salt to permanganic acid, which possesses a very strong colouring power. It may be observed that the coloration of the acid starts near the positive plate. When the cell is discharged, the red colour disappears, the permanganic acid being reduced. Sometimes it may happen that the manganese is not originally present in the acid but in the active medium of the plate; in this case it is oxidised to manganese dioxide, which is then dissolved by the acid, and the red coloration results as described. This operation is perfectly harmless.—J. F. B.

Ozone, by the Brush-Discharge in Oxygen; Formation of ——. E. Warburg. Preuss. Akad. Wiss., Berlin, Sitzb., 1900, **33** and **34**, 712—721.

The author advances the theory that, in the production of ozone by the brush-discharge in oxygen, besides the ozonising effect on the latter, there is a de-ozonising effect on the ozone, and that these factors, combined with the small spontaneous deozonising effect, control the percentage of ozone which it is possible to obtain. Assuming that the ozonising and de-ozonising effects are proportional respectively to the number of gram molecules of oxygen (n_2) and of ozone (n_1) present in the mixture, the increase in the number of molecules of ozone may be indicated by the formula—

$$dn_1 = b\frac{n_2}{v}\,dt - (a + a^1)\frac{n_1}{v}\,dt,$$

where a, n^1, and b are constants, and v the volume of the vessel. The constants b and a refer respectively to the ozonising and de-ozonising effects of the discharge, and a^1 to the spontaneous de-ozonisation; a^1 is found to be very small compared with a. The value of a is found to vary considerably with the temperature, being three times as great at 93° C. as at 0° C., whilst that of b is little affected, so that, as the temperature increases, the percentage of ozone present diminishes. The value of b for the negative discharge is almost three times as great as it is for the positive discharge, whilst the value of a is approximately the same for both.—A. S.

Water; Commercial Electrolysis of ——. M. Buffa. Electrician, 1900, [1172], 46.

One of the chief difficulties met with in the electrolysis of water on the large scale is the mixture of the oxygen and hydrogen given off at the two electrodes. If, in order to avoid this mixture, a diaphragm be introduced, the resistance of the cell increases to such an extent that the efficiency of the apparatus is seriously reduced. A better method is to use metallic septa; these separate the two gases perfectly, and act as intermediate electrodes. Since the reduction of voltage, both from the anode to one side of the septum and from the other side of the septum to the cathode, is insufficient to cause decomposition of the water, liberation of the products of electrolysis does not occur at either surface of the metallic septum, but is confined to the electrodes proper. In practice, iron electrodes in a 11 per cent. solution of caustic soda have been found to be most convenient and economical. The electrolyte is covered with a film of mineral oil, in order to prevent absorption of carbon dioxide from the air. It has been observed that the same protective action is afforded by a film of water vapour, which obtains when the temperature of the electrode is fairly high; when, however, the temperature drops to 10° C. or under, absorption of carbon dioxide takes place rapidly. In the electrolysis of water on the large scale, if the current be taken from a distant water power, it is generally necessary to convert an alternating current into a unit-direction current. Motor transformers are preferable to electrolytic one-direction devices, because the latter yield a current whose mean pressure is built up of a pressure below and a pressure above that which is critical. That which is below does not suffice for electrolysis; that which is above destroys the proper function of the intermediate conducting diaphragms and yields mixed gases.

It is stated that there is a works at Rome for the electrolysis of water which is capable of producing 0·086 cb. m. of hydrogen per horse-power; at Brussels, 0·12 cb. m. is produced for the same expenditure of energy. At Rome, where the kilowatt-gear costs 96·60 fr., the cost of 1 cb. m. of hydrogen and $\frac{1}{2}$ cb. m. of oxygen is 20 c., excluding interest and depreciation. The capital cost of an installation of 100 h.p., taking its current from a central station, is 110,000 fr.

Among the chief uses to which electrolysis of water can be adopted are:—The preparation of hydrogen for balloons, and the preparation of oxy-hydrogen gas for blowpipe and

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illuminating and heating purposes. For military balloons, electrolytic hydrogen is said to be preferable to hydrogen produced by the ordinary chemical processes. Thus, the respective weight of 1 cubic metre of the gas from each source, is: chemically pure hydrogen, 89 grms.; electrolytic hydrogen, 107 grms.; hydrogen obtained by the action of sulphuric acid on iron, 160 grms.—A. S.

PATENTS.

Accumulator Batteries; Active Mass for ——. R. Rodrian, Berlin. Eng. Pat. 216, Jan. 3, 1900.

An active material for accumulator batteries is made by placing plates of metallic lead in a solution of hydrogen peroxide, and afterwards forming or shaping them in a mixture of hydrogen peroxide and sulphuric acid. The active material for filling supports with a paste is made by kneading finely subdivided lead or lead oxide with a mixture of hydrogen peroxide solution and sulphuric acid, and oxidising the positive plates by sulphuric acid and reducing the negative plates by hydrogen peroxide.

—J. C. R.

Water; Apparatus for Electrolysis of ——. P. Garuti and R. Pompili, Tivoli, Italy. Eng. Pat. 12,950, July 18, 1900.

Relates to modifications of Eng. Pat. 23,663 of 1896 (this Journal, 1897, 337), by which much of the soldering work is diminished, and the perforated diaphragms are made to extend farther below the electrodes, so that the liberated gases do not so readily mix. The gases do not pass through the small holes pierced in the diaphragms, but under the edges thereof, particularly when the apparatus is very much forced.—J. C. R.

Electric Insulators [*Celluloid*]. C. A. y López, Madrid. Eng. Pat. 13,415, July 25, 1900.

Electric insulators are made of celluloid, which is heated to about 80° C., pressed in a mould, and subsequently cooled therein while under a pressure not exceeding three atmospheres.—J. C. R.

Telegraphs; Electro-Chemical or Copying ——. G. C. Dymond, Liverpool. From Kopier-Telegraph Ges. mit b. H., Dresden. Eng. Pat. 14,275, Aug. 9, 1900.

Mechanical improvements are described and claimed, relating to electro-chemical or copying telegraphic apparatus, based on the electro-chemical decomposition, resulting in the decolorising power of electric current, when acting upon certain known chemical compounds. The telegram to be transmitted, or the design, is written or drawn or printed with an insulating or conducting ink, which breaks or completes an electric circuit, made up of a transmitter, connecting line, and receiver.—J. C. R.

Chlorine and Caustic Soda or other Alkaline Hydrate; The Production of ——, *and Apparatus therefor*. Eng. Pat. 4269.

See under VII., *page* 1111.

Caustic Lyes and Ammonia, and Earth Alkaline Hydroxides; Process for directly obtaining by Electrolysis ——. Eng. Pat. 20,925.

See under VII., *page* 1111.

(*B.*)—ELECTRO-METALLURGY.

Aluminium by Electrolysis; Manufacture of ——. J. W. Richards. J. Franklin Inst. 1900, **149**, 451—459.

The cost of production of aluminium has been greatly reduced since the introduction of the electrolytic process. The lowest cost per pound is now about 20 cents, the selling price being 25 cents in Europe and 30 cents in the United States. It is stated that strong, light alloys are obtained by the addition of 5 per cent. of copper, nickel, or manganese, or 30 per cent. of zinc, to aluminium.

At the present time aluminium is being used for cooking utensils, in place of zinc for fruit-jar caps, for lithographic printing presses, and for electrical purposes. Aluminium leaf has entirely displaced silver leaf in decoration work. The metal is also used to a considerable extent in metallurgy as a reducing agent.—A. S.

Tin; Phenomena accompanying the Transition of ——. E. Cohen. Zeits. für Elektrochem. 1900, **7**, [17], 207.

The change from ordinary white tin to the spongy grey modification is a reversible reaction, the transition temperature being about 20° C. That is to say, white tin is the stable modification above 20°, whilst grey tin is the stable form below 20°. At −48° the rate of transition from white to grey reaches a maximum. The transition from white to grey tin, besides being induced by great lowering of the temperature, can also be started by "seeding." If grey tin is brought into contact with white tin, the latter is rapidly transformed into the spongy modification, the transition beginning at and spreading from the point of contact. The E.M.F. of a cell consisting of grey tin | dilute solution of tin salt | white tin, can be calculated by Nernst's formula—

$$E = \frac{R\,T}{n} \cdot \log \text{nat.} \frac{Pw}{Pg}$$

where Pw and Pg represent the solution pressure of white and grey tin respectively. At the transition temperature, when Pw = Pg, the E.M.F. is zero.

	Ratio $\frac{Pw}{Pg}$
Temperature, 5°	1·067
„ 10°	1·043
„ 15°	1·017
„ 20°	1·000

Below 20°, therefore, grey tin must be precipitated from a solution of a tin salt when a white tin rod is dipped in it, analogous to the precipitation of the gold group of so-called "noble" metals by those less noble.—J. S.

Tin; Electrolytic Deposition of Pure ——. — Quintaine. Rev. Prod. Chim. **3**, [15], 229.

To obtain a clear solution, and one that will act as a good conductor of the current, the precipitate first formed, on dissolving the tin salt in water, is redissolved by an ammonium salt (*e.g.*, chloride) and the solution filtered. The current should be weaker than that employed for copper, or the deposition will be irregular.—C. S.

Silicon; Analysis and Purity of Commercial Specimens of. B. Neumann.

See under XXIII., *page* 1146.

Electric [*Hearth*] *Furnaces.* R. Chavarria-Contardo. Eng. Pat.

See under II., *page* 1093.

XII.—FATS, OILS, AND SOAP.

Cotton-Seed Oil; Notes on Halphen's Test for ——. R. D. Oilar. Amer. Chem. J. 1900, **24**, [4], 355—373. (See also this Journal, 1899, 611 and 865.)

The author here summarises the work that has been done upon this test, and gives the results of his experiments on a large number of fats and oils. In the main he corroborates the conclusions of previous investigators, but finds that in order to obtain the proper coloration, the combined action of carbon bisulphide, sulphur, and amyl alcohol is necessary, and that none of these can properly be omitted, as has been stated by some. Ordinary alcohol gives the reaction more faintly than amyl alcohol.

As regards heat required to destroy the substance in the oil which produces the reaction, the duration of heating, and nature of the substance in contact with the oil, have an influence. In glass vessels the neutralisation temperature lies between 315° and 320° C., but oil

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heated in a steel frying pan for an hour at 140°—150° C. gave no coloration. The active substance is not only volatilised but completely destroyed, for the fumes from it give no coloration.

Of different oils examined by the author, four (sunflower, rape or colza, niger-seed and poppy-seed oils) gave colorations somewhat resembling that obtained with cotton-seed oil, but the same oils extracted from the seeds by the author himself showed no coloration whatever after several hours.—C. A. M.

Cedar-Nut Oil; Investigation of ——. L. von Schmoelling. Chem. Zeit. **24**, [77], 815.

THE oil derived from the seeds of the Siberian cedar, *Pinus cembra*, is of a golden yellow colour; it has an agreeable, but somewhat rancid taste, and is used locally as a food. It is but sparingly soluble in cold alcohol, carbon bisulphide, and benzene, but is readily dissolved in petroleum spirit, chloroform, acetone, and amyl alcohol; it dissolves, on warming, in ether, carbon bisulphide, and benzene. According to Glaesner, it gives, when treated with an equal volume of fuming HCl, a dark red zone at the junction of the two liquids, which is permanent for 24 hours, and if two drops of strong H_2SO_4 be added to 10 drops of the oil, a dark brown colour is developed. Crace Calvert state that the oil gives with H_2SO_4, sp. gr. 1·530, a yellowish-brown coloration. The author has found the following to be the constants for this oil:—Sp. gr. 0·930; Hehner number, 91·97; saponification number, 191·8; iodine number, 159·2; iodine number of the fatty acids, 161·3; acid number of the fatty acids, 193·0; glycerin, 10·31 per cent.; volatile fatty acids, 3·77 per cent.; free fatty acids, 1·6 per cent.; total fatty acids, 95·74 per cent.; mean molecular weight, 280; mean molecular weight of the fatty acids, 290; acetyl number of the fatty acids, after standing for six days in a closed flask, 81·9; fluid fatty acids, 87·0 per cent.; unsaponifiable matter, 1·3 per cent.; freezing point of fatty acids, 11°·3 C.; iodine number of fatty acids, 184; Maumené number, 98°. The author prepared a drying oil from the original oil by heating it with manganese borate for four hours at 140°-150° C. This dried, when spread on glass, in 48 hours.
—J. O. B.

esamé Oil by the Breinl Reaction; Detection of ——.

See under XXIII., *page* 1150.

Soaps; Determination of Free Alkali in ——. R. E. Divine.

See under XXIII., *page* 1150.

XIII.—PIGMENTS, PAINTS; RESINS, VARNISHES; INDIA-RUBBER, Etc.

(A.)—PIGMENTS, PAINTS.

Ultramarine Pigment for Enamel Painting. J. Salt. Monit. Céram. **31**, [7], 50.

A RICH ultramarine for enamel paintings, to be fired in the faïence muffle, is obtained by mixing: ultramarine base, 1,130 parts; flux No. 101, 2,490 parts; flux No. 102, 904 parts; and lead carbonate, 385 parts, the whole being ground in water for 43 hours.

The ultramarine base is prepared from 850 parts of cobalt oxide (RKO) and 3,250 parts of calcined alumina mixed, ground dry, sifted, and calcined for three hours in a crucible embedded in coke free from dust. An oxidising flame should be as far as possible maintained, or the product will turn out green. After the crucible has cooled down, the product is taken out, crushed, mixed with 10 per cent. of magnesium bicarbonate, ground, and re-calcined as before, the mass being then treated with "sufficient nitrohydrochloric (1 : 4) acid" in a covered vessel for 50—60 hours, and stirred twice a day. Finally the product is washed with water until perfectly neutral. The alumina should be as free as possible from iron; if prepared by calcining ammonium alum, it slightly reduces the pigmentary power of the cobalt oxide and gives a lighter-coloured product.

The flux, No. 101, consists of pure lead carbonate, 3,480 parts; ground and washed sand, 630; ground lead nitrate, 1,080; boric acid, 1,890 parts, the whole being then sifted, fused, poured into water and ground fine. The No. 102 flux is prepared in like manner, from lead carbonate, 6,830 parts; sand, 1,485; lead nitrate, 2,138 parts; in this case the fusing process must be carried out quickly, or the crucible will be perforated.—C. S.

PATENTS.

Lead Carbonate or White Lead; Manufacturing ——. F. J. Corbett, South Yarra, Victoria, Australia. Eng. Pat. 10,370, June 6, 1900.

FINELY divided lead or lead oxide is placed in a closed vessel, covered with aldehyde, alcohol, or mixtures thereof with water, and any suitable acid. Compressed or liquefied carbonic acid is then introduced, and the whole well agitated. The precipitate is washed with alcohol or aldehyde by decantation or on filters, and either packed up or ground directly into oil.—F. H. L.

Cold Water Paint, and Process for Manufacturing the same. G. R. King, New Brighton, New York State, U.S.A. Eng. Pat. 17,557, Oct. 3, 1900.

WET casein or milk curd is well mixed up with any suitable mineral base, the whole is dried, and ground to powder. Some of the product is mixed with slaked lime and glue in presence of water, also dried and ground to powder. The two main compositions are then mixed, the white or coloured pigment added, and the whole is diluted with water to working consistency. The material is claimed to be waterproof, not to act upon the brushes, to be capable of being diluted as may be required, and to give always a uniform appearance, even if the whole of a surface is not treated at the same time.—F. H. L.

(B.)—RESINS, VARNISHES.

Shellac Solutions in the Manufacture of Ornamental Papers. A. Weichelt. Papier Zeit. 1900, **25**, 3180.

SHELLAC solutions are largely employed in the preparation of ornamental papers, since the thin layer of resin obtained by their aid may be softened locally (or all over) by warmth and pressure, causing gold-dust and the like to adhere. The following are serviceable liquids:—(1) 750 to 800 grms. of shellac dissolved by agitation in 1 litre of cold alcohol, tinted, if desired, with a spirit-soluble dye, and filtered. (2) 9 kilos. of shellac are soaked overnight in 3 kilos. of strong ammonia and 10 litres of water, and the whole next day, with agitation, is poured into 40 litres of boiling water. This can be mixed with any basic colours; but as acid ones are not available, a green should be made from Alkali Blue and Auramine. (3) 7·5 kilos. of shellac are added gradually to a boiling solution of 2·5 kilos. of borax in 50 litres of water. (4) 7·5 kilos. of shellac are similarly added to a solution of 1·5 kilos. of sodium carbonate in 50 litres of water. (3) and (4) are finally passed through a fine sieve. (5) 16 litres of (3) or (4) are heated to the boil and poured gradually into a boiling solution of 12 kilos. of glue in 36 litres of water, adding, also by degrees, 1 litre of ammonia.—F. H. L.

Copals; Acid and Saponification Values of certain ——. W. Lippert and H. Reissiger. Zeits. angew. Chem. 1900, [42], 1047—1050.

FOR the determination of the acid value, the authors mixed 1 grm. of the copal in the finest possible state of division with 10 c.c. of chloroform or 25 c.c. of ether, and, after some hours, added 25 c.c. of alcohol, and warmed the whole gently on the water-bath. When cold, the solution was titrated with seminormal alcoholic sodium hydroxide.

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Dichlorhydrin, which was recommended by Flemming (Ger. Pat. 84,146) as a general solvent for resins, was not found applicable by the authors, since most copals require heating to bring them into solution and then turn dark brown.

Determination of the Saponification Value.—Henriques' method of cold saponification was not available, owing to the formation of resinous deposits in the final titration. A mixture of alcohol and ether was therefore used as the solvent, and the ordinary process employed.

The results obtained are summarised in the subjoined tables, where are also given the results of other observers.

Saponification and Ester Values.

Copal.	Saponification Value.	Saponification Value. Williams.	Saponification Value. Schmidt and Erban.	Ester Value.
Angola, red	148—152	136	148	58—62
Benguela, selected ..	111—126	..	..	50—64
Brazil, selected.....	148—157	..	..	1—5 (?)
Kauri, clear, ordinary	95—109	64·2	..	32—39
Manilla, selected....	147—152	179—188	..	44—50
Zanzibar.....	88—102	..	92	..

Acid Values.

(*p.s.* = partially soluble; *n.s.* = nearly soluble; *c.s.* = completely soluble; *l.s.* = little soluble.)

Copal.	Solvents.			According to Kremel.	According to Williams.	According to Schmidt and Erban.
	Alcohol.	Ether-Alcohol.	Chloroform-Alcohol.			
Angola, white.....	..	59—61 *p.s.*	..	..	57	..
„ red.....	..	81—82 *p.s.*	90 *n.s.*	..	60	..
Angostura.....	..	28—35 *l.s.*	48 *n.s.*	..	..	..
Benguela, selected.....	25—30 *l.s.*	61—62 *p.s.*	..	..	..	..
„ ordinary	..	84—87 *p.s.*	..	..	..	..
Brazil, selected.....	..	*p.s.*	153—158	..	..	..
Cammeroon	106—109 *c.s.* on heating	..	106 *c.s.*	..	..	..
Kauri, selected	..	81 *c.s.*	..	..	..	..
„ clear, ordinary.....	..	64 *c.s.*	63 *c.s.*	..	..	..
„ dark	..	66·5—70 *c.s.*	68—70 *c.s.*	..	..	..
Dammar.....	..	33—35 *c.s.*	..	31—34	22—26	33
Madagascar.....	..	25—30 *l.s.*	60 *c.s.*	..	..	..
Manilla, selected.....	103 *c.s.*	105—111 *c.s.*	103—108	..	..	..
„ soluble in alcohol..	144—148 *c.s.*	..	..	..	Borneo, 141	..
Sierra Leone.....	..	78—82 *c.s.*	..	..	84	..

As regards the valuation of copals for practical purposes, the author considers the determination of their fusing capacity, "Brenzreaction," as of primary importance.

Artificial Resins.—The acids of colophony can be readily converted into esters by treatment with alcohols, especially glycerin, at high temperatures, preferably in a vacuum. These esters have the characteristics of copals, and on account of their "neutrality" are frequently used in the preparation of acid-free lacquers for metals. Their quality is better in proportion as their colour is lighter, their hardness greater, and their acid value lower. Nearly all the esters examined by the authors had acid values of 17—45, and were never really neutral. Since they can only be re-saponified with the greatest difficulty, it is recommended as sufficient to heat about 1 grm. of the ester with 50 c.c. of neutral alcohol on the water-bath to the boiling point. This causes the ester to fuse, and the uncombined acids are dissolved. The titration is then carried out in the usual way. A good ester should not have an acid value exceeding 20.—C. A. M.

PATENT.

Removing Paints and Varnishes; Emulsion for ——. A. Klee, Viernheim, Germany. Eng. Pat. 14,114, Aug. 7, 1900.

A MIXTURE of water, linseed oil, soda, alcohol, and, more particularly, Venice turpentine.—F. H. L.

(*C.*)—INDIA-RUBBER, &c.

Caoutchouc from the Leaves of Rubber Trees; Properties of ——. Axel Preyer. Tropenpflanzer, **9**, 428; through Pharm. J. **65**, [1583], 464.

THE author describes the various kinds of caoutchouc obtained from the milk of the leaves of trees of different botanical origin by different methods, *e.g.*, by desiccation, by heating, by the aid of chemical coagulants, or by simple spontaneous coagulation. The caoutchouc thus obtained from *Manihot glaziovii* is soft, plastic, not viscous, and not easily torn. That from *Ficus elastica* and *Urceola esculenta* is viscous, non-elastic, and ductile. The leaves of *Hevea braziliensis* yield a good caoutchouc, which is non-viscous and elastic, while the leaves of *Castilloa markhamiana* and *Landolphia kirkii* contain so little latex that no opinion can be formed of the caoutchouc derived from it. All the leaves mentioned yield a latex which produces a caoutchouc on spontaneous coagulation more quickly than the latex from the trunks of the trees, possibly because the former contains a coagulating substance. Experiments recently carried out in Ceylon with *Hevea braziliensis* show that the cultivation is unprofitable, since a million trees per hectare produced, at the age of 18 months, only 27 kilos. of caoutchouc, owing to the rapid coagulation of the latex before it could be drawn from the leaves. Manual pressure was used, but even if mechanical pressure doubled the yield, the cultivation would be unprofitable.—J. O. B.

Balata and Gutta-Percha; Purified ——. G. Arends. Zeits. angew. Chem. 1900, [40], 1010.

THE following method is employed by the author for purifying balata. The commercial article is cut up, boiled with acidified water, washed, and dried. It is then treated with a mixture of equal parts of carbon tetrachloride and petroleum spirit. After settling, the clear solution is decanted into a distilling apparatus containing water, and the solvents distilled off. The balata which remains behind is freed from the last traces of the solvents by continued boiling. It is then well softened and rolled out.

Gutta-percha can be purified in the same way. Some samples, however, require an additional treatment with chlorine in order to bleach them.—J. S.

PATENT.

India-Rubber [*Substitute*]; "*Synthetic Production*" *of* ——. W. J. Cordner, London. Eng. Pat. 20,934, Oct. 19, 1899.

VARYING proportions of dried rhea fibre (China grass) and the latex of Pontianak gum (*Borneo mort*), with or without sulphur, potassium permanganate, and manganese borate, are mixed together under pressure and at elevated temperatures in the manner described.—F. H. L.

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XIV.—TANNING, LEATHER, GLUE, SIZE.

Chrome Tanning. W. Eitner. Der Gerber, **26**, [626], [627], [628], and [628]. (See this Journal, 1900, 754.)

It has been shown that the acid and neutral chrome salts possess the property of rapidly and uniformly permeating the hide. This tanning may be compared to the tanning with bark. On the other hand, the strong basic salts penetrate the hide far less easily, but they exercise a more effective tanning, giving more substance, because more chrome salts are fixed upon the fibre. The effect may be compared to that produced by the heavier tanning with myrobalans and valonia. It is, however, possible to transform the more easily absorbed acid salts which may be already in the inner fibres of the hide into the more effective tanning basic salts, by treating the tanned hide with an alkaline solution. By this means a rapid preliminary tanning is effected, and, what is of more importance, one of uniform character, otherwise unattainable with the more powerful salts.

In comparing the two processes of chrome tanning, *viz.*, the one-bath process and the two-bath process, the latter is characterised by the production of a fuller leather. This fulness is in part due to the deposition of sulphur, which is precipitated in the leather, and also in the bath. This deposited sulphur in the hide fibre serves in the same manner as flour does in the tawing of *glacé* kid—it "feeds" the leather. In leather tanned with the two-bath process, from 0·02 to 0·08 per cent. of sulphur has been found. This tanning action of sulphur, in a finely divided condition, forms the basis of a process patented by Wartenburger, of Hamburg. The tanning action may be explained in the same manner that Knapp explained the effect of stearic acid, when, as an alcoholic solution, it is introduced into the interior of the hide, *viz.*, by the isolation of the individual fibres of the tissue and the deposition amongst them of stearic acid. Sulphur is deposited between the fibres in a similar manner, and gives a pliant, full feel to leather thus tanned. The most objectionable consequence of tanning with sulphur is the unpleasant odour given to the leather, which is especially noticeable when it is afterwards "stuffed" with grease. The latter, in the presence of the sulphur, develops an exceedingly offensive odour, in consequence of decomposition, and in course of time the leather becomes brittle and easily torn. This especially applies to the case of leather used for machine belting.

The favourable effect of the sulphur can also be attained with the one bath process, by adding to a solution of chrome alum some sodium thiosulphate. By this process sulphuretted hydrogen is developed and sulphur precipitated, and a basic chrome salt is formed. In the same manner, leather which has been tanned with a neutral chrome salt can be treated with a solution of thiosulphate. The leather, however, must be in a slightly acid state.

It is clear that the amount of chrome fixed in the leather varies very considerably by different processes and with different kinds of leather. The chrome leather which contains the highest percentage of chrome salts is the weakest in tensile strength and wearing qualities. Further, different kinds of hide or skin absorb chrome salts in different degrees; sheep, horse, and kid hides generally absorbing less than goat, calf, or ox hide. Not only is it important that too much chrome should not be deposited upon the fibre, but that which is deposited should be deposited evenly, not only all over the skin, but evenly throughout from the flesh to the grain side. The grain of the skin must not be coarse, it must not be "pipey," or too loose. If a loose, "pipey" grain is produced, it may sometimes be tightened by subjecting it to a vegetable tanning on the surface.

In the manufacture of chrome leather, the selection of suitable skins is of extreme importance, and the wet work must be specially carried out. Pelt which is suitably prepared for vegetable tanning would in most cases be unsuited for the manufacture of chrome leather. The liming must be carried out in "healthy" limes, stale soaking and stale liming should be avoided, hence the author prefers the chemical bate, instead of the dung bate, for "pulling down" the skins. Generally speaking, green hides and skins are more suited for the production of chrome leather than skins which have not been salted or dried for the purpose of preservation.

After the skins have been suitably prepared they are placed in an acidified solution of potassium bichromate until, on cutting, they show an even yellow colour throughout. The strength of the solution and the time depend on the thickness of the skin and on its texture. Good results are obtained with 4 litres of a 1 per cent. liquor to every kilo. of pelt; this means 40 grms. of bichromate to every kilo. This quantity of bichromate is more than sufficient, but it must be used slightly in excess, the requisite quantity of acid being added at successive intervals.

An excess of hydrochloric acid has not been found to be in any way detrimental to the leather. It acts as a plumping agent, and counteracts the contracting effect of the free chromic acid. The author has obtained good results by using equal parts of bichromate of potash and hydrochloric acid; *viz.*, with a solution containing 1 per cent. of bichromate and 1 per cent. of hydrochloric acid.

The most common method of tanning skins is either in a paddle or in a drum. The paddle is on the whole to be preferred, the drum having the objection of always producing a grain upon the leather, which does not show until the skins come into the reducing bath.

The chromed skins, after being removed from the bath and allowed to drip, are set out on the table in order to remove the excess of chrome liquor, and in this state must not be exposed to the light. They are then put in a bath containing sodium thiosulphate, to which has been added sufficient hydrochloric acid to effect the reduction. This is likewise added in successive quantities. By this process the following reaction occurs:—

$$3CrO_3 + 3Na_2S_2O_3 = 3Na_2SO_4 + 3S + 3CrO_2.$$

If now an excess of sulphurous acid is allowed to act upon the chromic acid the following reaction takes place:—

$$2CrO_3 + 3H_2SO_3 = Cr_2(SO_4)_3 + 3H_2O.$$

In commencing the reduction of the skins, as described above, they are first put into a solution of sodium thiosulphate, to which has been added only a small quantity of hydrochloric acid. What now takes place can, therefore, be made clear by the following equation:—

$$3CrO_3 + 6HCl + 6Na_2S_2O_3 = 3Na_2S_4O_6 + 6NaCl + 3H_2O + 3CrO_2.$$

On the addition of a larger quantity of hydrochloric acid, the following reaction takes place:—

$$2CrO_3 + 12HCl + 6Na_2S_2O_3 = 3Na_2S_4O_6 + 2CrCl_3 + 6NaCl + 6H_2O.$$

By a further addition of hydrochloric acid, sulphur is also deposited, as follows:—

$$2CrO_3 + 6HCl + 3Na_2S_2O_3 = 3Na_2SO_4 + S_3 + 2CrCl_3 + 3H_2O.$$

Then, when the reduction is complete, the change of the neutral chrome salts into basic takes place:—

$$Cr_2(SO_4)_3 + Na_2S_2O_3 + H_2O = 2Cr\begin{cases}SO_4\\OH\end{cases} + SO_2 + S + Na_2SO_4.$$

$$2CrCl_3 + Na_2S_2O_3 + H_2O = 2Cr\begin{cases}HO\\Cl_2\end{cases} + SO_2 + S + 2NaCl.$$

—J. G. P.

Tanning; Rapid Process of ——. Mindus. Rev. Prod. Chim. **3**, [15], 228.

The following method is said to be equally applicable to "green" and dried hides, the proportions of materials employed being based on the weight (about 3 kilos.) of a couple of sheep-skins.

The skins are worked for half an hour in a solution of 25 grms. of picric acid per 8 litres of water, to open the pores, after which they are washed for five minutes and immersed for 20 minutes in a bath of: water, 7 litres;

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potassium bichromate, 240 grms.; alum, 220 grms.; common salt, 125 grms.; picric acid solution, ¾ litre. On removing the skins, 25 grms. of hydrochloric acid are added, and they are then returned to the bath, where they are thoroughly worked for ¾ hour. The next stage is to clean them well on the flesh side and enter in a bath of: cold water, 5 litres; sodium thiosulphate, 125 grms.; hydrochloric acid, 10 grms.; followed, after draining for a few minutes, by a bath of: hot water, 8 litres; sodium thiosulphate, 250 grms.; hydrochloric acid, 90 grms. Finally, they are washed in a weak lukewarm solution of ammonium chloride to clean them and facilitate dyeing; and, after scraping, to remove excess moisture and improve the lustre, are dyed and dried.—C. S.

Glue; Testing of ——. A. Heinemann. Chem. Zeit. 1900, **24**, 871.

The author wishing, primarily, to determine relative adhesiveness, and, secondarily, power of quick drying, tests samples of glue, by comparing them with a standard glue, under identical conditions. One per cent. solutions of each are first made. Well-glazed paper of medium strength is then cut into strips 4 × 3½ ins., and 2½ ins. of each strip is painted with the glue solutions; a dry piece of the paper of equal size is then placed, overlapping, on each, and the two are pressed together under a weight of 5 lb. for exactly one minute (or, if the air be humid, for 1½ or for 2 minutes). The strips are then clamped and tested to ascertain whether they can carry a weight. Usually, with solutions near the critical point of dilution, specimens will carry either a comparatively high (up to 30 lb.) load or practically none. By diluting, or strengthening the solution of the sample of glue under test, trial will soon indicate the relative dilutions of standard and sample necessary to give the same adhesion test. Different samples may give very different tests, in some cases 2 or even 5 per cent. solutions showing no adhesiveness, possibly owing to the presence of hygroscopic or slow-drying impurities. Generally, out of a given number of specimens of glue, that is the most adhesive which, *cæteris paribus*, gives evidence of this quality in the most dilute solution.—W. G. M.

XV.—MANURES, Etc.

Blast-Furnace Slag as a Fertiliser; Utilisation of —— A. D. Elbers. Eng. and Mining J. 1900, **70**, [18], 517.

The author discusses the question of the utilisation of highly calcareous blast furnace slag as a fertiliser, in place of ordinary lime, chalk, and marls. The author has previously pointed out (this Journal, 1894, 643) that although acid slags are unsuitable, basic slags, *i.e.*, slags "the silicate constitution of which is below the sesqui—or 1½ : 1 oxygen ratio," decompose readily in the soil, yielding silica and lime as plant food. It is essential, if blast furnace slag is to be used as a fertiliser, that it be in a suitable physical condition. Granulated slag and the slag meal made from it are entirely unsuitable, and slag that has become disintegrated by its own heat is preferable to that which has hardened on the dump, and has then been finely ground. Blast-furnace slag of ordinary composition and of subsilicate to singulo-silicate constitution becomes disintegrated into a more or less pulverulent mass, if, in order that it may cool very gradually, it is flushed into a ditch or pit in sufficiently large amount—say 20—30 tons. Such pulverulent slag does not clog the soil when mixed with it. The most suitable slags, both for this treatment and for utilisation as manure, are those high in lime, low in magnesia, nearly free from oxides of iron and manganese, and with an oxygen ratio of from 0·67 : 1 to about 1 : 1.

The author states that the following two tests will give an indication as to the suitability of a slag for application as manure:—(1) A sample of the fresh-tapped slag is "air chilled" and pulverised. If the slag meal is readily soluble in normal acid, then the slag, if disintegrated by slow cooling, will be sufficiently soluble for agricultural purposes. (2) A sample of the pulverised, "air-chilled" slag is roasted until free from sulphides, the free lime dissolved out of the residue, and ⅛—¼ oz. of the leached mass treated with "seltzer water" in a 4—8 oz. bottle. After standing 24 hours with occasional agitation, a small amount of oxalic acid is added, and if a precipitate is obtained indicating that the solution is "well saturated with carbonate of lime," then the slag, if disintegrated by slow cooling, will be suitable for use as a fertiliser.—A. S.

Filter-Press Cake [Sugar Cane] as a Fertiliser. West Indian Bull. **1**, [4], 395.

Twenty-five pounds of filter-press cake are obtained from each ton of sugar cane worked in the sugar house. If 1,000 lb. of such filter-press cake, containing about 7 lb. of nitrogen and 5 lb. of phosphoric acid, be carefully returned to the soil, it will restore an amount of nitrogen equivalent to that contained in 100 lb. of cotton-seed meal. It is stated that, according to the tariff of prices prevailing for commercial fertilisers, average filter-press cake is worth from 1·75 to 2 dols. per ton.—A. S.

XVI.—SUGAR, STARCH, GUM, Etc.

Beetroot Sugar Factories; Use of Superheated Steam in ——. H. Claassen. Zeits. Ver. Deutsch Zucker-Ind. 1900, **50**, [536], 807—813.

It is contended that any superheating of steam, even when only slight, lessens the coefficient of transmission of heat to a considerable extent. To prove this statement, the author has experimented with a model vacuum pan on the evaporation of water, and found that superheating to the extent of from 1° to 4·6° reduced the transmissibility of heat by 12 to 50 per cent.

When steam passes through a reducing valve to lower the pressure, it becomes superheated, and its duty as a heating agent in boiling juice is lessened. To remedy this it should be made to do work in drawing in exhaust and moist steam, since mere mixing with such steam does not remedy the defect. It is recommended to increase the number of boilers, instead of superheating, when the flue gases are found to be hotter than is necessary to produce a suitable draught in the chimney shaft.—L. J. de W.

Dark Beet Juice, caused by Homogentisinic Acid. M. Gonnermann. Pflüger's Arch. **82**, 289—302. Chem. Centr. 1900, **2**, [18], 984.

The dark colour of vegetable juices is due to the oxidation of the transformation products of tyrosin by enzymes. The enzymes first produce tyrosin from the albumin compounds. The tyrosin is also decomposed in absence of oxygen, but more slowly than in presence of the latter. In the decomposition of tyrosin by Bertrand's tyrosinase, which is apparently, however, not an enzyme, but a hydrolytic ferment, homogentisinic acid, hydroquinone acetic acid, is formed. This acid is formed, to a small extent, in the leaf stalks, "head," and root of the beet. The so-called tyrosinase fungus has been found by French authors in a number of fungi. The author has examined a large number of fungi as to the presence of a tyrosinase, but could only detect it in the extract of *Russula emetica*.—A. S.

Syrups; Determining the Density of ——, *with the Brix Saccharometer.* P. R. Pekelharing. Arch. f. Java-suikerind. 1900. Chem. Centr. 1900, **2**, [17], 924.

The usual procedure in the examination of syrups is to dilute a weighed quantity with a known amount of water, determine the density of the mixture, and calculate from this the density of the syrup. The results obtained thus do not, however, correspond exactly with those obtained by direct weighing in the pyknometer. The author recommends diluting the syrup to twice its volume, determining the density of the mixture with the Brix saccharometer, multiplying the result by two, and then making a correction for the temperature.—A. S.

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Sugar; Inversion of ——, by the Action of Salts. P. R. Pekelharing. Arch. f. Javasuikerind. 1900. Chem. Centr. 1900, **2**, [17], 924.

Sax has stated that in the crystallisation of sugar in motion, inorganic salts also crystallise out, and these salts afterwards exert an inverting action on the sugar. In sugar syrups, however, besides inorganic salts, various organic salts are present, and, according to Prinsen Geerlig (this Journal, 1898, 476), the latter prevent any inverting action by the former. The author examined the effect upon pure sugar of a mixture of salts like that which remains behind in the refuse of arrack manufacture, but could not observe any inversion of sugar, even at temperatures which do not obtain in practice.—A. S.

Trehalose; Compounds and Properties of ——. I. Schukow. Zeits. Ver. Deutsch. Zucker-Ind. 1900, **50**, [536], 818—823.

Manna Trehala was repeatedly extracted with alcohol and the trehalose crystallised out from water in hydrated form. It is obtained in colourless, transparent crystals which begin to melt at 94° C., and melt completely at 96°·5—97°·5 C.

The specific rotation of the hydrate is $\alpha_{D20} = 178°·3$, and of the anhydride 197°·1 as determined on a 7 per cent. solution.

By the Herzfeld inversion of a 2·5 per cent. solution, only traces of inversion were found, and it was incomplete even after 37 hours' heating at 65° to 71° C.

Even after long boiling with solutions of caustic soda, baryta, strontia, and lime, it showed neither browning nor a precipitate, and after heating with baryta to 170° C. for two hours, a considerable portion of the trehalose could still be crystallised out. By agitating with lime or strontia, and addition of alcohol, the compounds $2C_{12}H_{22}O_{11}$, $3CaO$, and the corresponding strontia saccharate, were obtained. By oxidation with nitric of sp. gr. 1·15, saccharic acid was formed. Bromine did not produce oxidation.

Benzoyl esters were obtained by Baumann's method, consisting chiefly of tribenzoyl trehalose but containing some tetrabenzoyl trehalose. These are readily saponified by alcoholic potash at 100° C. By Banormoff's modification of Baumann's method, hepta- and octo-benzoyl trehalose were formed. These are saponified with some difficulty. Attempts to detect the presence of trehalose in the residues from Dessau molasses gave negative results.—L. J. de W.

Molasses Residues from Dessau; Optically Active Substances in ——. I. Schukow. Zeits. Ver. Deutsch. Zucker-Ind. 1900, **50**, [536], 814—817.

The residue from the desaccharification of molasses by the strontium process in the works at Dessau is concentrated, and then forms a thick, viscous, dark-brown liquid, similar to molasses, of which it contains almost all the non-sugar constituents. Its specific gravity was 1·3983; polarisation, + 4·0; inversion polarisation (at 20° C.), + 8·2; water, 21·67 per cent.; ash, 28·80; organic non-sugar, 49·53; alkalinity, 0·65 as CaO, and it gave very little reaction with Fehling solution after inversion.

It is probable that the dextro-rotatory polarisation is not due to saccharose, but to other optically active substances. On treatment with strontium hydrate and 95 per cent. alcohol, and concentrating, a syrup was obtained which showed practically no invert sugar, but gave readings of zero on direct reading and + 1·1 on inversion of half normal weight. The precipitate, dissolved in water and freed from strontium by CO_2, and clarified by basic acetate of lead and the lead removed as sulphide, gave, on concentration, a syrup which did not appear to contain raffinose by the mucic acid test, but in which glutamic acid was found. The syrup appears, however, to contain other active substances besides saccharose and glutamic acid, but was not further examined.—L. J. de W.

Carbohydrates of Caragheen Moss. J. Sebor. Oesterr. Chem. Zeit. **3**, 441. Chem. Centr. 1900, **2**, [16], 846.

The algæ (*Chondrus crispus*) used for the preparation of the mucilage, yielded on oxidation 23·4 per cent. of mucic acid, corresponding to 29·6 per cent. of galactose; and on distillation with 10 per cent. HCl, 1·2 per cent. of furfural, corresponding to about 2·5 per cent. of pentoses. If the moss be heated with water for one hour on the water-bath, and the gelatinous mass pressed, then, on treatment with alcohol, the mucilage is precipitated as an amorphous, yellowish-brown powder, which forms a gelatinous mass with water and is coloured brown by iodine. It yielded, calculated to the dry substance, other than ash, about 41·9 per cent. of galactose (= 37·8 per cent. of galactan) and 4·1 per cent. of pentoses (= 3·6 per cent. of pentosans). In the mixture of sugars formed on the hydrolysis of the moss by 0·5 per cent. H_2SO_4, galactose, *d*-glucose, and fructose were detected; neither arabinose nor xylose could be isolated. The mucilage of Caragheen moss thus appears to be a complex carbohydrate formed from galactose, glucose, and fructose, and only contaminated by a small quantity of a pentosan, probably xylan. The sugars named, however, are not present in the same proportion as in raffinose.—A. S.

Starch Manufacture, Method of ——. Duryta. Rev. Prod. Chim. **3**, [15], 229.

To obtain a superior laundry starch, the author effects the separation of the coarser granules from the finer particles by sedimentation, the crude starch being mixed with water, so as to measure about 8° B., and left to settle for about 24 hours for the coarse granules to subside. The clear supernatant water is removed, and that containing the finer starch granules is decanted, or pumped out by a single stroke of the pumps, into another settling tank, where it is deposited, and afterwards dried in the usual manner.—C. S.

Soluble Starch, Dextrins, &c.; Preparation of ——. — Higgins. Rev. Prod. Chim. **3**, [16], 244.

A solution is prepared of 30 grms. of sulphuric acid and 85 grms. of boric acid in 4½ litres of water, and heated to 65°—70° C.; 2—3 kilos. of crude corn starch are then stirred in, and the mixture is heated to the gelatinising temperature of the starch until the latter passes into the soluble form. When this point is reached, the temperature is raised to liquefy the mass, which is then neutralised by adding 45 grms. of caustic soda solution of 40° B., and cooled, whereupon a very pure, white, soft, and unctuous paste is obtained.—C. S.

Sugars in Presence of Dextrin; Determination of ——. A. Bianchi.

See under XXIII., *page* 1152.

Filter-Press Cake [Sugar-Cane] as a Fertiliser. West Indian Bulletin, **1**, [4], 395.

See under XV., *page* 1125.

Sugar Analysis; Protocol of the Third Meeting in Paris of the Internat. Commission for Uniform Methods of ——.

See under XXIII., *page* 1151.

Cane Sugar; Inversion of ——, in various Pharmaceutical Preparations. A. H. Woltersdorf and W. O. Richtmann.

See under XX., *page* 1139.

Lactose; Determination of ——. R. Broquet and C. Dethier.

See under XXIII., *page* 1152.

Hydration; Reactions of ——. P. Rohland.

See under IX., *page* 1114.

Potatoes; Determination of Starch in ——. G. Baumert and H. Bode.

See under XXIII., *page* 1152.

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XVII.—BREWING, WINES, SPIRITS, Etc.

Arsenic in Beer. Chem. and Druggist, **57**, [1091], 980.

THE commission of experts, consisting of Sir Lauder Brunton, Dr. Thomas Stevenson, Dr. A. P. Luff, Mr. A. Gordon Salamon, Mr. Samuel Buckley, and Mr. J. Fletcher Moulton, Q.C., M.P., appointed by the Manchester Brewers' Central Association, have presented a report to the Association. The commission have thought it necessary to investigate, and determine what is the most suitable method of testing beers for arsenic, and recommend the Reinsch test in preference to all others at present known, because their investigations have satisfied them that it is the best and most reliable test for arsenic in beer. The mode of performing it is as follows:—

Take 200 c.c. of the beer in a porcelain evaporating dish. Raise the liquid to the boiling point, and then add 30 c.c. of pure concentrated hydrochloric acid. Insert a piece of pure bright copper foil, about $\frac{1}{4}$ in. by $\frac{1}{2}$ in. in size, and keep the solution gently boiling for forty-five minutes. If at the end of that time the copper remains bright and red, the beer is free from arsenic.

If a deposit is obtained on the copper, the foil is to be washed successively with water, alcohol, and ether (care being taken that these are pure), dried at a temperature not exceeding 100° C., and subjected to slow sublimation in a thin reduction tube of small section, and not less than 2 ins. long, the upper portion of which should be warmed before the sublimation begins. For the purpose of the sublimation a small spirit-lamp flame should be used. If any sublimate is obtained, it must be examined under a magnifying power of about 200 diameters. Any sublimate which does not show well-defined octahedral or tetrahedral crystals is not to be considered arsenical.

N.B.—It must be borne in mind that the blackening of the copper or a deposit thereon from the preliminary operation does not demonstrate the presence of arsenic in beer. Abundant blackening and deposit may be obtained from the purest beer.

Inactive Sorbose. J. H. Adriani. Rec. trav. chim. Pays-Bas, **19**, 183—185. Chem. Centr. 1900, **2**, [16], 846.

SATURATED solutions in 85 per cent. alcohol at 12·8° C. contain 0·1713 grm. of *d*-sorbose and 0·1223 grm. of *i*-sorbose. From consideration of the solubility curves of the two compounds, and of the optical behaviour of saturated solutions of mixtures of the two isomerides, the author concludes that *i*-sorbose is a true racemic compound, and not a mixture of *l*- and *d*-sorbose.—A. S.

Raffinose; Hydrolysis of ——, *by Mould Fungi* [*Penicillium glaucum*]. H. Gillot. Bull. Assoc. Belge des Chim. **14**, [5], 202—220.

THE results of the author's researches may be summarised as follows:—

In a mineral-acid medium, *Penicillium glaucum* secretes a zymase capable of inverting raffinose; and the neutralisation of the medium does not affect this secretion, though decreasing the rapidity of germination of the spores.

The action of the zymase results in an increased acidity of the medium, owing to the formation of oxalic and succinic acids. The intensity of the inversion, whether produced by the fungus or by the extracted enzyme, decreases as time goes on, probably owing to the retardive effect of the reaction products. Inversion still goes on in solutions containing as little as 2 per cent. of raffinose, though the general appearance of the culture is modified considerably.

In alkaline media the development and activity of the fungus are retarded at first, soda being less active in this respect than potash or ammonia, but the alkalinity is gradually overcome by the formation of the above-named acids.—C. S.

Yeast; Expressed Cell Plasma of —— [*Buchner's "Zymase"*]. *I.* A. Macfadyen, G. H. Morris, and S. Rowland. Ber. 1900, **33**, [14], 2764—2790.

THE authors give the following summary of their work:—

The top-fermentation yeast of the English breweries yields, on suitable treatment, an expressed extract which possesses the transient property of splitting up sugar into alcohol and carbon dioxide. The quantity of gas evolved by an active extract is equal to, or greater than, that obtained by Buchner. The extracts prepared by the authors were subject to very considerable auto-fermentation, the yield of gas from which exceeded, in some cases, that obtained by mixing the same samples with cane-sugar solution. A moderate dilution (1:2) with water, or with a 0·75 per cent. solution of sodium chloride, practically destroys all the fermentative properties of the extracts. Only in the case of a very active extract is the ratio of alcohol to carbon dioxide comparable with that of ordinary alcoholic fermentation. When the expressed extract is allowed to act upon sugar—cane sugar or glucose—the quantity of sugar destroyed is considerably greater than is required for the production of the alcohol and carbon dioxide obtained. The authors express their opinion that their results point to the conclusion that fermentation by means of expressed yeast extract is a phenomenon of the vital activity of the yeast protoplasm, and not the work of an enzyme.

The authors have introduced certain important modifications in Buchner's method for obtaining the extract. The yeast is washed before grinding by the aid of a centrifugal, and a machine has been devised for breaking up the cells with sand without manual labour. The length of time allowed to elapse between collecting the yeast and grinding it with sand has a considerable effect on the yield and the activity of the extract obtained; the activity appears to reach a maximum on the third or fourth day. The fermentative power rapidly decreases on keeping the extract, owing to the energetic action of the proteolytic enzyme. Lower concentrations (10 per cent.) of sugar solutions yield more favourable results than stronger ones; cane sugar is somewhat better than other sugars.—J. F. B.

Yeast; Variation during Cultivation of a Bottom-Fermentation ——. W. Henneberg. Woch. für Brau. 1900, **17**, [43], 633—634.

THE author gives an account of a curious experience with what was originally a normal, high-attenuating, bottom-fermentation yeast. This yeast was sent out to breweries and behaved quite normally at first; after eight months, however, complaints were received that a top-fermentation yeast had been supplied; four months later these complaints increased, and after another two months it was definitely established that the yeast had quite changed its character. The foam on the top of the fermenting wort was full of bubbles, and slimy, and contained the whole of the yeast; the sediments also resembled those of top-fermentation types. The beers obtained were perfectly normal. The cause of this variation is unknown, and the top-fermentation character has persevered for 16 months. The author has tried all known means to obtain a reversion to the original type, but without avail. The behaviour towards raffinose, the spore formation on gypsum blocks, and the manner of growth in a droplet culture (Lindner) remained the same as with a normal bottom-fermentation yeast. No such permanent change from the bottom-fermentation habit to the top has been recorded hitherto, although the reverse has been observed.—J. F. B.

Hops; Alkaloid of ——. Hantke. Letters on Brewing, July 1900; through Woch. für Brau. 1900, **17**, [44], 650.

AS the existence of an alkaloid in hop seeds was still doubtful, the author undertook a re-investigation of this question. Working with Oregon hops he obtained a yield of 15·1 per cent. of seeds, which had the following composition:—

Moisture	5·59
Carbohydrates	11·81
Ethereal extract	28·18
Nitrogen = 4·53 per cent., calculated as Albumin	28·35
Cellulose	18·22
Ash	12·94
	105·00

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The whole of the nitrogen, therefore, should not be calculated as albumin, and the ethereal extract probably contained other substances besides resins, oils, and wax. The finely ground seeds were repeatedly extracted with very faintly acid 90 per cent. alcohol, the extract was evaporated at a low temperature, the residue taken up with water, filtered, neutralised, and extracted with chloroform. After a long process of purification, crystals of a volatile alkaloid were obtained. This alkaloid is very deliquescent; it crystallises in needles or prisms soluble in water and alcohol. The melting point was not constant, but was about 90°—92° C. The solutions have an odour of tobacco. With concentrated nitric acid the alkaloid gives a faint blue coloration in the cold, no coloration on warming; with bromine water it yields a blue colour, and with concentrated nitric acid and tin chloride it yields a blue coloration. It gives precipitates with concentrated sulphuric acid and sodium phosphotungstate, with sulphuric acid and bichromate, with tannic acid, iodine and potassium iodide, platinum chloride, picric acid, and mercuric chloride, but no reaction with Fehling's solution. The yield of alkaloid was only one-thirty-fourth of a per cent. on the seeds, and it appears to be confined only to the seeds of the hops.—J. F. B.

Fission Fungi [*Schizomycetes*]; *Fermentation by* ——. O. Emmerling. Ber. 1900, **33**, [14], 2477—2479.

In a former paper (see this Journal, 1899, 934) the author described the fermentation of malic acid by *B. lactis aërogenes*, with the production of succinic, acetic, and carbonic acids.

This organism has been regarded by Baginsky as the cause of spontaneous lactic acid fermentation in milk sugar; it produces very little lactic acid, the main product being acetic acid, together with carbonic acid, hydrogen, and marsh gas. The author confirms this observation as regards acetic acid, but could detect no lactic acid; on the other hand, he found considerable quantities of succinic acid, which Baginsky appears to have missed. In the case of milk sugar, the source of the nitrogenous nutrition had no influence on the fermentation. Among the products of the fermentation of glucose by this bacterium, no succinic acid could be detected (or, at most, only traces), but, together with much acetic acid, some lactic acid of the inactive modification was produced. The presence or absence of air had no influence on the fermentation either of milk sugar or of glucose. Mannite yielded little volatile acid, but much succinic acid; in this case, in contrast to the sugars, a fair amount of alcohol was also formed. None of these fermentations are complete; they die down whilst still a large quantity of the substance is unfermented. In the case of milk sugar in presence of chalk, the liquid becomes viscous, owing to the formation of a gum; this only occurs with free access of air. Some of this gum was isolated; it turned out to be a galactan, $C_6H_{10}O_5$; it reduces Fehling's solution only after boiling with acid. It is also obtained in the fermentation of galactose, but not of glucose; a very small quantity is capable of rendering a large volume of liquid ropy. In certain cases it may possibly be formed in milk.

—J. F. B.

Amylomyces (*so-called*); *Comparative Investigations on certain Species of* ——. A. Sitnikoff and W. Rommel. Woch. für Brau. 1900, **17**, [42], 621—625.

The authors have studied five samples of so-called Amylomyces or Mucors: the *Amylomyces Rouxii* originally described by Calmette, the *Mucor* now employed in the Belgian distilleries, commonly termed "Koji," and three samples from the Seclin laboratories, *Mucors* α, β, and γ, of which *Mucor* β was of Japanese origin, and γ obtained from Tonkin rice. The results brought out the complete identity of *Mucor* α with *A. Rouxii*, and of *Mucor* β with the Belgian "Koji" (see this Journal, 1899, 157 and 699; 1900, 839). Variation of the composition of the liquid media had most effect on the α species; the media containing glucose showed no external mycelium, whilst those containing only peptone or asparagin, but no glucose, showed a slight growth of air-mycelium with sporangia. With the β and γ species, which ordinarily produce an air-mycelium, the effect of glucose was to suppress this external growth to some extent. Air-mycelia are only formed by the α species in rare cases, and are of a white colour, whilst the β and γ species always produce them of a black or grey colour. In the manner of growth in different media, the species β and γ are very slightly differentiated; there are only small differences in height and colour of the external mycelia. The authors studied these two species morphologically; details and illustrations are given in the paper. Gemmae and sporangia are formed by both species in exactly identical manner; zygospores are never formed. The dry spores of the β species are slightly larger than those of the γ species. Small differences in the width of the mycelia threads can be magnified by the addition of cane sugar, since the β species ferments this sugar and the γ does not.

The authors conclude that the only morphological differences between the two species are differences of dimensions, and these are so slight as to be scarcely distinguishable in the ordinary course of microscopic analysis.

The following table shows the behaviour of the three species (by Lindner's method) towards the various sugars and carbohydrates:—

Sugar.	α-Amylomyces (*A. Rouxii*).	β-Amylomyces (Belgian "Koji").	γ-Amylomyces.
1. Cane sugar	−	+ + +	−
2. Glucose	+ + +	+ + +	+ + +
3. Maltose	+ + +	+ +	+ +
4. Galactose	+ + +	+ + +	+ + +
5. Fructose	+ + +	+ +	+ +
6. Milk sugar	−	−	−
7. Raffinose	−	+ +	−
8. *d*-Mannose	+ + +	+ + +	+ + +
9. Xylose	−	−	−
10. β-Methylglucoside	−	−	−
11. *d*-Glucoheptose	−	−	−
12. Arabinose	−	−	−
13. Rhamnose	−	−	−
14. Trehalose	+ + +	−	+ + +
15. Sorbose and *d*-Galactose.	−	−	−
16. ψ-Tagatose	−	−	−
17. ψ-Tagatose and Tagatose.	−	−	−
18. α-Methylglucoside	+	−	−
19. Melibiose	−	+ +	−
20. Dextrin	+ + +	+ +	+ + +
21. Inulin	−	+ + +	−
22. Soluble starch	−	−	−
23. Beer wort	+ + +	+ + +	+ + +

+ + + indicates large bubbles of gas, + + smaller, and + very few bubbles.

With a partially saccharified starch paste, species α produced about 50 per cent. saccharification and 3·4 per cent. of alcohol, whilst β and γ gave complete saccharification but only 1·5 per cent. of alcohol.—J. F. B.

Beer; Bad Influence of Evil Odours on ——, *especially from Moulds and Putrefactive Bacteria.* P. Lindner. Woch. für Brau. 1900, **17**, [41], 605—607.

Wort and beer may readily absorb any odours to which they may be exposed. Foremost among these may be mentioned smoke; the wort lying in the cooling vats may come in contact with smoke from the fires; smoke and other odours may also be absorbed by the malt. If any nitrogenous matter or malt sweepings and straw be burnt, the odour evolved is most offensive, and may readily penetrate to the malt, wort, or beer. But a smoky flavour in beer is not always due to smoke; many races of yeast, especially low-attenuating varieties which separate in clots, are capable of producing this flavour. Other causes of bad odours and flavours are moulds; for instance, the species of *Mycoderma* described by Will and Jörgensen's *Oidium pullulans*. Moulds in the fermenting rooms, on the walls or in corners, where beer has been spilt or splashed, may evolve odours sufficient to spoil the beer. Mould fungi may get into the Lager casks through the bung-hole; films of mould have often been observed on the surface of the beer in these casks. If the Lager casks be left for some time empty without cleaning, the develop-

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ment of moulds will be excessive. A mould growth in absence of air will very readily give place to putrefactive fermentation. Yeast vessels often evolve sulphuretted hydrogen or ammonium sulphide, which may taint the beer. Excess of moisture in fermenting rooms and cellars must be avoided, and the deposition of dew, owing to excessive ventilation of cooled cellars, will also encourage a growth of mould. A very small proportion of certain organisms will often be sufficient to scent the whole room; for instance, a small culture of *Cladothrix odorifera* will make the neighbourhood smell of fresh earth, and one of *Sachsia suaveoens* will fill a room with a wine bouquet. Fresh masonry evolves a characteristic odour, doubtless due to micro-organisms. Wood is very susceptible to mouldiness, and unseasoned wood contains a certain amount of putrescible extractive matter, apart from any organic matter it may have absorbed; the flavour of mouldy or rotten wood is very common. The bad effect of tainted air is apparently due to an absorption and concentration of the odours by the substances which remain in contact with it; filtering media and shavings are exceptionally absorbent in this respect. In all breweries great care must be exercised to obtain perfectly pure air, and special attention must be paid to the method of disposal of waste waters and the state of the drain-holes. Exhausted grains should not be allowed to lie about near the brewery, as they rapidly become putrid.—J. F. B.

Mucedinæ in the Distillery; The Collette-Boidin Process. Engineering, 1900, Oct. 26, 523—526.

A DESCRIPTION is given of the process and plant in use at the Seclin Distillery, as dealt with in this Journal, 1899, 157 and 699. In the latter reference it was stated that the original *Amylomyces Rouxii* have been replaced by a more energetic ferment, Mucor β, capable of saccharifying worts of 25 kilos. of grain per hectolitre. A culture containing about 1 grm. of mucor is sufficient for 25 tons of grain, thus replacing 3,000 kilos. of malt and avoiding a loss of about 300 kilos. of starch in the malting process (equivalent to 2 hectolitres of pure alcohol) per charge.

The residues contain no starch and acidify very slowly; consequently they have a considerable value as a fodder for cattle. Feeding experiments have been carried out at Temesvar, in Hungary. At Seclin the vinasse is filtered by a filter-press, an operation which is readily effected, owing to the absence of gummy matter, and the cakes are dried to 4 or 5 per cent. of moisture. The liquid is concentrated in a multiple evaporator to a density of 25° Bé.; the dried cakes are worked up with a little syrup and moulded into fodder-cake.

Mucor β secretes about 30 per cent. of its weight of oil, and, since the yield of mucor per vat amounts to 600—700 kilos., about 100 kilos. of oil are obtained by extracting the cakes, having a value estimated at 75 francs.

Plant is now being erected at Seclin for the extraction of glycerin from the liquid residues.—J. F. B.

Secondary Fermentation [*Distillery*]; *Temperature of* ——. F. Just. Zeits. Spiritusind. 1900, **23**, [45], 410.

THE author set up two vats under the same conditions; after primary fermentation at 29·5° C., one of them was allowed to warm up to 31° C. for the secondary fermentation, this being the usual course followed in this distillery. This vat showed a final real attenuation at 0·7° Balling, with an acidity of 0·8°, the acidity of the fresh mash being 0·5°. The other vat was kept at 29° C. during secondary fermentation, as is customary in general practice. The final density in this case was 1° Balling, with an acidity of 0·9°. Hence the higher temperature gives a slightly better attenuation.

It was found that more amyl alcohol was produced at 31° C., and, although this temperature must never be allowed in the primary fermentation, it appears to favour the yeast after its main work has been accomplished.

—J. F. B.

Caramels. J. W. Lovibond. J. Fed. Inst. of Brewing, 1900, **6**, 306—324.

A CARAMEL colour may be qualitatively described by the use of the terms orange-yellow and black, and quantitatively when these terms are associated with their unit value. The term "black" is used only in a relative sense; it indicates the degree of lessened luminosity caused by the absorption of white light, and it may be a property of the caramel itself, or it may arise from loss of light caused by the "scattering" effect of solid matter in suspension. Turbid caramels should therefore be first filtered. The orange factor governs the colour depth when no black is present; when recording colour depth, the unit value of the orange factor is sufficient for general purposes. The yellow factor influences character of colour without much affecting colour depth.

Experiments were made to find the temperature which gave the highest tinctorial results for each material by heating a number of 1 grm. portions in an air-bath; samples were taken from time to time at increasing temperatures, and then measured for colour in a Lovibond's tintometer.

Separate experiments were next made with each material, beginning at that temperature which brought about the first sign of colorisation, and carried on to the point of total carbonisation. A considerable number of sugars of different origin were examined in the manner described, and the point is brought out that lower temperatures are required for the caramelisation of invert sugars, as compared with cane sugars, the range of the former being 160°—190° C., and 190°—207° C. for the latter. The results of the colour analysis of some commercial caramels and black malts are given, and their stability generally towards light.

—J. L. B.

Platinum and other Metals; "Ferment-like" [Catalytic] Properties of ——. Bredig.

See under XXIV., *page* 1155.

Sulphuric Acid; Joint Determination in the same Liquid [Vinegar or Wines] of Free and Combined ——. A. van Engelen.

See under XXIII., *page* 1149.

PATENTS.

Waste Liquors [Beer]; Method and Means of Reclaiming ——. J. Bardsley, Oldham. Eng. Pat. 20,413, Oct. 12, 1899.

THIS invention relates to beer engines, and consists of a small supplementary pump, attached to and operated by the piston of the main pump, for raising out of a receiver the waste or spilt liquor, and discharging it into the jug or other vessel together with the fresh liquor.—L. A.

Pasteurising Liquids; Apparatus for ——. A. F. Gasquet. Eng. Pat. 12,694.

See under I., *page* 1093.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(*A.*)—FOODS.

PATENTS.

Nitrogenous Food; Manufacture of a ——. W. P. Thompson, London. From W. Lehrke, Brunswick, Germany. Eng. Pat. 21,149, Oct. 23, 1899.

THE claims of this patent are for a food prepared by treating cheese curd with ammonium carbonate. The curd is thus made soluble, and may be mixed with other food materials to increase their nitrogenous value.—W. P. S.

Food from Yeast; Manufacture of a ——. J. T. Knowles, London. From G. Eichelbaum, Berlin. Eng. Pat. 25,760, Dec. 30, 1899.

ORDINARY washed and pressed brewery yeast, which has previously been killed by heating, is sown with the spores of a culture of *Aspergillus Oryzæ*, *Wentii*, or other allied fungus, and mixed. The mass is then kept at a temperature of about 32° C. to 38° C. for 10 days, with occasional stirring. Grape sugar and phosphates may be added for promoting the growth of the fungus. After 10 days,

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sodium chloride is added, in amount about equal to 5 per cent. of the weight of the yeast employed, and the mass is allowed to stand for another two days. It is then extracted with hot water, filtered, pressed, and evaporated to the consistency of a syrup. The product obtained amounts to about 20 per cent. of the yeast originally taken, and closely resembles ordinary meat extract.—W. P. S.

Bread-making; Process of ——. R. Haddan, London. From L. E. Jacotin and P. A. Guilloux, Paris. Eng. Pat. 10,518, June 8, 1900.

THE process claimed consists in making bread of flour, leaven, and bran, with the addition of fermentable substances, such as fermented bran, the pepsin ferments of pine-apple, &c., and diastases. The use of yeast may be dispensed with.—W. P. S.

Yeast for Fermenting Starchy Materials; Process for Cultivating ——. E. Bauer, Raab, Hungary. Eng. Pat. 11,760, June 28, 1900.

A MAIZE, rice, or potato mash is acidified with 0·1 per cent. of sulphuric acid, or an acid other than lactic acid. A quantity of beer yeast extract is added, and the mixture is sterilised by heating to 60° R., preferably in closed vessels. After cooling to the temperature of fermentation, the mixture is inoculated with mother yeast, or fresh pure yeast, as usual. The beer yeast extract above mentioned is added as a nutrient material, and is prepared by mixing unwashed pressed beer yeast with one-tenth of its quantity of liquefied yeast which has already undergone the acidifying process, and allowing the mixture to stand for 6 to 12 days at a temperature of 30° C. to 45° C. The coagulable albumins are thus rendered soluble. From 1 to 1½ litres of this extract, of sp. gr. 1·08, are used for every 100 litres of mash.—W. P. S.

Dough for Bread; Process and Appliance for Fermenting ——. A. A. Scola, Bensheim a. d. Bergstrasse, Germany. Eng. Pat. 16,615, Sept. 18, 1900.

THE dough to be fermented is placed in a closed chamber underneath the furnace of the baking oven. This closed chamber is provided with shelves for the reception of the dough. To prevent loss of moisture in the dough, vessels of water are placed in the chamber. The oven fire heats both the oven and the fermenting chamber.—W. P. S.

Meats; Preservation of ——. F. W. Bright, Kansas City, Missouri, U.S.A. Eng. Pat. 13,314, July 14, 1900.

THE claims relate to a continuous process for preserving and handling meats in metal packages. It consists in first hermetically sealing the packages in a vacuum, then heating in a liquid which does not volatilise at a temperature of 240° F. (tallow is suitable). The packages are now washed in a hot solution of sodium carbonate, passed through hot water, cooled in cold water, and further cooled in a stream or spray of cold water. All these operations are carried out automatically by special machinery.—W. P. S.

Frozen or Chilled Meat of all Kinds, whilst being Thawed; Means for Treating ——. H. H. Lake, London. From A. H. Chapman, Kurow, Oarmaru, New Zealand. Eng. Pat. 15,321, Aug. 28, 1900.

FOR the purpose of preventing frozen meat becoming wet during the process of thawing, the inventor encloses it in water-proof and air-proof bags or wrappers.—W. P. S.

Condensed Milk; Estimation of Fat in Sweetened ——. J. F. Geisler.

See under XXIII., *page* 1151.

Fat in Finely powdered Substances, specially in Cocoa and its Preparations; Determination of ——. P. Welmans.

See under XXIII., *page* 1151.

Antipeptone. M. Siegfried.

See under XX., *page* 1141.

Pasteurising Liquids; Apparatus for ——. A. F. Gasquet. Eng. Pat. 12,694.

See under I., *page* 1092.

Tin and Tinplate Articles; Analysis of ——. V. Mainsbrecq.

See under XXIII., *page* 1149.

(*B.*)—SANITATION; WATER PURIFICATION.

Moorland Waters (Solvent Action on Lead); A Limiting Standard of Acidity for ——. Wm. Ackroyd, Brit. Assoc. (Sect. B.), Bradford, 1900. (See this Journal, 1899, 164.)

IT has only during the present decade been clearly understood that the plumbo-solvent action of moorland waters is to be associated with acidity. An idea of the relationship is afforded by the following determinations :—

	Acidity in Equivalent of Sulphuric Acid.	Lead Dissolved from ½-inch Piping.
	Parts per 100,000.	
1	0·29	In 1 hour, 0·03
2	0·30	„ 1 „ 0·057
3	0·29	„ 1 „ 0·025
4	1·34	„ ¼ „ 0·71
5	1·59	„ ¼ „ 0·95

The author, after some years of experience, has never learnt of the occurrence of any case of plumbism where the acidity of the water has been below the equivalent of 0·5 part of sulphuric acid per 100,000 of water, and this he tentatively proposes as a limiting standard of acidity for potable waters of moorland origin when the acidity is determined by the method described in this Journal, 1899, 164. The average acidity of nine samples of water not above suspicion in this respect was 0·63, ranging from 0·53 to 0·91; whilst sixty-one samples above reproach, from neighbourhoods where plumbism has not been known, had an average acidity of 0·27, the extremes being 0·20 and 0·41.—L. A.

Chlorine in the Waters of West Yorkshire; the Distribution of ——. Wm. Ackroyd. Brit. Assoc. (Sect. B.), Bradford, 1900.

THE present observations are the preliminaries to an attempt to construct isochlors for this part of Yorkshire, as has been done in the United States for Massachusetts and Connecticut. The British normal figures are very high in comparison with the American, as might be expected, owing to the greater proximity of the sea, and the greater density of population in, and antiquity of, the inhabited areas. The unit isochlor is coextensive with the highest hills, and their becks, deans, and gills. The following determinations with waters from the upper reaches of the Wharf, Wenning, Ribble, Aire, and Calder, will be sufficiently illustrative :—

	Chlorine. Parts per 100,000.
Barden	1·0
Grimwith Beck	1·2
Gate-up-Gill	0·7
Bleabeck	1·0
Buckden Pike	1·0
Starbottom	0·8
Kettlewell	1·0
Buckden Village	1·2
Gaping Ghyll	1·2
Beck Head, Clapdale	1·3
Ingleborough Cave	1·2
Lower Bentham	1·4
Malham Tarn Outlet	1·0
Malham Cove	0·95
Airehead	1·0
Old Smelt Mill	1·1
Gordale Beck	1·2
Hanlith Beck	1·1
Hardcastle Craggs	1·1
Walshaw Dean	1·1

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As the sea is approached, and more populous districts are reached, the chlorine rises, and remarkable examples of rise may be met with on the same hill slope. Halifax furnishes a striking instance. The town rests on a sloping bed of millstone grit, the ancient and most thickly populated part being towards the bottom of the incline. The ground waters of the highest parts (Mount Tabor) vary from 1·6 to 2·6; widely separated wells about halfway down yield the figure 3·8; while, towards the bottom of the slope, two wells give the figures 4·7 and 5·5. The public water supply from Pennine gathering grounds, 10 miles away, stands at 1·3.—L. A.

PATENTS.

Water and other Liquids; Purification of ——. H. H. Lake, London. From The Jewell Export Filter Co., New York, U.S.A. Eng. Pat. 12,861, July 17, 1900.

In order to coagulate the suspended substances and impurities in water, sewage, and other liquids, so as to assist in their removal by settling or filtration, ferrous bisulphite solution is added to the water, either alone or together with a suitable precipitant. The iron solution is prepared continuously by generating SO_2, passing the gas into water, and causing the solution to pass over iron scrap. The solution may be used as prepared, or oxidised before use, and precipitation of the iron may be effected either before or after the solution has been added to the water to be purified.

—L. A.

Purifying Water; Apparatus for Use in the Production of Reagents for ——, *and for* ——. H. H. Lake, London. From The Jewell Export Filter Co., of New York, U.S.A. Eng. Pat. 12,863, July 17, 1900.

Sulphur is burnt in a furnace of special design, and the sulphur dioxide is forced by means of a steam-jet into a chamber filled with scrap iron, down which water is sprayed from a perforated pipe. The solution of ferrous bisulphite flows through a tank containing more scrap iron into a store tank, from which it passes through a valve into the water to be purified.

In another form of apparatus water is caused to cascade down a tall chamber, into which the SO_2 is injected, and the solution of sulphurous acid is led into a revolving barrel containing scrap iron. The ferrous bisulphite solution formed flows into a closed tank, where it is oxidised to ferric sulphate by blowing air through. The ferric sulphate solution is then added to the water to be purified.—L. A.

(*C.*)—DISINFECTANTS.

Paris Green; Determination of Free Arsenic in ——. E. W. Hilgard.

See under XXIII., *page* 1150.

PATENT.

Anti-Fouling or Protective Compositions for Ships. M. Ragg, Vienna. Eng. Pat. 10,328, June 5, 1900.

The essential feature in this invention consists in the employment as active ingredient of anti-fouling paint of cuprous oxide combined with cyanogen, ferrocyanogen, or thiocyanogen. In this manner both the basic and the acid radicles of the protective substance are toxic to marine growths; and the compounds are not too soluble in sea water. The proportion of the copper salt will vary according to the water in which the ship floats; for the Mediterranean about 10 per cent. is sufficient. Other poisonous bodies may also be added if desired.—F. H. L.

XIX.—PAPER, PASTEBOARD, Etc.

Paper-Rag; Electrical Bleaching of ——. Papier Zeit. 1900, **25**, [86], 3221.

The "S" electrolysing plant, designed by Paul Schoop, Zürich, consists of a series of steps, each furnished with a pair of platinum electrodes bedded in a layer of paraffin. Over these a dilute solution of common salt flows in a thin stream, with the result that at every step it becomes richer in active chlorine; the liquor only requiring to be cooled from time to time. The initial cost of a plant that will daily convert 300 kilos. of rock salt into the equivalent of 200 kilos. of chloride of lime, with the expenditure of 15 h.p., is 2,000*l.*, the necessary dynamo, refrigerator, and electrical fittings amounting to another 1,000*l.* It is claimed that the wear on the platinum is practically *nil*, and that a weaker salt solution can be utilised by this than by any other apparatus.—R. L. J.

Surfaced Paper; "Size" Spots on ——. J. Fels. Papier Zeit. 1900, **25**, 3178.

It frequently happens that surfaced or loaded papers exhibit spots or "eyes," which appear darker than the rest of the material, as the layer of pigment is so thin that the natural colour of the paper shows through. This defect is generally attributed to grease in the size; but the explanation is certainly incorrect. By extraction with petroleum spirit, size gives amounts of fat ranging between 0·04 and 0·35 per cent.; by Fahrion's process the total fat is shown to be 0·4 to 0·8 per cent., the bulk of it being in the form of hydroxy-fatty acids. Even bone-glue, made from bones which have been previously treated with light petroleum, always contains grease, for the bones still retain from 0·3 to 0·5 per cent. of fat. These quantities cannot account for the spots, for if, for example, 180 parts of barium sulphate be made into a paste with 16 parts of a size containing 0·2 per cent. of fat, the dry coating will only contain 0·02 per cent. thereof. The true cause of the phenomenon is still unknown. The spots may appear if the layer of colouring matter is dried unevenly. whilst temperature and the consistency of the paste also have something to do with the trouble.

—F. H. L.

PATENT.

Paper Pulp; Apparatus for Straining ——. J. Wilson, London. Eng, Pat. 21,163, Oct. 23, 1899.

The invention relates to an apparatus containing, in combination with one or more strainer plates, means for supplying pulp to the plates and a sluice at each end of the plates. The sluice at the inlet end is usually open, and that at the outlet end is usually closed. Means are provided for periodically opening and closing the sluices, so that one is open when the other is closed. The pulp comes to the strainer plates by way of a tank, provided with sluices for supplying the plates when required. When the supply is cut off from one of the plates, the liquid drains off, leaving the dirt and coarse fibre on the plate; this is washed off by the rush of liquid, when the inlet sluice is again opened.

—J. F. B.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

New Remedies, Photographic Developers, &c.; Index-List of Names and Synonyms of ——. *Compiled from Various Sources.* (See Chem. Ind. **23**, [14, 15, 16], and this Journal, 1898, 725.)

Abrastol (*Asaprol*).— A calcium salt of β naphthol monosulphonic acid.

Abrin.—A proteid from Jequirity seed (*Abrus precatorius*).

Acetaminol.—*p*-acetamido-benzyl-eugenol.

Acetanilide. See antifebrin.

Acetocaustin.—50 per cent. solution of trichloracetic acid.

Acetolsalicylic Ester. See salacetol.

Acetonal.—Aluminium sodium acetate.

Acetophenonephenetidine Citrate. See malarine.

Acetophenone. See hypnone.

Acetpara-amidosalol. See salophene.

Acetparaphenetidine. See phenacetine.

Acetylethoxyphenylurethane. See thermodine.

Acetylphenylhydrazine. See pyrodine.

Acetyltannin. See tannigen.

Acid aseptic (*Aseptin*).—Mixture of hydrogen peroxide solution, boric acid and salicylic acid.

Acid caffeïnosulphuric. See symphorol.

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Acid cresotinic or *Cresotic.*—Homologue of salicylic acid, obtained from sodium cresolate and carbonic acid.

Acid guaiacolo-carbonic.—Made from sodium guaiacolate and carbonic acid. Not to be confused with guaiacol carbonate.

Acid α-naphtholo-carboxylic.—See acid oxynaphthoic α-.

Acid oxynaphthoic α-.—Obtained by the action of carbon dioxide and sodium on α-naphthol.

Acid sozolic. See aseptol.

Acid sulpho-ichthyolic. See ichthyol.

Acid thiolinic.—Sulphurated linseed oil. Substitute for ichthyol and thiol.

Acoin. — Di - *p* - anisylmonophenetolguanidine hydrochloride.

Actol.—Silver lactate.

Adeps-lanæ.—Pure anhydrous wool-fat.

Adurol.—Chlorine or bromine substitution product of hydroquinone; photographic developer.

Agathine.—Salicyl-α-methylphenylhydrazone.

Agopyrine.—Said to be a mixture of cinchonine sulphate, ammonium chloride and salicin.

Airoform.—Identical with airol.

Airogen.—Identical with airol.

Airol.—Bismuth oxyiodogallate. Substitute for iodoform.

Ajacol.—Pyrocatechol mono-ethyl ester, identical with guaethol, ethacol and thanatol.

Alapurin = Adeps lanæ purissimus.

Albolene.—Refined petroleum product.

Aleptone.—The colloidal form of iron manganese peptonate or saccharate.

Aleuronate.—Pure vegetable albumin from wheat.

Alexin.—Collective term for the products of bacterial metabolism. See tuberculin.

Alkarnose.—A food consisting of animal and vegetable albumins, carbohydrates and flesh extractive substances.

Alkasal.—Aluminium potassium salicylate.

Allylthiocarbamide. See thiosinamine.

Allylthio-urea. See thiosinamine.

Alpha-guaiacol.—Identical with crystallised guaiacol.

Alpha-creosote.—Creosote containing 25 per cent. of crystallised guaiacol.

Alphol, α-naphtholsalol.—Salicylic ether of α-naphthol.

Alsol = 50 per cent. solution of aluminium aceto-tartrate.

Alumini borotannate. See cutal.

Aluminium borotartrate. See boral.

Aluminium naphtholosulphonate. See alumnol.

Aluminium sodium acetate. See acetonal.

Aluminium paraphenolsulphonate. See sozal.

Aluminium salicylate. See salumin.

Aluminium subgallate. See gallal.

Aluminium subtannate. See tannal.

Alumnol. —Aluminium naphtholsulphonate.

Amido-acetparaphenetidine. See phenocoll.

Amidol.—Diamidophenol hydrochloride. Photographic developer.

Aminoform.—Hexamethylenetetramine.

Aminol.—Mixture of trimethylamine and other amines prepared from herring brine.

Ammonium sulphoichthyolate. See ichthyol.

Ammonium sulpholeate. See polysolve.

Ammonol.—Stated to be ammoniated phenylacetamide.

Amygdophenine.—A compound of *p*-amidophenol with the mandelic acid radical and the ethyl carbonate group, *viz.* phenyl-glycolyl-*p*-phenetidine.

Amylene chloral. See dormiol.

Amylocarbol.—Disinfectant, said to consist of carbolic acid, 9 parts; amyl alcohol, 160 parts; green soap, 150 parts; and water, 690 parts.

Amyloform.—Condensation product of starch and formaldehyde. Substitute for iodoform.

Amylo-iodoform.—Compound of iodine, starch, and formaldehyde. Substitute for iodoform.

Anæmin.—Iron pepsin saccharate.

Anæsthyl (*Anestile*).—Mixture of 1 part of methyl chloride and 5 parts of ethyl chloride.

Analgene.—*o*-Ethoxy - ana - monobenzoylamidoquinoline, or ethoxy, (1) acetylamido, (4) quinoline.

Analyesine.—Identical with antipyrine.

Anaspalin.—Impure wool-fat.

Anesin, Aneson, Anäsin. — An aqueous solution of trichlorpseudobutyl alcohol or aceto-chloroform.

Anilipyrine, α and β.—Condensation products of antipyrine and antifebrin.

Annidaline.—Identical with aristol.

Anodynine.—Identical with antipyrine.

Anozol.—Iodoform deodorised by 10—20 per cent. of thymol.

Anthione.—Solution of potassium persulphate. Photographic reagent.

Anthrarobin. — Obtained by the reduction of alizarin by zinc dust and ammonia. Substitute for pyrogallol.

Antidiabetine.—Said to be a mixture of saccharin and mannite.

Antidysentericum.—Consists principally, it is said, of extracts of pomegranate root and myrobalans.

Antifebrin. See Acetanilide.

Antifungin.—Magnesium borate.

Antikamnia.—Preparation said to contain sodium bicarbonate, antifebrin, and caffeïne.

Antimelline. See djoeatin.

Antinervin.—Mixture of antifebrin, ammonium bromide, and salicylic acid.

Antinonnin. — Potassium *o*-dinitrocresolate made into a paste with soap and glycerin.

Antinosin.—The sodium salt of nosophen (*which see*).

Antipyrine (*Phenazone*).—Phenyldimethylpyrazolone.

Antipyrine mandelate. See tussol.

Antipyrine salicylate = salipyrine.

Antirheumatine = fluorrheumine (*which see*).

Antisepsine.—Parabromacetanilide.

Antiseptine.—Said to be a mixture of zinc iodide, zinc sulphate, boric acid, and thymol.

Antiseptol.—Cinchonidine iodosulphate. Iodoform substitute.

Antispasmine.—Mixture of narceïne sodium and sodium salicylate.

Antistreptococcine.—A special serum.

Antithermine. —Levulinic acid phenylhydrazone.

Antitussine.—Difluorodiphenyl.

Anusol = bismuth iodoresorcinol-sulphonate.

Anytine.—Ichthyolsulphonic acid in 33 per cent. aqueous solution.

Anytol.—Solution of essential oils, phenols, &c., in anytine.

Apolysine.—Monophenetidine citrate.

Aqua fluoroformi.—Solution of fluoroform, containing 2·8 per cent.

Argentamine.—Solution of the compound of ethylene diamine and silver phosphate (6·5 per cent. Ag).

Argentol.—Silver compound of hydroxyquinoline.

Argentum colloidale.—Colloidal silver.

Argonin.—A casein silver compound ($4\frac{1}{4}$ per cent. of Ag).

Aristol.—Dithymol di-iodide. Iodoform substitute.

Arsen-Hæmol.—Hæmol containing 1 per cent. of As_2O_3.

Arsycodile.—The active constituent is cacodylic acid or its sodium salt.

Arthriticine.—Nitrile of ethylcresol, amido-acetic acid and of diethylene imide.

Asaprol.—A calcium salt of β-naphthol monosulphonic acid. See *Abrastol.*

Asepsine = antisepsine (*which see*).

Aseptol (*Sozolic acid*).—33 per cent. solution of *o*-phenolsulphonic acid.

Aseptoline.—Solution said to contain 2·74 per cent. of phenol and 0·018 per cent. of pilocarpine.

Asparol.—Fluid extract of asparagus.

Aspirine.—Salicylic acid acetic ester. Substitute for salicylic acid and salicylates.

Asterol.—Mixture of ammonium tartrate with mercury *p*-phenol sulphonate and ammonium tartrate.

Auramine. —Coal-tar dyestuff. See pyoctaninum aureum.

Aurantia.—Diphenylamine Orange. Ammonium salt of hexanitrodiphenylamine.

Basicine.—A quinine compound containing caffeine.

Benzacetine.—Acetamido-ethyl-salicylic acid.

Benzanalgene. See analgene.

Benzanilide. Phenylbenzamide.

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Benzoic Sulphimide = Saccharin. (Benzoyl sulphonic imide.)

Benzonaphthol.—β-naphthyl ester of benzoic acid.

Benzosol.—Benzoylguaiacol; Guaiacol benzoate. Tasteless substitute for guaiacol.

Benzoyl pseudotropeïne.—See tropacocaine.

Betol.—β-naphthyl ester of salicylic acid.

Bioguaiacol.—Guaiacol preparation of unknown composition.

Bismal.—Bismuth methylenedigallate.

Bismutan.—Mixture of basic bismuth nitrate, resorcinol, and tannin.

Bismutol or *Bismutal.*—Mixture of bismuth sodium phosphate with sodium salicylate.

Bismuth β-naphtholate. See orphol.

Bismuth dithiosalicylate. See thioform.

Bismuth iodoresorcinol-sulphonate. See anusol.

Bismuth oxyiodogallate. See airol.

Bismuth oxyiodopyrogallate. Substitute for airol.

Bismuth subgallate. See dermatol.

Bismuth tribromophenolate. See xeroform.

Bonal.—Said to be an aqueous solution of formaldehyde, sodium sulphite, chloride and phosphate, and milk-sugar.

Boral.—Aluminium borotartrate.

Boralide.—Boric acid and antifebrin in equal parts.

Borol.—Mixture of boric acid and sodium bisulphate.

Brenzcain.—Guaiacol benzyl ether. Guaiacol substitute.

Bromacetanilide. See antisepsine.

Bromalbacid. Bromo-albumin containing 6 per cent. of bromine.—Substitute for bromides.

Bromaline. — Hexamethylenetetramine bromethylate. Substitute for alkali bromides.

Bromamide.—Tribromaniline hydrobromide.

Bromated Hæmol.—Hæmol containing 2·7 per cent. Br.

Bromipine.—Bromine addition compound of sesamé oil, containing 10 per cent. of bromine.

Bromocoll.—Bromo-tannin-gelatin compound with 20 per cent. of combined Br.

Bromol.—Tribromophenol.

Bromopyrine.—Mixture of antipyrine, caffeine, and sodium bromide.

Bromosine.—Bromine albumin compound, containing 10 per cent. of bromine.

Caffeinechloral.—Compound of caffeine and chloral.

Caffeine sodium iodide. See iodocaffeine.

Caffeineiodol.—Obtained by the interaction of alcoholic solutions of the components.

Calmine.—Mixture of antipyrine and heroine.

Camolin.—1·5 per cent. aqueous solution of formaldehyde.

Camphoroxol.—Alcoholic solution of hydrogen peroxide, containing 1 per cent. of camphor.

Cancroine.—Aqueous solution of neurine citrate.

Captol.—Condensation product of tannin and chloral.

Caput mortuuan vitrioli.—Red oxide of iron.

Carboformal.—Mixture of crude phenol and formaldehyde.

Carniferrine.—Iron compound of an acid containing phosphorus obtained from meat extract (30 per cent. Fe).

Carniferrol.—A flesh peptone iron compound (10 per cent. of meat peptone and 0·4 per cent. Fe).

Carvacrol iodide. See iodocrol.

Caseïn Ammonia. See eucasine.

Caseïn sodium. See nutrose.

Caseo iodine.—Substance resembling thyroiodine, obtained from caseïn periodide. Contains 8·7 per cent. of iodine.

Caseon = plasmon (*which see*).

Cearine.—Base for ointments, composed of fluid paraffin, carnauba wax and ceresine.

Ceral = pasta cerata (*which see*).

Cerebrine.—Said to be a syrupy alcoholic solution of antipyrine, caffeïne and cocaine.

Chelene = ethyl chloride.

Chloralamide = chloralformamide.

Chloralantipyrine. See hypnal.

Chloralbacid.—Albumin chlorine compound, containing 3 per cent. of chlorine.

Chloralcaffeïne. See caffeïnechloral.

Chloralformamide = chloralamide.

Chloralimide.—Obtained by heating the chloral-ammonium compound to 100° C.

Chloralose.—Anhydro-gluco-chloral, $C_8H_{11}Cl_3O_6$. Condensation product of chloral and glucose.

Chlorol.—Said to be a solution of 1 part of mercuric chloride, 1 part of sodium chloride, 1 part of hydrochloric acid, and 3 parts of copper sulphate in 1,000 parts of water.

Chlorolin.—Mixture of mono- and trichlorophenol.

Chlorosalol.—The salicylic ether of chlorophenol.

Chloryl = mixture of methyl and ethyl chlorides.

Chroatol = A terpene hydriodide.

Chrysarobine triacetate. See eurobine.

Cinchonidine iodosulphate. See antiseptol.

Cineol. See Eucalyptol.

Citrophene.—Triphenetidine citrate, or citro-*p*-phenetidine.

Citrurea.—Mixture of urea, citric acid, and lithium bromide.

Cittosol.—Emulsion of ichthyol.

Cocapyrine.—Said to be a mixture of 100 parts of antipyrine with 1 part of cocaine hydrochloride.

Coffeïnechloral = caffeïnechloral.

Colchi-sal.—Colchicine salicylate.

Collaform.—Powdered formaldehyde gelatin.

Collargolum = *argentum colloidale* (*which see*).

Copper-Hæmol = hæmol containing 2 per cent. Cu.

Corba Oil. See sphagnol.

Cordol = tribromosalol.

Cordyl.—Acetylcordol.

Coryl.—Mixture of methyl and ethyl chlorides.

Cosaprine.—Sodium acetylsulphanilate.

Cotarnine hydrochloride. See stypticine.

Crealbine.—Combination of albumin and creoline.

Creoform.—Condensation product of creosote and formaldehyde.

Creoline.—A solution of aromatic hydrocarbons in rosin soap (Pearson), or a mixture of cresol sulphonic acids with aromatic hydrocarbons.

Creosoform = creoform.

Creosal = tanosal (*which see*).

Creosolid.—Magnesium compound of creosote and guaiacol.

Creosotal = creosote carbonate (*which see*).

Creosote carbonate.—Mixture of the carbonic esters of guaiacol and cresol.

Creosote oil. See oleocreosote.

Creosote phosphate.—The phosphoric ester of creosote.

Creosote phosphite.—The phosphorous ester of creosote.

Cresalol.—The cresyl ester of salicylic acid. Cresol (Seloli); homologue of Salol.

Cresamine.—Ethylene diamine cresol compound.

Cresaprol = cresine.

Cresine.—Mixture of crude carbolic acid and sodium cresoxylacetate.

Cresoquin.—Quinoline cresylsulphonate.

Cresolin.—Disinfectant composed of crude phenol and rosin soap.

Crurin.—Compound of quinoline and bismuth thiocyanates $(C_9H_7N.HSCN)_2Bi(SCN)_3$.

Crystallin.—Solution of guncotton in methyl alcohol and amyl acetate.

Crystallose = Saccharin sodium.

Cupro-hæmol (*Merck*).—Hæmol with 20 per cent. of Cu. See Hæmol.

Cutal or *Cutol* = aluminium borotannate.

Dermatol = bismuth subgallate.

Dermol = bismuth chrysophanate.

Desichthol.—Odorless ichthyol, obtained by driving off the volatile oil from ichthyol.

Disinfectol.—Solution of coal-tar oils in rosin soaps.

Dextroform. — Condensation product of dextrin and formaldehyde.

Diabetin = lævulose.

Diaphtherin = hydroxyquinaseptol, obtained from hydroxyquinoline and *o*-phenol sulphonic acid.

Diaphthol = hydroxyquinoline sulphonic acid. Quinaseptol.

Dibromogallic Acid. See gallobromol.

Diethylacetal. See aceta um.

Diethylenediamine. See piperazine.

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Diethylsulphonediethylmethane. See tetronal.
Diethylsulphonemethylethylmethane. See trional.
Difluordiphenyl. See antitussine.
Di-iodoform = tetra-iodoethylene.
Di-iodoparaphenolsulphonic acid. See sozo-iodol.
Dimethylamido-antipyrine. See pyramidone.
Dimethylcarbinolchloral. See dormiol.
Dimethylpiperazine. See lupetazine.
Dionine.—Ethylmorphine hydrochloride.
Diphenal = diamidohydroxydiphenol ; photographic developer.
Dithan = trional.
Dithion.—Sodium salt of dithiosalicylic acid.
Dithymol di-iodide. See aristol.
Diuretin.—Compound of sodium theobromine and sodium salicylate.
Djoeatin.—Remedy said to contain the active constituent of *Syzygium jambolanum.*
Dormiol = amylene chloral, condensation product of amyl alcohol and chloral.
Dulcine = phenetolcarbamide, sweetening agent.
Duotal = guaiacol carbonate.
Dynamogen.—Preparation resembling hæmatogen.
Eigon.—Iodo-albumin and iodopeptone preparations.
Eikonogen.—Sodium salt of amido-β-naphthol-β-sulphonic acid. Photographic developer.
Eka-iodoform.—Mixture of iodoform with 0·05 per cent. of paraformaldehyde.
Enterol.—Mixture of *o*-, *m*-, and *p*-cresol.
Enterol carbonate.—The carbonic ester of enterol.
Enterorose.—Dietetic food, consisting of albumins, fat, and carbohydrates.
Eosolic acid and eosolates.—Aliphatic creosote-ester sulphonic acid and its salts.
Eosote = creosote valerate.
Epicarine = hydroxynaphthol-*o*-hydroxytoluic acid. By condensation of β-naphthol with cresotinic acid.
Epidermin.—Mixture of fluorxylene and difluordiphenyl in the proportions 1:5.
Ethacol.—Pyrocatechol mono-ethyl ester. See ajacol and guethol.
Ethol.—Cetyl alcohol, a constituent of spermaceti.
Ethoxy-ana-monobenzoylamidoquinoline. See analgene.
Ethoxycaffeïne.—From monobromocaffeïne and alcoholic potash.
Ethoxyphenylsuccinimide. See pyranthine.
Ethoxyphenylurethane. See thermodine.
Ethylene ethenyldiamine. See lysidine.
Ethylenimine. See piperazine.
Ethylidenediethyl ether. See acetal.
Ethylol = ethyl chloride.
Eucaine A.—Methyl ester of benzoylmethyltetramethyl-γ-hydroxypiperidine carboxylic acid.
Eucaine B. — Benzoylvinyldiacetonalkaminehydrochloride.
Eucalypteol = eucalyptene (*d*-pinene) hydrochloride.
Eucalyptol.—A constituent of eucalpytus oil. Cineol.
Eucalyptusanytol. See eucasol.
Eucasine.—Caseïn ammonia compound.
Eucasol.—An ichthyol preparation.
Eudermol = nicotine salicylate.
Eudoxine.—The bismuth salt of nosophene (*which see*).
Eugallol = pyrogallol monoacetate.
Eugenoform = eugenolcarbinol sodium compound.
Eulactol.—Dietetic food prepared from milk and vegetable albumin.
Eulyptol.—Mixture of eucalyptus oil, salicylic acid, and carbolic acid.
Eumenol.—Extract of the root of the Chinese plant *tang-kui.*
Eunatrol = sodium oleate.
Eunol α and β.—Compounds of α- and β-naphthol with eucalyptol.
Euphorin = phenyl-ethyl-urethane.
Euphthalmine. — Hydrochloride of the mandelic acid derivative of a labile *n*-methylvinyldiacetonalkamine.
Euquinine.—Quinine ethyl chloro-carbonate.
Euresol = resorcinol monacetate.
Eurobin = chrysarobine triacetate.
Europhen.—Isobutyl-*o*-cresol iodide.
Eurythrol.—Extract of the spleen of cattle.
Exalgine = methylacetanilide.
Ferratin = iron albuminate.
Ferratose.—A liqueur containing ferratin.
Ferriptone.—Concentrated iron peptone preparation.
Ferripyrine, Ferropyrine.—Ferric chloride-antipyrine.
Ferrosol = liquor ferri oxydati natronati sacchar.
Ferro-somatose = somatose containing 2 per cent. Fe.
Ferrostyptine, solution of ammon. chlorat. ferrat. and acetanilide.
Filmogen.—Solution of nitrocellulose in acetone.
Floricine.—Castor oil made soluble in mineral oils and vaseline.
Fluorol = sodium fluoride.
Fluorrheumine.—Said to be a mixture of 1 part of fluorophenetol, 4 parts of difluorodiphenyl, 10 parts of vaseline, and 85 parts of wool fat.
Formaldehydecasein. — Condensation product of the components.
Formalin = 40 per cent. aqueous solution of formaldehyde.
Formalith.—Infusorial earth containing 40 per cent. of formaldehyde.
Formin = urotropine (*which see*).
Formol. See formalin.
Formopyrine = salubrol (*which see*).
Fortoïn.—A cotoïn preparation.
Gallacetophenone = Alizarin Yellow O (methylketotrihydroxybenzene).
Gallal = aluminium gallate.
Gallanol or Gallinol.—Anilide of gallic acid.
Gallicin.—Methyl ester of gallic acid.
Gallobromol.—Dibromogallic acid.
Galloformin.—Condensation product of gallic acid and hexamethylenetetramine.
Gelanthum.—Solution of tragacanth, gelatin, and glycerin in water.
Geoform.—Condensation product of guaiacol and formaldehyde.
Geosote = guaiacol valerate.
Germol.—Disinfectant consisting of crude cresols.
Globone.—A food obtained by treating nucleo-albumins with alkalis.
Glucin.—Amidotriacin sulphonic acid, or its sodium salt.
Glusidum. See Saccharin.
Glutoform = formaldehyde gelatin.
Glutoid Capsules.—Gelatin capsules hardened by formaldehyde.
Glutol = formaldehyde gelatin.
Glycin.—Oxyphenylglycocoll. Photographic developer.
Glycoformal.—Official (Ph. G.) formaldehyde with 10 per cent. of glycerin.
Gomenol.—Essential oil of *melaleuca viridiflora.*
Gonorol.—Identical with santalol, the active constituent of sandal-wood oil.
Gorite = calcium peroxide.
Guaiacamphol.—The camphoric ester of guaiacol.
Guæthol.—Pyrocatechol ethyl ether, or Guaiacol-ethyl. Identical with ajacol (*which see*).
Guaiacetine.—Sodium pyrocatechol acetate.
Guaiacolsalol.—Guaiacol salicylic ester.
Guaiacol cinnamate. See styracol.
Guaiacophosphal = guaiacol phosphite.
Guaiacyl.—Calcium guaiacol sulphonate.
Guaiacol phosphite. See guaïacophosphal.
Guaiaform = geoform.
Guaiamar.—Guaiacol glyceryl ester.
Guaiaperol.—Piperidine guaiacolate.
Guaiaquin.—Guaiacol bisulphonate of quinine.
Guaiasanol.—Diethylglycocollguaiacol hydrochloride.
Hæmalbumin.—Iron albuminate.
Hæmatin-albumin, hæmatigum, hæmochromogen, hæmoferrum.—Iron albumin compounds.
Hæmatogen.—A fluid iron albuminate.
Hæmatol.—Sterilised pure hæmoglobin.
Hæmatose.—Albumin preparation containing Naphthol Green.
Hæmogallol.—Obtained by the action of pyrogallol on defibrinated blood.

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Hæmol.—Hæmoglobin reduced by zinc.

Hæmoneïn contains meat extract and the mineral constituents of blood.

Hæmotrophin.—New hæmoglobin preparation.

Hedonal.—Methylpropyl carbinol urethane.

Helicosal or Helcosol.—Basic bismuth pyrogallate.

Hemicranine.—Said to be a mixture of 5 parts of phenacetine, 1 part of caffeïne, and 1 part of tartaric acid.

Heparadene.—Extract of pigs' liver.

Heratol.—Chromic acid dissolved in sulphuric or acetic acid, for purifying acetylene (Ulmann).

Heroïn.—Morphine diacetic ester.

Hetocresol.—Cinnamic *m*-cresol eser.

Hetol.—Pure sodium cinnamate.

Hexamethylene-tetramine. See urotropine.

Hexamethylene-tetramine salicylate. See saliformin.

Holocaïne = *p*-diethoxyethenyldiphenylamidine.

Holzine.—60 per cent. solution of formaldehyde in methyl alcohol.

Holzinol.—Mixture of holzine and menthol.

Homocresol = ajacol (*which see*).

Honthine.—Tannin albumin preparation.

Huminal.—Alcoholic extract of peat.

Hydracetine = pyrodine (*which see*).

Hydragogin.—Said to be a mixture of the tinctures of digitalis, strophanthus and squills.

Hydrargoseptol. — Quinosol mercuric sodium chloride compound.

Hydrargyro-Iodo-Hæmol.—Hæmol containing 12·35 per cent. Hg and 28 per cent. I.

Hydrargyrol = mercury paraphenyl-*o*-sulponhate.

Hydrargyrum bichloratum carbamidatum solutum.—Solution of the mercuric chloride compound of urea.

Hydrargyrum colloidale.—Soluble colloida mercury.

Hydrargyrum formamidatum solutum.—Obtained by the action of formamide on mercuric oxide.

Hydrargyrum glutinopeptonatum hydrochloricum solutum.—Double compound of glutinpeptone hydrochloride and mercuric chloride.

Hydrargyrum glycocolicum solutum.— Prepared from amido-acetic acid and mercuric oxide.

Hydrargyrum imidosuccinum solutum = hydrarg. succinimidatum (*which see*).

Hydrargyrum Succinimidatum.—Obtained from succinimide and mercuric oxide.

Hydrosol.—Aqueous solution of colloidal silver.

Hypnal = chloralantipyrine.

Hypnoacetin. — Acetophenone - acetyl - *p* - amidophenyl ester.

Hypnone = acetophenone, phenylmethyl acetone.

Hyrgol.—Colloidal mercury.

Iatrol.—Oxy-iodomethyl anilide.

Ibite.—Bismuth oxyiodo-tannate.

Ichthalbine.—Compound of ichthyol and albumin.

Ichthoform.—Condensation product of ichthyol sulphonic acid and formaldehyde.

Ichthyol (Ammonium sulpho-ichthyolate).—Prepared by destructive distillation of bituminous shale, by treating the distillate with sulphuric acid, and then with ammonia.

Intestin.—Said to be a mixture of naphthalene, bismuth oxide, and benzoic acid.

Iodal.—Tetra-iodo pyrrol.

Iodalbacid.—Iodine albumin compound containing 10 per cent. of iodine.

Iodocasein. See caseo-iodine.

Iodipine.—Iodine addition compound of sesamé oil, containing 10 per cent. of iodine.

Iodocaffeïne.—Caffeïne combined with sodium iodide.

Iodocresine. See traumatol.

Iodocrol = carvacrol iodide.

Iodoformal.—Substitute for iodoform, composition unknown.

Iodoformin.—Compound of iodoform and hexamethylene tetramine.

Iodoformogen.—Compound of iodoform and albumin.

Iodogallicine.—Bismuth oxyiodide methylgallate.

Iodo-Hæmol.—Hæmol containing 16·6 per cent. of I.

Iodol = tetra-iodopyrrol.

Iodophene = nosophene (*which see*).

Iodopyrine = iodo-antipyrine.

Iodo-Salol.—Di-iodo salicylic phenyl ester.

Iodosine.—Iodine albumin compound.

Iodotheobromine.—Compound of theobromine and sodium iodide.

Iodothymoform.—Iodised thymoform. See *the latter.*

Iodothyrin = thyroiodine.

Isutan = bismutan (*which see*).

Itrol.—Silver citrate.

Jequiritin. See Abrin.

Jurubeba. — The root, leaves, and fruit of *solanum insidiosum.*

Kaïrin and Kairolin = ortho - hydroxyethyl quinoline tetrahydride.

Katharol.—Hydrogen peroxide solution.

Kefir or Kephir.—Alcoholic ferment for milk.

Kelene = ethyl chloride.

Kelenemethyl.—Mixture of ethyl and methyl chlorides.

Kil.—"Mineral soap mass made from clay."

Korestol.—Secret remedy, said to contain zinc hydroxymethyl sulphonate, iodine compounds of unsaturated hydrocarbons and gaseous unsaturated hydrocarbons.

Kreoform, &c. See under creoform, &c.

Krustol.—Alcoholic soap solution of hydrocarbons containing sulphur.

Kryofine.—Condensation product of phenetidine and methylglycollic acid, methoxy-acet-*p*-phenetidine.

Lactol.—β-naphthol lactic ester.

Lactophenine.—*p*-lactylphenetidine.

Lactosomatose. See tannin-milk-somatose.

Lanaïn = adeps-lanæ.

Lanichol = adeps-lanæ.

Lanoform.—Preparation of formaldehyde and wool fat.

Largin.—Silver albumin compound (11·1 per cent. Ag).

Laurenol.—Said to be an aqueous solution of aluminium chloride, zinc- and copper sulphates.

Lenigallol.—Pyrogallol tri- or tetracetate.

Lenirobin.—Chrysarobin tetracetate.

Lepsine. — Solution of zinc hydroxymethylamidosulphonate and sodium di-iodophenolate.

Leuco-alizarin. See anthrarobine.

Levurine.—Dry yeast.

Lianthral.—Coal-tar extract. Substitute for wood-tar.

Lienadene.—Extract of ox spleen.

Lignosulphite.—By-product in the treatment of cellulose with sulphurous acid.

Limanol.—Extract of Russian peat.

Linadin. — Dry preparation of ox spleen, containing iodine.

Lipanine.—Olive oil with 6 per cent. of free oleïc acid.

Liquor antihydrorrhoicus. — Alcoholic solution of chlorinated ether.

Liquor anthracis.—Alcoholic solution of coal-tar with benzene.

Liquor carbonis.—Alcoholic solution of coal-tar with *Quillaia* tincture.

Lorenite.—*p*-iodo-ana-hydroxyquinoline-*o*-sulphonate.

Loretine.—*m*-iodo-*o*-hydroxyquinoline-ana-sulphonic acid.

Losophane = tri-iodo *m*-cresol.

Lupetazine = dimethylpiperazine (dipropylene diamine).

Lycetol = dimethylpiperazine tartrate.

Lycresol.—Crude cresol dissolved in soap.

Lysidine = methylglyoxalidine (ethylene ethenyl diamine).

Lysitol, Lysol.—Crude cresol dissolved in soap.

Malakine.—Salicyl-*p*-phenetidine.

Malarine = acetophenonephenetidine citrate.

Mallein.—Product of the metabolism of the bacterium of glanders.

Markasol.—Bismuth borophenate.

Mayol. — Preservative composed of ethyl and methyl alcohols, boric acid, glycerin and ammonium fluoride.

Menthol valerate. See validol.

Menthoxol. — Alcoholic solution of hydrogen peroxide with 1 per cent. of menthol.

Mercuriol.—Mixture of mercury (40 per cent.), aluminium, magnesium, and chalk.

Mercurol.—Nuclein mercury compound.

Mercury compounds. See under Hydrargyrum.

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Metasol = *m*-cresolanytol. See anytol.
Methacetine = *p*-acetanisidine, or *p*-oxymethylacetanilide.
Methæmoglobin.—Obtained by oxidation of hæmoglobin.
Methylal = methylenedimethyl ether.
Methylene Blue. — The hydrochloride of tetramethyl thionine.
Methylglyoxaldine. See lysidine.
Methylsulphonal = trional.
Metole = methyl-*p*-amido-*m*-cresol salt; photographic developer.
Microcidine = Sodium β-naphtholate.
Mietose.—Meat extract containing albumin.
Migranine.—Mixture of antipyrine, caffeïne and citric acid.
Migrol.—Mixture of equal parts of guaiacetine and caffeïne pyrocatechol mono-acetate.
Milk-somatose.—Albumoses of milk containing 5 per cent. of tannin.
Mollinum.—Superfatted soap with glycerin.
Monobromacetanilide. See antisepsine.
Monol = calcium permanganate.
Monsel's salt.—Basic ferric sulphate.
Morrhuol.—Alcoholic extract of cod liver oil.
Musine.—Aperient containing tamarind.
Mutase.—Dietetic food prepared from leguminosæ, &c.
Mydrine.—Mixture of ephedrine and homatropine.
Mydrol.—Iodomethylphenylpyrazolone.
Myronin.—Mixture of *oleum chaenoceti*, potassium stearate, wax, and water.
Myrosin.—A ferment of widespread occurrence. (Mustard seed, radish, &c.)
Myrrholin.—Myrrh resin, dissolved in castor oil.
Naphthalan.—Fractionated crude petroleum product from Armenia, containing soap.
Naphthalol. See betol.
Naphtho-aristol.—Di-iodo-β-naphthol.
Naphthoformin.—Condensation product of naphthol and formaldehyde.
Naphtholeucalyptol. See eunol.
Naphthol sodium. See microcidine.
α-Naphthol salol. See alphol.
β-Naphthol salol. See betol.
Naphthol bismuth. See orphol.
Naphthopyrine.—Antipyrine naphthol.
Naphthoxol.—Alcoholic hydrogen peroxide solution with 2 per cent. of naphthol.
Narceïne sodium—Sodium salicylate. See antispasmine.
Neurodine.—Acetyl-*p*-hydroxyphenylurethane.
Neurosine.—Nitroglycerin with caffeïne.
Nicotine Salicylate. See eudermol.
Nirvanin.—Diethylglycocoll - *p*-amido-*o*-hydroxybenzoic acid methyl ester hydrochloride.
Nosophen = tetra-iodophenol-phthaleïn.
Nucleïn.—Constituent of the cell nucleus containing phosphorus, obtained from yeast or spleen (Horbaczeuski).
Nutrose.—Caseïn sodium (13 per cent. N).
Oculin.—Preparation obtained from ox eyes.
Oesypus.—Crude wool fat.
Oleocreosote.—The oleïc ester of creosote.
Omal = trichlorophenol.
Orexine, basic = Phenyldihydroquinazoline.
Organosol.—Alcoholic solution of colloidal silver.
Orphol = bismuth naphtholate.
Orthin.—Hydrazine-*p*-hydroxybenzoic acid.
Orthoform = *p*-amido-*m* hydroxybenzoic methyl ester.
Orthoform, new = *m*-amido - *p* - hydroxybenzoic methyl ester.
Ortol.—Methyl - *o* - amidophenol and hydroquinone. Photographic developer.
Ossagen.—Calcium salt of the fatty acids of red bone marrow.
Ossalin. = adeps ossium.
Oxaphor.—50 per cent. solution of oxycamphor in alcohol.
Oxycamphor.—$C_8H_{14}(CO)CH.OH$, oxidation product of camphor.
Oxydimethylquinicine. See antipyrine.
Oxyiodomethyl-anilide. See Iatrol.
Oxyquinaseptol. See diaphtherine.
Oxyquinolinethylhydride. See Kaïrine.
Pancreadene.—Extract of the pancreas.
Para-acetanisidine. See methacetine.
Para-acetphenetidine. See phenacetine.
Paraform (Trioxymethylene). — Polymerised formaldehyde.
Parodyn. See Antipyrine.
Pasta cerata.—Saponified beeswax.
Pental = trimethylethylene.
Peptomedullin, Peptovarin, Peptothyroidin, obtained by peptonising the substances contained in the particular organ.
Peronin.—Morphine benzyl ester hydrochloride.
Pertussin = extractum thymi saccharatum.
Peruol.—Benzyl benzoate with castor oil.
Peruscabin.—Synthetic benzyl benzoate.
Petrosulfol.—Product from tar containing sulphur.
Phenacetine = *p*-acetamidophenetol = *p*-acetphenetidine.
Phenalgine.—Ammonium phenylacetamide.
Phenazone. See antipyrine.
Phenegol.—Mercury potassium salt of nitro-*p*-phenolsulphonic acid.
Phenetidine salicylic aldehyde. See malakine.
Phenetolcarbamide. See dulcine.
Phenine = phenacetine.
Phenocoll hydrochloride = amidoacet-*p*-phenetidine hydrochloride.
Phenosalyl.—Said to be a mixture of phenol, salicylic acid, lactic acid, and menthol.
Phenosol.—Salicylacetic acid phenetidide.
Phenosuccine = pyranthine (*which see*).
Phenylacetamide. See antifebrin.
Phenyldihydroquinazoline. See orexine.
Phenyldimethylpyrazolone. See antipyrine.
Phenylhydrazine levulinic acid. See antithermine.
Phenylmethylketone. See hypnone.
Phenyl salicylate = salol.
Phenylurethane. See euphorine.
Phesin.—Acet-*p*-phenetidine sodium sulphonate.
Phosphatol, Phosphotal.—Creosote-phosphite.
Phosote, Phosphote.—Creosote phosphate (*which see*).
Picrol.—Potassium di-iodoresorcinol sulphonate.
Pixol.—A wood-tar preparation soluble in water.
Plasmine.—Liquid obtained by expressing bacteria.
Plasmone.—Milk caseïn made soluble by alkalis.
Polyformin.—Condensation product of formaldehyde and resorcinol.
Polysolve.—Sodium and ammonium salt of sulpholeïc or sulphoricinoleïc acid.
Prasoid.—Solution of globularin and globuraretin.
Protargol.—Proteïn silver compound soluble in water (8 per cent. Ag).
Protogene.—Methylene compound of albumin.
Pyoctanin Aureum = Auramine.
Pyoctanin Cœruleum = Methyl Violet.
Pyraloxine.—Oxidised pyrogallol. Substitute for pyrogallol.
Pyramidone. — Dimethylamido - antipyrine, or dimethylamidophenyl dimethylpyrazolone.
Pyranthin (Pyrantine) = *p*-ethoxyphenylsuccinimide.
Pyrantinum Solubile. — The sodium compound of pyranthine.
Pyrazol.—Phenyl-methyl-pyrazol-carbonic acid.
Pyrazoline = antipyrine.
Pyrocaine.—Guaiacol benzyl ester.
Pyrodine = acetylphenylhydrazine.
Pyroform.—Obtained by treating pyraloxine with bismuth oxyiodide. Substitute for pyrogallol.
Pyrogallol tri- or tetracetate. See lenigallol.
Pyrosal.—The acid salicylacetate of antipyrine.
Pyrozone.—Ethereal solution of hydrogen peroxide.
Quinalgene. See Analgene.
Quinaphthol = quinine β-naphthol-α-sulphonate.
Quinaseptol. See diaphthol.
Quinoform.—Formaldehyde compound of cinchotannic acid.
Quinoline Bismuth Sulphocyanide. See crurin.
Quinoral.—Mixture of quinine salt with chloral hydrate.
Quinosol = potassium hydroxyquinoline sulphonate.
Resopyrine.—Resorcinol-antipyrine.

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Resorbin.—Base for ointments, containing oil, water, and a mucilaginous binding medium.

"*Resorcinol.*"—Mixture of resorcinol and iodoform.

Resorcinol acetate. See Euresol.

Retinol (*Merck*).—Rosin oil.

Rhinalgin.—Said to be a mixture of cacao oil (1·0 grm.), alumnol (0·01 grm.), menthol (0·025 grm.), and oil of valerian (0·025 grm.).

Rhodallin. See Thiosinamine.

Rodinal (*Rodinalum*).—Solution of *p*-amidophenol. Photographic developer.

Saccharin.—Benzoyl sulphonic imide.

Salacetol.—The salicylic ester of acetylmethyl alcohol. (From monochloracetone and sodium salicylate.)

Salactol.—Solution of sodium salicylate and lactate in 1 per cent. hydrogen peroxide solution.

Salicylaldehyde methylphenylhydrazone. See agathine.

Salicylic cresyl ester. See cresalol.

Saliformine = hexamethylenetetramine salicylate.

Saligallol.—33 per cent. solution of pyrogallol disalicylate in acetone.

Salinaphthol. See Betol.

Saliphene.—Salicyl *p*-phenetidine.

Salipyrine.—Antipyrine salicylate.

Salitannol.—Condensation product of salicylic and gallic acids.

Salithymol.—Salicylic thymol ester.

Salocoll.—Phenocoll salicylate.

Salol.—Salicylic phenyl ester.

Salophen.—Acet-*p*-amidophenyl salicylate.

Salosantal.—Mixture of salol and sandal wood oil.

Salubrol.—Tetrabromoderivative of methylenediantipyrine.

Salumin (soluble) = aluminium ammonium salicylate.

Salumin (insoluble) = aluminium salicylate.

Sanatogene.—Glycerophosphoric acid sodium-caseïn compound.

Sanatol.—Crude sulphonated phenols.

Sanguinoform.—Preparation from embryonic blood-forming organs.

Sano.—Barley meal containing dextrin formed by heating.

Sanoform.—Di-iodosalicylic methyl ester.

Sanose.—Contains 80 per cent. of caseïn and 20 per cent. of albumoses.

Sapocarbol.—Cresols dissolved in soap.

Saprol.—Mixture of crude cresol and hydrocarbons.

Savonale.—Neutral potassium oleate.

Sedatine.—Valeryl-*p*-phenetidine.

Septicidin.—Serum protecting against swine fever.

Seraphthin.—Serum protecting against foot and mouth disease.

Serum Paste.—Sterilised serum of ox blood mixed with zinc oxide.

Sicco = hæmatogenum siccum.

Sidonal.—Piperazine quinate.

Silberol.—Silver phenolsulphonate.

Sirolin.—10 per cent. syrupy solution of potassium guaiacolsulphonate.

Sodium acetylsulphanilate. See cosaprine.

Sodium dithiosalicylate. See dithion.

Sodium oleate. See eunatrol.

Solutol.—Solution of cresols in sodium cresolate.

Solveol.—Solution of cresols in sodium cresotinate.

Solvin = polysolve (*which see*).

Somatose.—An albumose preparation from meat (albuminoids, 90·5 per cent., phosphates, 7·5 per cent., peptones, 0·2 per cent.).

Somnal.—Chloral urethane alcoholate. Solution of chloral hydrate and urethane in alcohol.

Soson.—Albumin preparation from meat.

Sozal.—Aluminium *p*-phenolsulphonate.

Sozolic Acid. See Aseptol.

Sozo-iodol.—Mercury, potassium, sodium and zinc salts of di-iodo-*p*-phenolsulphonic acid.

Sphagnol.—Bituminous product of distillation, containing benzene, anthracene, cresols, and phenols.

Sphygmogenin.—Preparation from the suprarenal capsules of cattle and sheep.

Spleniferrin.—Said to be a mixture of cattle spleen with a compound of ferrous oxide and albumin.

Splenin.—Preparation of the spleen of cattle.

Steresol.—Said to be a solution of resins, phenol, and essential oils in alcohol.

Steriformium chloratum and iodatum.—Said to be a mixture of formaldehyde, pepsin, milk-sugar, and ammonium chloride or iodide.

Sterisol.—Milk-sugar solution saturated with formaldehyde.

Stypticin.—Cotarnine hydrochloride, $C_{12}H_{15}NO_4.HCl$. Cotarnine obtained along with opianic acid, by oxidising narcotine.

Styracol.—Guaiacol cinnamate.

Styrolin.—The active ester of styrax.

Styrosapon.—Neutral potassium soap with 25 per cent. of styrolin.

Sucrol = dulcine (*which see*).

Sudol.—A preparation of formaldehyde.

Sulphaminol.—Thiohydroxydiphenylamine.

Sulphonal.—Diethylsulphonedimethylmethane—

$$C(CH_3)_2(SO_2.C_2H_5)_2.$$

Sulphosote.—10 per cent. syrupy solution of the potassium sulphonates of guaiacol and cresol.

Supradin.—Dry preparation from the suprarenal capsules of cattle; contains iodine.

Sycose, Sykorine.—(Saccharin). Benzoyl sulphonic imide.

Symphorol.—Sodium, lithium, or strontium salt of caffeïne sulphonic acid.

Taka-diastase.—Enzyme formed upon swollen rice by *Aspergillus oryzae, Cohn.*

Tannalbin.—Desiccated tannin albuminate.

Tannalborin.—Aluminium tannate and borate.

Tannal (soluble).—Aluminium tannic tartrate.

Tannal (insoluble).—Aluminium tannate.

Tannigen.—Diacetyltannin.

Tannin Milk-somatose.—Preparation of somatose obtained from milk caseïn, containing 5 per cent. of combined tannin.

Tannipyrine.—Condensation product of antipyrine and tannin.

Tannocasum.—Condensation product of tannin and caseïn.

Tannoform.—Condensation product of gallo-tannic acid and formaldehyde.

Tannon and Tannopine.—Hexamethylene-tetramine-tannin.

Tanocol.—Condensation product of glutin and tannin.

Tanosal.—Guaiacol tannate.

Taphosote.—Tannin creosote phosphote.

Tartarlithine.—Effervescent lithium bitartrate.

Terpineol.—Obtained by fractionating terpinol; used in perfumery.

Terpene Hydriodide. See chroatol.

Terpinol.—Obtained by the action of dilute sulphuric acid upon terpin hydrate.

Terralin.—Base for ointments, contains gypsum, kaolin silica, lanolin, glycerin, &c.

Tetrahydro-p-quinanisol. See thallin.

Tetriodo-ethylene. See di-iodoform.

Tetramethylthionine hydrochloride. See Methylene Blue.

Tetronal.—Diethylsulphonediethylmethane—

$$C(C_2H_5)_2(SO_2.C_2H_5)_2.$$

Thalline.—Tetrahydro-*p*-quinanisol.

Thanatol = guaethol, ethacol, or ajacol (*which see*).

Theobromine sodium iodide. See iodotheobromine.

Theobromine lithium — Lithium salicylate. See uropherin.

Thermifugin.—Solium salt of methoxy-hydroquinoline carboxylic acid.

Thermine.—A tetrahydro-β-naphthylamine hydrochloride.

Thermodine.—Acetyl-*p*-ethoxyphenylurethane.

Thiocarbamide.—Photographic reducing and fixing agent.

Thiocol.—Potassium guaiacol sulphonate.

Thioform.—Basic bismuth dithiosalicylate.

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Thiol.—Sulphonated coal-tar oil containing sulphur.
Thioresorcinol.—Sulphur compound of resorcinol.
Thiosapol.—Soap containing combined sulphur.
Thiosinamine. — Allylthiocarbamide, allylsulpho-urea. See also rhodallin.
Thioxydiphenylamine. See sulphaminol.
Thiuret.—Oxidation product of phenyldithiobiuret.
Thymacetin.—Acetylamidothymol ethyl ester.
Thymobromal.—Said to be a mixture of bromal hydrate, Extr. thymi, and Extr. castaneæ vescae.
Thymoform. — Condensation product of thymol and formaldehyde.
Thymotol = aristol (*which see*).
Thyraden.—Dry extract of thyroid glands prepared by Haaf's method.
Thyreïn = iodothyrin (*which see*).
Thyreoidin.—The dried powdered thyroid glands of sheep.
Thyroglandin.—Preparation of thyroid glands.
Thyroiodine.—Iodine compound from the thyroid glands of sheep.
Tolyldimethylpyrazolone. See tolypyrine.
Tolyldimethylpyrazolone salicylate. See tolysal.
Tolypyrine.—Tolyldimethylpyrazolone.
Tolysal.—Tolyldimethylpyrazolone salicylate.
Traumatol.—Iodocresol.
Trefusia.—Natural iron albuminate.
Tribenzoylgallic Acid.—Obtained from benzoyl chloride and gallic acid.
Tribromophenol. See bromol.
Tribromosalol. See cordol.
Tricresol.—Mixture of *o*-, *m*-, and *p*-cresol.
Triformol. See paraform.
Tri-iodocresol. See losophane.
Trimethylethylene. See pental.
Trional.—Diethylsulphonemethylethylmethane—

$$C(CH_3)(C_2H_5)(SO_2.C_2H_5)_2.$$

Triphenetidine citrate = citrophene (*which see*).
Triphenine.—Propionyl-phenetidine, obtained by heating *p*-phenetidine with propionic acid.
Tropacocaine.—Benzoylpseudotropeine.
Tropone.—Mixture of animal and vegetable albumins.
Tuberculin.—Product of the metabolism of cultures of the tuberculous bacterium.
Tuberculocidine.—Purified tuberculin.
Tuberculol.—Toxic product of the metabolism of bacteria.
Tumenol.—Mineral oil distillate containing sulphur.
Tussol.—Antipyrine mandelate.
Uralium or Uraline.—Chloral urethane.
Urethane.—Carbaminic ethyl ester.
Uricedin.—Said to be a mixture of sodium citrate, sulphate, chloride, acetate, tartrate, malate, traces of iron, sodium pectinate, and extractive matters.
Urisolvin.—Mixture of urea and acid lithium citrate.
Uropherin.—Lithium theobromine combined with lithium salicylate.
Urosin.—Wafers containing lithium quinate and sugar.
Urotropine.—Hexamethylenetetramine.
Urotropine salicylate. See saliformine.
Ursal.—Compound of urea and salicylic acid.
Valerydine.—Valerylphenetidine.
Validol.—Mixture of menthol valerate and menthol.
Vaseline, Vasogen, Vasol. — A mineral oil product used as basis for ointments.
Vellolin = adeps-lanæ.
Xeroform.—Bismuth tribromophenolate.
Zinc-Hæmol.—Hæmol containing 1 per cent. of Zn.
Zinol.—Mixture of alumnol and zinc acetate.
Zuckerin = Saccharin.
Zymoidin.—Mixture of antiseptics, such as zinc oxide, iodol, boric acid, phenol, and salicylic acid.—A. C. W.

Tartaric Acid; New Pyrogenic Product from ——. L. J. Simon. Comptes Rend. **131**, [15], 586—588.

By distilling under reduced pressure the products of the action of heat and potassium bisulphate on tartaric acid, esterifying the residue by prolonged boiling with alcohol, distilling off the pyruvic and pyrotartaric esters under reduced pressure, and finally distilling the residue at the atmospheric pressure, there was obtained from 25 kilos. of tartaric acid about 25 grms. of a crystallised product, melting at 164° C., and readily subliming, easily soluble in alcohol, less so in water or acetic acid, feebly acid, and having the molecular formula, $C_7H_8O_3$. It is unsaturated, absorbs bromine, and reduces permanganate, but not Fehling's solution. Its potassium salt is readily soluble in water, and the solution gives with silver nitrate a yellowish gelatinous precipitate which very quickly blackens. The author considers this acid to be isomeric, not identical, with Wislicenus and Stadnicki's pyrotritaric or dimethylfurfurane-carbonic acid. (See next abstract.)—J. T. D.

Isopyrotritaric Acid. L. J. Simon. Comptes Rend. 1900, **131**, [16], 618—620.

The author communicates further details as to this acid, $C_7H_8O_3$, which is one of the products of heating tartaric acid (see preceding abstract). Its main characteristic is the intense violet coloration which it yields with ferric salts, and which is of a very stable nature. This coloration is due to the behaviour of the ferric compound—

$$Fe(C_7H_7O_3)_3 + 2H_2O,$$

which the author has prepared. This compound dissolves in water with a red colour, which, on the addition of acid, changes to a violet, discharged by excess, and which becomes yellow on the addition of alkali. The colour changes are very sharp, and the compound is highly recommended as an indicator. The free isopyrotritaric acid does not change the colour of solutions of this ferric salt, but the addition of salicylic acid causes the violet coloration. It is suggested, provisionally, that isopyrotritaric acid may be a dihydro-oxybenzoic acid.—J. F. B.

Iodoform; Electro-Chemical Synthesis, by Electrolytic Methods, of ——. O. Dony-Henault. Bull. Assoc. Belge des Chim. **14**, [6], 247—265.

The author concludes that the synthetic production of iodoform, by purely chemical or electrolytic means, is not due to direct action of the iodine on the alcohol in alkaline solution, but to a secondary action of alcohol on the hypoiodous acid initially formed. This acid is very unstable and tends to decompose, within the alcoholic solution, on two different lines, the one resulting in the production of iodates and the other in iodoform, the yield of which latter product depends on the relative speed at which these competitive processes go on.

The basis for this hypothesis is the absence of anodic depolarisation of the iodine when alcohol is added to the potassium iodide and sodium carbonate solution, and in the slight depolarisation of the iodine by the alkali carbonate. Indirect confirmation is afforded by the circumstance that the best conditions for producing iodoform by electrolysis as above are also the most favourable for the formation of hypoiodous acid in absence of alcohol. The output of iodoform can be increased, if the conversion of the hypoiodous acid into iodate be retarded by adding an excess of iodide or iodate. Direct confirmation of the secondary formation of iodoform is afforded in the preparation of that product from hypoiodous anhydride free from any trace of uncombined iodine.—C. S.

Thiopyrine. A. Michaelis and H. Bindewald. Ber. 1900, **33**, [15], 2873—2874.

By the action of aqueous or (better) alcoholic alkali upon the chlormethylate of 1-phenyl-3-methyl-5-chloropyrazol, antipyrine is formed. Thio-antipyrine is produced by an analogous reaction when equal parts by weight of the chlormethylate and potassium hydrosulphide are brought together in alcoholic solution. Excess of sulphide is removed by carbonic acid, the potassium salts filtered off, the solution evaporated to dryness, and the residue recrystallised. Thiopyrine, $C_{10}H_{12}N_2S$, forms colourless plates, which melt at 166° C., and are tolerably soluble in cold water. It dissolves in caustic soda solution with difficulty, more readily in hydrochloric acid, producing a salt.

In the Ger. Pat. 113,384, of July 19, 1899, compounds, obtained by heating aniline or toluidine with antipyrine

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and phosphorus oxychloride, are described. The author considers that these compounds are formed by the action of aniline or toluidine upon the above chlormethylate, which is first produced by the action of the phosphorus oxychloride. —A. C. W.

Cane Sugar, Inversion of ——; *in Various Pharmaceutical Preparations.* A. H. Woltersdorf and W. O. Richtmann. Pharm. Arch. May and June 1900. Through Pharm. J. **65**, [1583], 471.

In all cases where cane sugar is employed in galenical preparations, heat increases the rapidity of inversion, while cold retards it; syrups and similar preparations should therefore be stored at the lowest possible temperature. Wherever free acid is present alone, whether it be organic or inorganic, inversion takes place, and more rapidly with the former than with the latter. If a neutral salt as well as free acid, be present, the rate of inversion is retarded; this is notably the case with potassium citrate, and the greater the quantity of the neutral salt, the less is the inversion. Alcohol and glycerin are without any inhibitive effect on inversion.—J. O. B.

Alkaloidal Salts from Acidified Solutions; Crystallisation of ——. A. J. Cownley. Pharm. J. **65**, [1583], 465.

The tendency of certain alkaloidal salts to crystallise from solvents, such as water or alcohol, in the presence of free acid, which was formerly incorrectly ascribed to the formation of less soluble acid salts, has an important bearing, indicating a means of obtaining in a crystalline form, salts which do not readily separate from neutral solutions. *Caffeine* will yield a crystalline sulphate only in the presence of an excess of sulphuric acid, and the hydrochloride of that base is obtained easily only under similar conditions. The ipecacuanha alkaloids, *emetine*, *cephaeline* and *psychotrine*, all yield crystalline hydrochlorides under these conditions; cephaeline hydrochloride could not at first be obtained in crystals, until advantage was taken of this property, by slightly but distinctly acidulating the aqueous solution with hydrochloric acid. In all these cases the salts formed have been proved to be neutral hydrochlorides. *Strychnine hydrobromide*, under the same conditions, separates out more readily from aqueous solution containing a little free hydrobromic acid, than from neutral solutions. Strychnine hydrochloride has previously been shown to behave in a similar manner.—J. O. B.

Laudanosine, one of the rarer Opium Alkaloid; Partial Synthesis of ——. A. Pictet and B. Athanasesco. Comptes Rend. **131**, [17], 689—691.

By reducing iodomethylate or chloromethylate of papaverine with tin and hydrochloric acid, a base is obtained, which, if papaverine be represented by Goldschmiedt's formula, must be N-methyltetrahydropapaverine. This base is chemically identical with laudanosine from opium, but physically isomeric with it, melting at 115° C. instead of 89° C., and being optically inactive. By treatment with quinic acid, the authors succeeded in separating the base into two, a lævo-rotatory ($[\alpha]_D = -105°$), and a dextro-rotatory ($[\alpha]_D = +98{\cdot}7°$). The latter was practically identical in all its characters with laudanosine ($[\alpha]_D = +106°$); and the identity was further confirmed by mixing equal masses of laudanosine and the lævo-rotatory base, dissolving in alcohol and precipitating by water, when the inactive base, melting at 115° C., was obtained.—J. T. D.

Delphinium Staphisagria; The Alkaloids of ——. Katz. Zeits. angew. Chem. 1900, [40], 1013.

In this preliminary communication the author assumes provisionally that only two alkaloids, *viz.*, delphinine and staphisagroïne, exist in the seed, and that the delphinioïdine and staphisagrine of other investigators, are only decomposition products.

Preliminary experiments to determine the amount of alkaloids contained in the seeds showed that Keller's process was unworkable. It was found when the seeds were extracted first with ether and then with alcohol that all the alkaloids were removed. From 50 kilos. of the seeds, 30 grms. of delphinine were obtained. Further experiments (*viz.* analyses, preparation of salts, hydrolysis) were made to characterise this substance. From the results obtained and the solubility of the salts in chloroform the author considers it probable that delphinine is a compound of the nature of an ester.—J. S.

Apiin. E. Vongerichten. Ber. 1900, **33**, [15], 2904—2909.

Apiin is a glucoside contained in parsley and celery (Ber. 1900, **33**, 2334). Apiin methyl ether is obtained by boiling apiin with a large excess of caustic potash and methyl iodide in methyl alcohol solution. On cooling, it separates in thick white needles, which melt after recrystallisation from dilute alcohol, at 185° C.; other preparations, obtained in a similar manner, melted between 185° and 200° C. The methyl ether, $C_{28}H_{30}O_{14}.2H_2O$, gives an intense yellow coloration with sodium carbonate solution, in which it does not dissolve; it is soluble in caustic soda, but insoluble in ammonia. When boiled with dilute hydrochloric acid, it gives apigenin methyl ether in a yield corresponding with the equation—

$$C_{28}H_{32}O_{15}.H_2O + H_2O = 2C_6H_{12}O_6 + C_{16}H_{12}O_5.$$

Apigenin methyl ether crystallises from alcohol in yellowish warts, which melt at 256°—257° C. after purification by means of the acetyl derivative. When boiled for one hour with 30 per cent. caustic potash solution, it is decomposed; *p*-acetylanisol, anisic acid and phloroglucinol are formed.

When apiin is boiled for eight hours with a little water and a large excess of caustic potash and methyl iodide, a small quantity of a substance is formed, which appears to be the glucoside of apigenin dimethyl ether. This compound is decomposed by hydrochloric acid into a reducing sugar and an apigenin derivative, soluble in caustic soda, which melts at 264° C.—A. C. W.

Senna. A. Tschirch and E. Hiepe. Arch. der Pharm. **238**, 427—449; Chem. Centr. 1900, **2**, [16], 871.

The crude *anthragluco-sennin* prepared from different varieties of senna was separated into three portions; (1) a portion soluble in ether; (2) a portion soluble in acetone; and (3) an insoluble portion.

(1.) The portion soluble in ether contained *senna-emodin*, $C_{15}H_{10}O_5$, melting at 223°—224° C. The *triacetyl-emodin*, $C_{15}H_7O_5(C_2H_3O)_3$, m.p., 170° C., is identical with the triacetyl derivative of the emodin from aloes: rheum-emodin and frangula emodin are also identical. The senna-emodin is slightly soluble in hot alcohol and toluene, soluble in benzene and ether with a yellow colour, and in concentrated sulphuric acid and ammonia with cherry red colour. *Senna-chrysophanic acid*, $C_{15}H_{10}O_4$, m.p., 171°—172° C., is soluble in benzene, glacial acetic acid, and alcohol; its alcoholic solution is coloured dark brownish-red by ferric chloride, and cherry-red by chloride of lime; towards ammonia the acid behaves in a similar manner to the chrysophanic acid prepared by Hesse from rhubarb. The third body obtained by the ether extraction was insoluble in toluene but soluble in alcohol. It formed an amorphous yellow powder, which when sublimed, yielded fine red needles, melting at 163° C. The yellow powder, after purification, yielded small crystals from aqueous alcohol, which melted above 260° C., and had the composition $C_{22}H_{18}O_8$. The substance thus appears to be an emodin glucoside and is named by the authors, *glucosennin*.

2. The portion of the crude anthraglucosennin soluble in acetone, gave, on addition of petroleum spirit to the alcoholic solution of the evaporation residue, a light yellow, amorphous substance, readily soluble in alcohol, and glacial acetic acid. The compound is isomeric with senna-emodin and is named by the authors, *senna-iso-emodin*. The acetone extract, after being exhausted with petroleum spirit, was evaporated to dryness, and the residue dissolved in caustic potash solution. The filtrate was precipitated with hydrochloric acid and again filtered. The filtrate when extracted with ether, and treated with alkali, no longer gave the cherry-red oxymethylanthraquinone reaction, but gave the orange-yellow rhamnetin reaction. The body is not

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identical with true rhamnetin; it is named by the authors *senna-rhamnetin*. It can be, however, better prepared from the aqueous percolate of the leaves.

3. The insoluble portion, free from all decomposition products of the oxymethylanthraquinone group is soluble in alkalis with a red colour, and in sulphuric acid and phenol with a black colour. After being purified by dissolving in ammonia and reprecipitating with hydrochloric acid, it was obtained as a black powder, *senna-nigrin*. It is converted by boiling nitric acid into chrysaminic acid.

Senna; Determining the Value of.—For the valuation of senna, the authors suggest a determination of the bodies which yield oxymethylanthraquinone or, in practice, the amount of the latter body obtainable. For this purpose, 0·5 grm. of the drug is boiled for five minutes, with 50 c.c. of alcoholic potash, the solution filtered, the drug heated again with a further 50 c.c. of alcoholic potash, and the solution again filtered. The united filtrates are acidified with 20 c.c. of dilute hydrochloric acid, shaken twice with ether (100 c.c. each time), and the ethereal extract shaken twice with 100 c.c. of dilute ammonia. The ammoniacal solution, which contains the oxymethylanthraquinone, is made up to 500 c.c., and the amount of active substance present estimated by adjusting the thickness of the solution so that the latter will produce the same spectrum (quantitatively) as a solution of pure aloe emodin of known strength.—A. S.

Benzyl Benzoate. E. Erdmann. Pharm. J. 1900, **65**, [1580], 387.

The author states that benzyl benzoate constitutes the therapeutically active portion of Peru balsam, and forms the larger portion of the mixed product formerly known by the name of cinnamein, and generally described as consisting chiefly or entirely of benzyl cinnamate. It is a colourless oil, boiling at 173° C. under 9 mm. pressure. The benzyl cinnamate associated with it, in smaller proportion, is crystalline, melts at 37° C., and boils, under reduced pressure, at 213°—214° C. The two esters can be separated by fractional distillation *in vacuo*. It is stated that synthetic benzyl benzoate is as efficacious, therapeutically, as the ester obtained direct from Peru balsam, whilst it has the advantages that it is free from colour or smell, is constant in composition, and does not cause the irritation sometimes a consequence of using Peru balsam, owing to the free acids present.—A. S.

Lotus Arabicus; Nature and Origin of the Poison of ——. W. R. Dunstan and T. A. Henry. Proc. Royal Soc. **67**, [437], 224—226.

This leguminous plant is indigenous in Egypt and Northern Africa and is used as fodder. At certain periods of its growth—notably up to the time of seeding—it is found to be possessed of highly poisonous properties, in consequence of which it has been a source of much trouble to the Egyptian authorities. The authors have inquired into the nature and origin of the poison, and now publish a preliminary notice on the subject. The poison is hydrocyanic acid produced by the hydrolysis of a yellow crystalline glucoside, to which they give the name *lotusin*, by the influence of an enzyme, which they term *lotase*. The products of the hydrolysis of the *lotusin* are *lotoflavin* (a new yellow colouring matter), dextrin, and hydrocyanic acid.
—H. H. B. S.

Essential Oils. Refractometric Constants as a Guide to Purity. Utz. Apoth.-Zeit. **15**, 441. Chem. Centr. 1900, **2**, [13], 746.

The author has examined, by aid of the Zeiss butyro-refractometer, a large number of essential oils as to their refractive power. In the results communicated are given the refractive indices of the oils at 25° and 40° C., the "colour fringes" observed, as indicating the amount of dispersion, the density, and the polarisation. The author recommends the determination of the refractive power as an auxiliary means of judging the purity of an essential oil. It affords a clue as to the age of the oil and the amount of terpenes contained in the same.—A. S.

Eucalyptus Oil; Two New Varieties of ——. Schimmel's Semi-ann. Rept. Oct. 1900, 32.

Oil of Eucalyptus bicolor.—According to Maiden, this is identical with *E. largiflorens* F. v. M. The oil had the sp. gr. 0·8866, opt. rot. − 21° 50′. It was insoluble in alcohol, 70 per cent.; soluble in 9 volumes of 80 per cent. alcohol. It contained much phellandrene, and but little cineol.

Oil of "Red Gum of Tenterfield."—The botanical source of this oil is not specified; the red gum yielding it is indigenous to the N.E. portion of New South Wales, near the Queensland border. The oil had the sp. gr. 0·9144; opt. rot. − 2° 38′; it was insoluble in alcohol, 70 per cent., but dissolved in an equal volume of 80 per cent. alcohol. It had an odour like cumic aldehyde, contained cineol, but was free from phellandrene.—J. O. B.

Rosemary Oil. Jeancard and Satie. Chem. and Druggist 1900, **57**, [1082], 658.

The following results were obtained by the analysis of samples of rosemary oil from different localities:—

Locality.	Specific Gravity.	Optical Rotation.	Percentage of Esters.
Bouches du Rhone	0·9016	+ 4°	3·10
Gard	0·9088	+ 8° 5′	4·65
Tunis.....	0·9146	+ 1° 36′	..
Provence	0·9042	+ 5° 3′	..
Pyrenees	0·9018	+ 2° 30′	..

The esters were calculated as bornyl acetate. The variation of specific gravity per degree of temperature was 0·00085. With the exception of No. 5, which required 8·5 volumes, all the samples were soluble in 3·4 volumes of 80 per cent. alcohol. At 20° C., 1 volume of oil required for solution, 15·5 volumes of 70 per cent., 3·4 volumes of 80 per cent., and 0·6 volumes of 90 per cent. alcohol.
—A. S.

Rose-Wood [Lign-aloe] Oil; Preparation and Properties of ——. Eug. Theulier. Rev. Gén. Chim. pure et appliq. 1900, **3**, 262; through Chem. Zeit. Rep. 1900, **24**, [86] 315.

Rose-wood (*bois de rose femelle*) known also as "likari Kanali" is the wood of the so-called Brazilian lign-aloe, and comes to France from Guiana in pieces of 1·2 to 1·3 metres in length, and of various thicknesses, from small boughs to large stems, with a circumference sometimes exceeding one metre. The bark, which is wrinkled and of a grey-chestnut colour, contains no ethereal oil, and is without special odour. The wood is a strong gold-yellow colour with a longitudinal row of small veins interrupted by a dark red brown when dry; its specific gravity is 0·6789 in petroleum ether at 15° C. The yield of oil (linaloe oil) depends on the healthy condition of the tree when felled, its age, the particular portion extracted, and whether the proportion of oil in a given piece of wood is the same for the outer and inner layers. To obtain the oil, the wood must be finely divided and distilled without loss of time in an ordinary retort arranged for steam distillation. The oil distils rapidly, not less than 1 per cent., and sometimes as much as 1·6 per cent. being obtained; it is at first a pale yellow, but after rectification quite colourless, and with the characteristic odour of the wood, that is, mild and pleasant, but with a slight trace of pungency. Its specific gravity is 0·875—0·8527 at 14·5°, rotatory power −15°·5′ to −15°·2′ at 13° C., saponification number, 1·385, and boiling point 192° C.—210° C. It is soluble in 2 volumes of alcohol (70 degrees), consists mainly of *l*-linalool, and is used for perfumery and soap making. The exhausted wood is utilised as a packing material and for fuel.—R. L. J.

Lign-aloe Oil; Constituents of ——. Schimmel's Semi-Ann. Rept., Oct. 1900, 42—44.

From the results obtained by working up large quantities of saponified lignaloe oil, and from the known specific gravities of the constituents, the alcoholic portion of the

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oil should consist, approximately, of lævo-linalool, 90 per cent.; dextro-terpineol, 6·5 per cent.; and geraniol, 3·5 per cent.—J. O. B.

Ginger Oil; New Sesquiterpene in ——. H. von Soden and W. Rojahn. Pharm. Zeit. **45**, 414; through Schimmel's Semi-Ann. Rept. Oct. 1900, 35.

THE authors have isolated a new sesquiterpene, zingiberene, $C_{15}H_{24}$, from ginger oil, by fractionating the saponified oil. It had the following characters:—Sp. gr. 0·872; opt. rot. − 69°. It boiled, at normal pressure, at 269°—270° C., with slight decomposition. At 14 mm. pressure it boiled at 134° C. It was a thin liquid, and, like all light sesquiterpenes, had a tendency to resinify. The first fractions of ginger oil yielded a substance combining with bisulphite, but the quantity obtained was too small for investigation.

—J. O. B.

Parsley, Essential Oil of; Constituents of ——. Bignami and Testoni. Gaz. chim. ital., 1900, **30**, [1], 240; through Pharm. Zeit. **45**, 606.

MOURGUES has found in parsley oil, in addition to the known constituents apiin and apiol, a new body, boiling between 277°—285° C., which he named cariol, and identified as a dimethyl or ethyl apiol, having the formula $C_{14}H_{18}O_4$. The authors, as a result of further investigation, claim that this substance contains nearly 50 per cent. of a body of which the formula is—

$$C_6H_2(OCH_3)(O_2CH_2) : C_3H_5.$$

—J. O. B.

Lemon Oil; Presence of Traces of Bodies yielding Iodoform in ——. Schimmel's Semi-Ann. Rept., Oct. 1900. 26.

A SAMPLE of lemon oil having been adversely reported on as containing traces of alcohol, the reliability of the usually employed iodoform reaction for this substance has been investigated. By fractionally distilling the aqueous solution obtained by washing 900—1,000 grms. of lemon oil, the first few c.c. which pass over were found to yield iodoform on treatment with iodine and potash. This reaction does not necessarily indicate the presence of ethyl alcohol, since it may be derived from certain aldehydes and ketones, such as acetaldehyde and acetone, which may be natural constituents of certain oils. To prove this, a specimen of American turpentine oil, when treated in a similar manner, was found to give a much more marked iodoform reaction than lemon oil. To infer from this the addition of alcohol, for fraudulent purposes, would be, in this case, absurd.

—J. O. B.

Orange Oil, Sweet; Constituents of ——. Schimmel's Semi-Ann. Rept., Oct. 1900, 28—31.

AFTER removing terpenes by fractional distillation, the following constituents have been isolated from the concentrated oil:—Decylic alcohol, dextro-linalool (coriandrol), dextro-terpineol, nonylic alcohol, and caprylic acid (present as an ester).—J. O. B.

Wintergreen Oil; Local Distillation of ——. Schimmel's Semi-Ann. Rept., Oct. 1900, 64—65.

THIS oil is distilled in large quantities in Ashe, Watanga, and Mitchel counties in the North West, and in smaller quantities in S.E. Tennessee. The bark used is that of *Betula lenta*, known locally as "Black Birch." Trees from 12 to 24 ins. in diameter are felled when they are in sap, and the bark is stripped off. Some wintergreen herb known as "mountain tea" is frequently added. The still is of the most primitive type. It is made of wood, about 2½ ft. wide, 3 ft. deep, and 7 ft. long. The bottom is of galvanised iron, and is nailed on with suitable packing. The whole stands on a foundation of masonry, which, at the same time, serves as a fire-chamber. The bark is laid on laths about 4 ins. above the bottom. One-inch iron pipes connect the still with the condenser. The oily water, separated from the oil, is led back to the still by a special pipe. There are usually from 10 to 20 trees on an acre of land, and the distiller frequently buys them for 10 cents each. The still always remains fixed at the same spot, so the bark has sometimes to be brought from considerable distances. The distiller, as soon as he has obtained from 2 to 10 lb. of oil, sells it to a local merchant. The chief season is from May to the end of September.—J. O. B.

Lavender Oil, French; Adulteration of ——, *with Resin.* Schimmel's Semi-Ann. Rept., Oct. 1900, 39—40.

A CONSIGNMENT of lavender oil from Grasse was found to have the following characters. Sp. gr. 0·916, opt. rot. − 8° 4′ to − 7° 41′, and ester content, 45·8 to 45·3 per cent. It was abnormally viscous, and left, on evaporation, and also on distillation *in vacuo*, from 11·2 to 12·6 per cent. of a hard brittle residue. It is noteworthy that the solubility in 70 per cent. alcohol was not affected, and the adulteration could not be detected by the saponification test. The specific gravity was, however, much increased; if, therefore, a specimen of lavender oil show a specific gravity above 0·895, the amount of residue on evaporation should be determined.—J. O. B.

Lavender Oil; Presence of Coumarin in ——. Schimmel's Semi-Ann. Rept., Oct. 1900, 40—41.

ON distilling French lavender oil *in vacuo*, the residue still contains a considerable quantity of ester-like bodies; on saponifying this, and decomposing the oil-free liquor with acid, a mixture is obtained which is only partly re-dissolved in cold dilute alkali. The insoluble portion, distilled *in vacuo*, gives, in its higher boiling fractions, a body which crystallises on cooling. This proved to be coumarin, which is a normal constituent of lavender oil. That its presence is not due to accidental causes, is proved by the fact that it has been also obtained in the oil distilled from dried lavender flowers. With these, the whole of the coumarin passes over into the distillate, the steam exhausted flowers treated with ether yield none, but o-coumaric acid was found in the ether extract.—J. O. B.

Kæmpferia Oil. Schimmel's Semi-Ann. Rept., Oct. 1900, 38—39.

IN a communication to the *Koninklijke Akademie van Wetenschappen*, Amsterdam, P. van Ramburgh states that the rhizomes of *Kæmpferia galanga* yield by steam distillation a volatile oil. The first portion which distils floats on water, the later portions of distillate sink and ultimately crystallise. The crystals prove to be the ethyl ester of paramethoxy-cinnamic acid, melting at 50° C. This is the first record of this body existing as a constituent of a volatile oil. The liquid portion of the oil contains a terpene, boiling between 160° and 170° C. and also a bluish-green liquid, boiling at 150° C. *in vacuo*; this last is probably a sesquiterpene. An acid with a low melting point is also present but has not been identified.—J. O. B.

Cassia Oil; Adulteration of ——. Schimmel's Semi-Ann. Rept., Oct. 1900, 14.

SPECIMENS of cassia oil adulterated with resin are still occasionally met with. Recently, two samples have been received, one yielding 20 per cent. of solid residue on distillation, the other 12 per cent. It is therefore still necessary to apply the distillation test as well as to determine the percentage of cinnamic aldehyde.—J. O. B.

Antipeptone. M. Siegfried. Ber. 1900, **33**, [15], 2851—2858.

ANTIPEPTONE was obtained by the tryptic digestion of blood fibrin or Witte's peptone; the operation lasted 3—9 weeks and was conducted in a thermostat at the normal temperature of the body. The following method was adopted for the complete removal of albumoses from the product of the digestion; during the whole process the temperature was not allowed to exceed 40° C. Ammonium sulphate and strong sulphuric acid are added to the solution at the ordinary temperature, until no further turbidity occurs; the filtrate is neutralised by ammonia gas or aqueous ammonia saturated with ammonium sulphate, and then made strongly acid by sulphuric acid. A solution of iron ammonium alum in saturated ammonium sulphate solution is then added; it

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produces iron precipitate I, which is carefully washed with ammonium sulphate, ground and again washed with the same reagent. This precipitate contains the last portions of the albumoses, together with peptones, whilst the filtrate is free from albumoses. The precipitate is digested with dilute ammonia at a temperature below 40° C., with continuous stirring; after filtering, the solution is acidified by sulphuric acid and completely saturated with ammonium sulphate, when the albumoses are entirely precipitated. The product of the digestion appears to contain substances which prevent the precipitation of albumoses; when the former are removed the albumoses are readily separated. The solution, now free from albumoses, is again precipitated by iron alum, the precipitate treated as before, decomposed by ammonia, freed from sulphuric acid by baryta, the solution evaporated *in vacuo*, the residue dissolved in dilute acetic acid, and the solution precipitated by alcohol. A monobasic acid, $C_{11}H_{19}N_3O_5$, is obtained.

The filtrate from the iron precipitate I is stirred with powdered iron alum and addition of strong ammonia, care being taken that the reaction remains acid. This iron precipitate II is washed as before, and should be dissolved in ammonia, the solution saturated by ammonium sulphate and again precipitated by iron. The iron precipitate is dissolved by means of a little sulphuric acid, a slight excess of baryta water (saturated at 40° C.) added, the filtrate freed from baryta by carbonic acid and the solution evaporated *in vacuo*. The residue has a strongly acid reaction, but contains the ammonium salt of peptone; it is dissolved in dilute acetic acid to a thin syrup, which is mixed with alcohol until the initial turbidity disappears, and the solution poured into absolute alcohol. The separated peptone is washed with alcohol and ether and dried *in vacuo* over sulphuric acid. It is a snow-white, non-deliquescent powder, of intensely acid reaction and pleasant acid taste. Analyses, &c. indicated the formula $C_{10}N_3H_{17}O_5$; it is a monobasic acid.

The author proposes the names α- and β-antipeptone for the acids $C_{10}N_3H_{17}O_5$ and $C_{11}N_3H_{19}O_5$ respectively.

—A. C. W.

Santonin; Determination of ——. K. Thaeter.

See under XXIII., *page* 1152.

Hops; Alkaloid of ——. Hantke. Letters on Brewing, July 1900, through Woch. für Brau. 1900, **17**, [44], 650.

See under XVII., *page* 1127.

Citral and certain other Aromatic Compounds; Colour Reaction for ——. H. E. Burgess.

See under XXIII., *page* 1150.

PATENTS.

Cream of Tartar; Manufacture of ——. T. Gladysz, Montredon, France. Eng. Pat. 22,117, Nov. 4, 1899.

Potassium bitartrate is readily precipitated from its hydrochloric acid solution by the addition of an alkali or alkaline earth sulphite. For this purpose the "lyes" (lees?) or "tartars" are treated with sodium bisulphite, or the sulphite is formed in the liquor itself, by first adding lime and then passing into it a current of sulphur dioxide. The mixing is done in the cold, and lead vessels must not be used. The precipitated tartrate is freed from mother-liquor, washed with cold water saturated with bitartrate, and dried.—J. W. H.

Carbamic Ethers; Manufacture of ——. H. E. Newton. London. From Farbenfabriken vormals F. Bayer und Co., Elberfeld, Germany. Eng. Pat. 25,069, Dec. 18, 1899.

The manufacture of the carbamic acid esters or urethanes derived from certain secondary alcohols, such as methylethylcarbinol, may be carried out, according to this invention, in two ways, either by allowing cyanogen chloride or cyanic acid to act on the respective alcohols, or by treating the neutral carbonic acid esters of the alcohols with ammonia. An example of the process is the following: a current of gaseous cyanogen chloride is slowly passed through a mixture of 25 parts of methylpropylcarbinol and 1 part of water until saturated; the vessel is then closed and heated for several hours; the mixture is next filtered and heated to 120° C. to drive off the unchanged methylpropyl carbinol. On extraction of the crystalline mass obtained on cooling, with hot benzene and evaporating the resulting solution, methylpropylcarbinolurethane is obtained.—J. W. H.

Pancreas; Manufacture of an Aseptic Preparation from the ——. A. G. Bloxam, London. From Chemische Fabrik Rhenania, Aachen, Germany. Eng. Pat. 14,413, Aug. 11, 1900.

The process claimed relates to the preparation of extracts from the pancreas gland, and especially the removal of albuminous matters from the said extracts. 100 grms. of pancreatin are shaken with a litre of 10 per cent. salt solution, and filtered. To the filtrate a concentrated solution of 15 to 20 grms. of salicylic acid or benzoic acid is added, and the mixture shaken. The precipitate is filtered off, washed with water, pressed, and dried. Fresh pancreas juice may be used. By adding alkali or an alkali salt to the moist or dry precipitate, a soluble preparation is obtained.—W. P. S.

Pancreas Preparation capable of Resisting Stomach Juices; Manufacture of a ——. A. G. Bloxam, London. From Chemische Fabrik Rhenania, Aachen, Germany. Eng. Pat. 14,414, Aug. 11, 1900.

A process for rendering the enzymes of the pancreas insoluble, so that they are not acted on by the gastric juice, whilst they remain freely soluble in alkaline fluids and capable of exercising their digestive properties. To effect this, an extract of the pancreas or an extract containing pancreatin is precipitated with tannin. The precipitate produced is filtered, washed, and dried.—W. P. S.

XXI.—PHOTOGRAPHY.

Sodium Sulphite in Thiosulphate Fixing Baths; Detection of ——. Chem. Zeit. Rep. 1900, **24**, [35], 308. From Phot. Rundschau, 1900, **14**, 201.

The presence of sodium sulphite in thiosulphate may be recognised by adding to the solution a little strontium nitrate or chloride, and filtering, when the difficultly soluble strontium sulphite would remain on the filter. The existence of the sulphite in the ordinary fixing bath is of no consequence, but in the toning fixing bath it exerts a prejudicial influence, and in certain small proportions completely prevents toning.—W. G. M.

Pyrocatechol; Photographic Development with ——. W. W. S. Davenport. Brit. Jour. Phot. 1900, **47**, [2112], 676.

Catechol, when used as a developer is almost free from stain, and with tribasic sodium phosphate as an accelerator, is very vigorous in action, and gives great latitude of exposure. The developer may be made up as follows:—No. 1. Catechol, 5 grms. or 80 grains; water, 250 c.c. or 10 oz. No. 2. Tribasic sodium phosphate, 25 grms., or 1 oz. avoird; sodium sulphite, 10 grms. or 3 drms; water, 250 c.c. or 10 ozs. For normal exposure take equal parts of each and water; for over exposure, omit the water and increase the quantity of No 1; adding bromide if necessary: for under exposure increase the amount of water and add more of No. 1. This developer is very slow in action, but may be quickened by increasing the quantity of tribasic sodium phosphate by 50 or 100 per cent. in No. 2.

—J. W. H.

Platinotype Work; Use of Ammonium Oxalate in ——. R. Jacoby. Chem. Zeit. Rep., 1900, **24**, [35], 308. (From Phot. Wochenbl. 1900, **26**, 314.)

J. E. Watson recommends the use of a 5 per cent. aqueous solution of ammonium oxalate in place of the last

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acid clearing bath, whereby the last traces of iron are removed from the prints and a clear blue-black tone is obtained. The greater clearness and permanence of the whites results, not from the removal of traces of basic iron salts, but from that of platinum salts, which almost always remain in the prints and afterwards impart to them the yellowish shade which they frequently exhibit on long keeping. Almost all the alkali salts of the fatty acids act as clearing agents, but the ammonium salts are the best, and the oxalate and citrate of ammonium are the best of all tried at present. Nitrates and sulphites also clear the whites, but attack the sizing of the paper too strongly.

—W. G. M.

Cyanotype Prints, The "After-blueing of." N. Grün. Phot. Wochenbl. 1900, 26, 321. Through Chem. Zeit. Rep. 1900, **24**, [86], 316.

THE colour and brilliance of cyanotype prints are known to become more pronounced after washing and drying. This effect can he immediately produced by adding to the washing water hydrochloric acid or a little of a ferric salt, but both substances have certain disadvantages.

The author finds that if a little hydrogen peroxide is added at the last washing, the prints at once become an intense dark blue to violet colour. By the help of this reagent also, old cyanotype paper can be made to give faultlessly clear and brilliant copies; the copies must be printed deeply, cleared with a little soda, and then intensified by hydrogen peroxide at the last washing. The effect is doubtless due to the immediate oxidation of the Turnbull's blue usually formed, to the much more intense Prussian blue.

—R. L. J.

Silver Photographic Prints; Permanence of. L. Ough. Chem. and Druggist, 1900, **57**, [1082], 664.

THE liability of silver prints to fade is due to the incomplete elimination of the sodium thiosulphate used in fixing. When the print is immersed in the fixing solution, the unaltered silver chloride is acted upon by the sodium thiosulphate with the formation of two complex double salts, one of which is readily soluble in water, whilst the other is almost insoluble in water, but easily soluble in excess of the fixing solution. If traces of these compounds remain in the finished print, fading is, sooner or later, certain to occur, as they are decomposed by the action of light and by the acid vapours of the air. It has been stated that the difficulty may be overcome by fixing in two separate baths. The proportion of insoluble double salt formed in the first bath is rendered soluble by the excess of solution in the second, and can then be removed, together with excess of thiosulphate, by thorough washing. The following is given as the most trustworthy method of ascertaining whether the print is quite free from thiosulphate:—A few drops of the washing water are allowed to fall on to a white plate, and a drop of 10 per cent. silver nitrate solution added. The presence of thiosulphate is indicated by the production, in the course of a few minutes, of a brown coloration or precipitate. It is important that the silver solution be added to the washing water and not *vice versa*. The reaction is only applicable for sodium thiosulphate or the soluble double salt, not for the insoluble double salt.

According to Abney, the tendency of a print to fade is influenced to a considerable extent by the quality of the washing water. The latter should be soft; if spring water be used, a small proportion of alkali should be added for the first washing. The prints should be carefully washed between toning and fixing, as any traces of an acid toning solution left on the prints when they placed in the fixing bath, would tend to decompose the thiosulphate.—A. S.

Photographic Plates; Maturing of ——. C. A. Lobry de Bruyn. Rec. trav. Chim. Pays-Bas, **19**, 236—249; Chem. Centr. 1900, **2**, [17], 888.

THE author has observed that many substances which form precipitates insoluble in water, remain colloidally dissolved if formed in a solution of gelatin. He has prepared gelatinous colloidal solutions of silver, mercury, gold, lead iodide, several sulphides and hydroxides, silver chromate, copper ferrocyanide, Prussian blue, manganese peroxide, and silver chloride. The method proved unsuccessful with calcium oxalate, magnesium ammonium phosphate, and barium sulphate.

In view of his observations, the author advances the following explanation of the maturing of photographic plates. The silver bromide is formed in the colloidal condition in the gelatin, and the latter remains clear. On long standing, or rapidly on warming, the plate becomes turbid through separation of silver bromide, and at the same time the plate becomes sensitive. The author concludes that the turbid plate alone is sensitive to light, and that the light passes through the transparent film without action. Luther (Die chemischen Vorgänge in der Photographie, Halle, 1899) has put forward the view that the maturing is due to a partial reduction of the silver bromide to subbromide by the organic matter of the gelatin. This theory is, however, at variance with the fact that the maturing is slower, the more concentrated the gelatin is, whilst the reducing action must be more energetic. The author also points out that an emulsion of silver bromide in gelatinous silicic acid, with exclusion of any reducing agent, is even more sensitive to light than a mature gelatin plate.—A. S.

Photographic Work; Defects caused by Polluted Air. B. Kohlmann. Zeits. öffentl. Chem. **6**, 329; Chem. Centr. 1900, **2**, [17], 924.

IT was observed at a photographic establishment that the pictures produced on certain days were clouded. The author has ascertained that the fault was caused by the presence of SO_2 in the air, owing to the entrance into the studio of flue gases, when the wind was blowing in a particular direction. No defects have been noted since the precaution was taken of passing the air which entered the studio by means of the ventilators, through a weak alkaline solution.—A. S.

Lippmann Process. E. D. Fawcett. Brit. Journ. Phot. **47**, [2110], 645.

A RECENT advance in this process consists in the use of Methyl Violet as a "chromatiser." Lippmann adds to 100 c.c. of a suitable emulsion, $2\frac{1}{2}$ c.c. of a 1 per cent. alcoholic solution of Methyl Violet (crystallised); the plates produced give remarkably brilliant and faithful results. The author was not very successful with this process until he adopted the plan of developing very partially and intensifying with a modified "developer"; 30—40 parts of a metol-sulphite "developer" without alkali, are added to 5—6 parts of a solution made up as follows: Ammonium thiocyanate, 24 grms.; sodium sulphite, 24 grms.; sodium thiosulphate, 5 grms.; silver nitrate, 4 grms.; potassium bromide, $\frac{1}{2}$ grm.; water, 100 c.c.

—J. W. H.

Photographic Pictures on Textile Fibres; Production of ——, by means of Mordants and Dyestuffs. F. Dommer.

See under VI., *page* 1107.

Light; Chemical Action of ——. G. Ciamician and P. Silber.

See under XXIV., *page* 1155.

PATENTS.

Photographic Negatives; Reducing Agents for ——. B. J. B. Mills, London. From A. Lumière et ses fils, Lyon-Monplaisir, France. Eng. Pat. 470, Jan. 8, 1900.

THIS relates especially to the now well-known cerium sulphate reducer; to a 10 per cent. solution, a little sulphuric acid is added to keep the salt in solution under all conditions. The inventors claim "the employment of peroxidised salts, and more particularly" those of cerium and titanium "in aqueous solution, as reducers of photographic images obtained by salts of silver upon glass or upon paper."—J. W. H.

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Photographic Films and Plates; Apparatus for Coating ——, with Sensitive Emulsion. C. E. Hearson, Camberwell, Surrey. Eng. Pat. 994, Jan. 16, 1900.

THE coating machine described has means whereby the emulsion is delivered on the plates or films at a rate proportional to the speed at which they pass through the machine, and if through any chance, coating be stopped, the emulsion is returned to the reservoir. The means of control of the flow of emulsion consists of a flexible tube through which the emulsion passes, and which is squeezed intermittently by rollers on a rotating shaft. Films after coating are moistened on the back to prevent buckling; arrangements for their further treatment are also described. —J. W. H.

Photographic Pictures in Natural Colours. R. Krayn, Berlin. Eng. Pat. 10,003, May 31, 1900.

THE invention relates to the production of coloured photographic prints by the superposition of three coloured films. For the middle component the inventor uses a chrome-gelatin stripping film, which, after developing and colouring, is transferred and cemented between the two outer components.—J. W. H.

XXII.—EXPLOSIVES, MATCHES, Etc.

Picrates; New Method of Preparing ——. Girard. Rev. Prod. Chim. **3**, [14], 213—214.

A MIXTURE of 30 kilos. of castor oil and 10 kilos. of powdered picric acid is prepared and incorporated with a sufficient quantity of the base—in the state of oxide or carbonate—to saturate the acid. The reaction occurs in molecular proportion, consequently the above quantity of picric acid requires 2·44 kilos. of potassium hydroxide, 1·220 kilos. of calcium hydroxide, 0·899 kilo. of calcined magnesia, 1·943 kilos. of ferric hydroxide, 4·850 kilos. of litharge; or 5·810 kilos. of lead carbonate, and so on.

The soluble alkalis are used as a 45° B. solution, the alkaline earths in the state of fine powder, whether anhydrous or hydrated; whilst other metallic oxides are employed as finely powdered hydroxides, except those of lead and zinc, which may also be anhydrous.

The reaction may commence at the ordinary temperature, the heat developed by the alkali- and alkaline earth oxides being sufficient to start combination; or the oil and acid mixture may be first heated to about 100° C. The proportions of oil and acid may be varied, but the oil should not be less than 5 parts per 10 of acid. The metallic oxides may be replaced by the corresponding salts of such fatty acids as will dissolve in the oil when displaced by the picric acid (*e.g.*, oleates, stearates, palmitates, &c.).

Volatile solvents are employed to extract the resulting picrates, in order to avoid the inconvenience attending their recovery from aqueous solutions.—C. S.

Picra-borate Explosives. Billet. Rev. Prod. Chim. **3**, [14], 214.

A SERIES of explosives, partly double salts, partly simple mixtures, according to the proportions employed, can be formed from picrates and borates, the preparation of sodium picra-borate being taken as typifying the mode of manufacture. For this purpose 190 grms. of crystallised sodium borate are dissolved in 1,000 c.c. of water, then heated to boiling, and saturated by the addition of about 170 grms. of picric acid. The crystalline mass formed on cooling has merely to be drained and dried.—C. S.

PATENTS.

Explosives; Manufacture of ——. C. E. Bichel, Hamburg. Eng. Pat. 22,712, Nov. 14, 1899.

PROCESS for the production of "ammonia-saltpetre explosives," by intimately mixing together "ammonia-saltpetre" (ammonium nitrate), a suitable organic compound, like nitrotoluene, and flour or similar substance containing starch or gluten. The mixture is preferably made by the aid of heat and addition of water; the mixing and "pasting together" are effected by grinding, the gluten of the flour serving as binding material. As an example of the approximate proportions to be adopted, the following may serve:—8 parts of trinitrotoluene, 86 parts of ammonium nitrate, 6 of flour; to these about 7 parts of water are added so as to form a paste.—A. M.

Picric Acid; Process for Producing ——. A. Gutensohn, London. Eng. Pat. 16,628, Sept. 18, 1900.

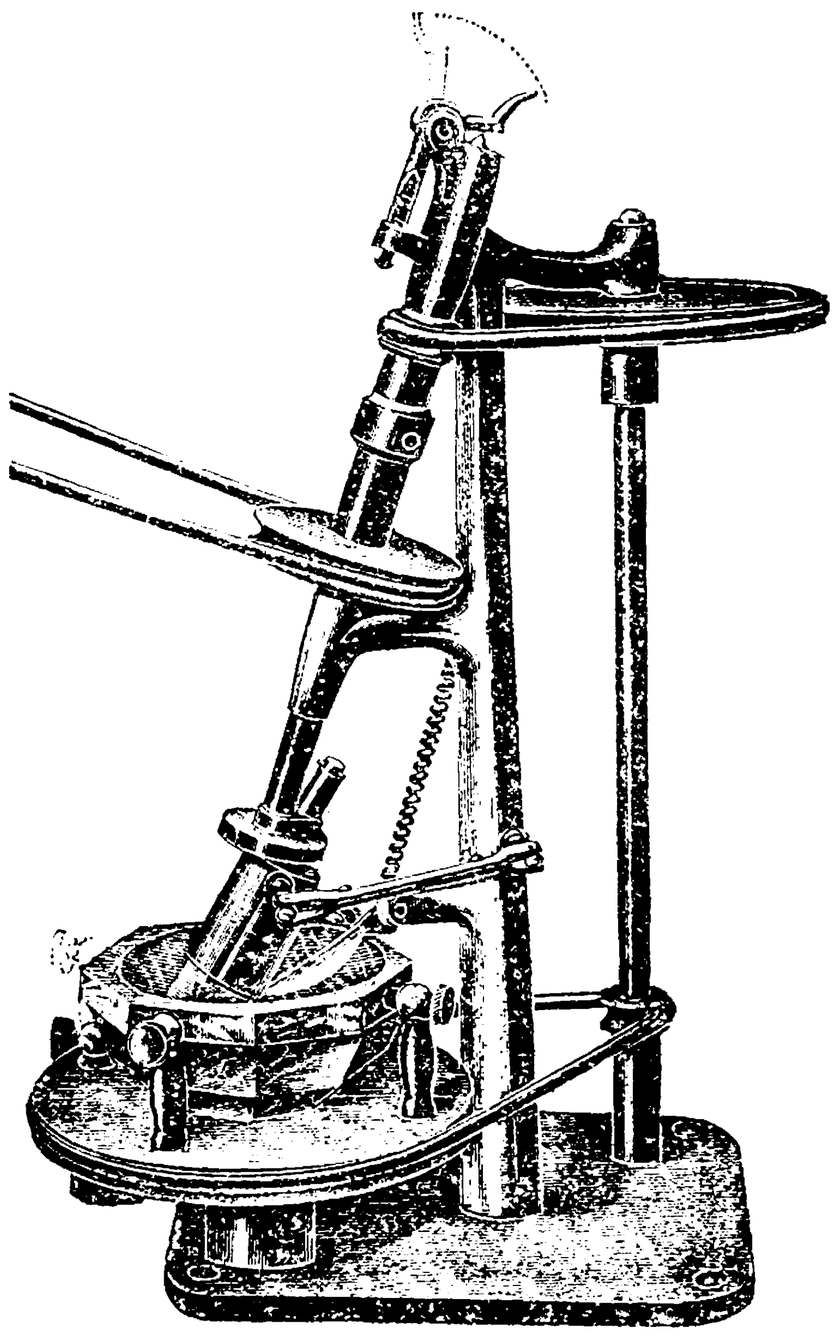
THE requisite quantity of phenol is dissolved in paraffin or similar oil and the solution added gradually to the nitric acid, which has been previously covered with a thick layer of the same oil. By this means violent action is prevented, without having recourse to the use of sulphuric acid, in which the phenol is usually dissolved.—D. B.

XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS, ETC.

Ore Grinder; The McKenna Laboratory ——. Eng. and Mining J., 1900, **70**, [16], 462.

IT is claimed that this apparatus reproduces almost exactly the motions used in hand grinding. The spring at the top of the sliding rod, to which the agate pestle is attached at the bottom, can be adjusted to give any desired pressure, or can be thrown back entirely, to allow the pestle to be raised when it is desired to remove the agate mortar. This is accomplished by loosening one of the set screws, and dropping one of the four posts holding the mortar in place. The pestle should make about 200 revolutions per minute, the mortar moving very slowly in the same direction. The scraper keeps the ore in the centre of the mortar, and, it is



stated, the combined rolling and sliding motion controlled by the ball and socket supporting side arm reduces the hardest ore very rapidly. The power required to operate this ore grinder is less than $\frac{1}{8}$ h.p.—A. S.

PATENT.

Explosive Gas or Dust in the Atmosphere; Apparatus for Detecting ——. C. E. G. Simons, Merthyr Tydfil. Eng. Pat. 21,714, Oct. 31, 1899.

PLATINUM wire or other catalytic agent, contained in a case open to the atmosphere which is suspected of containing explosive gas or dust, is raised in temperature if either

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or both should be present. The increase of temperature is measured either by the increased resistance which the wire offers to an electric current, or by the direct heating effect of a coil of the wire on the bulb of a thermometer. The rise of the column of mercury, in the latter case, completes a circuit and sets an electric alarum ringing when the gas or dust approaches a dangerous proportion. Other warning devices are described in connection with the resistance method of observing the increase in temperature. The explosive dust and gas may be differentiated by filtering the dust from the air which enters the case, in one trial, and then making a second trial without filtering the air.

—J. A. B.

INORGANIC CHEMISTRY.—QUALITATIVE.

Glucose; Detecting Arsenic in ——. E. Dowzard. Chem. and Druggist, **57**, [1089], 921.

The presence of arsenic in beer is due to the use of arsenical glucose and invert sugar in brewing. Unfortunately the usual tests for arsenic do not give satisfactory results with these substances, owing to the large amount of sulphites present.

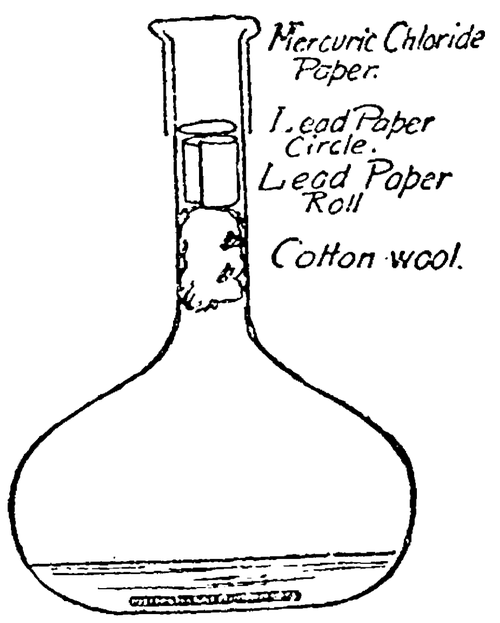
After trying modifications of all the usual tests, the author finds the following to give the best results.

Before examining any samples, the reagents should be tested as follows :—

Select a flat-bottomed flask (capacity about 130 c.c.) with a neck about 3½ ins. long and ½ in. in diameter.

A mixture of 30 c.c. of water, 5 c.c. of hydrochloric acid, and a small drop of a 5 per cent. solution of platinic chloride is introduced into the flask.

A piece of filter-paper, 12 ins. long by ¾ in. broad, is soaked in a 25 per cent. solution of lead acetate, allowed to drain for a few minutes, then doubled and rolled. A circle of filter-paper, about ⅜ in. in diameter, is also soaked in the lead-acetate solution and drained.



A rod of pure zinc, about 1½ in. long and $\frac{3}{16}$ in. in diameter, is placed in the flask, and the neck plugged with a small tuft of cotton wool. The roll of damp lead acetate paper is now gently placed on the cotton wool, and covered with the circle of lead paper. Before applying the mercuric chloride paper, see that the lead-paper is from ½ to ¾ in. below the mouth of the flask.

The mercuric chloride cap is taken off after 30 minutes, and examined : there should not be the slightest coloration.

Fifteen grms. of glucose or invert sugar are dissolved in a mixture of 20 c.c. distilled water, 7 c.c. hydrochloric acid, and 0·5 drop of a 5 per cent. solution of platinic chloride. The procedure is then exactly the same as in the blank experiment.

The roll of lead-paper is rarely darkened beyond half its length, but, if the whole should be darkened, the test must be repeated, using a roll 1 in. or more in length. If the top portion of the roll has not been affected, it may be safely assumed that all the H_2S has been absorbed. The roll should be so arranged that the gas will come in contact with as large a surface as possible.

A faint but quite perceptible yellow spot on the mercuric chloride paper is produced by 0·00005 grm. of arsenious acid. Working on 15 grms. of sample, this test will detect 1 part of arsenious acid in 300,000. If a more stringent test is required, 30 grms. may be used. It will, of course, be necessary to increase the amount of water and acid in proportion. In this case about 1 part of arsenious acid in 600,000 parts can be detected.

An approximate estimate of the amount present can be made by varying the amount of glucose or invert sugar until a spot is produced which is equal in intensity to that produced by 0·00005 grm. ($\frac{1}{20}$ mgrm.) of arsenious acid, under the same conditions.

The mercuric chloride paper must be dried before use, and should always be examined in full daylight—never by gas or electric light.

The illustration shows the respective positions of the cotton wool, lead-acetate roll, and circle.

This test may be used for the detection of arsenic in sodium phosphate.

The cotton-wool plug should be rather tight. As a precautionary measure, a piece of filter-paper about 2 ins. square should be soaked in the lead acetate solution, drained, divided into two or three pieces, and packed on top of the roll. In estimating the amount of arsenic present the standard test must be made with the same weight of glucose free from arsenic, because the glucose retards the evolution of arseniuretted hydrogen; $\frac{1}{20}$ mgrm. of arsenious acid will give a much deeper colour without the glucose than with it. The arsenious acid should be in the form of sodium arsenite.

Acids; Analytical Separation and Identification of the ——. R. Abegg and W. Herz. Zeits. f. Elektrochem. 1900, **7**, [11], 131. From Zeits. f. anorg. Chem. **23**, 236—240.

The authors propose the following scheme for the separation and identification of acids. The group reagents employed are $\overset{++++}{Ca}$, $\overset{++}{Ba}$, and $\overset{++}{Zn}$, as nitrates or chlorides, and a special test for $\bar{Cl}$ and $\bar{NO_3}$ is therefore necessary.

1. Boil the substance to be analysed with dilute HCl or HNO_3.

CO_2. Effervescence. Turns drop of lime water milky.
SO_2. Effervescence. Smell.
N_2O_3. Red vapours. Smell.
H_2S. Smell. (Separation of S.) Turns lead acetate paper black.
HCN. Smell of bitter almonds (see also 2).
$C_2H_4O_2$. Smell of vinegar, after boiling off preceding (see also 5).

2. Boil with concentrated sodium carbonate solution, which removes all the cations with the exception of those of the alkalis. Filter off precipitate. Acidify filtrate with HCl or HNO_3, boil off all CO_2, and, after making solution alkaline with ammonia, add $CaCl_2$ or $Ca(NO_3)_2$.

Insoluble in acetic acid :—	Treated with dilute HCl :—
$\bar{F}$ as CaF_2	Insoluble. Gives HF with H_2SO_4 (etching glass).
$\bar{\bar{C}}_2\bar{\bar{O}}_4$ as CaC_2O_4	Soluble. Reprecipitated by ammonia.
Soluble in acetic acid :—	
$\bar{C}\bar{N}$ as CaC_2N_2	Boiled with $\overset{++}{Fe}$ + $\overset{+++}{Fe}$ + $\bar{OH}$ and acidified gives Prussian blue.
$\bar{C}_4H_4\bar{\bar{O}}_6$ as $CaC_4H_4O_6$.....	With much $\overset{+}{K}$ gives $KHC_4H_4O_6$. Filter.
$H\bar{\bar{A}}sO_3$ as $CaHAsO_3$	H_2S gives As_2S_3 immediately in the cold. Filter.
$H\bar{\bar{A}}sO_4$ as $CaHAsO_4$	H_2S in the heat precipitates $S_2 + As_2S_3$ slowly. Filter.
$H\bar{\bar{P}}O_4$ as $CaHPO_4$	Ammonium molybdate or $\overset{++}{Mg}$ + $\overset{+}{NH_4}$ + NH_3 gives yellow precipitate or $MgNH_4PO_4$.

3. Add $BaCl_2$ or $Ba(NO_3)_2$ to the filtrate from 2.

Soluble in HCl. Yellow solution :—	
$\bar{\bar{C}}r\bar{\bar{O}}_4$ as $BaCrO_4$	Solution boiled with alcohol turns green.
$\bar{\bar{C}}r_2\bar{\bar{O}}_7$. Yellow.....	
Insoluble in HCl. Ignite :—	Permanent. Insoluble in HCl.
$\bar{\bar{S}}O_4$ as $BaSO_4$	Evolves SiF_4, which gives SiO_2 with water. The residue of BaF_2 is soluble in HCl.
$\bar{\bar{S}}iF_6$ as $BaSiF_6$	

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4. Neutralise filtrate from 3 *exactly* with HCl or HNO_3 and add $ZnCl_2$ or $Zn(NO_3)_2$.

Dissolve on adding OH:—	Addition of Fe^{+++} and H^{+} produces:—
$Fe(CN)_6$ as $Zn_3Fe_2(CN)_{12}$ Brownish yellow.....	Brown coloration.
$Fe(CN)_6$ as $Zn_2Fe(CN)_6$. White	Prussian blue.

5. To a small portion of the filtrate from 4, add a trace of Fe^{+++} solution. A red coloration indicates :—

On boiling :—

CNS as $Fe(CNS)_2$	Permanent.
$C_2H_3O_2$ as $Fe(C_2H_3O_2)_3$	Precipitation takes place and solution becomes clearer,

6. If 5 has shown the presence of CNS^-, and if NO_2^- reagents have been employed, test a drop of the filtrate from 4, with Ag^+ solution. Formation of a precipitate indicates Cl^-, Br^-, or I^-.

Test a portion of the filtrate from 4, with CS_2 and a drop of chlorine water.

I^-. CS_2 coloured violet, and disappears with excess of chlorine water.

Br^-. Gives brown colour permanent with excess.

Mix the remaining portion with $K_2Cr_2O_7$. Evaporate to dryness. Fuse and test for Cl^- by distilling with concentrated H_2SO_4. Production of CrO_2Cl_2 indicates Cl^-.

7. Test a portion of an aqueous extract of the orignal substance with $Fe^{++} + H^+$. NO_3^- is detected by the formation of NO. Evaporate and test for halogen oxy acids by the evolution of oxygen.

In the event of Cl^- reagents having been employed up to 5, apply the test with $AgNO_3$, instead of 6 and 7. I^- and Br^- are identified as in 6. Boil off the Cl and CS_2 and test for NO_3^- according to 7. Finally test for Cl^- and halogen oxy acids as in 7 (see next abstract).—J. S.

Acids ; Analytical Separation and Identification of the ——, by the Abegg-Herz System. W. Fresenius. Zeits. anal. Chem. 1900, **39**, [9], 566—574.

THE author gives a detailed criticism of this system (see preceding abstract). The statement that the calcium cyanide is precipitated from ammoniacal solution is at variance with practice and literature. If a solution of Liebig's potassium cyanide be treated with calcium chloride. a white precipitate is formed. In the filtrate, together with excess of calcium chloride, cyanide can be detected by the Prussian blue reaction, but the precipitate, after being thoroughly washed and then dissolved in hydrochloric acid, will not give this reaction. If pure potassium cyanide in ammoniacal solution be treated with calcium chloride, no precipitate is formed, except after standing a long time with access of air, when crystallised calcium carbonate is slowly deposited. If the mixture be allowed to stand in a stoppered vessel, no precipitate is formed after 24 hours. Barium chloride also gives no precipitate with pure potassium cyanide. In like manner the statement as to arsenious acid is erroneous, as this also gives no precipitate in ammoniacal solution with calcium chloride. A third erroneous statement is, that the brown coloration produced by a little chlorine water with bromides is permanent on the addition of excess of chlorine water. It is known that the violet coloration due to iodine disappears before the appearance of the brown coloration due to the bromine, but with a sufficient excess of chlorine water the latter is also fugitive. The table in which one coloration is designated transient, and the other permanent, is therefore, at least, liable to lead to misunderstanding.

The author also draws attention to some points which are only conditionally correct. In order to completely precipitate tartaric acid with calcium chloride, the solution must stand a tolerably long time before being filtered, and in the crystalline condition which the precipitate then shows, it will by no means dissolve with certainty in acetic acid, for tartaric acid can be precipitated from acetic acid solution by calcium chloride (this Journal, 1899, 301). Thus, according to this method, tartaric acid may be mistaken for oxalic acid. A further difficulty is that, if the phosphoric acid be precipitated by an excess of calcium chloride, then, after long standing (as is necessary for the complete precipitation of the tartaric acid), the calcium phosphate becomes crystalline, and is no longer soluble in acetic acid. This acid can thus also be mistaken for oxalic acid.

It appears, therefore, that, of the five acids, the calcium salts of which should form precipitates soluble in acetic acid, two are usually not precipitated, and two, under the conditions necessary for complete precipitation, give precipitates insoluble in acetic acid.

It is also pointed out that boric acid and silicic acid have not been taken into consideration ; and also that, if nitrate reagents have been used, the detection of chlorine as chromium oxychloride will be difficult.—A. S.

Indicator ; Isopyrotartaric Acid as an ——. L. J. Simon.

See under XX., *page* 1138.

Arsenic in Beer ; Detection of ——.

See under XVII., *page* 1127.

INORGANIC CHEMISTRY.—QUANTITATIVE.

Ozone ; Quantitative Estimation of ——. O. Brunck. Ber. 1900, **33**, [16], 2999—3001.

A REPLY to Ladenburg's criticism (Ber. **33**, 2282) of the author's communication (this Journal, 1899, 776). The author had thought it superfluous to state that, after passing ozone through neutral potassium iodide solution, the liquid was acidified before titration, though it was implied in the context. Ladenburg's method of controlling the iodometric estimation of ozone, by determining the density of the gas, can only be regarded as approximate : a difference of almost 5 per cent. was found.—A. C. W.

Silicon ; Analysis and Purity of Commercial Specimens of ——. B. Neumann. Chem. Zeit. 1900, **24**, 869—870, and 888—889.

HEMPEL and von Haasy's method of igniting the silicon in chlorine is not suitable for the analysis of commercial silicon, prepared in the electric furnace, nor is that of Bornträger, in which the crushed sample is first treated with a 10 per cent. caustic soda solution. The samples are liable to contain iron, aluminium, and calcium from the furnace lining and charge, and carbon and ash constituents from the electrodes. The iron exists partly as metal, partly as ferro-silicon, and not all as carbide, which is incompatible with so great an excess of silicon. The calcium is mostly present as carbide, as evidenced by the bubbles of acetylene which are frequently to be seen on long immersion of the commercial silicon in water. Besides the above, silica and silicon carbide are usually present.

The analysis is conducted as follows :—The sample is crushed in an agate mortar, rubbed and bolted (bag apparatus), in order to ensure the uniform fineness of the material, as coarser particles fail to dissolve, and so vitiate the result. From 8 to 10 grms. of caustic soda are dissolved in about ten times the quantity of water in a 200 c.c. silver dish, and 1 grm. (or with impure specimens 0·5 grm.) of the silicon is introduced, little by little, into the hot solution, the dish being covered with a dial glass to prevent splashing. The whole is then heated on a water-bath until the evolution of gas is no longer observable ; the solution is then diluted and filtered through an ashless filter. The residue, which must be washed until no longer alkaline, contains all impurities except a portion of the aluminium, which passes as sodium aluminate into the solution (B). The black, grey, or greenish residue is treated on the filter with hot HCl, which dissolves Fe, Al, Ca, and Mg. The Fe and Al are precipitated by ammonia, and thus separated from the Ca and Mg, which are determined by the usual methods. The Fe and Al are

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redissolved in HCl and placed on one side (C). The original residue (A), freed from Fe, &c., is ignited in a platinum crucible and weighed; it is mainly ferro-silicon (Fe_2Si), silica, and silicon carbide (SiC). If to be further examined, it is treated with *aqua regia* to break up the ferro-silicon, the Fe and Si in which may be determined as usual, the SiO_2 formed remaining with that already present. The iron may be found by difference, after the treatment with *aqua regia*, by igniting the residue and re-weighing. This residue is now treated with successive portions of hydrofluoric acid to remove SiO_2, after which the final residue is red silicon carbide (mixed with unaltered silicon if the sample was not sufficiently finely crushed at the outset).

The Al in the original filtrate B is precipitated either by passing CO_2 for a long time through the warm solution, or better, after supersaturating with HCl, by adding excess of ammonia and boiling. The precipitate, which contains much SiO_2, is treated repeatedly with HCl, alternated with evaporation to dryness, or is treated with HCl and H_2SO_4 until fumes of the latter are evolved, and the SiO_2 present is thus removed, the solution of Al being added to solution C, which must, however, be first evaporated with HCl to remove SiO_2. The Fe and Al are then determined in aliquot parts of the solution. It is to be remarked that the quantity of silica found is a little less than it should be, owing to its slight solubility (even in the form of quartz sand), in a 10 per cent. caustic soda solution.

Every specimen of silicon yet examined has contained, at least, 2·5 per cent. of impurities. The analyses of 12 examples are quoted below :—

Fe.	Al.	Ca.	Residue.	Si.	Residue consists of—			Remarks.
					Fe_2Si.	SiO_2.	SiC.	
1·26	0 25	0·52	17·12	80·85	0·74	5·56	10·82	From electric furnace.
1·04	0·28	0·22	4·63	93·83	0·89	..	3·74	„ „ „
1·03	0·53	0·28	2·08	96·08	..	..	..	„ „ „
3·57	0·77	1·24	23·75	70·67	1·35	9·54	12·86	„ „ „
0·10	0·14	0·24	4·35	95·17	..	0·68	3·67	„ „ „
0·20	0·16	0·37	3·63	95·64	..	0·26	3·37	„ „ „
0·10	0·21	0·18	2·85	96·66	..	0·20	2·65	„ „ „
0·22	0·16	1·42	19·97	78·23	1·23	2·34	16·40	„ „ „
0·28	..	0·25	1·95	97·52	Almost pure SiO_2			„ „ „
0·04	..	..	2·45	97·51		„ „ „		Graphitic ... } Made by chemical
0·02	..	..	3·70	96·28		„ „ „		Crystalline.. } method.
0·52	0·09	..	3·73	95·66	..	1·78	1·95	Amorphous . }

—W. G. M.

Pyrites; New Method for Determining Gold and Silver in ——. W. Buddëus. Chem. Zeit. 1900, **24**, 922—923.

Of the usual methods—roasting with lead in scorifiers in a muffle, or fusion with lead and flux—the former is the more accurate, but is very costly, both on account of the large quantities of materials used and by reason of the time required, and even at best the results are to some extent too low through volatilisation, owing to the high muffle temperature necessary, and through retention of precious metal in a little regulus that is always formed between the lead and the slag.

In the author's method the sample is crushed to pass a sieve of 300—400 meshes per sq. cm.; 100 grms. (for material containing 50 grms. and upwards of gold per 1,000 kilos.), or 200 grms. (for that containing less than 5 grms. per 1,000 kilos.) of the ore are placed in a crucible, which is best made of white Paris chamotte, and should hold 70 c.c. or 130—140 c.c., according to the weight of ore operated on. The crucible is then placed, lightly covered, in a muffle at a bright red heat for $\frac{1}{2}$ to $\frac{3}{4}$ hour—until, indeed, no further sulphur flame is observed. It is then placed on an iron plate until cool, whereupon the contents are emptied into a beaker or porcelain dish of 1 to 2 litre capacity. The roasted ore, consisting mainly of iron sulphide, is only lightly sintered, and is readily detached from the crucible, (the last portions, if necessary, with a camel-hair brush). It is usually found to have taken the shape of the inner surface of the crucible, but does not require breaking up, and is treated at once with a mixture (250—500 c.c.) of ordinary HCl free from arsenic, and an equal bulk of water. After standing for an hour in a warm place, another 250—500 c.c. of the acid mixture is added, and the whole is boiled for some time. The iron sulphide (forming $\frac{8}{9}$ths of the whole) dissolves readily, leaving the whole of the gold and silver with the silica and clay of the gangue-stuff. When the sulphide is thus decomposed, the solution is diluted with water, until the beaker is nearly full, and filtered. The residue is washed twice or thrice with water, dried, transferred with the filter-paper to a Hessian crucible of 150—300 c.c. capacity, mixed, by means of a spatula, with 50—100 grms. of assay lead and 5—10 grms. of borax, and melted in the muffle. Instead of the assay lead, 100—200 grms. of a mixture of equal parts of lead acetate and anhydrous soda is recommended. After cooling, the crucible is broken, and the lead is detached and cupelled at once the gold and silver being subsequently separated as usual.

The cost of an assay of 200 grms. of ore by the old method, using 1,400 grms. of pure lead (at M 1·20 per kilo.), 60 scorifiers, and including firing and wages charge (at M 1), is M 3·88, whilst by the new method, using 500 c.c. of HCl, 100 grms. of assay lead, and a crucible, and including firing and wages, it is M 0·37—0·72. The results are accurate and concordant, control assays never differing by more than 1 mgrm. The results, as shown by quoted comparative tests, are uniformly higher than those obtained by the old method.—W. G. M.

Ferrous Iron in Minerals; Determination of ——. W. F. Hillebrand and H. N. Stokes. J. Amer. Chem. Soc. 1900, **22**, [10], 625—630.

This paper claims to settle the question of superiority between the Mitscherlich and hydrofluoric acid methods of determining ferrous iron in rocks and minerals. In the former method the mineral is decomposed by heating it with moderately strong sulphuric acid in a sealed tube; in the latter, by treatment with a mixture of dilute sulphuric and hydrofluoric acids at atmospheric pressure, and at a temperature below 100° C. In both processes air is excluded, as far as possible, and the resulting ferrous sulphate is titrated with permanganate. The methods were found to give discordant results; the higher the percentage of iron present, the greater the discrepancy, Mitscherlich's method always giving the higher figure. The explanation given is, that the sulphur of the sulphides (which are practically always associated with iron in minerals) is converted into sulphuric acid at the expense of the ferric oxide (also present), which is thereby reduced to the ferrous state. Further, ferrous sulphate is formed by the action of the sulphuric acid upon the sulphide present. With the hydrofluoric acid method these actions do not take place to anything like the same extent, and the error is negligible so long as the amount of sulphide present does not exceed that usually found in igneous rocks.—E. H. T.

Tungsten in Ores; Determination of ——. F. Bullnheimer. Chem. Zeit., 1900, **24**, 870—871.

The analysis of impure or undressed tungsten ores is troublesome, in large measure by reason of the presence of

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phosphorus and arsenic (from apatite and arsenical pyrites respectively), which form double compounds with tungstic acid, so that the exact precipitation of pure tungsten compounds is impossible. Treatment with *aqua regia* is tedious, and fusion with cyanide and soda unsatisfactory. The author recommends preliminary fusion with sodium peroxide and a little caustic soda in a nickel crucible, the soda increasing the fluidity of the charge and giving an extended life (up to 20 fusions) to the crucible. The resulting melt may contain besides sodium tungstate, stannate, arseniate, molybdate, phosphate, and silicate, as well as non-interfering impurities, and these must be separated.

1—2 grms. of the ore are mixed in a nickel crucible with 4 grms. of sodium peroxide and 3 grms. of caustic soda; the latter, in one piece, should rest on the bottom of the crucible, which is then gently heated over a small Bunsen flame until the whole mass is softened, when the full flame is applied, with steady stirring, until the charge is quite fluid and the bottom of the crucible begins to glow. Wolframite is readily and completely dissolved by this method, whilst tinstone remains in part unchanged. After solidification, but while still hot, the crucible is transferred to a beaker containing water, and the resulting solution is rinsed into a 250 c.c. flask. If manganate be present, the green colour is discharged by hydrogen peroxide. After cooling, the flask is filled to the mark with water, and half the quantity is withdrawn and filtered. 20 grms. of ammonium nitrate are then added (sufficient to convert all free sodium hydroxide into ammonium hydroxide, with a distinct excess of ammonium salt), and when it has dissolved, the mixture is allowed to stand, to cause the precipitation of silicic and stannic acids, and then sufficient magnesium nitrate is added, in small quantities, with stirring, to precipitate the arsenic and phosphoric acids present. The magnesia salt must not be added until the silicic and stannic oxides have separated, or some tungsten will be found in the precipitate. Nitrates of ammonia and magnesia must be used, as the chlorides or sulphates would interfere with the subsequent use of mercurous nitrate. After standing for from 6 to 12 hours the precipitate is filtered, and is washed, first with ammonia, and then with water. The filtrate is rendered slightly acid with nitric acid and (after cooling, if the acidification has caused appreciable generation of the heat) 20 to 30 c.c. of a mercurous nitrate solution are added, prepared by gently warming 200 grms. of $HgNO_3$ and 20 c.c. of nitric acid with a little water, diluting to 1 litre and storing over mercury. After some hours ammonia is added, until the solution is only slightly acid, and the whole is allowed to stand until the liquid above the dark precipitate is clear. The precipitate is then filtered and thoroughly washed with water containing mercurous nitrate. If the above conditions have been carefully followed, the precipitate should give no trouble by running through the filter, even during washing. The precipitate is next ignited over a Bunsen flame, and then over the blow-pipe in air, until the weight is constant. When much molybdenum is present, which is rarely the case, some time may elapse before it is all volatilised and the weight becomes constant. The end may then be hastened if, after the first strong heating, a little ammonium chloride is added, and strong heating is again resorted to, with the crucible first covered and then open.—W. G. M.

Lead; Defence of Hampe's Method for Determining ——, Langer. Chem. Zeit, 1900, **24**, 946—947.

In a recent paper (Zeits. Berg. Hütten-, u. Salinenw. 1899, **47**, 246), Hübner—Tarnowitz has thrown doubts on the trustworthiness of the Hampe process, and the author, now, after describing the method, as practised at the Kgl. Friederichs mines in the assay of slimes (containing 2·09 per cent. of PbO; 0·04, S; 0·0041, Ag; 10·56, CaO; 5·32, MgO; 25·89, $Fe_2(OH)_3$; 2·17, FeO, MnO, and NiO; 3·86, ZnO; 14·15, CO_2; 9·22, Al_2O_3; and 26·09 SiO_2), defends it, and shows how concordant and satisfactory are the results actually obtained in practice.—W. G. M.

Copper; Volumetric Method of Estimating ——.
S. W. Parr. J. Amer. Chem. Soc. 1900, **22**, [10], 685—689.

This method involves the precipitation of the copper as cuprous thiocyanate, the oxidation of the copper without decomposition of the alkali thiocyanate, and the titration of the acidified thiocyanate with standard permanganate, the two latter steps being performed in one operation.

To the solution of copper salt, containing about 6 mgrms. of copper per c.c., and 1—2 per cent. of free nitric acid, a strong solution of sulphur dioxide is added, in small quantities at a time. A 10 per cent. solution of sodium sulphite may be used instead, in which case it is not necessary to add any more acid. The copper is now precipitated with 20 c.c. of a 10 per cent. solution of potassium thiocyanate, and the whole heated on a water-bath or hot-plate until the supernatant liquid has become perfectly clear. The precipitate is then filtered through a thick ($\frac{1}{8}$-in.) asbestos felt, well packed in a $1\frac{1}{2}$-in. porcelain funnel, a filter-pump being used. It is washed with hot water until a few drops of the acidified filtrate no longer decolorise a drop of permanganate. The precipitate, with asbestos pulp, is then placed in a beaker, and 2—3 c.c. of 10 per cent. caustic soda added, with agitation. After warming to 60°—70° C., and standing a few minutes, the liquid is ready for titration. This operation is effected in two parts. The first consists in running in the permanganate until the yellow tint of the cuprous hydrate (which was precipitated by the soda) is no longer seen, and the liquid has assumed a greenish tint. In the second part, dilute sulphuric acid (1 : 5) is slowly added, with constant stirring, and when the liquid is quite clear, more acid is put in, the temperature raised to 60°—70° C., and the titration continued till the usual pink coloration appears. Should a precipitate form, more acid is added. The permanganate used in oxidising the copper is about one-sixth of that used in the subsequent titration. The average time taken for a determination is from 30—40 minutes.

The reactions may be summarised in one equation, thus:—

$$10\,CuCNS + 7K_2Mn_2O_8 + 21H_2SO_4 = 7K_2SO_4 + 14MnSO_4 + 10HCN + 10CuSO_4 + 16H_2O,$$

from which it will be seen that 10 atoms of cuprous copper are oxidised by 7 molecules of permanganate. The copper value of the latter may be found by multiplying the iron factor by 0·1602.—E. H. T.

Copper; Determination of Oxygen in ——. L. Archbutt. Analyst, 1900, **25**, 253.

In 1896, dissatisfied with the then existing methods for the determination of oxygen in copper, Blount described a process (this Journal, 1896, 296) in which the metal was fused in a stream of hydrogen, and the water produced was absorbed in a weighed sulphuric acid tube. Archbutt, however, finds that the extreme heat necessary in the above method is somewhat inconvenient; and that it is quite possible, by modifying the original Hampe's process (Zeits. anal. Chem. 1874, 176), to obtain perfectly accurate results. 30—40 grms. of copper in drillings small enough to pass through a tube $\frac{1}{3}$ in. in diameter, freed from grease with ether, and dried on the water-oven and desiccator, are weighed out into a special tube of Jena glass. This is 205 mm. long over all, and 5 mm. in diameter; at its centre it is expanded into a cylindrical bulb 65 mm. long and 31 mm. in diameter. It is supported over a flat-flame Bunsen in a sheet-iron box, jacketed with asbestos millboard. The tube is connected with an apparatus for the supply of pure hydrogen, which is passed slowly enough to ensure any sublimate of As_4O_6 being reduced within the tube. The temperature is raised to a red heat for one hour, and, finally, the loss in weight of the copper is ascertained. The annexed table gives the results obtained on six samples of

——	Blount.	Archbutt.
1	0·18	0·17
2	0·22	0·21
3	0·05	0·003
4	0·03	0·03
5	0·13	0·12
6	0·25	0·25

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metal by Blount with the fusion method, and by Archbutt as above; the discrepancy in 3 (see table) being probably due to the fact that the material was too coarse to permit a sufficient quantity being used by the former.—F. H. L.

Tin and Tin-plate Articles; Analysis of ——. V. Mainsbrecq. Rev. intern. falsific. **13**, 113. Chem. Centr. 1900, **2**, [13], 743.

In Belgium the use of alloys containing lead, zinc, arsenic, and antimony, for vessels which may hold foods for a lengthened period, is prohibited by royal decree; for vessels which are in contact with the food for only a short period, the presence of zinc and antimony is allowed, and up to 1·5 per cent. of copper.

For the examination of tin vessels, 10 grms. of fine cuttings are treated in an Erlenmeyer flask with concentrated hydrochloric acid, the mixture allowed to stand overnight, filtered from undissolved arsenic, antimony, and the main portion of the copper, and the residue treated with nitric acid, whereby the arsenic and copper are dissolved, and the antimony converted into antimony pentoxide. The arsenic, which should only be present in traces, is precipitated from the filtrate as magnesium ammonium arsenate. In the first filtrate the tin is determined by Löwenthal's method, *viz.*, by oxidising with nitric acid, neutralising with ammonia, making faintly acid with hydrochloric acid, and precipitating the tin by a concentrated solution of ammonium nitrate. The filtrate contains lead, the remainder of the copper, and iron and zinc. The lead and copper are precipitated by sulphuretted hydrogen, and separated by potassium sulphocyanide. The iron is precipitated by ammonia, and the zinc determined as sulphide. The tin and copper are determined in a second sample, 1 grm. is dissolved in *aqua regia*, the tin precipitated according to Löwenthal's method, and the copper determined in the filtrate, either colormetrically or as cyanide.

Tin plate articles are examined in a similar manner, except that here the presence of copper has not to be taken into consideration.—A. S.

Aluminium; New Method of Determining ——. E. T. Allen and V. H. Gottschalk. Amer. Chem. J. 1900, **24**, [4], 292—304.

The substance is dissolved in water or a mineral acid, the solution in the latter case being nearly neutralised with ammonia. From 1 to 2 grms. of potassium hydroxide, in which the amounts of silica, iron, and alumina are known, are dissolved in water, and the solution run from a burette into the solution of the aluminium salt until the precipitate which forms, is just redissolved. A current of carbon dioxide is now passed in (about 20 minutes being sufficient for the precipitation of 0·2 grm. of alumina) and the precipitate washed several times on a 9 cm. filter, without the aid of a filter-pump, and returned to the beaker, where it is boiled for a few minutes with 150 to 200 c.c. of water containing a little pure ammonium chloride or nitrate. The precipitate is then left to subside, washed by decantation, and on a filter with hot water, and dried, ignited, and weighed in a covered crucible of known weight. When the weight is constant a deduction is made for the impurities introduced with the potassium hydroxide.

The precipitate thrown down by carbon dioxide from sodium or potassium aluminate is a basic aluminium carbonate mixed with a little alkali carbonate, which is removed by boiling with a dilute solution of ammonium chloride or nitrate. At the same time the precipitate is converted into the hydroxide. The method is shown by test experiments to yield concordant results, and is more rapid than the older method. It gives accurate results in the presence of sulphates, whereas the figures obtained with the older method are too high. It is applicable in the estimation of iron and aluminium together, but the presence of alkaline earths or lithium interfere with it. Barium, when present, may be precipitated as sulphate, and the aluminium precipitated from the filtrate, after nearly neutralising it, with ammonia.—C. A. M.

Sulphuric Acid; Joint Determination in the same Liquid [Vinegar or Wine] of Free and Combined ——. A. van Engelen. Bull. Assoc. Belge des Chim. **14**, [5], 221—222.

To examine the accuracy of the ordinary method often employed in the analysis of vinegars and wines, the author worked with a mixture of 100 c.c. of dilute sulphuric acid (47·38 grms. H_2SO_4 per litre) and 5 grms. of potassium sulphate (99·78 per cent. pure), the whole being made up to 500 c.c. with water. The result of the alcoholic extraction was that, of the 0·4738 grm. of H_2SO_4 taken, only 0·375—0·385 grm. was recovered in the barium sulphate precipitate; whilst, on the other hand, sulphuric acid corresponding to 0·651—0·672 grm. of K_2SO_4 was recovered in place of that equivalent to the 0·4986 grm. of this salt taken. In respect of free H_2SO_4 the method therefore furnishes results about 25 per cent. below the truth.—C. S.

Phosphorous Acid; Determination (Volumetric) of ——. O. Kühling. Ber. 1900, **33**, [15], 2914—2918.

This process depends on the oxidation of phosphorous acid by means of potassium permanganate, according to the equation: $3H_3PO_3 + 2KMnO_4 = 3H_3PO_4 + 2MnO_2 + K_2O$, and is carried out as follows:—The solution to be titrated, which, in the author's experiments, contained 0·07—0·32 grm. of phosphorous acid in 20 (or 40) c.c. of liquid, is placed in a 250 c.c. Erlenmeyer flask, to which is added 20 (or 40) c.c. of a 10 per cent. solution of crystallised zinc sulphate. The mixture is then treated in one of two ways. (1) A standard solution of permanganate is run gradually in, the liquid being meanwhile heated on a water-bath, and shaken from time to time; this is continued until, after 10—15 minutes' heating, the solution remains pink. (2) An excess of the permanganate solution is added, and the liquid heated and shaken as above. After complete oxidation, which requires from a half to one and a half hours, according to the amount of phosphorous acid present, the flask is carefully cooled and the liquid diluted with an equal volume of water. The manganese dioxide is then filtered off, well washed, and the filter paper with the precipitate shaken up with acidified potassium iodide solution, by which means the manganese dioxide is dissolved and the equivalent quantity of iodine precipitated. The iodine is then titrated with sodium thiosulphate solution, the better method being to run in excess of the latter and then titrate back with standard iodine solution. If a large excess of permanganate be avoided, the liquid may, after cooling and diluting, be filtered through an ordinary filter paper; if this is not the case, an asbestos filter must be employed. In place of determining the manganese dioxide, the excess of permanganate may be estimated iodometrically, the results being equally good in the two cases.

The method is not influenced by the presence of small quantities of sulphuric acid, but it cannot be used when hydrochloric acid or a chloride is present.—T. H. P.

Persulphates; their Determination and Uses in Analysis and Industry. R. Namias. L'Orosi, **23**, 218—223. Chem. Centr. 1900, **2**, [15], 806.

The author recommends the following analytical method:—The solution of the persulphate is treated with potassium iodide, and, after standing in the cold for 10—12 hours, the iodide set free is titrated with sodium thiosulphate solution. The reaction is expressed by the equation—

$$2KI + (NH_4)_2S_2O_8 = (NH_4)_2SO_4 + K_2SO_4 + 2I.$$

Chromium oxide, when treated with excess of ammonium persulphate solution in the warm, is oxidised in about one hour to chromic acid:—

$$Cr_2O_3 + 3(NH_4)_2S_2O_8 + 3H_2O = K_2(NH_4)_2SO_4 + 3H_2SO_4 + 2CrO_3.$$

This reaction may be applied to the determination of chromium in chrome steel. If a manganese salt be heated for a short time with ammonium persulphate and ammonia, the manganese is completely precipitated as dioxide.

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In industry, persulphates should find various uses by reason of their oxidising and bleaching properties. In sulphuric acid solution, persulphates have proved to be energetic depolarising agents; they can, for example, advantageously replace nitric acid in the Bunsen cell. Alcohol, when heated to 70°—80° C. with persulphate, is rapidly and easily converted into aldehyde. Organic closed-chain compounds give, with persulphate, sulpho derivatives; for example, hydroquinone yields a sulpho derivative of quinone, whilst diamidophenol, *p*-phenylenediamine, *p*-amidophenol, &c. give characteristic colour reactions. By the action of persulphate on aniline hydrochloride in the cold, there is formed a deep green-coloured precipitate, insoluble in water and alcohol, which, on treatment with caustic soda or sodium carbonate, is coloured blue, but remains insoluble.

(See also this Journal, 1897, 326—399.)—A. S.

Paris Green; Determination of Free Arsenious Oxide in ——. E. W. Hilgard. J. Amer. Chem. Soc. 1900, **22**, [10], 690—693.

In testing Paris green for free white arsenic a preliminary microscopic examination should always be made. The lustrous white octahedrons of the oxide are readily detected, whether they adhere to the surface of the grains of the pigment or are disseminated among them. In estimating the oxide the usual method of extracting with a few hundred c.c. of water for a few hours fails to account for all the arsenious oxide present. At least 600 c.c., and, if possible, 1,000 c.c., of water per grm. of solid should be used, and the extraction continued for 24 hours. That method by which the Paris green is dissolved out with ammonium hydrate is worthless, because the ammonium arsenite formed, readily dissolves the arsenious oxide; in addition, the latter is somewhat soluble in ammonia.

—E. H. T.

ORGANIC CHEMISTRY.—QUALITATIVE.

Sesamé Oil by the Breinl Reaction; Detection of ——. A. J. J. Vandevelde. Bull. Assoc. Belge des Chim. **14**, [5], 222—226.

On comparing the results obtainable by the Breinl reaction (agitating 10 c.c. of oil with 0·1 c.c. of a 3 per cent. alcoholic solution of vanillin or heliotropin, and 10 c.c. of concentrated hydrochloric acid) with those furnished by the Camoin and Baudoin test, the author found the latter to be superior in point of delicacy, and also, that the reaction it gives is a special one for sesamé oil, whereas the Breinl reagent furnishes colour reactions with other oils as well.

Petroleum and the Breinl Reaction.—Moreover, the solvent (petroleum spirit) employed by Breinl in his comparative tests forms a source of error by itself, giving a violet colour reaction with vanillin and heliotropin. The higher distillates of petroleum also furnish characteristic colorations: the fraction boiling at 80° C. gives a dark violet; that boiling at 130° a deep red-violet; and the lubricating oils very intense reds. With the lighter distillates the hydrochloric acid layer gradually turns dark green or indigo blue, the colour persisting after the evaporation of the petroleum.

Tinctorial Properties of Vanillin and Heliotropin.—In hydrochloric acid solution these reagents, colourless in themselves, impart a deep violet colour to wool after a short immersion, and, if the exposure be prolonged to a couple of hours, the dye becomes fixed and no longer extractible by water; in presence of a base (*e.g.*, ammonia) the colour changes to red, and is insoluble in ether, benzene, or chloroform, even at a boiling temperature.—C. S.

Alcohols; Detection of ——, *by New Colour Reaction.* R. Grassini. L'Orosi, **23**, 224. Chem. Centr. 1900, **2**, [15], 821.

The author has observed that if a mixture of cobaltous chloride and potassium sulphocyanide solutions be covered with a layer of alcohol the latter is coloured blue. The presence of nickel does not hinder the reaction, which is apparently due to reduction of the cobalt salt, as addition of hydrogen peroxide destroys the coloration. Methyl-, amyl-, and isobutyl alcohol also give the reaction, but ether and esters do not. The author recommends the reaction as a means of detecting alcohol in ether, and in commercial fruit essences, &c. 2—3 c.c. of a 5 per cent. solution of cobaltous chloride are mixed with an equal volume of potassium sulphocyanide solution, and the ether or ester to be examined is added from a pipette, with gentle agitation. In presence of alcohol the upper layer, after standing for some time, is coloured a more or less intense blue, which is particularly distinct at the zone of contact of the two layers. The test, by reason of its simplicity and the rapidity with which it can be executed, appears to be specially suitable for the Customs authorities. The reaction can also be used for the detection of cobalt.—A. S.

Red Wines; Detection of New Colouring Matter for ——. Truchon. Ann. Chim. anal. appliq. 1900, **5**, 292; through Chem. Zeit. Rep. 1900, **24**, [86], 313.

Under the name of "Toulouse Red" a new colouring matter for red wines has come into the market. The ordinary reagents fail to detect it but the following method serves:—50 c.c. of the suspected wine are placed in a porcelain dish together with a woollen thread, acidified with 2 c.c. of N/10 sulphuric acid, and boiled for five minutes. If this colouring matter be present, the thread remains a brilliant red after washing; if absent, only a weak dirty-red coloration is left on the wool.—R. L. J.

Citral, and certain other Aromatic Compounds; Detection of ——, *by a New Colour Reaction.* H. E. Burgess. Analyst, 1900, **25**, 265.

The reagent consists of 10 grms. of mercuric sulphate dissolved and made up to 100 c.c. with 25 per cent. sulphuric acid. 2 c.c. of the substance are shaken in a corked bottle with 5 c.c. of the reagent, and the colour is observed at once, and after standing 10 minutes. Smaller quantities can be tested on a tile. The results are: *Citral*, a bright red colour on shaking, which disappears, leaving a whitish compound floating on the aqueous liquid. *Citronellal*, a bright yellow, permanent colour. *Limonene*, a very faint, transient, flesh colour, then a white compound. *Linalyl acetate*, a brilliant permanent violet colour, increasing slightly in depth. *Linalool*, an immediate deep violet colour. *Carophyllene*, a yellowish compound but no violet colour. *Eugenol*, a slight violet colour on standing. *Terpineol*, flesh colour and precipitate. Cinnamic aldehyde, formaldehyde, acetaldehyde, benzaldehyde, and anisic aldehyde give no reaction.

Among essential oils, *Oil of Cassia* yields a yellowish compound, floating on the oil; no reduction on shaking. *Oil of Cinnamon*, a brown compound and faint violet aqueous portion; on standing, a uniform solid black mass. *Oil of Cloves*, after some time a violet colour in the aqueous liquid, which increases on standing.—F. H. L.

ORGANIC CHEMISTRY—QUANTITATIVE.

Soaps; Determination of Free Alkali in ——. R. E. Divine. J. Amer. Chem. Soc. 1900, **22**, [10], 693—695.

The total alkali is estimated by treating an alcoholic solution of the soap with an excess of stearic acid, and then titrating back with soda. The caustic alkali is found by titrating with stearic acid after the carbonate has been precipitated with barium chloride.

Two grms. of the soap are placed in a 300 c.c. round-bottomed flask, together with 50 c.c. of alcohol and a few drops of phenolphthaleïn. A definite volume of N/10 stearic acid solution is then introduced in an amount judged sufficient to neutralise the free alkali present. The flask is closed with a cork stopper through which passes a glass tube which acts as a reflux condenser. This tube is 30 ins. long and has a $\frac{1}{4}$ in. diameter, and it tapers to a point at its lower extremity. The whole is heated for 30 minutes on a steam-bath, and should the liquid become red, more acid is run in, and the boiling is continued another 20 minutes. After cooling, the excess of acid is titrated back with N/10 caustic soda. Whilst the above is in

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progress, another 2 grms. of soap are heated with 50 c.c. of alcohol on a steam-bath. When the total alkali is known, a 10 per cent. barium chloride solution is added in sufficient quantity to react with the whole of the alkali reckoned as carbonate. After heating a few minutes, the liquid is titrated with N/10 stearic acid in presence of phenolphthaleïn. The titration must be performed slowly, and with thorough agitation in order that the precipitated barium hydrate may be neutralised by the stearic acid. If necessary, a correction must be made for carbon dioxide present in the alcohol employed.—E. H. T.

Fat in Finely Powdered Substances, specially in Cocoa and its Preparations; Determination of ——. P. Welmans. Zeits. öffentl. Chem. **6**, 304—314. Chem. Centr. 1900, **2**, [14], 786.

The degree of fineness of the material under examination has a considerable influence on the results obtained, in the determination of cocoa butter. Commercial cocoa powders and chocolates are in a sufficiently fine state of division, but cocoa beans should be subjected to a preliminary treatment. 20—30 grms. of the beans, after removing the husks, are rubbed in a mortar warmed to 50° C., until coarser particles can no longer be observed. The fluid mass is allowed to solidify in a tin mould, the cold mass rubbed on a "sugar-grater," and the whole operation repeated. 5 grms. of the finely divided mass are weighed off, ground in a smooth mortar with an equal quantity of sand, and the mixture introduced into a paper casing ready for the extraction. The latter should be prepared with particular care, to ensure that it will retain the finely divided material.

The author recommends the following method for the direct extraction of the fat:—5 grms. of the finely divided material are continuously agitated in a separator with 100 c.c. of ether which has been saturated with water, till coherent particles can no longer be perceived. 100 c.c. of water which has been saturated with ether, are then added, and the mixture again vigorously agitated, till a complete emulsion is formed. The mixture is then allowed to stand and separate into two layers. 50 or 25 c.c. of the clear ethereal layer are removed by means of a pipette, the ether distilled off, and the residue weighed. The author points out that, in calculating the percentage of fat, it should be noted that the weight of fat obtained is not that present in 100 c.c. of ether, but in 100 *minus* the volume of the fat. For the purpose of making the necessary correction, the specific gravity of the cacao butter may be taken as 1. It is stated that satisfactory results have been obtained by this method during the past three years.

The amount of substances soluble in water is determined by evaporating to dryness an aliquot portion of the lower aqueous layer. A similar correction to that made in the determination of the fat is necessary, the specific gravity of the dry extract being taken as 1·5 for chocolate, and 1·3—1·4 for cocoa. The results are stated to be trustworthy. The author has also applied Bonnema's method (this Journal, 1899, 869) to the determination of the fat in cocoa. 5 grms. of cocoa, or 5—10 grms. of chocolate, are vigorously agitated for about two minutes with 100 c.c. of absolute ether, 50 c.c. of water are added, an emulsion formed by shaking, then 5 grms. of finely powdered gum tragacanth added, and the whole vigorously agitated until the tragacanth has conglomerated. 50 c.c. of the ether solution are filtered off, the ether evaporated, and the residue weighed. If the amount of fat be less than 10 per cent., the method gives good results, but with a larger proportion of fat the results are too high; 1 per cent. too high with 20 per cent. of fat; 1·5 per cent. with 25—30 per cent.; and 2—2·5 per cent. too high with 30—40 per cent. of fat. If a suitable correction be made for this, and also for the volume of the fat, the process is useful as a rapid method of determining the fat.—A. S.

Fat in Sweetened Condensed Milk; Determination of ——. J. F. Geisler. J. Amer. Chem. Soc. 1900, **22**, [10], 637—645.

The "Adams coil" and "asbestos-tube" methods of estimating fat in sweetened condensed milk are brought under criticism. If, in applying the first mentioned, as much as 2 grms. of the specimen be used, then it is not possible to extract the whole of the fats in a 4—5 hours' treatment. The best results are obtained by taking 1 grm. of the milk for every coil used, and extracting for 4—5 hours; it is essential, however, that the coil be free from fat to begin with. The "asbestos-tube" method gives too low results, owing to the incomplete extraction of the fat. To obtain a better result, the residue must be extracted with water, then dried, submitted to four hours' exhaustion with petroleum ether, dried and re-exhausted with the same solvent. It is probably possible to modify the details of this method to such an extent as to make it as reliable as the other good methods in use. Any method capable of yielding results which do not vary by more than ± 0·1 can be accepted as sufficiently accurate for all practical purposes.—E. H. T.

Sugar Analysis; Protocol of the Third Meeting in Paris of the International Commission for Uniform Methods of ——. Zeits. Ver. Deutsch. Zucker-Ind. 1900, **50**, [536], 357—363.

Although the Physical Institute of the German Government found that the normal weight of 26·048 grms. for Mohr's cubic centimetre at 17·5° C. corresponds to the metric volume at 20° C., using brass weights of 26·01 grms., the Commission decided that, considering the deviation was so small, 26·00 grms. should in future be adopted as the normal weight for metric 100 c.c. at 20° C.

The rotation of chemically pure sugar shall be taken as the basis for saccharimetry. This sugar shall everywhere be prepared in the same manner as that known as the method of the British chemists.

The purest commercial sugar is further purified as follows:—A hot aqueous solution is prepared and the sugar precipitated with absolute ethyl alcohol, and then carefully "spun off" in a small centrifugal machine and washed in the machine with alcohol. The sugar so obtained is again dissolved in water to make a saturated solution, precipitated with alcohol, "spun off" and washed as before. The product of the second centrifugalising is dried between filter-paper and kept for use in glass bottles. The moisture still remaining in the sugar is determined, and allowance made for it on weighing out a quantity for use.

It is further proposed that centres shall be indicated in each country to undertake the preparation and forwarding of chemically pure sugar. Where this arrangement cannot be carried out, quartz plates, the value of which have been determined by chemically pure sugar, shall be used to control the saccharimeter.

Generally, analyses of sugar are to be made at 20° C. The polarimeter shall be adjusted at 20° C. For apparatus requiring the German normal weight, 26 grms. of pure sugar are dissolved in a flask of 100 metric c.c., the weighing being made in air, with brass weights, and the solution polarised in a room at 20° C. The apparatus must show 100·00.

The temperature of 20° C. is necessary both for solution and polarisation. For those countries where the temperature is in general higher, some other standard temperature is to be chosen, say 30° C., and the instrument adjusted at this temperature. The solution and observation must then always be made at the temperature fixed upon.

It is advisable that a uniform normal weight be adopted for all countries.

For the polarisation of all substances containing sugar, half-shadow instruments alone should be used. During observation the apparatus must have a fixed, immovable position, and be so far from the source of light that the polarising Nicol is not heated. As a source of light, lamps are recommended with intense flame, as triplex gas jet with metal chimney, lens and reflector, the Auer burner, electric lamps, petroleum duplex lamps, and sodium light. All the apparatus used is to be checked as to graduation, &c. Scratched cover glasses are not to be used. Several readings are to be made and the average taken, and single readings not to be chosen from these. The whole normal weight or a multiple is to be taken, in each case making up

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the solution to a corresponding volume. The only clarifying agents to be used are basic lead acetate prepared according to the German pharmacopœia (lead acetate, 3 parts; litharge, 1 part; water, 10 parts); Scheibler's colloidal alumina, and concentrated solution of alum. Bone charcoal and decolorising powder are absolutely excluded. In filtering, the whole of the contents of the flask are to be poured on the dry filter paper, the portion running through first being rejected.

For normal beetroot sugar, water is to be determined at 105°—110° C. Abnormal beet sugar and colonial sugar allow of no commercial method of water estimation.

Ash is determined in raw sugars by Scheibler's method, using pure concentrated sulphuric acid. The incineration is to be carried out in platinum dishes in platinum or fire-clay muffles at as low a temperature as possible (not over 750° C.), and a deduction of 10 per cent. is made from the result obtained, before entering on the certificate.

No proposal is made as to method of determining the alkalinity, as this is no indication of the keeping quality of raw sugar.

Invert sugar is to be determined in raw sugars by Herzfeld's method.

Samples are to be kept only in well-closed glass vessels, and should be at least 200 grms.—L. J. de W.

Sugars in Presence of Dextrin; Determination of ——, A. Bianchi. Oesterr.-ung. Zeits. Zucker-Ind. u. Landw. **29**, 515. Chem. Centr. 1900, **2**, [15], 822.

The author has examined several methods as to their applicability for the quantitative determination of invert sugar and dextrose in presence of dextrin. With Wiley's method, which depends upon the variation of the optical rotation of levulose at different temperatures, the results are influenced by the presence of maltose, which frequently occurs in commercial glucose. On examining Sachsse's method, in which, according to Soxhlet, the different reduction coefficients of levulose and glucose towards Fehling solution and Sachsse's mercury iodide solution are made use of, the author found that with different concentrations the reduction coefficients of the sugars towards Sachsse's solution are only slightly altered in the case of glucose, but very considerably with levulose. Lieben's method (decomposition of the levulose by hydrochloric acid and determination of the reducing sugar before and after the treatment) is of no use, as reducing substances are also formed from the dextrin. Attempts to remove the dextrin by means of baryta or alcohol proved unsuccessful, owing to the different behaviour of the individual dextrins towards the reagents.—A. S.

Potatoes; Determination of Starch in ——. G. Baumert and H. Bode. Zeits. angew. Chem. 1900, [43], 1074—1078, and [44], 1111—1113.

In the manufacture of starch from potatoes, an accurate knowledge of the starch-contents of the raw material is an item of considerable importance. Of the various analytical processes in use, some are physical, *i.e.*, the starch is separated by washing, &c., and weighed as such. In others its amount is deduced from the cupric oxide reducing power, or optical activity of the sample after diastatic or acid hydrolysis. The major portion of the authors' communication is devoted to a critical examination of these processes. They conclude that the physical methods yield low results because of the difficulty of separating the whole of the starch; whereas the chemical methods furnish results that are too high, by reason of the presence in the potato of pentosans and other substances, which yield, on hydrolysis, soluble matters possessing gyratory and reducing properties.

In conclusion they propose as the result of their experiments, the following method, claiming for it freedom from the errors inherent with most chemical processes; together with great accuracy as shown by the closely concordant figures obtained on repetition.

Three grms. of the finely ground air-dried potato sample are digested in a porcelain beaker with 50 c.c. of cold water for one hour. The liquid is then decanted through a small asbestos filter (filter-plate 2—3 cm. diameter), the asbestos plus adhering starch returned to the beaker, 50 c.c. of water added, the beaker covered, and heated for $3\frac{1}{2}$ hours in an autoclave at approximately (not over) three atmospheres pressure.

The mass is then transferred with boiling water to a 250 c.c. flask, and the solution boiled for 10 minutes, cooled to 15° C, diluted to the mark, mixed, and filtered through a ribbed paper. To 100 c.c. of the filtrate, 10 c.c. of sodium hydrate solution (100 grms. of NaHO per litre) is added; and 25 c.c. of the alkaline liquid gradually mixed with 100 c.c. of alcohol (94—96 per cent.). During this operation about 1 grm. of fine flocculent asbestos must be added and the liquid violently stirred until the precipitated sodium starch and asbestos settle out, leaving the supernatant solution clear. Should this not occur after one minute, a little more asbestos may be added. The liquid is then decanted through a Soxhlet filter tube (plugged with asbestos), the precipitate transferred by the aid of 80 per cent. alcohol, washed with the same, finally with absolute alcohol, followed by ether. During filtration compression of the precipitate must be avoided, and the filter tube kept full of liquid. Afterwards the precipitate is sucked as dry as possible and the tube heated to 120°—130° C. in a current of air until constant in weight. The starch precipitate is then burnt in a current of air or oxygen, and the tube again weighed. The decrease in weight represents starch.—H. T. P.

Lactose; Determination of ——. R. Broquet and C. Dethier. Bull. Assoc. Belge des Chim. **14**, [6], 265—267.

Having failed to obtain concordant results by the optical method when employing basic lead acetate as a clarifying agent, the authors sought for the cause of this defect. They find that this reagent precipitates part of the lactose. Consequently they recommend, as a substitute, neutral lead acetate, too large an excess being undesirable.—C. S.

Santonin; Determination of ——. K. Thaeter. Archiv. der Pharm. **238**, (5), 383—387.

K. Thaeter gives the following process. For the quantitative determination of santonin, 10 grms. of the powdered drug (*Flores Cinæ*) is extracted with ether for 12 hours in a Soxhlet's tube; the extract, after the evaporation of the ether, is heated for an hour with 5 grms. of caustic lime and about 300 c.c. of water, then filtered and washed with water. The resulting filtrate is acidified with sulphuric acid, warmed until crystals of santonin are formed, when 100 grms. of the official solution of aluminium acetate of the German Pharmacopœia are added. The liquid is then evaporated to dryness, the residue is powdered, mixed with 3 grms. of magnesium oxide, again moistened with water, dried, and finally, after drying at 105° C., extracted with anhydrous, acid-free ether for five hours. In this manner the total santonin present is extracted, and may be obtained, on the evaporation of the solvent, in a pure condition for weighing.—J. O. B.

Senna; Determining the Value of ——.

See under XX., *page* 1139.

Lactic Acid; Determination of Value of Commercial ——. F. Jean. Ann. Chim. anal. appliq. 1900, **5**, 285; through Chem. Zeit. Rep. 1900, **24**, [86], 312.

Commercial lactic acid, which usually contains free mineral acids, oxalic acid, volatile organic acids, and various salts, may be examined in the following manner:—(1) For total acidity, by titrating 5 to 10 c.c. and calculating the result as sulphuric acid. (2) For free acids, by evaporating a similar quantity three times on the water bath, dissolving the residue each time in water, and finally titrating as before. (3) For lactic acid, by evaporating 10 c.c. several times, dissolving the residue in water, heating it to the boiling point and neutralising with barium carbonate, the filtered solution being then evaporated in a platinum dish, the residue incinerated to carbonate, extracted with boiling water, collected on a filter, well washed, and finally dissolved in a known measure of N/10 hydrochloric acid The solution, after removal of carbon dioxide by heating, is

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titrated with N/10 alkali, and the volume of N/10 hydrochloric acid fixed by the carbonate, found by subtraction. This number of c.c. multiplied by the factor 0·009 gives the weight of lactic acid originally present. In a commercial sample, the authors determined 0·60 per cent. of oxalic acid and 2·16 per cent. of lactic acid.—R. L. J.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Atmospheric Hydrogen; Sources of ——. A. Gautier. Comptes Rend. **131**, [17], 647—652.

The author has found that granite, taken from the centre of a large block, rapidly broken up and sifted in an atmosphere of carbon dioxide, and then treated with an acid (preferably syrupy phosphoric acid) at 100° C. or with water at 280°—300° C. in glass vessels, which are afterwards exhausted by the mercury-pump, gives off into the vacuum very considerable amounts of gas, largely consisting of hydrogen. The following table gives the volume of gas in cubic centimetres given up by a kilo. of (*a*) a granite from Vire, treated with acid; (*b*) a Brittany granite treated with water:—

——	*a.*	*b.*
Hydrochloric acid	Traces	..
Hydrogen sulphide	165·7	1·3
Carbon dioxide	261·4	7·2
Hydrocarbons absorbed by bromine	5·8	..
Methane	Traces	..
Nitrogen	51·24	0·3
Oxygen	None	..
Hydrogen	915·75	46·0

These gases arise, no doubt, from the action of the acid or water on metallic sulphides, carbides, nitrides, &c., included in the granite as a sort of mother liquor at the time of its formation and subsequently solidified; in particular, much of the hydrogen seems to come from an iron nitride N_2Fe_6 (N_2Fe_4 and N_2Fe_5 have been actually found by Silvestre in fissures in the lavas of Etna), for ammonia in almost corresponding quantity is formed at the same time.

The author points out that this action forms a probable source of hydrogen, not only in the past, but at the present time, for the temperature of 280° C. is reached at no great depth. As at present we know of no reaction by which hydrogen is removed from the atmosphere, the question arises whether the amount of hydrogen (and of methane) in the atmosphere is not continually increasing.—J. T. D.

Copper; Poisonous Action of ——. L. Lewin. Deutsch. med. Wochenschr. 1900, **26**, 689.

The author discusses the question as to whether metallic copper or its salts have the power of producing chronic poisoning in men. As a result of the careful examination of workers who had been employed for several years in the working of copper in its various forms, he found that occasionally acute disorders are caused by the copper dust, but could not discover any phenomena indicating chronic poisoning.—A. S.

Acid Salts; Taste and Ionisation of ——. L. Kahlenberg. J. Phys. Chem. 1900, **4**, 533—537.

The author states that the sour taste of acids and acid salts is due simply to the chemical reactivity they possess by virtue of the presence of hydrogen replaceable by a metal or basic radicle, the taste being more intense the more readily this hydrogen is replaceable. This explanation he deems quite sufficient without any recourse to Richards' ionisation theory.—A. S.

Denaturing of Acetic Acid in France. E. Blondel. Rev. Gén. des Mat. Col. 1900, **4**, [46], 312.

By a recent order of the Government of France, all acetic acid used in the textile and pottery industries in that country must be admixed with a certain quantity of crude wood acid, or of sulphuric or hydrochloric acid. The author opposes the use of the first of these on account of the disagreeable smell which it gives to the fabrics to which it is applied, the smell imparted to them by the ordinary acetic acid of commerce, in which, despite a second distillation, small quantities of empyreumatic matters are present, being found to be sufficiently objectionable. As regards the mineral acids, the object of the enactment can easily be frustrated, since these can be neutralised with soda, without serious detriment to the value of the mixture in the manufacture of vinegar. The salts which are formed in this treatment, however, act as precipitants for dyestuffs, and, consequently, considerably lessen the value of the acetic acid as a solvent for the latter. It is impossible to employ the mixtures containing the free mineral acids in the printing of cotton fabrics, owing to the "tendering" action of such acids upon the fibre.—E. B.

Hydrated Mixed Crystals; Varying Composition of ——. W. Stortenbeker. Zeits. Phys. Chem. **34**, 108—123.

The author has continued his work on this subject, and now finds that the mixed crystals of copper-zinc sulphate and of copper manganese sulphate consist of concentric layers of different composition, the outer layers being richer in copper than the inner. He considers that this peculiarity is common to all mixed crystals, although the fact can only be definitely proved in favourable cases.—A. S.

Ferrous Chloride and Bromide; Action of Ammonia upon ——. Gilbert J. Fowler. Chem. News, **82**, [2139], 245.

In the cold, ammonia is very rapidly absorbed by ferrous chloride, the crystals swelling up to a white powdery mass with evolution of heat, the temperature rising to above 40° C. On introducing ferrous chloride into ammonia gas over mercury, the ammonia is instantaneously absorbed, the experiment being a striking one for lecture illustration. Quantitative experiment showed that from 5 to 6 molecules of ammonia are thus taken up. On exposure to the air the white mass rapidly turns brown, with formation of hydrate of iron. On heating the white substance to the boiling-point of alcohol, in a tube connected with a manometer, no appreciable amount of ammonia was evolved; at 100°, however, a rapid evolution of this gas took place.

In order to investigate the action of ammonia upon ferrous chloride at higher temperatures, the ferrous chloride was spread, in a thin layer, in a hard glass tube contained in a Lothar-Meyer furnace, given temperatures which can be kept regular up to 500°. Ammonia gas was first of all passed through at the ordinary temperature till all the air was expelled. The temperature was then raised, and at 160° ammonia came off very rapidly from the white compound of ammonia and ferrous chloride formed in the cold, but no gas unabsorbed by hydrochloric acid was obtained. At 300° this ammonia had not ceased coming off, but no sublimation of ammonium chloride was noticed.

At a temperature about 300°, but below the melting-point of lead, 335°, the mass began to darken, a large amount of ammonium chloride was formed, indicating a decomposition of the ferrous chloride, but very little unabsorbed gas was evolved. At the melting-point of zinc, 433°, a small amount of gas was found to be unabsorbed by the acid in the nitrometer connected with the apparatus. On allowing the apparatus to cool, complete absorption of the ammonia took place in the nitrometer, showing that the gas collected was not due to any air having diffused into the apparatus. The temperature was kept low in this experiment, in order better to observe the formation of products intermediate between ferrous chloride and nitride of iron, which, according to Fremy, is the final product of the reaction. The gas evolved was nitrogen, produced in the course of the reaction. The solid residue in the tube consisted partly of unaltered ferrous chloride, as, on allowing to cool, more ammonia was absorbed. On treating the mass with dilute sulphuric acid, and rapidly pouring off the solution obtained, a residue of less soluble substance was left, having all the external properties of nitride of iron prepared by other methods, and slowly soluble in sulphuric acid with formation of ferrous and

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ammonium sulphates. Nitride of iron is therefore formed by the action of ammonia upon ferrous chloride at the temperature of molten lead.

When ferrous chloride is heated with ammonia, the latter is first absorbed to form the molecular compound already mentioned. On further heating, reduction of the ferrous chloride takes place, resulting in the formation of ammonium chloride, nitride of iron, and a small quantity of nitrogen. To prepare the nitride in quantity by this method, a temperature of about 600° appears to be necessary.

Ferrous bromide was prepared and similarly treated. The temperature of reaction was not sensibly lower, and the products of reaction were analogous.

Sodium Chloride; Electrolysis of ——. C. G. L. Wolf. J. Phys. Chem. 1900, **4**, 200—206.

THE author describes, with the aid of a diagram, an apparatus well adapted for lecture demonstrations, as the conditions can be rapidly varied with a minimum of rearrangement, and the effect of adding alkalis, acids or salts can be shown without interrupting the current. It is in the form of a U-tube, with a central limb for the insertion of a stirring arrangement; each of the side limbs is fitted with a thermometer, a platinum electrode, and an outlet-tube for conveying the gases evolved to a measuring tube. The author subjected to electrolysis in this apparatus, a solution containing 300 grms. of sodium chloride, and 1·8 grms. of potassium chromate per litre, using a current of about 1 ampère, the anode and cathode current densities being respectively 0·14 and 6·66 ampères per sq. cm. The average efficiency was about 80 per cent., and in a little over seven hours 12·7 per cent. of the sodium chloride was oxidised to chlorate. The author states that if a high efficiency is to be attained, the electrolyte must be kept well agitated, and a constant temperature maintained.

—A. S.

Metals; Passive Conditions of the ——. W. Hittorf. Zeits. für Elektrochem. 1900, **7**, [15], 168—170.

FARADAY ascribed the passive state of iron to the presence of an invisible film of oxide. Hittorf (this Journal, 1898, 185, and 1899, 835) found that chromium could also exist in such a state and carefully investigated the conditions for its passivity. He arrived at the conclusion that it was not due to the presence of a film of oxide. Further experiments by the same author lead him to believe that the passive state of iron is not due, as was formerly supposed, to a thin protecting film of oxide, but to the same cause which induces the passive state in the case of chromium. Nickel and cobalt also can assume the passive condition.

—J. S.

Iron and Steel from the Standpoint of the Doctrine of Phases. H. W. Bakhuis Roozeboom. Zeits. physik. Chem. **34**, 436—487; Chem. Centr. 1900, **2**, [13], 706. (See this Journal, 1900, 1016.)

FUSIONS containing more than 4·3 per cent. of carbon, separate graphite on cooling, until the temperature, 1130° C. is reached, when the eutectic mixture of graphite and *martensite*, containing 4·3 per cent. of carbon, solidifies. *Martensite* is a solid solution of carbon in the γ-modification of iron, which is stable above 890° C. If from 2 to 4·3 per cent. of carbon is present, the "martensite mixed crystals" containing at the most, 2 per cent. of carbon, which solidify first, form the framework, between which, the eutectic mixture of graphite and *martensite* is deposited. Fusions containing 0—2 per cent. of carbon, solidify to a single phase, the *martensite*, the carbon content of which changes from the beginning to the conclusion of the solidification.

Solid alloys containing more than 2 per cent. of carbon, still separate carbon, on cooling from 1130° to 1000° C. At 1000° C., the *martensite* and carbon from *cementite*, Fe_3C, a definite chemical compound, containing 6·6 per cent. of carbon. With alloys containing less than 6·6 per cent. of carbon, the *cementite* is accompanied by some *martensite*. As the temperature falls, the *martensite* becomes more and more impoverished in carbon, which goes to form *cementite*, until at 690° C., *martensite* is no longer capable of existence. The transformation point of the γ-iron into α-iron is lowered to such an extent by the amount of carbon present, that there is no formation of β-iron, which is only stable at higher temperatures. At 690° C., the γ-iron is completely converted into α-iron, *ferrite*, which probably has no solvent action on carbon. The carbon is then present in the form of *cementite*. If the fusions be cooled rapidly, *cementite* is formed immediately.

Alloys containing 0·85 to 2 per cent. of carbon, when cooled slowly from 1000° to 690° C., separate *cementite*, and at 690° C. are composed of *cementite* and *ferrite*. With rapid cooling, however, the mixed crystals of *martensite* may remain permanent. Alloys containing 0—0·35 per cent. of carbon, separate, between 890° and 770° C., the third modification of iron, β-iron, which is stable between these temperatures, and which also has probably no solvent action on carbon. At 770° C., the β-iron is converted into α-iron, and on further cooling, only α-iron is formed from the mixed crystals of *martensite*. Alloys containing 0·83—0·85 per cent. of carbon, separate, only below 770° C., iron in the form of α-iron. All alloys containing from 0 to 0·85 per cent. of carbon are converted at 690° C. into a conglomerate of *ferrite* and *cementite*. *Perlite* is the eutectic conglomerate with 0·85 per cent. of carbon. With the alloys, also, if they are cooled suddenly by sprinkling, the mixed crystals of *martensite* may remain permanent. *Austenite*, the author believes to consist of mixed crystals, which separate from the more concentrated solid solutions, and which can occur in presence of both *martensite* and *cementite*. They are unstable, and on gradual cooling, are converted into a mixture of *martensite* and *cementite*.—A. S.

Nickel; Selenides of ——, Fonzes-Diacon. Comptes Rend. **131**, [14], 556—558.

THE monoselenide, NiSe, is obtained in crystals by passing selenium vapour, diluted with nitrogen, over nickel at a dull red heat. The crystals are regular tetrahedra, grey, with a bluish lustre. The same compound is formed when hydrogen selenide is passed over nickel chloride at a bright red heat.

When hydrogen selenide is passed over nickel chloride at a low red heat, products are obtained of formulæ varying from Ni_2Se_3 to Ni_3Se_4.

The biselenide, $NiSe_2$, is formed as a dull blackish grey powder, when hydrogen selenide is passed over either nickel chloride or nickel oxide at 300° C.

All of these selenides, heated to bright redness in a current of hydrogen, lose selenium, and yield a golden-yellow metallic-looking substance, Ni_2Se. If the temperature be raised to whiteness, this also gives up selenium to the hydrogen, and nickel is reduced in a filiform condition.

By reducing nickel seleniate in hydrogen, an oxyselenide appears to be formed; but the analyses leave it a little doubtful whether this is not a mixture of selenide and oxide.

Hydrochloric acid, even when concentrated, acts but slightly on these selenides. The gaseous acid at a high temperature slowly converts them into chloride—a conversion which is much more rapidly effected by chlorine. Nitric acid oxidises them to selenites. Heated in a stream of oxygen they yield nickel oxide and selenium dioxide.

—J. T. D.

Cobalt; Selenides of ——. Fonzes-Diacon. Comptes Rend. **131**, [18], 704—705.

BY the action of dilute vapour of selenium on cobalt, the author has obtained the four selenides $CoSe_2$, Co_2Se_3, Co_3Se_4, CoSe. Hydrogen at a high temperature reduces these to Co_2Se, and ultimately to selenium.

The reduction of cobalt selenate by hydrogen gives oxyselenides or mixtures of oxide and selenide, according to the temperature.—J. T. D.

Cobalt; Ammoniacal Arsenates of ——. O. Ducru. Comptes Rend. **131**, [17], 675—678.

WHEN ammonium arsenate is added to a solution of a cobaltous salt containing a salt of ammonium, a gelatinous precipitate falls which when heated on the water bath in its mother liquor becomes pink and crystalline. It then has the crystalline form and the composition of the mineral

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erythrine or cobalt-bloom, $Co_3(AsO_4)_2.8H_2O$. If the solution of the cobalt salt contain free ammonia as well as an ammonium salt, the precipitate also contains ammonia, increasing in amount with the increase of the amount of ammonia in the solution, but reaching a limit when that amount is about 70 grms. of NH_3 per litre; the precipitate then has the composition $Co_3(AsO_4)_2.3NH_3.5H_2O$. Between this and *erythrine*, precipitates of any intermediate composition are obtainable, the ammonia appearing to take the place of some of the water of crystallisation; but determinations of the decomposition-tensions lead the author to believe that there exist, besides the two already mentioned, only two definite compounds, $Co_3(AsO_4)_2.2NH_3.6H_2O$ and $Co_3(AsO_4)_2.NH_3.7H_2O$.—J. T. D.

Nickel; Ammoniacal Arsenates of ——. O. Ducru. Comptes Rend. **131**, [18], 702—704.

By the same method as that employed in the case of cobalt (see preceding abstract), the author has obtained three nickel arsenates, derived from *annabergite*, $Ni_3(AsO_4)_2.8H_2O$, by the substitution of one, two, and three molecules respectively of H_2O by NH_3. They are more difficult to prepare than the similar salts of cobalt: the proportions of ammonia in the liquor must be exactly those requisite in each case, and the heating must therefore be done in closed vessels—those used for pasteurising beer being very convenient.—J. T. D.

Platinum and other Metals; Ferment-like [Catalytic] Properties of ——. Bredig. Zeits. angew. Chem. 1900, [42], 1053—1054.

In the ferment-like phenomena caused by platinum and other metals, the liquid acts as a colloidal solution, forming an intermediate stage between the solid and dissolved conditions. As regards the influence of toxic substances on the "fermentation," the author finds that they vary in degree. The most prejudicial are hydrocyanic acid, cyanogen iodide, iodine, hydrogen sulphide, sodium thiosulphate, carbon monoxide, hydrogen phosphide, arseniuretted hydrogen, and mercuric chloride; then come bromine, carbon bisulphide, phosphorus, amyl nitrite, hydroxylamine hydrochloride, and mercuric cyanide; in the third series are included nitrous acid, aniline, and pyrogallol; whilst the least toxic effect is produced by arsenious acid and nitrobenzene. Potassium chlorate does not destroy the catalytic power of the solutions, although, in general, substances which act as poisons to the blood are also toxic to inorganic "ferments." As a rule, a poisoned solution recovers its fermentative power on the removal of the toxic substance, as, for instance, when hydrocyanic acid is expelled by a current of air. Only after the addition of iodine and cyanogen iodide—which, in extremely dilute solutions, had an injurious effect—did the author find any permanent loss of catalytic power.

—C. A. M.

Light; Chemical Action of ——. G. Ciamician and P. Silber. Ber. **33**, [15], 2911—2913.

According to O. de Coninck and Devrien (Comptes Rend. **130**, 1768), when an alcoholic benzophenone solution is exposed to sunlight, aldehyde is produced, together with a substance, $C_{17}H_{16}O$, which separates in colourless crystals, and melts at 182° C., to which they assign a constitutional formula. An analogous compound is obtained from acetophenone. The matter is, however, simpler than stated, the ketones in alcoholic solution under the influence of light being converted into the corresponding pinacones. In one experiment a solution of 4 grms. of benzophenone, dissolved in 20 c.c. of absolute alcohol, was exposed to direct sunlight for eight days. On opening the tube, aldehyde was readily detected, and the crystals, which separated in colourless prisms, weighed 3·6 grms., melted at 186° C., and possessed all the properties of benzpinacone—

$$(C_6H_5)_2C(OH).C(OH)(C_6H_5)_2.$$

Similarly acetophenone yields acetophenone pinacone, melting at 122° C. Thus these ketones behave similarly to quinone and to nitrobenzene, which, when exposed in alcoholic solution to sunlight, form respectively hydroquinone and aniline, accompanied by aldehyde in both cases.—T. A. L.

Phosgene [Carbonyl Chloride]; New Reaction of ——. B. Kühn. Ber. 1900, **33**, [15], 2900—2904.

In conjunction with W. Spindler and P. v. Gartzen, the author finds that phosgene, $COCl_2$, is capable of breaking down the combination between a carbon atom, and the nitrogen atom of a tertiary amino-radicle, the free valencies being satisfied by the groups CO and Cl_2. Thus with the acetyl-derivatives of *o*-, *m*- and *p*-amidobenzylpiperidine, phosgene reacts according to the equation—

$$2CH_3.CO.NH.C_6H_4.CH_2.NC_5H_{10} + COCl_2 = CO(NC_5H_{10})_2 + 2CH_3CO.NH.C_6H_4.CH_2Cl.$$

The new acetylamidobenzylchlorides obtained in this way and also the initial acetylamidobenzylpiperidines used for their preparation are described.—T. H. P.

New Books.

Chemisch-Technisches Repertorium. Uebersichtlicher Bericht über die neuesten Erfindungen, Fortschritte und Verbesserungen auf dem Gebiete der technischen und industriellen Chemie, mit Hinweis auf Maschinen, Apparate und Literatur. Herausgegeben von Dr. Emil Jacobsen. 39. Jahrgang. 1900. Erstes Halbjahr. Erste Hälfte. Mit in den Text gedruckten Illustrationen. R. Gaertner's Verlagsbuchhandlung, Hermann Heyfelder, Schönebergerstrasse 26, Berlin, S.W.

The number of the "Repertorium" for the first half of the first half year of 1900. It treats of the following subjects:—I. Building Materials, Cements, and Artificial Stone. II. Dyestuffs, Dyeing, and Calico Printing. Coal-tar Products. III. Fats, Oils, Illuminating and Heating Materials. IV. Fermented Liquors. V. Tanning, Leather, and Glue Manufacture. VI. Textiles. VII. Glass and Earthenware. VIII. Wood and Horn. IX. India-rubber and Gutta-percha. X. Cements and Adhesives. XI. Lakes, Varnishes, and Paints. XII. Metals.

Coal-Tar and Ammonia. Third and Enlarged Edition. By George Lunge, Ph.D., Professor of Technical Chemistry in the Federal Polytechnicum, Zürich. Gurney and Jackson, 1, Paternoster Row, London. 1900. Price 2*l.* 2*s.*

8vo volume, containing preface, table of contents, and subject-matter filling 912 pages; an appendix of three pages addenda filling three pages, and an alphabetical index of subjects completes the work. The text is illustrated by 285 wood engravings. In the preparation of this edition of his great work, the author has been assisted by Dr. Hippolyt Köhler. The last edition of 1887 contained 739 pages and 191 engravings. The Introductory Chapter I. is devoted to the subject of Destructive Distillation, and the Products of Gas, Tar, &c. Historical Notes on the Applications of Coal-tar and its Products, &c., and the Quantities produced from Gas Works and Coke Ovens. Chapter II. Processes for Obtaining Coal-tar. III. The Properties of Coal-tar and its Constituents. IV. Applications of Coal-tar without Distillation. V. The First Distillation of Coal-tar. VI. Pitch. VII. Anthracene Oil. VIII. Creosote Oil. IX. Carbolic Acid and Naphthalenes. X. Light Oil and Crude Naphtha. XI. Rectification of Steam. Final Products. XII. Sources from which Ammonia is obtained. XIII. Composition and Analysis of Ammoniacal Liquor, and Properties of its Constituents. XIV. Working up of Ammoniacal Liquor. XV. Technically important Ammonium Salts, including Methods of Estimating Ammonia, free or combined.

An Introduction to Modern Scientific Chemistry, in the form of Popular Lectures suited for University Extension Students and General Readers. By Dr. Lassar-Cohn, Professor in the University of Königsberg.

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Translated from the Second German Edition by M. M. Pattison Muir, M.A. H. Grevel and Co., 33, King Street, Covent Garden, London, W.C. 1901. Price 6*s*.

Small 8vo volume, with author's preface, table of contents, 337 pages of subject-matter illustrated with 58 woodcuts, a tabular arrangement of the Elements (Mendeleef), and the alphabetical index.

A popular treatise, yet "on strictly scientific lines," intended specially for the younger chemists.

A School Chemistry, intended for use in High Schools and in Elementary Classes in Colleges. By John Waddell, Ph.D., D.Sc., &c., Lecturer in Chemistry in the School of Mining, Kingston, U.S.A. The Macmillan Company, New York. Macmillan and Co., Ltd., London. 1900. Price 4*s*.

In this little work of 274 pages and 90 woodcuts, to quote the author in his preface, "The endeavour is made to help the pupil in the discovery of new facts, to enable him to see their connections, to show how facts lead to theory, and theory leads to investigation, and in the discovery of further facts."

Modes Opératoires des Essais du Commerce et de l'Industrie: Leçons Pratiques d'Analyse Chimique faites aux Laboratoires Bourbouze. Par L. Cuniasse et R. Zwilling; avec Préface, &c. par M. Ch. Girard. G. Carré et C. Naud, Éditeurs, 3, Rue Racine, 3, Paris. 1900.

Small 8vo volume, with preface, introduction, and 279 pages of subject-matter, and a detailed table of contents. The pages are illustrated with 48 wood engravings. An alphabetical index ends the work. It is a treatise on the chemical analysis of technical products. I. Qualitative Analysis. II.—(i.) Metals; (ii.) Acids. III. Analytical Characteristics and Reactions. IV. Quantitative Analysis. V. Volumetric Solutions. VI. Water Analysis. VII. Air. VIII. Chlorine. IX. Sulphur. X. Soda and Potash. XI. Limes, Cements, and Mortars. XII. Iron. XIII. Zinc. XIV. Assay of Manganese. XV. Copper. XVI. Silver Alloys. XVII. Mercury. XVIII. Lead. XIX. Alloys of Gold. XX. Manures. XXI. Pyrotechnic Mixtures. XXII. Analysis of Glass.

Second Part: Analysis of Organic Matters. I. Carbonaceous Matters and Fuel. II. Farinaceous Substances. III. Sugars. IV. Petroleums. V. Mineral Oils. VI. Vaseline. VII. Creosote. VIII. Vulcanised India-rubber. IX. Analysis of Gutta-percha. X. Coal-tar Dyestuffs. XI. Fatty Matters. XII. Milks. XIII. Soap. XIV. Analysis of Paper. XV. Textile Materials. XVI. Leather Analysis. XVII. Glue and Gelatins. XVIII. Wines. XIX. Vinegar Analysis. XX. Beers. XXI. Spirits and Alcohols. XXII. Urine Analysis.

Trade Report.

LEGISLATION; TARIFF CHANGES AND CUSTOMS REGULATIONS.

Tariff Modifications in New Zealand.

A copy has been received at the Board of Trade, through the Agent-General for New Zealand, of an Act dated the 15th September last, and which was to be considered as being in force in New Zealand from the 18th August last, substituting the following modified rates of duty in respect of the articles specified for the rates which were previously in force.

The Act also provides that the customs duties charged on the undermentioned goods, wares, and merchandise shall cease to be levied:—

Kerosene, rice manufactured into starch in bond, salt, confectioners' moulding starch, machinery for the manufacture of beetroot sugar, liquid chlorine, and cyanide of sodium, picric acid prussiate of potash, and hyposulphite of sodium.

Articles.	Unit.	Rate of Duty.
		s. *d.*
Stearine, for match-making	„	0 0¾
Paraffin wax	„	0 0¾
		Per Cent.
Patent medicines	*ad val.*	15
Proprietary medicines and medicaments:—		
1. Bearing the name of the proprietor on label or package.	„	15
2. Bearing a prefixed name in the possessive case		
3. Not otherwise enumerated, prepared by any occult secret or art.		
Sarsaparilla	„	15
Drugs and druggists' sundries and apothecaries' wares, not otherwise enumerated.	„	15
Chemicals not otherwise enumerated, including photographic chemicals and glacial acetic acid (B.P. standard).	„	15
Tinctures and medicinal spirits of any recognised pharmacopœia, containing 50 per cent. proof spirit or less.	„	15

Customs Decisions in United States

Parchment Tracing Paper.—Paper made from rags and treated under various processes which render it translucent, and known commercially as parchment tracing paper, is dutiable as parchment paper under paragraph 398 of the Tariff, at 2 cents per pound and 10 per cent. *ad valorem*.

Sheep Dip.—(1) A dry yellow powder, imported in cases of 85 lb. each, valued at 30*s*. sterling per case, and composed of sulphur, arsenic, and soda, and intended expressly for, and exclusively used as, sheep dip, and not susceptible of being used for other purposes, is exempt from duty under paragraph 657 of the Tariff.

(2) A dark brown fluid with a tarry odour, imported in drums of 5 galls. each, and composed of potash and fatty anhydrides, and tar acids of dead oil—or potash soap and creosote oil—which, being used to some extent in the treatment of sheep for certain diseases, is included in the class of non-poisonous dips, but is extensively used as a disinfectant, antiseptic, and for other medicinal purposes, is not exempt from duty under paragraph 657 of the Tariff.

Cinnamic Acid and Anthranilic Acid.—(1) Cinnamic acid can be made from the benzaldehyd, which is produced from bitter almonds, and also from indigo and gum benzoin. For economic and commercial reasons it has, however, within recent years been produced synthetically, almost wholly, if not entirely, as a commercial article, from the hydrocarbon toluol or toluene derived from coal-tar.

(2) Anthranilic acid of commerce is likewise at the present time produced almost entirely, as a commercial article, from the same coal-tar hydrocarbon product by different methods.

Both articles differ essentially from the benzaldehyd and benzoic acid of commerce, being more advanced and expensive products, and consequently are not exempt from duty under paragraphs 524 and 464 respectively of the Tariff.

Varnolette.—A composition of resinate of lead—or resin and compounds of lead—manganese and lime, which is used as a siccative or drier in varnish, linseed oil, paints, inks, and stains, and which is generally known in commerce as "varnolette," is a chemical compound, dutiable at 25 per cent. *ad valorem* under paragraph 3, Act of July 24, 1897, and not at 20 per cent. *ad valorem* under section 6, or by similitude or otherwise under section 7, of said Act.—Protest of Strohmeyer and Arpe against decision of Collector of Customs at New York; United States Board of General Appraisers.

Carbolic Soap, Medicinal.—So-called "carbolic soap," imported in iron drums in the condition of a brown stiff paste, and intended and adapted for use as an insecticide, germicide, disinfectant, and antiseptic in spraying trees, flowers, and plants, and also externally on the human and animal body, consisting of potash and soda soap combined with carbolic acid, is dutiable at 15 cents per lb. as medicated soap under paragraph 72 of the Tariff.

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Kryofine.—So-called "kryofine" is a medicinal compound, in the preparation of which alcohol is used, and is closely allied in chemical constitution, character, and use to phenacetin. It is accordingly dutiable at 55 cents per pound under paragraph 67 of the Tariff as an alcoholic medicinal preparation, and not at 20 per cent. *ad valorem* under paragraph 15, nor at 25 per cent. *ad valorem* as a chemical compound or as a medicinal preparation, under paragraphs 3 and 68 of the Tariff.

Coloured Cellulose Paper in Germany.

Cellulose paper, coloured in bulk, to which a dull glossy black colour has been given by means of paint and varnish, and an appearance of leather has been imparted by impression with rollers (so-called "Kytogen" imitation), and which offers as much, if not more, resistance to tearing than leather, and is therefore quite as strong and tough as the cardboard used in making the cigar cases mentioned above, is to pay duty as "coloured imitation leather" under No. 21*b* of the Tariff at the rate of 36 marks per 100 kilos. (18*s*. 4*d*. per cwt.).

Coal-Tar Products in Russia.

The Russian Customs Department has issued a circular notifying that oleaginous products obtained from the working of coal-tar containing more than 50 per cent. of phenol or kindred substances shall be classified as carbolic acid in a purified state, and admitted into Russia at the conventional duty of 2 r. 25 cop. per poud gross (14*s*. 9*d*. per cwt. gross).

Storage Prohibitions at St. Thomé (Portuguese West Africa).

A Royal Decree prohibits the storage of the following goods in Customs warehouses in Portuguese West Africa:—Acetate of iron; concentrated acetic acid; phenol, citric, sulphuric, chlorhydric, and hydro-fluosilicic acids; spirits in casks or barrels; essence of terebinthine; tar and pitch; alkalis, solid or liquid; alcohol; guncotton and gunpowder; aluminates of alkalis; ammonia; rope torches and similar articles; benzine; collodion and other products compounded with alcohol and ether; creosote; dynamite; sulphur; methylated spirits; fuses of all kinds; essences or ethers of petroleum and gas or gasoline; quick matches; ethers; felts covered with tar; rockets and other fireworks; hypochlorites; naphtha; nitrobenzine; nitrocellulose; mineral oils; phosphoric wicks; phosphorus; pierates of potash and ammonia; potassium; loaded projectiles; sodium; bisulphide of carbon; terebinthine; prepared dyes; varnish in metal casks or barrels.

The prohibition is not applicable to compounds containing alcohol, ether, or mineral oils, when imported in vessels holding not more than one litre.

EXTRACTS FROM DIPLOMATIC AND CONSULAR REPORTS; GENERAL TRADE NOTES, &c.

I.—GENERAL.

Russian Trade.

Bd. of Trade J., Dec. 6, 1900, 517.

Trade with United Kingdom.—As regards imports from the United Kingdom, larger quantities were imported of tea, spices, artificial manures, coal and coke, raw cast iron, cotton, fireproof bricks and tiles, cast iron and iron and steel (all worked), wire, machinery and apparatus of iron and steel, iron vessels, and cotton and woollen tissues, though these to no great extent. At the same time, a diminution in the importation of British goods took place, chiefly under the heads of salted fish, tallow, seeds and plants, chemical products, dyes and colouring substances, raw steel, copper, lead, tin, jute, wool, raw and spun, agricultural machinery, and flax and hemp goods.

Trade with Germany.—According to the Russian Customs Returns for 1899, Germany exports in greater quantities to Russia than we do, raw hides and dressed leather, furs, chemical products, dyes and dye substances, raw iron, copper, lead in rolls, sheets, pipes and wire, zinc, raw silk and wool, woollen yarn, fancy leather goods, leather belting, clay products, china and earthenware, glassware, gold and silversmiths' work, articles of copper and brass, cast-iron goods, articles of iron and steel, tin-plate goods, wire of all kinds, machinery and apparatus of all kinds, and parts of machinery, locomotives, agricultural machinery, instruments and appliances (mathematical, physical, electric, &c.), paper goods, cotton, flax, silk and other goods, materials for writing, drawing, and painting, &c.

Mineral Production of Russia.

Eng. and Mining J., Nov. 17, 1900, 576.

The production of metals and the more important minerals in Russia, for 1897 and 1898, is given in the table below from the official statement just published by the Mining Department of the Government. The figurest are in metric tons and kilograms.

—		1897.	1898.	Changes.	Per Cent.
Gold	Kilos.	38,098	38,972	I. 874	2·3
Platinum	„	5,602	6,140	I. 538	9·6
Quicksilver	Tons	616	363	D. 253	41·4
Copper	„	6,132	6,359	I. 227	3·7
Zinc	„	5,874	5,664	D. 210	3·6
Pig iron	„	1,838,655	2,207,896	I. 369,241	20·1
Manganese ore	„	260,213	302,655	I. 42,442	16·3
Coal	„	11,192,455	12,235,860	I. 1,043,405	9·3
Crude petroleum	„	7,288,444	8,330,868	I. 1,042,424	14·3
Salt	„	7,539,892	1,487,300	D. 52,592	3·4

The notable increases were in pig iron, crude petroleum, and coal. There was also a considerable increase in manganese ore. Outside of these items the changes were not of special importance.

Mineral Production of Greece.

Bd. of Trade J., Dec. 13, 1900, 592.

According to the official returns of the trade of Greece of 24th ult., the exports of minerals from Greece for the first quarter of the current year included 3,278 metric tons argentiferous lead ore; 8 tons galena; 90,561 tons manganiferous iron ore; 49,100 tons hematite iron ore; 4,515 tons calamine, and 3,561 tons blende zinc ore; 1,123 tons emery; 60,918 tons miscellaneous—chrome ore, manganese ore, magnesite, alum earth, and kaolin.

Chemical Apparatus.

Comm. Intelligence, Dec. 8, 1900, 10.

The *Oil and Colourman's Journal* points out that in the many chemical laboratories of our country there are used large quantities of porcelain and glass apparatus, fully 90 per cent. of which are "made abroad." Why could not our English porcelain and glass makers compete in the production of these articles? The prices at which these are sold are such as to leave a good profit; and, further, the English maker might, even by reason of less cost of carriage and less risk of breakage over that incurred by his foreign rival, offer his goods at a lower price. If any of our manufacturers would turn their attention to this neglected field, they might secure a good business.

Swiss Trade.

Foreign Office Misc. Series, No. 542, *Nov.* 1900.

There is a way of opening up trade with Switzerland, namely, through the local business agents. An agent of Swiss nationality knows how to approach his fellow-countrymen, and if he is supplied with price lists in German or French, and in foreign currency, he will have a better chance of doing business than an English traveller who is ignorant of the language. One of the principal agents recently admitted that the Swiss representatives were glad to take up agencies of good British firms, as experience has

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shown them that the agency was not taken away from them as soon as they had worked up a good business connection, in order that it might be worked direct, and thus save expense.

Swiss Imports from Great Britain.

Bd. of Trade J., Dec. 6, 1900, 519.

Table.	Description.	Value. 1898.	Value. 1899.	Net Increase in 1899.	Net Decrease in 1899.
		£	£	£	£
1	Wool and woollen goods	297,303	345,060	47,757	..
2	Cotton and cotton goods	695,342	795,314	99,972	..
3	Silk and silk goods	27,982	34,257	6,275	..
4	Mineral produce.....	24,748	30,812	6,064	..
5	Iron, ironware, and wire goods.	348,855	433,328	84,473	..
6	Copper and brass goods.	12,329	16,888	4,559	..
7	Leather and shoe goods .	75,448	69,659	..	5,789
8	Flax, hemp, jute, ramie, &c.	97,115	79,033	..	18,082
9	Alimentary products....	38,249	49,856	11,607	..
10	Ready-made articles of clothing.	32,050	35,894	3,844	..
11	Druggists' sundries and chemicals.	55,062	54,483	..	579
12	Machinery and vehicles.	113,522	102,069	..	11,453
13	Gold, silver, plated goods, and jewellery.	21,450	6,703	..	14,747
14	Aluminium, zinc, tin, and lead goods.	18,877	26,919	8,042	..
15	Pottery and china goods.	18,059	18,123	64	..
16A	Cattle.....	32,133	44,781	12,648	..
16B	Animal products				
17	Wood, wooden goods, furniture, and brush goods.	6,315	5,709	..	606
18	Music, musical instruments, art and literature, scientific instruments, and electrical apparatus.	14,588	15,818	1,230	..
19	Paper and paper goods..	13,291	11,776	..	1,522
20	Manure, rags, and fodder	11	156	145	..
21	Colouring materials.....	12,470	17,011	4,541	..
22	India-rubber and gutta-percha goods.	29,260	28,398	..	862
23	Glassware	966	1,162	197	..
24	Agricultural products...	4,434	2,576	..	1,858
25	Oils, soaps, and fats.....	29,906	12,876	..	17,030
26	Watches and clocks, and parts of same.	2,230	2,042	..	188
27	Writing and drawing materials, toys, straw, lamps, hardware.	16,349	16,555	206	..
	Total.....	2,038,351	2,257,259	291,624	72,716
	Actual increase of British imports into Switzerland in 1899.	..	..	218,908	

II.—FUEL, Etc.

Calcium Carbide Syndicate.

Chem. and Druggist, Nov. 11 *and Dec.* 15, 1900.

The international meeting of the calcium carbide manufacturers at Berlin on Nov. 9 for the purpose of forming a syndicate proved unsuccessful, but a syndicate of German, Swiss, Austrian, Swedish, and Norwegian carbide manufacturers was formed in Frankfurt on Nov. 30, and the Deutsche Gold- und Silberscheide-Anstalt there was appointed as sale office. The chief aim of the union is to raise the sale prices and keep them steady.

Torch for Marine Use.

Pharm. J., Dec. 8, 1900, 670.

A floating torch has been invented, which consists of a brass cylinder, the bottom part of which is charged with calcium carbide, and the top fitted with a number of gas-burners, the whole being so balanced that it floats upright. Water can penetrate to the carbide through small holes bored in the side of the tube, so that acetylene gas is generated by the well-known reaction whenever the apparatus is immersed. Close to the burners is a chamber containing calcium phosphide, which gives off phosphoretted hydrogen in contact with water, and as that gas takes fire spontaneously in the air, the issuing acetylene is ignited. If the torch should be extinguished by being submerged, it is relighted by the action of the phosphoretted hydrogen on coming to the surface again.

Producer Gas for the Midlands.

Chem. Trade J., Dec. 8, 1900, 454.

In the list of Bills and Provisional Orders relating to gas, of which notice has been given for the next session of Parliament, one which will attract much attention is relative to a proposal to establish works for the manufacture and distribution of Mond producer gas in a large and thickly populated district near Birmingham. The extent of the area of supply includes such towns as Walsall, Wolverhampton, West Bromwich, and Smethwick. Power will be asked to purchase nearly 150 acres of land for manufacturing purposes, and "to manufacture, sell, and supply gas, and particularly the product known as 'Mond gas,' for motive or other power, heating, or for any other purpose to which such gas can be supplied, except illumination, and to manufacture, supply, or let on hire, machinery, and apparatus of any description for or in connection with the aforesaid objects, or any of them."

Liquid Fuel in Straits Settlements.

Bd. of Trade J., Dec. 20, 1900.

The report on the Straits Settlements for 1899, recently received at the Colonial Office, states that liquid fuel from Koetie, in Dutch Borneo, was brought in to the extent of 24,000 tons, and it is probable that trade in this fuel will show considerable expansion in the near future.

Petroleum consignments increased from all places except Sumatra, supplies from Burma being double the 1898 figures.

It is noteworthy that the importation in cases and tins of Russian oil from Batoum has been entirely superseded by consignments in bulk.

The Carbide and Acetylene Industries in Germany.

Foreign Office Misc. Series, No. 540, *Nov.* 1900.

Germany has maintained and increased her early ascendancy in the carbide and acetylene industries. There are now probably about 8,000 acetylene installations, of all capacities, in Germany (see also this Journal, 30 Nov. 1900, page 1051). Acetylene is now used in place of oil-gas for the manufacture of lampblack, of which it yields three to four times the quantity, of good quality. Acetylene is coming into use for driving gas-engines; 160 litres develop 1 horse-power, for the development of which 600 litres of coal-gas are required. The small weight of carbide needed for the production of a given illumination gives acetylene an advantage over other illuminants for colonial and military uses, where the cost of transport forms an important item. The high temperature of 2,700° of the acetylene Bunsen flame renders it valuable for soldering purposes. For miners' and other portable lamps a portable acetylene generator is now largely used. Acetylene is also adopted in factories and other places where colours have to be distinguished and compared by artificial light. Investigations on the Elbe have recently shown that acetylene is very suitable for lighthouse illumination and for signalling at sea. Carbide containing a high percentage of phosphorus is useful for destroying parasites on vines.

Between 200 and 250 firms in Germany are engaged in carbide manufacture or acetylene lighting. The three firms having the largest amounts of capital invested in the business of acetylene lighting are the Allgemeine Carbid- und Acetylen-Gesellschaft, Berlin (80,000*l.*); Hera-Prometheus, Berlin (60,000*l.*); and Falbe and Co. (50,000*l.*).

The carbide works established or in course of erection in Germany should theoretically yield about 9,000 tons of carbide per annum, while the German railways alone will this year consume about 8,000 tons. There is a large

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importation of carbide from other European countries; the value thereof last year was 110,000*l*. Water power which can be profitably utilised is now nearly all taken up in Germany, and new carbide works there will have to use either steam power or the waste gases from blast furnaces. This last source of power is being rapidly utilised for the manufacture of carbide and other products, as is shown by the fact that the Dentz Engineering Works have delivered or are constructing 30 gas engines for waste gases with a total of 13,100 horse-power.

The price of carbide has fallen during the past year to such an extent that many works have been forced to cease producing it until the price improves. The depression is probably only of a temporary character. In the winter of 1898–99, the price of carbide in loads of about 10 tons at Hamburg was from 400 to 600 marks per metric ton; in October 1899 it was 345 marks; in February 1900, 310 marks; and in June 1900, 265 marks. The reduction in the price of carbide seems to indicate that acetylene may become available for lighting larger towns than hitherto; *i.e.*, towns of 8,000 inhabitants and upwards. Even some of the small towns which now have acetylene installations supply the gas at a very low price for driving gas engines; *e.g.*, at Ellerbeck the charge is 1*s.* 2½*d.* per cubic metre. The following summary of results, obtained by Bork in 1898, in the lighting of railway carriages shows the superiority of a mixture of 3 vols. of oil-gas with 1 vol. of acetylene to the oil-gas hitherto used in Germany:—

—	Cost per C. M.	Hourly Consumption per Burner.	Power Candle obtained.	Cost, including Maintenance and Capital Charges.	
				Per Burner.	Per Candle Power.
	Pf.	Litres.		Pf.	Pf.
Oil gas	30	27·5	5	1·625	0·325
Acetylene, 1 vol.; oil gas, 3 vols.	54	27·5	15	2·285	0·152
Acetylene	130	12·0	15	2·360	0·158

The reduction in price of carbide since 1898 has made the present cost of lighting by the mixed gas or by acetylene considerably lower than these figures indicate.

—J. A. B.

III.—TAR PRODUCTS, PETROLEUM, Etc.

Petroleum in India.

Comm. Intelligence, Dec. 8, 1900, 10.

The total production of petroleum in 1899 was 33,000,000 galls., no less than 32,300,000 galls. coming from Burmah. The output in Burmah rose steadily from 3,800,000 galls. in 1890 to 18,420,000 in 1898; but in 1899 there was a sudden expansion to the extent of 75 per cent. beyond the yield of 1898. The exportation of Indian mineral oil is increasing, 1,272,000 galls. being shipped to the Straits Settlements in 1899—1900. Demands for exportation, as well as for fuel for the furnaces of steamers in the Indian Ocean, may be expected to develop. India, however, requires far more oil than she can produce, and in 1899—1900 she imported nearly 75,000,000 galls.; in spite of the duty of 1*d.* per gall.

Petroleum Land in the Island of Saghalin.

Petroleum Rev. 1900, **3**, [91], 494.

The Russian *Eastern Messenger* reports that a German mining engineer, Herr F. F. Kleie, has received permission to exploit petroleum lands on the island of Saghalin. On the eastern coast of the island there are rich natural outcrops of oils, which prove the existence of a great pressure of gases which forces the oil to the surface. A very large quantity of oil has been thus forced up to the surface, and then dried up in the form of grease, but in some places it can still be found in a liquid state. Mr. Kleie is now trying to form a company to work these oil fields.

IV.—COLOURING MATTERS, Etc.

Indigo in Germany.

Comm. Intelligence, Dec. 8, 1900, 14.

During the first half of this year Germany imported but 437 metric tons (of 2,204·6 lb.), against 805 tons of natural indigo imported during the same period of 1899, equivalent to a decrease of 45 per cent. Sixty-eight per cent. of this imported indigo came from the East Indies.

Germany's exports of indigo (almost entirely composed of the artificial article) during the first six months of 1900 reached 947½ metric tons—74½ per cent. in excess of those of the same period in the preceding year. Of this artificial indigo, the United States took 29·9 per cent.; Austria-Hungary, 14·7 per cent.; England, 10·4 per cent.; &c.

VII.—ACIDS, ALKALIS, AND SALTS.

The Chlorate of Potash Explosion at St. Helens.

Chem. Trade J., Dec. 15, 1900.

At the Liverpool Assizes on Friday, the 7th inst., before Mr. Justice Bucknill and a special jury, the trial of the action of The St. Helens Corporation *v.* The United Alkali Company, Limited, was commenced. The plaintiffs are owners of the gasworks in the borough of St. Helens, and the defendants are the owners of certain works within the borough wherein they carry on the business of chemical manufacturers. These works are close to the gasworks. The plaintiffs alleged that in the course of the defendants' business they manufactured, collected, and stored in large quantities a highly dangerous, inflammable, and explosive substance known as chlorate of potassium, which, either alone or in combination, or in proximity with other chemicals or substances, was a source of danger to the gasworks and premises of the plaintiffs. On the 12th May 1899 an explosion occurred upon the defendants' premises, in consequence of which the premises and plant of the gasworks were damaged and in part destroyed. The plaintiffs further said that the defendants were negligent in the conduct of their business, and that the explosion was the result of such negligence. They claimed 5,000*l.* damages. The defendants denied that they manufactured and stored chlorate of potash, and, in the alternative, they said that chlorate of potash was not dangerous, and that they were not guilty of negligence in their business of manufacture and storage.

The judge, in submitting questions to the jury, analysed the evidence at considerable length, and drew attention to the diversity of view held by the various experts who had been called or quoted. He pointed out that Mr. Brock, the manager of the defendants' works, had not made experiments to ascertain the properties of chlorate of potash. It might be thought, he said, that persons who turned out such an enormous amount of this material every week ought to have had the evidence of some scientific man, to, at some time or other, advise them upon that most difficult subject, so as to satisfy them that under no circumstances could it be said that they were wrong in manufacturing, grinding, and storing it as they did.

The jury found that potassium chlorate by itself was not a dangerous substance; that it was not known to the defendants before the date of the explosion that it was an explosive when unmixed with other substances; that they ought to have known it was explosive when unmixed with other substances; that in the manufacture and storage of the material they did not take all reasonable care and precaution to prevent accident by fire or explosion; that such want of reasonable care and precaution in the manufacture or storage contributed to the explosion, and that the fire was not one which happened by mere chance and without negligence.

Plaintiffs' counsel said this amounted to a verdict for the plaintiffs, and asked for judgment.

The application was deferred for consideration in London on Wednesday, Dec. 19.

On Dec. 19, after considerable argument, Mr. Justice Bucknill gave judgment. He thought the Plaintiffs were

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entitled to succeed. At the trial the jury found that the Defendants did not know that chlorate of potash in its pure condition was a dangerous substance, and he entirely agreed with that view. Here was a building used for the manufacture of chlorate of potash under one roof, except one part, which was open to the sky. Under this one roof were two crystallising tank rooms, one in which the tanks were of iron, in which the fire did not take place, and another, where the fire did take place, in which the tanks were of wood lined with lead. The next room was where the milling took place, and where there was an engine. That was a fireproof room. There was also a storing-room in which from 100 to 160 large casks of chlorate of potash were stored. Some casks had been rolled into the crystallising room and placed one against another, so that when a spark struck the wooden casing of the crystallising tanks, which, being saturated with chlorate of potash was in a highly inflammable condition, at once a fire was started, which spread with marvellous rapidity to the roof of the room. There was nothing at all to prevent the fire spreading to the roof of the other store-rooms. It burnt downwards, setting fire to the topmost tier of 13 tiers of casks, burning down 11 tiers. In consequence of the great heat, there was an explosion so great that it rent the top of the gasholder, which was not far away, and the gas escaping into the air became ignited. Then was seen a column of flame 500 or 600 ft. high, and an enormous amount of damage was done; houses were destroyed, five persons killed, and others injured. The jury having, he thought properly, found on the evidence that the Defendants were not aware that chlorate of potash in a pure state was an explosive substance, found nevertheless that in the manufacture and storage of the stuff the Defendants did not take all reasonable care and precautions to prevent accidents by fire and explosion, and that such want of reasonable care and precautions contributed to the explosion. It was contended that judgment could not be entered for the Plaintiffs unless it were found that Defendants knew the substance was dangerous, but he thought there was a fallacy in that argument. There was sufficient evidence to justify the jury in finding that chlorate of potash, when mixed with other things, was probably dangerous. What was the duty of a manufacturer having that knowledge? Was it not to take the greatest possible care that such a mixture should not be brought about? He considered the verdict of the jury was quite proper on the evidence, and that the finding that there was negligence and an absence of reasonable care and caution in the manufacture and storage of the substance was justified. In regard to the reference that had been made as to the Government having not yet made any rules or regulations on the subject, though they had this terrible explosion before them, he was astonished. It might be that that the Government were waiting for the decision of the highest tribunal in the land on the question; but, at any rate, he was astounded that no rules had been made as to the storage of this material, which had now been found to be highly explosive. Plaintiffs were entitled to judgment with costs, the damages to be assessed or agreed between the parties.

A stay of execution was granted in view of an appeal.

Sulphate of Copper for Use in Vineyards in Greece.

Bd. of Trade J., Nov. 22, 1900, 398.

H.M. Consul at Patras states that, owing to the destruction caused by "peronosporous" to the currant and grape vineyards in Greece, there will be a very large demand for sulphate of copper.

It is roughly estimated that 4,000 to 5,000 tons of sulphate of copper will be imported by that country during the coming six months, as the output of the local chemical works is comparatively small.

It is absolutely imperative that the article supplied for the spraying of vines should contain not less than 95 per cent. of crystallised sulphate of copper; any smaller percentage renders it ineffective, and, as many doubts were expressed of the quality of much of the sulphate of copper imported from abroad last year, it would be well if British manufacturers were to supply their correspondents or agents in Greece with some test by which it could be readily and easily demonstrated to buyers by analysis that the article offered to them really contained the required percentage.

Dealers and growers in the consular district, where British trade, honesty, and straightforwardness are justly held in high repute, will certainly give preference to the British article, and the British Consulate at Patras will gladly supply British manufacturers of sulphate of copper with all information they may require in order to push their interests in Greece.

Sulphur Trade of Sicily in Italy.

Bd. of Trade J., Nov. 22, 1900, 422.

With reference to the notice on p. 603 of the *Board of Trade Journal* for November 1899, and to subsequent notices on p. 339 of the issue for 8th February last, p. 411 of the issue for 24th May last, and p. 587 of the issue for 6th September last, the following are particulars relating to the production and exports of sulphur from Sicily in the past two years, which have been received at the Board of Trade through the Foreign Office:—

——	1898—1899.	1899—1900.
	Tons.	Tons.
Production of sulphur.....	503,187	509,721
Exports of sulphur.....	450,072	520,683
Stock in hand on 31st July	188,621	227,449

Salt and Saltpetre in India.

Comm. Intelligence, Dec. 8, 10.

A million tons of salt is annually produced, but internal transport is so costly that 400,000 tons a year from Liverpool and Hamburg are required. Saltpetre is less in demand than formerly, and in 1899 the production was but 11,250 tons. Other minerals are of comparative unimportance.

Chemical Imports of Nagasaki in 1899.

Foreign Office Annual Series, No. 2541, *Dec.* 1900.

There was a large decrease in the import of chemicals. The principal item was caustic soda, to a value of 2,235*l.*, from England, but bicarbonate of soda and alum were also imported. Alcohol is included under this heading. The value of its whole import into Japan in 1899 was about 210,000*l.*, as compared with 275,000*l.* in 1898, and a striking illustration of the effect of the new Customs tariff, which, since August 1st last, specifies a duty of 250 per cent. on this item, is afforded by the fact that while the duties collected on it in 1898 were only 13,782*l.*, in 1899 they amounted, on less than two-thirds of the same quantity, to 65,671*l.*

Chemical Imports of Ghent in 1899.

Foreign Office Annual Series, No. 2540, *Dec.* 1900.

Chemicals for 1899 show an increase of 10,791 tons. In the total are included 18,383 tons of nitrate from Chile, and 18,095 tons of ground phosphate rock from Florida. Trade in these fertilisers has been brisk, and there is every indication of this activity being maintained, which is very desirable in the interests of British shipping. Nitrate has furnished cargoes for Ghent for many years, but direct imports of phosphate rock date only from 1896. The warehouses along the water-side, in connection with the rail and canal services to the interior, have encouraged the making of depôts here for these articles.

VIII.—GLASS, POTTERY, AND ENAMELS.

Glass Imports of Nagasaki in 1899.

Foreign Office Annual Series, No. 2541, *Dec.* 1900.

There was an increase of 2,156*l.* in the value of the import of glass manufactures. Of the whole import, the

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value of window glass amounted to 4,567*l.*, nine-tenths of which came from Belgium and the balance from England, and that of glassware, principally from England, to 841*l.*

IX.—CEMENTS, Etc.

Cement Exports of Ghent.

Foreign Office Annual Series, No. 2540, *Dec.* 1900.

One of the most prosperous of Ghent industries is the manufacture of cement, cement stones, and similar objects, and the export trade to the British Isles has of late years taken considerable extension. Total exports, which for 1897 were registered at 14,040 tons, increased in 1898 to 21,076 tons, and in 1899 to 26,067 tons. Although in these totals are included the consignments from the interior of the country, notably from Tournai, the bulk is made up of shipments from Ghent works. Great effort is made to maintain the reputation of the article for quality; and the price at which it can be offered by reason of cheap labour secures a ready market in the British Isles and in the colonies.

Asphalt in Argentina.

Bd. of Trade J., Dec. 20, 1900.

The *Southern Cross* (Buenos Aires) states that the existence of a lake of natural asphalt in the province of Jujuy determined the Argentine Minister of Agriculture to have an analysis made of the material, which has turned out to be of excellent quality. The Jujuy asphalt in its natural state is said to be just as good as that used in the paving of Argentina streets. Samples have been sent by the discoverers to the United States to be refined and prepared by the same methods as those used in the case of the Trinidad product.

X.—METALLURGY.

Plumbago Mining in Ceylon.

Bd. of Trade J., Dec. 20, 1900.

The report on Ceylon for 1899, recently received at the Colonial Office, states that plumbago is attracting capital within and without the island, and with the settlement of the question as to the terms on which the industry can be exploited, more capital will, no doubt, be attracted.

In the year 1899 prices ruled as high as Rs. 1,000 a ton for large lumps, and although the price fell to Rs. 700 towards the close of the year, the handsome profits to be earned caused exceptional activity in this form of mining, which was stimulated further by the grant of licenses to prospect on Crown lands.

Kurunegala has 154 plumbago mines. In the Southern Province 117 acres of land supposed to contain plumbago were leased for 10 years for Rs. 333,450, and in the Central Province 126 declarations of intention to open mines were recorded.

The method of working plumbago pits is in some instances unscientific and rudimentary, but European firms are now in the field, and it is to be hoped will prove as keenly interested in introducing improved methods of working as they are strenuous in their endeavours to secure more favourable terms for working their holdings.

Manganese Mining in United States.

Bd. of Trade J., Dec. 6, 1900, 537.

According to the *Railway Age* (Chicago) of 9th ult., the mining of manganese has been commenced on the south shore of Lake Superior. Several attempts have been made to mine the manganese in this region, but it is associated with a small percentage of copper.

Now, however, it is understood that there is a new metallurgical process for the elimination of this copper making the manganese valuable.

Copper Ore in Sikkim.

Bd. of Trade J., Dec. 6, 1900, 535.

A report has been received at the Board of Trade on the administration of Sikkim in the year 1899–1900. The Political Officer in this report refers as follows to some new finds of copper ore discovered during the year:—

"This year several new finds of copper ore have been discovered, *viz.*, at Rhenok, up the Rishi river, below Rinchenpong, and at Bodang Khani.

"A sample of ore from the latter place gives the following analysis:—

Composition:

Iron	27·00
Copper	3·55
Tin	0·35
Lead	1·53
Arsenic	0·24
Zinc	2·40
Nickel	0·70
Alumina	6·78
Sulphur	18·72
Silicious matter	38·02
Water	9·25

"This ore, on being assayed, was found to contain—

	Oz.	dwts.	grs.	
Silver	1	19	20	per ton.
Gold	Heavy trace.			

"The Political Officer has been over the locality and finds that the ore is distributed all over a hill extending to over a quarter of a mile square, and there appears to be a great quantity of ore. He thinks that this ore might be worked with advantage. Water-power, with a little expenditure, is available.

"A large deposit of lime has also been found in the Rishi valley. Coal was also found up the Rungeet valley, but its quality is very bad. One or two pieces were good, and, if worked to a lower level, might turn out well. Natives are not able to work the ores profitably.

Tin Production of Billiton.

Eng. and Mining J., Oct. 10, 1900.

The production of tin in the Billiton district in Java, for the year ending 30th June 1900, was 10,767,261 lb., against 12,524,216 lb. in 1899, and 11,680,592 lb. in 1898. The largest output ever reported from the district was 14,130,585 lb. in 1891–92; since that time the production has been gradually decreasing.

Monazite Deposits in Brazil.

Chem. and Druggist, Nov. 24, 1900, 837.

The Brazilian Government has refused to confirm the renewal of the concessions to Mr. John Gordon, an American, to remove monazite sands from the sea-beaches in Bahia, and also the transfer to him of the concessions granted to Mr. S. S. Schindler, Srs. A. Ribeiro & Co., and Mr. S. Manoel Goncalves Duart. This, it is expected, will defeat the organisation of a monopoly for working these valuable sands. The Minister decides that each grantee should have his concession surveyed, and should confine his operations within its limits, which is proper and right.

The United States Tin-Plate Industry.

Bd. of Trade J., Dec. 13, 1900, 576.

A report has been received by the Board of Trade, through the Foreign Office, from H.M. Consul at Chicago, on the tin-plate industry of the United States.

This industry has been built up entirely within the last eight years, as previous to the passing of the McKinley Tariff Bill, which went into effect on 1st July 1891, the manufacture of tin-plate in a commercial way was practically unknown in the United States.

The following is a statement showing the imports of tin-plate into the United States, and its production in that country, for the years named, ending 30th June:—

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Year ended 30th June.	Imports.	Production.
	Lb.	Lb.
1891-2	422,176,202	13,646,719
1892-3	628,425,902	99,819,202
1893-4	454,160,826	139,223.467
1894-5	508,038,938	193 801,073
1895-6	385,138,983	307,228,621
1896-7	230,073,683	446,982,063
1897-8	171,662,345	681,674,028
1898 9	108,484,826	791,371,488

The imports, with the exception of a very small quantity from Canada, are practically all from the United Kingdom. A rebate of 99 per cent. of the duty, or say $\frac{3}{4}d.$ per lb., is allowed on the re-export of these plates in the form of cans or tins containing provisions, petroleum, &c.

There are at the present time 44 tin-plate plants and over 300 mills in the United States, which are controlled by five different corporations, and distributed throughout the country as follows:—Maryland, 4; Pennsylvania, 16 (approximately); Virginia, 3; Ohio, 9; Indiana, 7; Kentucky, 1; Michigan, 1; Illinois, 1; Missouri, 1; New York, 1.

American plates are said to be superior to the Welsh, owing to the steel being of better quality, and the plates being more uniformly coated.

The principal labour-saving devices supplied to the plants in the United States factories are electric travelling cranes, cold-rolled transfer mechanism, and annealing furnace chargers.

Metals in Switzerland: Comparison between other Imports and the Imports from Great Britain into Switzerland in 1899, with Duties.

Foreign Office Misc. Series, No. 542, *Nov.* 1900.

Description.	Total Imports from all Countries.		Imports from Great Britain exclusively.		Duty per 100 Kilos.
	Weight.	Value.	Weight.	Value.	
	Kilos.	£	Kilos.	£	£ s. d
Pure aluminium	5,100	528	..	..	0 4 0
Aluminium alloy.....	7,800	827	..	..	0 1 3
„ alloy,rolled	7,500	1,587	..	..	0 2 6
„ goods	3,300	990	..	..	1 12 0
Galena and plumbing lead.	52,600	736	..	..	Free.
Soft lead, in barrels..	2,804,900	44,878	..	..	0 0 3
Rolled lead, hard lead	1,353,000	24,354	7,700	311	0 1 3
Unfinished lead goods	32,100	1,734	..	..	0 6 6
Finished lead goods..	3,800	426	..	..	0 14 5
Printing type	131,400	19,447	..	..	0 6 6
Nickel	3,000	660	..	..	0 2 6
„ German silver, &c., rolled.	130,700	30,140	..	..	0 5 9
„ and German silver goods.	26,100	8,352	400	128	1 16 0
*Zinc, in bars	454,000	12,531	..	..	0 0 3
* „ rolled.....	1,834,200	53,559	..	..	0 0 10
„ goods, unfinished.	44,900	3,592	..	..	0 12 3
* „ goods, finished	58,600	6,094	..	..	1 4 0
Tin in bars	1,023,900	126,964	203,400	25,222	0 0 10
Rolled tin and Britannia metal.	34,100	5,202	1,200	189	0 4 0
Unfinished tin and Britannia metal goods.	8,700	1,740			0 8 0
Finished tin and Britannia metal goods.	60,500	14,520	1,800	432	1 12 0
Other metals (not described).	163,600	1,145	300	2	Free.
Antimony	37,300	1,626	9,800	428	0 0 10
Quicksilver	4,000	880	..	..	0 2 6
Cadmium and bismuth.	1,800	432	..	..	9 4 0
Goods marked with asterisk.	..	..	..	207	..
Total	..	362,944	..	26,919	..

XII.—OILS, Etc.

Oils in Egypt.

Comm. Intelligence, Dec. 15, 1900.

There is a very considerable importation of boiled linseed oil, and a favourite brand in the country is that known as "Imperial." The Arab buyers like a pale boiled oil, and dark varieties, although, perhaps, of better quality, do not sell so well. At a time like the present, when prices for linseed oil for spot delivery are so high, it is often possible to do a very good business in Egypt by offering forward delivery at a concession something less than the difference between spot and forward in the home markets. The merchants of the country do not know of the extraordinary divergence in price between immediate and delayed delivery here, and the writer has sometimes done a very large trade in consequence, when otherwise it would have been impossible to sell a single ton. The same applies to cotton oil, of which a considerable quantity is imported, in spite of the fact that it is made in the country. It must be remembered, however, that oil refined by the atmospheric process must never be sent to that country, as when warm it gives off an unpleasant smell. The cotton oil—and a great portion of the raw linseed oil—imported by Egypt is for edible purposes, and this fact must be borne in mind by those who mean to compete for the trade. The sweeter and the less aromatic the oil, the better it will be liked by Arab dealers. White hard tallow, if sweet, can also be sent to the Soudan, where it is used as an unguent by the natives. Exporters of tallow should not forget, however, that what may be hard here, even in the summer-time, may not necessarily retain its solidity under a tropical sun. It is well also to pack in barrels of such a kind as to be oil-proof. There is also a demand for lubricating tallow in Egypt, chiefly confined to Alexandria and the cotton-ginning district round Tantah; but even this should be capable of remaining solid at high temperatures. The thermometer stands at nearly 125° F. in the shade at Cairo at times. There is a considerable demand for lubricating oils in the Tantah district, but our makers should make themselves more perfectly acquainted with the kind of lubricant required. It is useless to send oils which work satisfactorily in our own manufacturing districts, where temperature rarely rises above 70°. A visit to the cotton-ginning works, and a conversation with the various managers, would be worth the while of any lubricating-oil firm.

Oil Industries of Sylhet.

Bd. of Trade J., Dec. 13, 1900, 595.

The *Indian Import and Export Trades Journal* for October last publishes some particulars of the manufactures, trade and industry of Sylhet (an important district in Assam, with a population of over 2,000,000), taken from the report of the Deputy-Commissioner. A noteworthy industry of the place, although on a small scale, is the manufacture of attar, from a resinous substance known as agar found in the wood of a forest tree. The attar sells at a high figure, and is exported to Calcutta, and even, it is said, to Arabia, the perfume being highly valued. A less attractive manufacture, but one of higher commercial value, is the growing fish-oil industry in the Sunamganj and Habiganj subdivisions. This oil is obtained from the fish caught in the dry season in such enormous quantities in that low-lying country. It is exported to Calcutta.

Oil and Soap Imports of Switzerland.

Foreign Office Misc. Series, No. 542, *Nov.* 1900.

The total imports of oils, soaps, and fats amounted in 1899 to 437,600*l.*, of which Great Britain supplied 12,876*l.* (only 3 per cent. of the total), this being a material *decrease* on British imports of 1898, which amounted to 29,906*l.* Of this decrease, 15,000*l.* was in soaps. The main cause of the reduced imports arises from the fact that one of the largest English soap firms established a factory in Switzerland in the autumn of 1898. Olive soaps for industrial purposes, which were formerly largely imported, are

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now made in Switzerland, and Swiss consumers are beginning to recognise that their home producers can fully meet the demand.

The following goods showed a decrease in 1899: ordinary soap (9,681*l.*), perfumed soap (809*l.*), oils for trade purposes (5,352*l.*), linseed oil in barrel (714*l.*), tallow (530*l.*), various (338*l.*).

Cod-liver oil was imported from Great Britain to the value of 394*l.*

Cotton-seed Industry of the United States.

Galveston News, Nov. 18; *through Bd. of Trade J., Dec.* 20, 1900.

There is probably no great industry in America about which so little is known as that of cotton-seed. Twenty years ago cotton-seed was thrown away. To-day, although the business is but in its infancy, there are more than 500 mills in the south that represent an investment of probably 5,000,000*l.*, while the value of the products of these mills is in excess of 10,000,000*l.* per year.

The French industry in the making of oils from ground nut has seriously fallen off, cotton-seed oil having supplanted it, and shiploads of partially refined oils go each season from Galveston and New Orleans to Marseilles to be refined by French manufacturers. To Genoa a considerable quantity of cotton-seed oil goes each year, which comes back, it is alleged, as pure olive oil.

Statistics in regard to the export of cotton-seed products are not complete. Through the port of Galveston in the season of 1897—1898 (the commercial year for cotton is from 1st September to 31st August) there were exported 212,596 tons of cotton-seed oil-cake and meal. In the season of 1898—1899 these exports reached 248,702 tons. In the season of 1899—1900 the total was 187,326 tons.

The cotton crop of 1899—1900 was very short. That is the explanation of the falling off in shipments. In the shipments of cotton-seed oil the season of 1899—1900 was the largest on record, despite the short crop. One firm of shipbrokers dealt with more than 30,000 barrels, mostly consigned to Rotterdam.

The oil is the most valuable product of the crushed seed. The average of the Texas mills is 35 to 40 gallons (7½ lb. to the gallon) per ton of seed crushed. But if the oil is valuable, so is every particle of the residue, the pulp making the meal and cake, useful for cattle food and fertiliser, the hulls good either for fuel or for coarse fodder, the ashes of hulls making a very rich phosphoric acid and potash fertiliser, and the refined oil being excellent for soaps.

XIII. A.—PIGMENTS, PAINTS, Etc.

Paints in Nagasaki in 1899.

Foreign Office Annual Series, No. 2541, *Dec.* 1900.

There was a decrease in the imports of paints of 3,714*l.* The principal items in the import were paints in oil, value 2,138*l.*, and paint for ships' bottoms, value 1,783*l.*, both from England, but lead, varnish, and oxide of cobalt were also imported.

Paints and Varnishes in Egypt.

Comm. Intelligence, Dec. 15, 1900.

The varnishes suitable for Egypt must be able to stand a sun of tremendous power, and should be specially prepared with this end in view; many varnishes sent out are of no use in such a climate, and are apt to ruin the reputation of the makers. A fair amount of trade can be done in the country with enamels and mixed paint in tins; but the quality must be good. It is of no use to send out the rubbish with which home markets have been flooded of late years.

Turpentine Production.

Comm. Intelligence, Dec. 15, 1900.

There seems a probability that the production of turpentine will before long become an important industry in India. The Punjab Government have recently sanctioned the establishment of a factory for the distillation of the crude resin, the experiments in the Dehra-Doon Laboratory and in Kranga having convinced the Forest Department that production on a very considerable scale is possible. In the Kranga Valley forests alone, last season, some 1,200 maunds of resin were collected.

Paints and Colours in Switzerland: Comparison between other Imports and the Imports from Great Britain into Switzerland in 1899, with Duties.

Foreign Office Misc. Series, No. 542, *Nov.* 1900.

Description.	Total Imports from all Countries.		Imports from Great Britain exclusively.		Duty per 100 Kilos.
	Weight.	Value.	Weight.	Value.	
	Kilos.	£	Kilos,	£	*s. d.*
Colouring earth, raw.	1,236,300	1,646	..	..	0 2
„ ground	2,724,600	13,793	14,600	146	0 6
Colouring berries	1,375,700	26,527	..	..	0 2
„ ground	603,300	7,251	..	..	0 6
Colouring woods in blocks.	870,800	7,736	..	..	0 2
Indigo.....	52,000	15,639	..	..	3 4
Orlean, orseille, cochineal.	6,200	276	..	..	3 4
Alizarine, artificial...	273,100	18,571	..	..	2 6
Other extracts for dyeing.	233,200	9,202	18,100	724	2 6
Lamp-black and red lead.	223,200	4,874	2,100	48	0 10
White lead, &c.	641,600	15,398	900	22	2 6
Varnishes	446,900	35,300	85,000	11,900	14 5
Oil varnishes	42,600	1,704	1,900	76	8 0
Aniline colours	312,900	62,580	8,300	1,660	6 6
Chrome yellow, mineral blue.	409,100	27,817	7,100	483	5 10
Colours and cakes in bottles.	33,400	2,116	13,000	1,040	16 0
Colours in boxes	37,400	5,984	2,400	384	16 0
Colouring materials (various)	1,425,000	36,993	19,400	504	2 6 to 4 0
Other bright colours.	178,200	14,256	300	24	16 0
Total.....	..	307,663	..	17,011	..

XIII. C.—INDIA-RUBBER, Etc.

India-Rubber Imports of Switzerland.

Foreign Office Misc. Series, No. 542, *Nov.* 1900.

The total imports of india-rubber and gutta-percha amounted, in 1899, to 118,933*l.* (of which Great Britain supplied 28,400*l.*), the principal items being for tubes and piping (30,000*l.*), of which Great Britain only supplied 1,000*l.*; india-rubber threads (24,000*l.*), Great Britain supplying 15,000*l.*

XIV.—TANNING, LEATHER, GLUE, SIZE, Etc.

Quebracho Exports of Argentina.

Bd. of Trade J., Dec. 6, 1900, 547.

According to the Buenos Aires *Handels Zeitung*, the export of quebracho wood from Argentina continues to increase in a satisfactory manner. Extract of quebracho always finds a ready market, and the wood itself is used for railway sleepers. Germany is the largest importer of quebracho wood for making sleepers.

The following table shows the quantities exported from Argentina in the last three years:—

Years.	Extract.	Quebracho Wood.	Sleepers.
	Tons.	Tons.	No.
1897	1,305	135,675	62,312
1898	1,192	188,260	10,000
1899	3,172	159,376	9,962

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The value of the export during the last three years was as follows: in 1897, 1,571,581 gold dollars; in 1898, 2,016,851 gold dollars; and in 1899, 1,925,860 gold dollars.

The following table shows the principal importing countries in 1898:—

Countries.	Extract.	Quebracho Wood.	Sleepers.
	Tons.	Tons.	No.
Germany	855	15,509	..
Austria-Hungary	..	1,400	..
Brazil	15	..	9,000
Belgium	..	6,662	..
United States	280	1,648	..
France	..	3,059	..
Italy	1	9,864	..
Netherlands	..	761	..
United Kingdom	..	3,627	..
Uruguay	11	137	1,000
Other countries	30	145,593	..
Total	1,192	188,260	10,000

Spanish Sheep Skins and Goat Skins.

Bd. of Trade J., Dec. 13, 1900, 577.

Sheep Skins.—The United States Consul-General at Barcelona, in a report dated 26th October last, states that several kinds of sheep are bred in Spain, but the most valuable, on account of the excellent quality of the skins, are those found in the provinces of Murcia and Catalonia, and in the district known as La Mancha, in New Castille; also those in the province of Estremadura, which, however, are esteemed more for their fine wool than for the pelt. It is a notable fact that the finer the wool the poorer is the skin for tanning purposes. The skin of the Estremadura sheep is unsuitable for gloves, and can only be used for inferior articles.

In Millau and St. Julien, in France, and also in several parts of Germany, there are large tanneries devoted to the preparation of the skins exported from Murcia, Catalonia, and La Mancha. These tanneries, either directly or through commission firms, send a large proportion of their output to the United States, which is an important market for glove skins.

Sheep skins are prepared in two ways: when tanned with sumac they are used for pocket-books and light articles; but for things which must be subjected to wear and tear, the skins are oak-tanned. The former are extensively exported to Germany, and the latter to Cuba and Porto Rico.

Goat Skins.—Nearly the whole supply of Spanish kid and goat skins is exported in the raw state to the United States for tanning into fine shoe leather. This trade appears to be in the hands of French commission merchants.

In order to preserve the skins from damage by moths, the dealer sprinkles them over with naphthalene while they are being stacked.

The Leather Industries.

Standard, Dec. 20, 1900.

Mr. W. L. Jackson, M.P., the Master of the Leather Sellers' Company, the Master of the Cordwainers' Company, and about 150 gentlemen actively engaged in the leather industries of the country, responded to the invitation of the Mayor of Leicester (Mr. Alderman Lennard) to take part in a gathering at Leicester on Dec. 19, to promote technical education, and to stimulate the use of English tanned leathers. English tanning, it seems, has fallen behind the times in the production of the highest classes of leathers which are essential to the great advance which has been made in the style, design, and quality, especially of boots and shoes; and the result has been that consumers have been compelled to depend upon American tanners for glacé, box calf, glove, and satin hides, and other leathers, of which producers in the United States have established almost a monopoly. To meet the enormous consumption of American leathers, not to speak of the importations from Australia, Canada, France, and Germany, the Mayor of Leicester considered that some practical service could be rendered by bringing together those who were most intimately associated with the various industries concerned, to ascertain the actual conditions which prevail, and to confer informally as to the best means of bringing those engaged in technical instruction, and producers and consumers, into closer contact and association. The leading boot and shoe factories and warehouses at Leicester were visited, and at night the Mayor of Leicester entertained the visitors at dinner at the Museum Buildings. Among those who took part in the proceedings were Sir Thomas Wright (Leicester), Sir John Turney (Nottingham), Sir James Woodhouse, M.P. (Leeds), Mr. Alderman Royce (President of the National Federation of Boot and Shoe Manufacturers), Dr. Gordon Parker (Herold's Institute, Bermondsey), Professor Procter (Yorkshire College Leeds), Mr. Alderman Wood, and others.

XVI.—SUGAR.

Sugar in 1900.

Comm. Intelligence, Dec. 15, 1900.

Beet sugar is now grown in most of the countries of Europe, and the following figures, which are published by the International Union for Statistics on Sugar, show the number of acres that have been planted with beet-sugar seed:—

Beet-Sugar Planting.

Country.	1899.	1900.	Increase.
	Acres.	Acres.	Per Cent.
Germany	1,057,939	1,090,521	3·1
Austria-Hungary	804,063	839,151	4·4
France	626,480	685,391	9·4
Russia	1,261,614	1,356,075	7·5
Belgium	158,235	170,028	15·0
Holland	109,703	112,878	2·9
Sweden	65,238	71,271	9·2
Denmark	34,594	34,594	..

The beet-sugar production of Europe this year is over 5,500,000 tons, while the production in the United States amounts to 73,000 tons. The beet sugar shows an increase over 1899 of 500,000 tons, while cane sugar shows a decrease of 250,000 tons. The Louisiana crop, according to the New York *Journal of Commerce*, is put in at but little more than half of what it was last year, the Porto Rico crop is charged with a like ratio of decline, and the Cuban crop is set down for 45,000 tons less than last year, and at much less than one-third of what it was in each of the two years next preceding the revolution. In Queensland and New South Wales the crop is estimated at very much below last year's figures, the decrease in the former colony being 40,000 tons, or nearly one-quarter, and in the latter 12,500 tons, or not much less than one-half.

To cope with the unremunerative nature of the cane industry, Barbados is endeavouring to obtain the capital to erect central factories, which would enable the colonists to extract more juice out of the canes, and also to produce a better quality of sugar, which would be more suitable to the Canadian and British markets. At present nearly all their sugar finds its way into the United States.

Progress of the European Industry.

To show the progress of the European beet-sugar industry, it may be stated that there are 213 factories in Austria-Hungary alone, the total output of raw sugar from this country in 1899 being computed at 1,083,000 tons. The Government sets aside a sum of 750,000*l.* for the payment of export bounties. The decision of the Legislative Council in Calcutta—following the example of the United States—to introduce a countervailing duty on bounty-fed sugar imported into India has made no change worthy of special notice in the trade between Austria and India. The chief burden of the countervailing duty, which is equal in amount to the export premium accorded to sugar in its country of origin, is thrown upon the Indian consumer, who has not only to pay more for the bounty-fed

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sugar, but also for the colonial sugar, which sympathetically rose in price.

Russia is now the largest producer of beet sugar in Europe, there being altogether 23 beet-cultivating provinces in this country. The industry in Germany is able to keep going 400 raw-sugar works and 150 refineries.

There are about 230 sugar factories now at work in Cuba, which is only about 60 per cent. of what there were before the war. Owing to the present competition of beet sugar, it is unlikely that the mills which have been destroyed will be replaced. During 1899 about 324,000 tons were exported.

There has been an improvement in the sugar industry in Jamaica, after a persistent decline for many years; 360,748 tons were exported last year. In British Guiana many of the sugar plantations can hardly pay their way, and future prospects are not encouraging. About 100,000 tons were exported from Georgetown, Demerara, in 1899. The whole of the sugar production of the Hawaiian Islands, amounting to 282,807 tons in 1899, went to the United States.

Sugar in Queensland.

Bd. of Trade J., Dec. 6, 1900, 513.

In the following table figures are given relating to the sugar industry of the colony of Queensland in the last three years, showing the area of cane crushed and the amount of sugar and molasses produced. With regard to the quantity of molasses shown in the table, this is far short of the quantity produced, but may be taken as the quantity conserved and utilised. Many mills allow this product to run to waste.

		1897.	1898.	1899.
Area of cane crushed..	Acres	65,000	82,000	79,000
Sugar produced.....	Tons	98,000	164,000	123,000
Molasses produced....	Galls.	2,364,000	3,998,000	3,093,000

XVII.—BREWING, WINES, SPIRITS.

The Industrial Use of Alcohol in France.

Chem. Trade J., Nov. 24, 1900, 411.

With a view to promoting the industrial use of alcohol in France, the Government appointed a committee some little time ago to report on what changes should be made in the method then in use for "denaturing" alcohol, or rendering it non-potable. This committee now recommend that the addition of methyl alcohol should be reduced from 10 per cent. to 1 per cent., and that the use of malachite green, a non-volatile material, now in use as a denaturant, should be abandoned. The mixture they suggest as meeting the requirements of the various industries, whilst adequately protecting the Treasury, is made up of 97 volumes of alcohol at 95° on Gay-Lussac's hydrometer, one volume of methyl alcohol, one volume of wood-washer's grease, and one volume of heavy benzene.

XIX.—PAPER, PASTEBOARD, Etc.

The Pulp Wood Industry in Canada.

Bd. of Trade J., Nov. 22, 1900, 426.

A pamphlet on the pulp wood industry of Canada, by Mr. George Johnson, F.S.S., Statistician of the Department of Agriculture at Ottawa, has been issued in connection with the Paris International Exhibition. Copies may be obtained gratis at the offices of the High Commissioner for Canada, Victoria Street, S.W.

XX.—FINE CHEMICALS, Etc.

Vanilla and Rubber in Mexico.

Bd. of Trade J., Dec. 6, 1900, 539.

H.M. Consul at Vera Cruz, in a report to the Foreign Office, states that vanilla and rubber, which at present are but small items in the returns, are destined in the future to become articles of the first importance.

Drugs and Chemicals in Switzerland: Comparison between other Imports and the Imports from Great Britain into Switzerland in 1899, with Duties.

Foreign Office Annual Series, No. 542, *Nov.* 1900.

Description.	Total Imports from all Countries.		Imports from Great Britain exclusively.		Duty per 100 Kilos.
	Weight.	Value.	Weight.	Value.	
	Kilos.	£	Kilos.	£	£ s. d.
Druggists' sundries—					
Pharmaceutical raw material (whole).	661,200	21,528	26,800	915	0 2 6
Pharmaceutical raw material (small).	40,500	1,963			0 6 6
Drugs	437,200	43,720	2,200	2,210	0 8 0
Iodoform	700	1,040	..	..	0 8 0
Mineral waters	..	33,726	..	..	0 1 3
Alkaloids	15,600	21,384	300	420	0 6 6
Extract of quinine, refined camphor.	66,100	7,932	3,800	456	0 6 6
Chloroform	7,100	760	..	..	0 6 6
Formaldehyde	2,800	180	..	..	0 6 6
Milk-sugar	2,400	130	..	..	0 8 0
Castor oil, transparent and purified.	31,400	1,167	..	..	0 4 0
Liquorice juice	59,000	4,012	..	..	0 5 10
Pharmaceutical preparations—					
Packed for wholesale.	83,400	26,834	12,100	3,872	1 16 0
Packed for retail	59,200	16,576	8,500	2,380	4 0 0
Brine-salt lozenges	2,800	728	..	..	1 12 0
Perfumes and cosmetics—					
Packed for wholesale.	4,400	704	100	16	2 0 0
Packed for retail.	52,000	10,400	2,200	440	4 0 0
Chemical products—					
Lemon juice	57,000	479	..	..	0 0 2
Gum	175,200	12,998	..	..	0 0 2
Exotic resins	25,300	1,721	..	..	0 0 2
Colophony, pitch, &c.	2,296,600	18,925	2,800	21	0 0 2
Sulphur	1,840,600	9,571	..	..	0 0 2
Coal-tar, liquid	378,100	404	800	1	0 0 2
Lees of wine, dried.	12,700	102	..	..	0 0 2
Tartar, raw	18,700	710	..	..	0 0 2
Saltpetre, raw	4,100	34	..	..	0 0 2
Other auxiliary materials, raw.	518,900	4,427	100	4	0 0 2
Caustic potash, caustic soda, &c.	2,545,200	27,488	30,500	329	0 0 3
Caustic potash, caustic soda, liquid	481,900	3,855	28,600	229	0 0 3
Calcium carbide	146,100	2,338	..	..	0 0 3
Alum	99,200	595	..	..	0 0 3
Chloride of lime	1,296,400	7,260	467,200	2,616	0 0 3
Liquid extracts of tannin.	1,174,500	15,769	..	..	0 0 3
Litharge	145,000	3,480	..	..	0 0 3
Hydrochloric acid, raw.	6,414,400	15,419	..	..	0 0 3
Sulphuric acid	6,144,500	17,819	..	..	0 0 3
Chlorine	50,700	2,028	..	..	0 0 3
Sulphuric acid, liquid	24,400	93	..	..	0 0 3
Sulphuric acid, compressed.	27,500	462	..	..	0 0 3
Soda, raw	11,700	56	..	..	0 0 8
" crystallised	1,143,600	2,745	1,600	4	0 0 3
" calcined	8,713,000	36,595	..	..	0 0 3
Acetate and sulphate of aluminium.	1,641,300	7,878	..	..	0 0 3
Sulphate of iron, copper and zinc.	1,309,000	25,388	273,000	7,098	0 0 3
Epsom and Glauber salts, chloride of barium, &c.	5,427,800	32,567	45,700	274	0 0 3
Aniline oil, &c.	843,700	33,748	18,700	748	0 0 6
" compounds.	29,200	46,720	900	144	0 0 6
Anthracene, benzoic acid, benzol, benzoline, carbolic acid, naphtha, &c.	4,138,500	99,324	83,400	2,002	0 0 10
Carbolineum (impregnating oil).	310,400	1,490	..	..	0 0 10
Paraffin, purified vaseline, &c.	212,400	5,522	16,600	432	0 0 10
Arsenic acid, sugar of lead, borax, salts of soda (not described).	2,485,000	59,640	163,200	3,917	0 0 10
Chlorate of soda	70,600	2,400	..	..	0 0 10
Catechu	1,119,300	20,147	..	..	0 0 10

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Description.	Total Imports from all Countries		Imports from Great Britain exclusively.		Duty per 100 Kilos.
	Weight.	Value.	Weight.	Value.	
Chemical products—*cont.*	Kilos.	£	Kilos.	£	£ s. d.
Gallic acid, tannic acid, solid extracts of tannin.	83,400	4,495	..	..	0 0 10
Glycerin	261,700	10,468	1,900	76	0 0 10
Pyroligneous acid, acetic acid, raw.	1,105,300	18,688	..	..	0 0 10
Oxalic acid, oxalate of potash.	56,400	1,918	..	..	0 0 10
Arseniate, bicarbonate, hyposulphite of soda.	285,900	1,944	5,200	35	0 0 6
Olein	621,400	12,428	24,000	480	6 0 10
Prussiate, chlorate, and red chromate of potash.	126,100	11,197	49,600	2,619	0 0 10
Phthalic acid, resorcine.	73,100	19,737	..	..	0 0 10
Potash.....	241,900	4,161	200	3	0 0 10
Castor-oil, unprepared, Turkey-red oil.	374,800	9,745	..	..	0 0 10
Salicylic acid	24,200	3,194	..	..	0 0 10
Sal-ammoniac, ammonia.	507,200	8,561	2,100	45	0 0 10
Refined nitre	430,100	8,430	1,300	25	0 0 10
Nitric acid.....	284,100	4,432	..	..	0 0 6
Sulphuric ether....	275,400	11,016	..	..	0 0 10
Stearine	814,400	33,553	75,800	3,123	0 0 10
Turpentine oil	873,000	30,297	..	..	0 0 10
Hydrate of alumina	9,300	223	..	..	0 0 10
Salts of tin.....	92,600	4,636	200	16	0 0 10
Carbonic acid	96,100	1,922	..	..	0 5 10
Boracic, pure carbolic, phosphoric acids, &c.	643,700	30,944	25,700	1,232	0 1 8
Tartar emetic, cyanide of potassium, phosphorus, &c.	45,900	6,060	17,200	2,581	0 1 8
Magnesium bromide, iodide, carbonate, &c.	169,300	33,860	47,700	9,540	0 1 8
Citric acid, tartaric acid.	137,800	15,489	8,700	978	0 1 8
Other auxiliary materials, prepared.	195,700	22,892	1,300	156	0 1 8
Potato flour.....	1,540,800	17,719	..	..	0 0 10
Starch and dextrine, for wholesale.	1,797,600	27,175	89,800	1,759	0 1 0
Starch and dextrine, for retail.	888,000	15,660	16,600	306	0 2 0
Purified resins and shellac.	84,200	5,917	14,000	1,037	0 2 6
Spirits of wine.....	5,984,400	71,346	..	..	0 5 10
Pyrotechnic preparations.	9,100	619	600	41	4 0 0
Explosive substances	143,100	13,084	800	80	2 0 0
Guncotton	27,100	3,035	..	..	2 0 0
Matches, wax	22,800	1,733	6,000	456	1 12 0
„ wood	278,800	6,134	2,000	44	1 0 0
Cart-grease	140,000	1,344	300	3	0 2 6
Blacking.....	94,400	2,115	5,700	128	0 5 10
Raw glue, &c.....	899,600	34,531	26,400	1,004	0 0 6
Gelatin and fish glues.	81,700	7,680	2,900	188	0 5 10
Total	..	1,231,363	..	54,483	..

Phosphoric Acid and Apothecary Wares in Mauritius.

Bd. of Trade J., Dec. 6, 1900, 514.

With regard to certain of the imports into the colony, the Acting-Governor of the colony reports as follows:—

Acid, Phosphoric [*as Superphosphates*].—The enhanced prices of the article from the United Kingdom may, to a certain extent, be responsible for the decreasing importation of the British article. The effect of the cost price upon the importation appears when comparing the quantity received from the United Kingdom, which was 289,213 kilos. in 1894, as compared with 118,177 in 1899.

Belgium made its appearance on the market of 1899 with 10,000 kilos., at a cost price of nearly 30·4 per cent. below English prices.

Apothecary Wares.—In consequence of large demands and use of patent French medicines in the colony, France shows a vast increase in the value of apothecary wares ever since 1895, when the imports reached Rs. 25,646.

During 1899 the importation reached Rs. 81,285, exclusive of charges and exchange, as against Rs. 36,545, imported from the United Kingdom in that year. In 1895 the importation from the United Kingdom was about 50 per cent. in excess of the value of French goods received in Mauritius, whilst in 1899 it is almost the reverse in favour of goods from France.

XXII.—EXPLOSIVES, MATCHES, Etc.

The Explosives Ordinance.

Chem. and Druggist, Dec. 8, 1900, 908.

It is notified in the *Ceylon Gazette* that the term "explosive," defined in section 3 of "The Explosives Ordinance, 1894," shall extend to calcium carbide, being a substance which appears to the Governor in Executive Council to be specially dangerous to life and property.

BOARD OF TRADE RETURNS.

Summary of Imports.

Articles.	Month ending 30th Nov.	
	1899.	1900.
	£	£
Metals.....	2,254,247	2,972,915
Chemicals and dyestuffs	418,903	400,357
Oils	875,679	1,102,777
Raw materials for non-textile industries.	5,178,602	5,171,637
Total value of all imports	44,244,811	49,733,730

Summary of Exports.

Articles.	Month ending 30th Nov.	
	1899.	1900.
	£	£
Metals (other than machinery)	4,013,752	3,659,401
Chemicals and medicines	780,713	707,079
Miscellaneous articles	3,166,354	3,227,428
Total value of all exports....	24,571,940	24,624,649

Imports of Miscellaneous Articles for Month ending 30th Nov.

Articles.	Quantities.		Value.	
	1899.	1900.	1899.	1900.
			£	£
Cement..... Tons	..	12,178	..	22,948
China and earthenware. Cwt.	..	32,737	..	79,942
Drugs ..... Value £	..	..	114,960	99,634
Glass:—				
Sheet ..... Cwt.	114,264	44,163	60,554	27,796
Plate ..... „	40,235	16,799	39,457	18,435
Flint ..... „	..	42,719	..	80,880
Bottles ..... Gross	116,046	128,323	46,948	58,912
Other..... Cwt.	84,090	26,305	155,682	47,322
Glue, size, and gelatin. „	..	17,447	..	34,964
Leather, unmanufactured. „	128,159	124,145	832,186	696,617
Oil seed cake .... Tons	38,565	35,053	243,747	243,148
Paints and pigments. Value £	..	..	..	113,620
Paper, pasteboard Cwt.	466,157	515,887	330,114	365,616
Scientific instruments. Value £	..	..	..	54,425
Soap and soap powder. Cwt.	..	14,713	..	18,913
Zinc manufactures. „	44,996	44,449	61,469	53,856

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Imports of Metals for Month ending 30th Nov.

Articles.		Quantities.		Value.	
		1899.	1900.	1899.	1900.
				£	£
Copper :—					
Ore	Tons	16,145	8,739	89,146	119,580
Regulus	„	6,014	7,229	157,601	276,355
Unwrought	„	4,113	5,575	302,002	418,193
Lead, pig and sheet	„	15,186	17,249	251,862	297,308
Pyrites	„	64,019	58,336	98,919	99,495
Quicksilver	Lb.	65,000	416,500	6,966	50,890
Silver ore	Value £	..	..	68,099	90,938
Tin	Cwt.	40,300	62,201	264,759	408,260
Zinc	Tons	5,013	5,270	115,568	102,161

Imports of Chemicals and Dyestuffs for Month ending 30th Nov.

Articles.		Quantities.		Value.	
		1899.	1900.	1899.	1900.
				£	£
Alkali	Cwt.	24,968	27,721	14,203	13,362
Bark	„	30,433	25,828	12,624	7,474
Borax	„	9,645	37,871	4,709	18,706
Brimstone	„	41,593	29,951	9,377	7,980
Chemicals, other	Value £	..	..	110,848	131,281
Cutch and gambier	Tons	1,299	1,526	23,810	30,031
Dyes :—					
Alizarin	Value £	..	..	15,530	13,297
Aniline and other	„	..	..	51,332	53,923
Indigo	Cwt.	1,322	67	19,270	2,268
Nitrate of potash	„	22,824	18,368	19,033	15,900
Valonia	Tons	2,762	2,490	36,314	24,433

Imports of Raw Material for Non-Textile Industries for Month ending 30th Nov.

Articles.		Quantities.		Value.	
		1899.	1900.	1899.	1900.
				£	£
Bark, Peruvian	Cwt.	1,337	1,511	3,656	3,938
Caoutchouc	„	38,756	39,505	562,931	481,281
Gum :—					
Arabic	„	5,636	10,471	13,637	18,043
Lac, &c.	„	9,226	4,406	30,742	14,220
Gutta-percha	„	8,101	8,533	108,028	154,181
Hides, raw :—					
Dry	„	32,332	24,304	87,020	64,186
Wet	„	91,063	70,922	197,230	164,189
Ivory	„	842	603	30,591	19,626
Manure :—					
Bones	Tons	6,951	4,556	34,514	18,069
Guano	„	1,001	279	6,085	1,054
Nitrate of soda	„	7,906	20,201	57,205	171,536
Phosphate of lime	„	41,015	25,120	71,512	39,198
Paraffin	Cwt.	95,170	91,140	98,564	133,965
Linen rags	Tons	1,892	1,241	14,299	12,602
Esparto	„	19,919	12,989	83,829	58,301
Pulp of wood	„	30,266	39,418	165,733	248,338
Resin	Cwt.	149,397	234,417	35,290	60,876
Skins :—					
Goat	No.	..	548,981	..	55,219
Sheep	„	..	999,576	..	111,766
Tallow and stearin	Cwt.	249,885	142,516	300,636	181,340

Imports of Oils for Month ending 30th Nov.

Articles.		Quantities.		Value.	
		1899.	1900.	1899.	1900.
				£	£
Cocoa-nut	Cwt.	50,625	54,154	58,355	64,319
Olive	Tuns	1,143	340	41,994	13,270
Palm	Cwt.	64,437	70,326	71,302	78,999
Petroleum	Gall.	18,789,287	30,808,176	410,312	629,751
Seed	Tons	3,586	4,134	66,474	113,595
Train, &c.	Tuns	2,741	1,879	46,167	36,921
Turpentine	Cwt.	60,919	58,269	104,276	89,370

Exports of Metals (other than Machinery) for Month ending 30th Nov.

Articles.		Quantities.		Value.	
		1899.	1900.	1899.	1900.
				£	£
Brass	Cwt.	9,702	9,680	50,689	52,786
Copper	„	70,685	70,886	286,897	276,707
Lead	Tons	2,685	2,418	46,434	47,507
Plated wares	Value £	..	..	45,528	56,565
Tin	Cwt.	11,212	10,229	80,182	68,192
Zinc	„	12,915	11,040	13,824	10,567

Exports of Drugs and Chemicals for Month ending 30th Nov.

Articles.		Quantities.		Value.	
		1899.	1900.	1899.	1900.
				£	£
Alkali	Cwt.	404,661	293,527	103,185	91,927
Bleaching materials	„	140,327	110,764	34,355	34,415
Chemical manures	Tons	35,066	31,815	203,211	184,836
Copper sulphate	„	876	758	20,811	17,816
Medicines	Value £	..	..	106,514	107,959
Other articles	„	..	..	312,637	270,126

Exports of Miscellaneous Articles for Month ending 30th Nov.

Articles.		Quantities.		Value.	
		1899.	1900.	1899.	1900.
				£	£
Gunpowder	Lb.	685,600	479,000	16,052	12,651
Candles	„	1,802,500	2,391,200	29,952	40,300
Caoutchouc	Value £	..	..	124,742	120,524
Cement	Tons	38,074	21,329	72,686	40,322
Products of coal	Value £	..	..	131,913	167,107
Earthenware	„	..	..	176,648	163,510
Stoneware	„	..	..	15,466	14,267
Glass :—					
Plate	Sq. Ft.	134,747	179,412	7,962	11,626
Flint	Cwt.	7,650	10,072	19,870	25,518
Bottles	„	66,802	73,031	32,147	35,053
Other kinds	„	18,841	18,615	18,516	19,723
Leather :—					
Unwrought	„	13,061	12,556	130,804	130,323
Wrought	Value £	..	..	41,388	48,246
Seed oil	Tons	4,293	4,021	90,881	105,341
Floorcloth	Sq. Yds.	2,032,500	1,924,300	93,783	92,685
Painters' materials	Val. £	..	..	156,364	163,043
Paper	Cwt.	82,601	96,937	119,536	150,988
Rags	Tons	7,435	4,362	40,954	23,891
Soap	Cwt.	81,733	74,759	87,446	77,762

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Monthly Patent List.

* The dates given are the dates of the Official Journals in which acceptances of the Complete Specifications are advertised. Complete Specifications thus advertised as accepted are open to inspection at the Patent Office immediately, and to opposition within two months of the said dates.

I.—PLANT, APPARATUS, AND MACHINERY.

Applications.

20,908. J. Smith and J. R. Smith. *See* Class XII.

21,172. W. J. Bosley, W. G. Owen, and A. G. Jones. An improved filter cloth for sewage, sludge, yeast, wine, or other filter presses. Nov. 23.

21,302. W. W. Harris. Improvements in refrigerating apparatus. Nov. 24.

21,431. G. T. Zohrab. *See* Class II.

21,571. J. B. Alliott and J. M. C. Paton. Improved apparatus for evaporating or concentrating *in vacuo*. Nov. 28.

21,914. A. J. Boult.—From C. Hromadnik, Germany. Improvements in or relating to apparatus for use in treating liquids or materials in liquids. Complete Specification. Dec. 3.

22,137. J. Mecredy. Improvements in evaporating apparatus. Dec. 5.

22,354. G. W. Blackburn. Improvements in or in connection with coolers, condensers, and heating apparatus. Dec. 8.

22,490. S. T. Bleyer. Improvements in furnaces. Complete Specification. Dec. 10.

22,581. H. Desrumaux. Improvements in apparatus for filtering liquids. Complete Specification. Dec. 11.

22,836. H. A. Vachell. Improved water distilling apparatus. Complete Specification. Dec. 14.

22,957. W. P. Thompson. Improvements in separating salt or other solid matters from their solutions, or for separating particles of superior specific gravity from fluids containing them in suspension. Dec. 15.

Complete Specifications Accepted.*

1899.

23,404. P. Naef. Method of and apparatus for treating liquids. Nov. 28.

23,598. J McNeil and C. McNeil. *See* Class XVI.

1900.

11,091. J. Gayley. Drying air, and apparatus therefor, applicable for extracting moisture from air for use in blast furnaces and steel converters, and other purposes in the arts for which dry air is useful. Dec. 5.

19,224. W. Sommer. Filter press. Dec. 5.

II.—FUEL, GAS, AND LIGHT.

Applications.

20,849. F. W. Schroeder, J. Peters, and P. W. Moran. An improvement on incandescent lights. Nov. 19.

20,854. W. G. Potter. Improvements in and apparatus for producing oil gas, being a combined generator and incandescent burner. Nov. 19.

20,893. H. Holm. Improvements in the carbonization of peat and in apparatus therefor. Nov. 19.

20,947. K. G. Gustafsson. Improvements relating to apparatus for generating acetylene gas. Complete Specification. Nov. 20.

21,105. J. J. Kermode. Improvements in apparatus for burning liquid fuel. Nov. 22.

21,106. J. J. Kermode. Improvements in apparatus for burning coal dust. Nov. 22.

21,156. H. J. Haddan.—From C., Paris, France. Improvements in heat insulators, principally for use with incandescent burners. Nov. 22.

21,213. The Honourable W. F. B. Massey-Mainwaring and J. Feitelson. Improvements in means for producing oxygen and hydrogen. Nov. 23.

21,264. E. Taylor. Improvements in the construction of grates and appliances for economising fuel and consuming smoke. Nov. 24.

21,290. F. Wilkinson and T. H. Brough. Improvements in supplying liquid fuel to burners for the generation of steam. Nov. 24.

21,295. E. C. Harvey. Improvements in or connected with gas heating and lighting appliances. Nov. 24.

21,387. A. Kitson. Means for the protection or preservation of incandescent mantles. Nov. 26.

21,431. G. T. Zohrab. Improvements relating to the drying and condensing of peat or other material, and the apparatus therefor. Nov. 27.

21,511. T. Rauthmell. Improvements in apparatus for generating acetylene gas for household lighting purposes. Nov. 28.

21,518. W. T. Purves and The Notkin Syndicate, Ltd. Improvements in automatic carburetting apparatus. Nov. 28.

21,519. W. T. Purves and The Notkin Syndicate, Ltd. Improvements in automatic carburetters. Nov. 28.

21,588. J. H. Cox. Improvements in or relating to a method for combining acetylene gas with air. Nov. 29.

21,641. A. Custodis. Improvements relating to the manufacture of coke. Complete Specification. Nov. 29.

21,746. J. B. De Lery. Improvements in or relating to the manufacture of incandescent gas burners and mantles or the like. Nov. 30.

21,752. H. E. Baker. Improvements in or connected with acetylene and similar generators. Nov. 30.

21,776. J. W. McBeath. Improvements in or relating to the heating of coal and other solid fuel before placing it on the firegrate. Dec. 1.

21,890. W. P. Thompson.—From Boguslaw Jolles and the firm of Zietz and Bruno Gesellschaft mit beschränkter Haftung, Germany. Improvements in burners for incandescent gas light. Complete Specification. Dec. 3.

21,974. G. A. Bronder. Improvements in machinery for discharging gas retorts. Complete Specification. Dec. 4.

22,088. C. Gluth. Improvements in and relating to incandescent gas burners. Complete Specification. Dec. 5.

22,129. K. Gossweiler. Improved process and apparatus for the preliminary heating of gas generators. Complete Specification. Dec. 5.

22,206. A. J. Boult.—From A. E. Grasset, France. Improvements in or relating to carburettors for air and gas. Complete Specification. Dec. 6.

22,226. C. E. J. Berthold. Improvements in automatic gas lighters. Complete Specification. Dec. 6.

22,470. O. A. Berend.—From J. R. Schauer, Bohemia, Improvements in gas lighting. Dec. 10.

22,491. C. Carpenter. Improvements relating to incandescent gas burners. Complete Specification. Dec. 10.

22,492. C. Carpenter. Improvements in apparatus for fitting pegs to incandescent gas burners. Complete Specification. Dec. 10.

22,587. W. P. Thompson. — From Wolff and Co., Germany. Improvements in self-igniting gas lighters. Dec. 11.

22,618. W. Harris. A shock-proof fitting for use in conjunction with incandescent gas lighting in particular. Dec. 12.

22,644. C. Humfrey. Improvements in washes for producer or other gases. Dec. 12.

Ze zbiorów Biblioteki Głównej Politechniki Łódzkiej

22,694. J. Blasco de Lery. Improvements in and relating to incandescent gas lighting, and to the manufacture of burners and incandescible elements therefor. Dec. 12.

22,738. S. S. Chandler and S. B. Chandler. Improvements in gas washers and scrubbers. Dec. 13.

22,782. W. W. Clark and G. Bone. Improvements in apparatus for generating acetylene gas. Dec. 13.

22,786. J. Wilson. Improvements in incandescent gas lighting. Dec. 14.

22,853. D. W. Anderson, E. B. Thaw, J. F. Chalmers, and J. T. Wright. Improvements in and relating to heating systems. Dec. 14.

22,860. C. A. von Welsbach. Improvements in the manufacture of osmium incandescent lamps. Dec. 14.

22,872. E. Bushe. A process for increasing the luminosity of electric incandescent lamps. Dec. 14.

22,943. W. J. Crossley and J. Atkinson. Improvements in apparatus for treating the gas from gas producers, and the air before passing it into the producer. Dec. 15.

22,960. J. Shackleton and A. Ross. Improvements in or relating to acetylene generators. Dec. 15.

Complete Specifications Accepted.

1899.

23,415. P. Naef. Method of and apparatus for treating solid materials, applicable to the manufacture of gas-coke and to other purposes. Nov. 28.

23,432. A. L. Kieny. Generators for the production of acetylene gas. Nov. 28.

23,572. H. H. Boehndel. Gas for illuminating and heating purposes. Dec. 5.

23,874. F. L. Toby and O. S. Borch. Process to manufacture mixtures of carbide of calcium which are free from any danger of explosion in generating gas. Nov. 28.

23,978. H. B. Helbing and F. W. Passmore. Solidification of liquid mineral oils. Dec. 5.

23,979. H. B. Helbing and F. W. Passmore. Solidification of liquid mineral oils. Dec. 5.

24,055. E. Springborn. Manufacture of artificial fuel. Dec. 5.

24,383. S. Chandler, jun., J. Chandler, and Kirkham, Hulett, and Chandler. Apparatus for washing and scrubbing gas. Dec. 5.

25,009.—A. J. Boult.—From A. Perrier, France. Apparatus for the production of gas. Nov. 28.

1900.

1791. D. W. Stapp. Apparatus for burning the unconsumed products of combustion from furnaces. Dec. 5.

23,415A. P. Naef. Method of and apparatus for treating solid materials, applicable to the manufacture of gas-coke and to other purposes. Nov. 28.

23,415B. P. Naef. Method of and apparatus for treating solid materials, applicable to the manufacture of gas-coke and to other purposes. Nov. 28.

23,415C. P. Naef. Method of and apparatus for treating solid materials, applicable to the manufacture of gas-coke and to other purposes. Nov. 28.

14,751. J. Brunschwyler and E. Pärli. Acelylene apparatus. Dec. 19.

15,476. C. Dörr. Method of producing artificial coal. Nov. 28.

17,466. A. E. Adolfsson. Acetylene gas generating apparatus. Dec. 12.

18,502. C. Walser and T. Cartier. Acetylene gas apparatus. Dec. 19.

20,275. M. Werthen. Mixing appliance for incandescence gas burners. Dec. 19.

IV.—COLOURING MATTERS AND DYES.

Applications.

20,864. O. Imray.—From The Basle Chemical Works, Switzerland. Manufacture of aromatic sulphinic acids. Complete Specification. Nov. 19.

20,924. E. Lefeuvre. Improved process for obtaining colouring and astringent matter from Cay-gia bark. Nov. 20.

21,310. R. B. Ransford.—From L. Cassella and Co., Germany. The manufacture of a sulphide colour, and of its leuco compound. Nov. 24.

21,365. G. B. Ellis.—From Société Chimique des Usines du Rhône, anciennement G. P. Monnet et Cartier, France. Improvements in the manufacture of sulphonated aldehydes and colouring matters therefrom. Nov. 26.

21,560. H. E. Newton.—From The Farbenfabriken vormals F. Bayer and Co., Germany. Improvements in the manufacture or production of anhydrides of organic acids. Nov. 28.

21,731. O. Imray.—From Farbwerke vormals Meister, Lucius und Brüning, Germany. Manufacture of indigo. Nov. 30.

21,821. B. Willcox.—From Badische Anilin und Soda Fabrik, Germany. Improvements in the manufacture of an initial material for the production of indigo. Dec. 1.

21,897. H. E. Newton.—From The Farbenfabriken vormals F. Bayer and Co., Germany. The manufacture or production of dyestuffs of the anthracene series. Dec. 3.

21,898. H. E. Newton.—From The Farbenfabriken vormals F. Bayer and Co., Germany. Improvements in the manufacture or production of dyestuffs containing sulphur. Dec. 3.

21,901. C. D. Abel.—From Actiengesellschaft für Anilinfabrikation, Germany. Manufacture of a colouring matter directly dyeing cotton. Dec. 3.

21,902. C. D. Abel.—From Actiengesellschaft für Anilinfabrikation, Germany. Manufacture of a colouring matter directly dyeing cotton. Dec. 3.

21,970. M. Lange. New or improved dyestuffs, and processes for the production of same. Complete Specification. Dec. 4.

22,214. G. B. Ellis.—From Société Chimique des Usines du Rhône, anciennement G. P. Monnet et Cartier, France. Improvements in the manufacture of substituted sulphinides. Dec. 6.

22,297. H. H. Lake.—From K. Oehler, Germany. The manufacture and production of new sulphonic acids and of colouring matters therefrom. Dec. 7.

22,328. W. L. Wise.—From Knoll and Co., Germany. Manufacture of biacetate of anthrapurpurine. Dec. 7.

22,391. O. Imray.—From Farbwerke vormals Meister, Lucius und Brüning, Germany. Manufacture of compounds of phenyldimethylpyrazolone and dimethylamidodimethylphenylpyrazolone with camphonic acid. Dec. 8.

22,397. H. H. Lake.—From K. Oehler, Germany. Manufacture and production of new colouring matters and of intermediate products for use therein. Dec. 8.

22,455. C. D. Abel.—From Actiengesellschaft für Anilinfabrikation, Germany. Manufacture of a black colouring matter directly dyeing cotton. Dec. 10.

22,456. C. D. Abel.—From Actiengesellschaft für Anilinfabrikation, Germany. Manufacture of sulphonated colouring matters belonging to the diphenylnapthylmethane series. Dec. 10.

22,758. O. Imray.—Farbwerke vormals Meister, Lucius und Brüning, Germany. Manufacture of phenylglycine-ortho-carboxylic acid. Dec. 13.

22,989. B. Willcox.—From Badische Anilin und Soda Fabrik, Germany. The manufacture and production of new products for use in the manufacture of colouring matters and of colouring matters therefrom. Dec. 15.

Ze zbiorów Biblioteki Głównej Politechniki Łódzkiej

COMPLETE SPECIFICATIONS ACCEPTED.

1899.

23,123. J. Y. Johnson.—From The Badische Anilin und Soda Fabrik, Germany. Manufacture and production of indigo-leuco compounds or other indigo products, and materials for use therein. Nov. 28.

23,123A. J. Y. Johnson.—From Badische Anilin und Soda Fabrik, Germany. Manufacture and production of indigo-leuco compounds or other indigo products. Nov. 28.

23,657. R. B. Ransford.—From L. Cassella and Co., Germany. Production of derivatives of indazol and of dyestuffs therefrom. Nov. 28.

24,954. O. Imray. — From The Farbwerke vormals Meister, Lucius und Brüning, Germany. Manufacture of blue mordant dyestuffs of the anthraquinone series. Nov. 28.

25,288. J. Y. Johnson.—From The Badische Anilin und Soda Fabrik, Germany. Manufacture and production of new colouring matters, and of products for use therein. Nov. 28.

1900.

889. J. Y. Johnson.—From The Badische Anilin und Soda Fabrik, Germany. Production of indigo paste. Dec. 19.

1293. T. R. Shillito.—From J. R. Geigy and Co., Switzerland. Process for transforming difficultly reducible crystalline indigo into an easily reducible form in paste and in powder. Nov. 28.

1387. J. Y. Johnson.—From The Badische Anilin und Soda Fabrik, Germany. Manufacture and production of products useful in the manufacture of colouring matters. Nov. 28.

1761. O. Imray.—From The Farbwerke vormals Meister, Lucius und Brüning, Germany. Manufacture of blue-violet dyestuff. Nov. 28.

2531. H. H. Lake. From Actiengesellschaft für Anilinfabrikation, Germany. Manufacture of a black colouring matter directly dyeing cotton. Dec. 5.

V.—TEXTILES: COTTON, WOOL, SILK, ETC.

APPLICATIONS.

21,044. W. A. E. Crombie. Improvements in the manufacture of fibreless threads from cellulose. Nov. 21.

21,072. F. V. M. Raabe. New or improved manufacture of yarn from certain vegetable waste material. Nov. 21.

21,073. F. V. M. Raabe. Improvements in the treatment of certain textile fibres preparatory to their conversion into yarn. Nov. 21.

21,397. F. Simons. Improvements in mercerising or silk-finishing cotton. Complete Specification. Nov. 26.

21,628. F. Shuman. Improvements in mercerising machines. Nov. 29.

21,786. H. B. Thorp. Improved apparatus for mercerising cotton woven fabrics. Dec. 1.

22,684. H. E. Newton. — From The Farbenfabriken vormals F. Bayer and Co., Germany. A new process for giving the crunching of silk to mercerised cotton. Dec. 12.

22,947. R. Spitz. Improvements in the manufacture of yarn, and cloth therefrom. Dec. 15.

22,954. J. C. W. Stanley. Improvements in or relating to the treatment of cotton seed hulls, and the obtaining of certain useful products therefrom. Complete Specification. Dec. 15.

COMPLETE SPECIFICATIONS ACCEPTED.

1899.

16,811. G. C. Dymond, of the Firm of W. P. Thompson and Co.—From L. Cruz-Pasqual-de-Bonanza, J. Selva-Javaloyes, D. Quilez-Quilez, M. Gonez-Valdivia, and A. Alonso-Blasco, Spain. Fibre applicable to all sorts of weaving and spinning, and processes for the treatment or separation of the same. Nov. 23.

20,907. A. Badoil. Method of and apparatus for retting or steeping flax. Nov. 28.

23,695. E. Price. Machine for mercerising cotton yarns, and apparatus connected therewith. Nov. 28.

24,234. E. Goldschmidt. Manufacture of a new fabric. Dec. 12.

1900.

16,332. W. G. Heyes.—From E. S. de La Grange, France. Production of impermeable threads and fabrics. Nov. 28.

VI.—DYEING, CALICO PRINTING, PAPER STAINING, AND BLEACHING.

APPLICATIONS.

20,940. C. L. Burdick. Apparatus for facilitating the application of colours or liquids to surfaces such as paper, porcelain, cloth, wood, and the like. Nov. 20.

21,130. H. E. Newton. — From The Farbenfabriken vormals F. Bayer and Co., Germany. An improved process for producing on wool blue shades fast to light. Nov. 22.

21,236. G. Bethmann. A process for dyeing wool or other animal fibre with aniline black. Complete Specification. Nov. 23.

21,764. R. C. H. Bonsor and W. McGhee, jun. Improvements in and relating to apparatus for scouring, mordanting and dyeing all fibres, either animal or vegetable, in the carded or combed ball. Dec. 1.

21,885. H. Werner, jun. An improved process for printing fabrics. Dec. 3.

22,033. H. W. Church. Improvements in dyeing machines. Complete Specification. Dec. 4.

22,049. J. Brandwood. Improvements in apparatus for bleaching, dyeing, or otherwise treating yarn in cop, cheese, bobbin, or other compact form. Dec. 5.

22,252. C. L. Jackson and E. W. Hunt. Improvements in apparatus for bleaching textile piece goods in the open state. Dec. 7.

22,402. B. Willcox.—From The Badische Anilin und Soda Fabrik, Germany. Improvements in printing textile materials with indigo. Dec. 8.

22,776. G. de Keukelaere. Improvements in machines for dyeing textile materials. Dec. 13.

COMPLETE SPECIFICATIONS ACCEPTED.

1899.

25,618. T. R. Shillito.—From J. R. Geigy and Co., Switzerland. Process for the production of bottoms on cotton with the addition of rosin soap, by means of soluble and insoluble azo colours. Nov. 28.

1900.

1736. W. Macconel, jun. Apparatus for mercerising, scouring, or dyeing yarns. Dec. 5.

2689. J. Y. Johnson.—From The Badische Anilin und Soda Fabrik, Germany. Discharging indigo-dyed silk goods. Dec. 12.

VII.—ACIDS, ALKALIS, AND SALTS.

APPLICATIONS.

21,214. D. de Vulitch and J. d'Orlowsky. An improved process of and apparatus for the production of calcium carbide. Nov. 23.

21,376. J. L. Kessler. Improvements relating to apparatus for the concentration of sulphuric acid. Complete Specification. Nov. 26.

21,557. M. Meslan. Improvements in apparatus for the production of fluorine and the like. Complete Specification. Nov. 28.

21,819. G. W. Johnson.—From Deutsche Gold- und Silber-Scheide-Anstalt vormals Rössler, Germany. Improvements in the manufacture or preparation of cyanamide and its compounds. Dec. 1.

21,820. G. W. Johnson.—From Deutsche Gold- und Silber-Scheide-Anstalt, vormals Rössler, Germany. Improvements in the manufacture or preparation of alkali cyanides. Dec. 1.

22,121. G. Craig and R. M. Paterson. Improvements in or connected with the production or purification of alkaline cyanides. Dec. 5.

Ze zbiorów Biblioteki Głównej Politechniki Łódzkiej

22,201. T. J. Smith. Carbonised bromides. Dec. 6.

22,482. G. Craig and R. M. Paterson. Improvements in apparatus for use in the obtainment of alkaline cyanides from crude materials containing cyanogen. Dec. 10.

22,488. C. Reim. An improved process for the production of a dry alkaline silicate. Complete Specification. Dec. 10.

22,590. T. Ingham. Improvements in the treatment of algin or its derivatives therefrom. Dec. 11.

COMPLETE SPECIFICATIONS ACCEPTED.

1899.

25,297. E. Edwards.—From The Krauschwitzer Thonwaarenfabrik für chemische Industrie (vormals L. Rohrmann), Germany. Process and apparatus for the production of acetic acid of high percentage and in large quantities by means of fractional distillation. Dec. 5,

1900.

16,253. E. Raynaud and L. Pierron. Process for the purification of sulphurous acid. Dec. 5.

16,254. E. Raynaud and L. Pierron. Manufacture of sulphuric acid by catalytic process. Dec. 5.

17,461. G. F. Jaubert. Preparing compressed peroxide of sodium, either alone or with the addition of other salts. Nov. 28.

VIII.—GLASS, POTTERY, AND ENAMELS.

APPLICATIONS.

20,940. C. L. Burdick. *See* Class VI.

21,148. B. J. B. Mills.—From Société Anonyme des Enduits Archambault, France. The treatment of carboys, bottles and other articles of glass pottery and the like, and of casks and other vessels of wood or other permeable materials, and of cork bungs and stoppers. Complete Specification. Nov. 22.

21,226. A. E. Brown. Improvements in or relating to the drying of earthenware articles, such as bricks, tiles, pipes, terra-cotta, pottery, clay or the like, or other articles such as timber, &c. Nov. 23.

22,435. S. A. Jones. A portable device for the spraying of pottery and the like. Dec. 10.

22,596. N. Meurer. A process for colouring glass yellow, red, brown, and black. Complete Specification. Dec. 11.

22,984. J. Noad. Improved means to be employed in fusing or fritting glass glaze and enamel compositions. Dec. 15.

COMPLETE SPECIFICATIONS ACCEPTED.

1899.

25,739. A. Froyck. Pressing glass. Dec. 19.

1900.

16,617. The Automatic Glass-Blowing Patents Syndicate, Limited.—From H. J. Colburn. Glass-blowing machines. Nov. 28.

16,623. The Automatic Glass-Blowing Patents Syndicate, Limited.—From W. E. Bock, United States. Glass-blowing machines. Dec. 12.

17,686. F. L. O. Wandsworth. Manufacture of prism glass, and apparatus for that purpose. Nov. 28.

19,646. J. R. W. Woodward and N. Collier. Kilns for burning earthenware and other articles. Dec. 12.

IX.—BUILDING MATERIALS, CLAYS, MORTARS, AND CEMENTS.

APPLICATIONS.

21,226. A. E. Brown. *See* Class VIII.

21,544. A. M. Effendi. A process for preserving and hardening wood. Nov. 28.

21,910. H. Alexander. An improved manufacture of bricks, artificial stone, and the like, from slags containing lime. Dec. 3.

21,913. A. Clemens. Improvements in presses for manufacturing facing bricks. Complete Specification. Dec. 3.

22,015. O. Imray.—From C. F. Buente, United States. Improvements in fire-proof floors. Complete Specification. Dec. 4.

22,105. A. C. W. Hobman. Improvements in street-paving. Dec. 5.

22,139. L. Hatschek. A process for the manufacture of slabs, plates, and other suitable articles of artificial stone. Complete Specification. Dec. 5.

22,766. J. F. Burn. Improvements in or relating to the manufacture of artificial stone and the like. Dec. 13.

22,941. J. Doyle. New or improved means for producing artificial stone. Complete Specification. Dec. 15.

22,952. G. Clue and E. Biehler. Improvements in the manufacture of conglomerates for building and other purposes. Dec. 15.

COMPLETE SPECIFICATIONS ACCEPTED.

1899.

22,549. J. C. Gostling, J. H. Frazer, and R. Booth. Apparatus for the manufacture of cement. Dec. 19.

24,812. E. Reese. Manufactnre of blocks, sets, and slabs from granite, slate, and the like refuse. Dec. 19.

25,734. P. Timofeeff. Manufacture of artificial stone and cement for building, paving, railway sleepers, and other purposes. Dec. 19.

1900.

15,960. A. G. fu. Guiseppe. Fire-proof coating for walls, floors, and the like. Dec. 5.

19,515. G. F. Leboida. Process and preparation for rendering wood fire-proof and rot-proof. Dec. 19.

19,608. C. W. T. Eustance and J. D. Colley. Plastering for the construction of ceilings, walls, partitions, temporary structures, and the like. Dec. 12.

X.—METALLURGY, MINING, ETC.

APPLICATIONS.

20,845. J. H. S. Bradley. Improvements in the treatment of metals and metal alloys. Nov. 19.

20,894. H. Goldschmidt. New and improved process for welding metals. Nov. 19.

21,158. S. Cowper-Coles. Improvements in uniting and burning aluminium. Nov. 23.

21,159. S. Cowper-Coles. A continuous process for the treatment of complex sulphide ores. Nov. 23.

21,195. D. Laird. An improved assay furnace. Complete Specification. Nov. 23.

21,244. Sir A. Wilson, Bart. Improvements in hardening armour plates, projectiles, and the like. Nov. 23.

21,345. L. Mach. Improvements in or relating to a process of manufacturing aluminium alloy. Complete Specification. Nov. 26.

21,357. F. W. Bühne. Process for comminuting metals. Nov. 29.

21,388. G. G. M. Hardingham.—From R. Davey, Italy. An improved rotary furnace applicable for use in roasting or calcining ores. Nov. 26.

21,416. T. N. Muller. Improvements in the manufacture of open-hearth steel. Complete Specification. Nov. 27.

21,455. R. G. Wood. Improvements in and relating to the manufacture of sheet metal. Complete Specification. Nov. 27.

21,497. G. Harrison, of the Firm of D. Young and Co.—From A. C. Lorenz, United States. Improvements relating to an electrolytic process and apparatus for the treatment of metalliferous ores and substances for the extraction of precious metals therefrom. Nov. 28.

21,552. A. J. Boult.—From E. Goldschmid, Germany. Improvements in or relating to the production of steel. Nov. 28.

Ze zbiorów Biblioteki Głównej Politechniki Łódzkiej

21,623. H. W. Wallis. Improvements in or relating to the treatment of ores. Nov. 29.

21,725. G. A. Herdman. Improvements in the manufacture of slag wool. Nov. 30.

22,059. J. Tulloch. An improved method of treating precipitates of copper. Dec. 5.

22,108. W. H. Hyatt. Improvements in manufacturing aluminium wire in conjunction with other metals. Dec. 5.

22,154. S. Cowper-Coles. An improved process for the reduction of sulphide ores. Dec. 6.

22,389. J. F. Duke. Improvements in the extraction of gold from sea water or other solutions containing the same. Dec. 8.

22,408. P. M. Justice.—From B. Talbot, United States. Improvements in the manufacture of iron. Dec. 8.

22,414. T. P. Sims and H. Martin. Improvements in the apparatus used to extract zinc from its ores. Dec. 10.

22,554. E. H. Hopkins. Improvements in or relating to the treatment of complex ores. Dec. 11.

22,556. J. B. De Alzugaray. Improvements in obtaining oxides from ores and the like. Dec. 11.

22,557. J. B. De Alzugaray. Improvements in or relating to the extraction of gold, silver, and other metals from ores and the like. Dec. 11.

22,570. H. F. Kirkpatrick-Picard. Improvements in or relating to the recovery of zinc from sulphide ores. Dec. 11.

22,699. H. A. Frasch. Process of recovering and separating metals from their ores and concentrates thereof. Complete Specification. Dec. 12.

22,777. O. Forsbach and E. Clerc. A new or improved crucible smelting furnace. Complete Specification. Dec. 13.

22,781. W. T. Forbes. Improvements in extracting gold from ores and clay and in apparatus therefor. Dec. 13.

22,785. M. L. E. Duval. Improved manufacture of ferro silicum. Dec. 13.

22,826. J. L. Stevenson. Direct continuous process for the manufacture of open-hearth steel. Complete Specification. Dec. 14.

22,827. J. L. Stevenson. Improvements in blast furnaces and casting the metal therefrom. Complete Specification. Dec. 14.

22,828. J. L. Stevenson. Improvements in open-hearth tilting furnaces. Complete Specification. Dec. 14.

Complete Specifications Accepted.

1900.

710. G. E. Davis and A. R. Davis. Process for the treatment of certain mixed sulphide ores for the recovery of their valuable constituents. Dec. 5.

2151. H. F. Kirkpatrick-Picard. Treatment of complex sulphide ores. Dec. 19.

13,470. H. H. Lake.—From Königl. Württemb. Hüttenverwaltung Wasseralfingen, Germany. Moulding and casting metals. Dec. 12.

14,942. W. Kennedy. Hoisting apparatus for blast furnaces. Dec. 5.

16,529. B. J. B. Mills.—From The General Electro-Chemical Company, United States. Processes for manufacturing abrasive material from bauxite or other hydrous oxides of aluminium. Dec. 12.

17,028. S. P. Kettering. Apparatus for the manufacture of wrought iron. Dec. 12.

17,138. G. W. Johnson.—From The Wellmann-Seaver Engineering Company, United States. Manufacture of open-hearth steel and furnaces therefor. Nov. 7.

17,390. M. Ekker and J. Krajesics. Production of nickel-coloured and silver-coloured metallic alloys. Dec. 5.

18,120. E. Sarg. Manufacture of an improved moulding material for use in casting steel. Nov. 28.

XI.—ELECTRO-CHEMISTRY and ELECTRO-METALLURGY.

Applications.

20,960. T. A. Edison. Reversible galvanic cells or so-called storage batteries. Complete Specification. Nov. 20.

21,004. R. F. Hall. Improvements in primary batteries. Nov. 21.

21,135. T. Pescatoro and The Tudor Accumulator Company, Ltd. Improvements in the manufacture of plates for secondary batteries. Nov. 22.

21,149. J. Meurant. Electrolytic process for the precipitation of metals and alloys from their solutions, as also for the deposition of metals or alloys or other metals or alloys or on other substances. Complete Specification. Nov. 22.

21,216. P. M. Justice.—The International Acheson Graphite Company, United States. Improvements in method of graphitizing electrodes. Complete Specification. Nov. 23.

21,233. T. Pescatore and The Tudor Accumulator Company, Ltd. Improvements in secondary batteries. Nov. 23.

21,566. C. A. von Welsbach. Improvements in accumulators or secondary batteries. Nov. 28.

21,759. S. Cowper-Coles. An improved process for the electro-deposition of metals. Dec. 1.

21,886. L. E. Lacroix, jun. Improvements in electrical storage or accumulators. Dec. 3.

22,019. A. Meygret. Improvements in storage batteries. Complete Specification. Dec. 4.

22,022. A. J. Boult.—From L. Sauvan, France. Improvements in or relating to secondary or storage batteries or accumulators. Dec. 4.

22,240. S. Cowper-Coles. Improvements in the electrolytic refining of metals. Dec. 7.

22,388. J. Bleichrode. Improved method for making an incandescent pile. Complete Specification. Dec. 8.

22,406. J. Greenwood. Improvements in the decomposition of alkaline salts by electrolysis and in apparatus therefor. Dec. 8.

22,605. T. Müller. Improvements in and relating to plate holders for electric accumulators. Complete Specification. Dec. 11.

22,206. T. Müller. A process for chemically consolidating the active material of electric accumulators. Complete Specification. Dec. 11.

22,607. T. Müller. Improvements in or relating to electric accumulator cells. Complete Specification. Dec. 11.

22,698. H. A. Frasch. Process of extracting and reducing metals by electrolysis. Complete Specification. Dec. 12.

22,703. S. Cowper-Coles. Improvements in the electrolytic refining of copper. Dec. 13.

22,902. E. Edser and M. Wilderman. Improvements in electrolytic methods and apparatus. Dec. 14.

Complete Specifications Accepted.

1899.

24,058. W. Bein. Means for carrying off the gases generated in electrolytic apparatus. Dec. 5.

24,451. H. H. Lake.—From C. Bruno, Italy. Storage batteries. Dec. 12.

1900.

466. W. J. Wells and Adamson. Apparatus for facilitating the escape of gas from electric storage batteries or accumulators. Nov. 28.

1457. W. Barnes. Electrolytic apparatus. Dec. 12.

5528. L. Gumiel. Electric accumulators. Nov. 28.

8471. L. Renaud. Electrical accumulators. Dec. 12.

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XII.—FATS, OILS, AND SOAP.

Applications.

20,908. J. Smith and J. R. Smith. Improvements in means or apparatus for filtering or cleansing oil and other liquids. Nov. 20.

21,468. R. Haddan.—From E. R. Edson, United States. *See* Class XIV.

21,469. R. Haddan.—From E. R. Edson, United States. Improvements in rendering apparatus. Complete Specification. Nov. 27.

21810. A. des Cressonnières. Improvements in soap-kneading machines and the like. Dec. 1.

21,971. L. Leclère. A new fatty substance obtained by the solidification of oils and its various applications. Dec. 4.

22,144. J. Davidson. An improved process for extracting oil from disintegrated nut products. Dec. 5.

22,145. J. Davidson. An improved process for extracting oil from seed or disintegrated seed or nut products containing mucilage. Dec. 5.

22,602. G. C. Warr and W. T. Wright. *See* Class XVIII.A.

22,867. M. S. Hudnall and H. Calvert. An improved lubricant, and process of making the same. Dec. 14.

Complete Specification Accepted.

1900.

11,860. M. Bärwinkel. Process for treating oil-yielding seeds. Dec. 12.

XIII.—PAINTS, PIGMENTS, VARNISHES, RESINS, INDIA-RUBBER, Etc.

Applications.

21,061. W. Ward. A quick-drying liquid cement paint for the coating of bottoms of iron and steel vessels, and other submerged surfaces, for the prevention of corrosion and fouling. Nov. 21.

21,314. R. C. Young and J. A. Gardner. Improvements in the manufacture of pigments or colour lakes. Nov. 26.

21,553. F. Gerhardt. Improvements relating to binding substances for colouring matters, and to protective coatings or paints. Complete Specification. Nov. 28.

Complete Specifications Accepted.

1899.

25,494. Siemens Bros. and Co., Ltd., and W. Dieselhorst. Manufacture of gutta-percha. Dec. 12.

1900.

18,536. E. Zühe. Process for producing a substitute for india-rubber and gutta-percha. Dec. 12.

XIV.—TANNING, LEATHER, GLUE, AND SIZE.

Applications.

20,910. R. J. C. Collins. Improvements in the manufacture of compositions known as flexible coments or flexible glues. Nov. 20.

21,385. J. Soussial. Improvements in or connected with the dyeing of skins and apparatus therefor. Nov. 26.

21,467. R. Haddan.—From E. R. Edson, United States. An improved process of and apparatus for making gelatine. Complete Specification. Nov. 27.

21,468. R. Haddan.—From E. R. Edson. Improvements in obtaining gelatine and oil from fish and other gelatine-yielding and oil-yielding material. Complete Specification. Nov. 27.

XVI.—SUGARS, STARCHES, AND GUMS, Etc.

Applications.

20,897. E. Casper. Improvements in centrifugal apparatus for treating raw sugar. Nov. 19.

20,898. E. Casper. Improvements in drums for drying sugar. Nov. 19.

20,900. E. Casper. Improvements in the treatment of raw sugar. Nov. 19.

20,901. E. Casper. Improvements in apparatus for treating raw sugar. Nov. 19.

20,992. R. Schrader. An improved process for making a molasses fodder and apparatus therefor. Complete Specification. Nov. 20.

21,256. R. Harvey. Improvements in and relating to continuous defecators for the clarification of sugar juice and other liquids. Nov. 24.

21,267. A. E. Berry and A. Boake Roberts and Co., Ltd. The manufacture of a new syrup for priming and hopping beers. Nov. 24.

22,078. H. Gouthiere and Ranson's Sugar Process, Ltd. Improvements in purifying and decolourizing saccharine liquors. Dec. 5.

22,767. W. P. Thompson.—From J. H. Lavollay and G. E. Bourgoin, France. Improvements in purifying and decolourizing saccharine solutions. Complete Specification. Dec. 13.

Complete Specifications Accepted.

1899.

23,134. J. Robin-Langlois. Method of and apparatus for refining sugar. Nov. 28.

23,598. J. McNeil and C. McNeil. Process and apparatus for the concentration and crystallisation of saccharine and other crystallisable liquids. Dec. 5.

XVII.—BREWING, WINES, SPIRITS, Etc.

Applications.

20,855. B. M. Drake and J. M. Gorham. Improved apparatus for cleansing casks. Nov. 19.

21,153. G. C. Marks.—From "Force" Société Anonyme, Belgium. Improvements relating to the treatment of yeast. Nov. 22.

21,267. A. E. Berry and A. Boake Roberts and Co., Ltd. *See* Class XVI.

21,355. H. Debeil. Improvements in mash-tuns for use in the preparation of beer wort. Nov. 26.

21,779. J. Fletcher. Apparatus for carbonating liquids and filling bottles under pressure. Dec. 1.

22,592. A. Müller. An improved process of dealcoholising fermented beverages and the like, and apparatus therefor. Complete Specification. Dec. 11.

22,723. R. D. Bailey. A method by which brewers and distillers may convert cane and beet sugars into invert sugar or saccharum without the use of yeast or acids. Dec. 13.

Complete Specifications Accepted.

1899.

24,846. C. Crepelle-Fontaine. Continuous rectification and distilling apparatuses. Dec. 19.

1900.

48. H. A. Hobson. Production of a concentrated hopped wort. Dec. 19.

356. A. Ferguson. Method of treating the waste products from distilleries and breweries so as to produce as a by-product a valuable material therefrom. Dec. 19.

11,639. J. Schröder and L. Diefenthal. Process for the manufacture of a food product from the exhausted grain residues in the manufacture of spirituous liquors. Dec. 12.

XVIII.—FOODS, SANITATION, Etc., AND DISINFECTANTS.

Applications.

A.—Foods.

21,626. J. H. G. Neisse and J. H. Boll. An improved process for the production of margarine. Nov. 29.

22,602. G. C. Warr and W. T. Wright. Improved method of manufacturing edible vegetable fat. Dec. 11.

Ze zbiorów Biblioteki Głównej Politechniki Łódzkiej

22,761. J. A. Timmis. Improvements in the manufacture of food. Dec. 13.

22,905. A. Pellerin. Improvements in the manufacture of margarine. Complete Specification. Filed Dec. 14. Date applied for July 12, 1900, being date of application in France.

B.—Sanitation.

22,856. A. Desgrez and V. Balthazard. Improvements in means or apparatus for regenerating and purifying air. Filed Dec. 14. Date applied for Aug. 13, 1900, being date of application in France.

Complete Specifications Accepted.

A.—Foods.

1899.

24,801. J. J. Möller. Process of and apparatus for preserving food-stuffs and the like, also applicable for disinfecting purposes. Dec. 12.

25,329. E. von Bühler. Process for pasteurising and sterilising milk and other liquids. Nov. 28.

25,484. A. Gürber. Process for the production of condensed milk. Dec. 12.

1900.

1484. W. W. Green and B. Green. Mixture or compound for preserving cream. Dec. 5.

11,639. J. Schröder and L. Diefenthal. *See* Class XVII.

B.—Sanitation.

1899.

23,209. A. J. Liversedge. Refuse destructor. Nov. 28.

1900.

550. R. F. W. Smith and The Pioneer Investment Trust, Ltd. Bacterial treatment of sewage effluent and the like. Dec. 12.

XIX.—PAPER, PASTEBOARD, Etc.

Applications.

21,150. C. K. Graham and The British Uralite Co., Ltd. Improvements in the manufacture of paper, cardboard, and the like, and in apparatus or machinery therefor. Nov. 22.

21,222. H. Schmolka. Improvements in or relating to apparatus for use in purifying paper pulp and the like. Complete Specification. Nov. 23.

22,418. The Westfield Paper Co., Ltd., and G. Stewart. Improvements in and relating to the surfacing of paper. Dec. 10.

Complete Specification Accepted.

1900.

4309. F. E. Keyes. Method of making fire-proof pulp board. Dec. 5.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, and EXTRACTS.

Applications.

21,058. W. M. Binnie and C. Smith. An improved process for the manufacture of camphor. Nov. 21.

21,709. G. W. Johnson.—From A. Verley, France. Improvements in the manufacture or production of perfume. Nov. 30.

22,122. O. S. Daniel. Improvements in the manufacture or production of perfumes. Dec. 5.

22,214. G. B. Ellis.—From Société Chimique des Usines du Rhône, anciennement G. P. Monnet et Cartier, France. *See* Class IV.

22,328. W. L. Wise.—From Knoll and Co., Germany. *See* Class IV.

22,329. W. L. Wise.—From Knoll and Co., Germany. Manufacture of salicylglycolic acid and its salts. Dec. 7.

22,887. B. Willcox.—The Badische Anilin und Soda Fabrik, Germany. Improvements in the oxidation of aromatic hydrocarbons and their derivatives. Dec. 14.

XXI.—PHOTOGRAPHY.

Applications.

21,817. B. Acres. A process for photographing in colour. Dec. 1.

22,385. P. A. Newton.—From Bunt und Luxuxpapier-Fabrik Goldbach, Germany. Improvements in the preparation of films for photographic purposes. Dec. 8.

Complete Specification Accepted.

1899.

17,165. J. E. Thornton and C. F. S. Rothwell. Transparent photographic films, and manufacture thereof. Nov. 28.

XXII.—EXPLOSIVES, MATCHES, Etc.

Applications.

21,065. L. Wöhler. Improvements in and connected with detonators. Complete Specification. Nov. 21.

21,068. J. Bonnet. Improvements in or relating to the manufacture of explosive substances. Filed Nov. 21. Date applied for Sept. 22, 1900, being date of application in France.

21,627. N. Ceipek. Improvements in explosive compounds. Nov. 29.

Complete Specifications Accepted.

1899.

25,033. A. J. Jacobs. Matches, fusees, and the like for use with cigarettes and cigars. Nov. 28.

1900.

15,057. G. A. Nahnsen. Building of sheds for the manufacture or storing of explosive materials. Dec. 19.

18,920. E. Gathmann. Manufacture of explosives. Nov. 28.

18,923. E. Gathmann. Manufacture of explosives. Nov. 28.

XXIII.—ANALYTICAL CHEMISTRY.

Application.

22,856. S. L. Fox. Improvements relating to instruments for ascertaining the amount or proportion of hæmoglobin in blood. Complete Specification. Dec. 14.

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