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Monday, March 10th, 1902:—

F. R. O'Shaughnessy, A.R.C.Sc. (Lond.), A.I.C. "Birmingham Sewage and its Treatment."

E. G. Clayton, F.I.C., F.C.S. "Remarks on the Technical Examination of Glue."

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THE JOURNAL OF THE SOCIETY.

In order that members may be supplied with information at as early a date as possible, the Journal is now issued twice a month, and contains abstracts of French and American, as well as British, patents.

INDEX, 1901, AND LIST OF MEMBERS.

The Index and Title Page for 1901, and the List of Members, will be issued under separate cover.

MEMBERS AND THEIR CONTRIBUTIONS.

Every Candidate for admission as a Member of the Society must be proposed according to the form set out in Rule 26. He must be proposed by one or more Members to whom he is known personally. The proposal form must be sent duly signed to the General Secretary, who shall lay the same before the Council at its next Meeting. If the majority of the Members of Council present are in favour of his election, the Candidate shall be declared duly elected, and his name shall be entered in the Register of the Society. At whatever period of the year a new Member may be elected, he shall be required (unless the Council shall determine otherwise) to pay his subscription for that year; having done which he shall be entitled to receive all the numbers of the Society's Journal for that year.

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THE SOCIETY OF CHEMICAL INDUSTRY.

We, the undersigned Members of the Society of Chemical Industry, hereby propose
(Candidate's Name in full)
as a fit and proper person to become a Member of the Society.

For Names only of }
Members recommend- }
ing the Candidate. }

And I, the said Candidate for Membership, hereby declare that if elected I will do my best to support the Society, and will observe its Bye-laws.

Signature of Candidate.....

Address to which the Candidate }
wishes the Society's publications }
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Date.....

(Extract from Bye-laws—Rules 27, 29, and 30.)

Each Member shall pay an annual subscription of Twenty-five Shillings, due on the First of January in each year; except that any Member may pay a life composition fee of Twenty Pounds in lieu of an annual subscription. He shall also pay, on receipt of notice of election, an entrance fee of One Guinea in addition to his first year's subscription; except that should a Member who has paid an entrance fee resign and subsequently seek re-election the Council may dispense with a further entrance fee.

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Authors of communications read before the Society, or any of its Local Sections, are requested to take notice that under Rule 43 of the Bye-laws the Society has the right of priority of publication for three months of all such papers. Infringement of this Bye-law renders papers liable to be rejected by the Publication Committee, or ordered to be abstracted for the Journal, in which case no reprints can be furnished to the author.

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- Carter, John Pim, 626, S. 24th Street, Philadelphia, Pa., U.S.A., Analytical Chemist.
- Converse, W. A., 27-34, Rialto Building, Chicago, Ill., U.S.A., Chemist.
- Craven, Alfred B., 91, Fielding Terrace, Armley, Leeds, Analytical Chemist.
- Dyson, George W., 89, Cowlishaw Road, Sheffield, Analyst.
- Ellis, Fred. R., 15, Shadwell Road, Bishopston, Bristol, Chemist and Druggist.
- Faill, James, 51, Partickhill Road, Glasgow, Technical Chemist.
- Fisher, Fred., Newaygo, Mich., U.S.A., Chemist.
- FitzGibbon, Thomas, 36, Averill Street, Fulham Palace Road, Hammersmith, W., Analytical Chemist.
- Flinn, Fred. B., Box 91, Newark, N.J., U.S.A., Chemist.
- Forster, Ferd. E. P., c/o Bass and Co., 19, Guild Street, Burton-on-Trent, Brewer's Chemist.
- Hosford, Roger F., 125, Milk Street, Boston, Mass., U.S.A., Chemical Engineer.
- Huntly, G. Nevill, 96, Gower Street, London, W.C., Analytical and Consulting Chemist.
- Jones, David Richard, Standard Chemical Co., Deseronto, Ont., Canada, Chemical Engineer.
- McFarland, A. R., c/o Solvay Process Co., Syracuse, N.Y., U.S.A., Alkali Works Manager.
- McKim, William, 69, Linden Street, Yonkers, N.Y., U.S.A., Colour Maker.
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- Neave, George B., Technical College, 204, George Street, Glasgow, Chemical Assistant.
- O'Neill, Charles, British Dyewood and Chemical Co., Ltd., Dyewood Mills, Parkhead, Glasgow, Chemist and Colourist.
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- Petsche, B. W., 25, Fairview Street, Yonkers, N.Y., U.S.A., Chemist.
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- Smythe, J. A., Durham College of Science, Newcastle-on-Tyne, Demonstrator in Chemistry.
- Stansfield, Edgar, The Technical College, Sunderland, Lecturer in Chemistry.
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- Walker, John H., Gourepore Co., Ltd., Bengal, India, Chemist.
- Webster, John, Chemical Laboratory, Guy's Hospital, London, S.E., Analyst.
- Williams, Percy, The British Uralite Co., Ltd., Higham, near Rochester, Kent, Chemist.
- Wilson, G. W., 18, Dinting Vale, Dinting, near Manchester, Works Chemist.



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Tate, Henry, Bolney House, Ennismore Gardens, London, S.W. Feb. 12.

Report

ON THE PATENT LAW AMENDMENT BILL.

PRESENTED TO THE COUNCIL BY THE PRESIDENT,
MR. IVAN LEVINSTEIN.

(Printed by Authority.)

General Objections.—The Bill is too narrow in its scope. Some most urgently needed reforms are omitted, whilst some of the amendments proposed would accentuate the existing evil and would add further injury to British industries.

Section 1. Examination of Previous Specifications.—This section attempts a compromise between American, German, and British methods with regard to granting patents. It is, however, not proposed that inquiry be made as to the novelty of the invention proposed to be patented, but only whether it has been claimed or described in any specification published not more than 50 years before the date of the application. The Comptroller will continue to grant patents, whether the inventions are obviously old or not, so long as they have not been described in previous specifications. If this section embodied the proposals contained in the joint note of Sir Edward Fry and Mr. Herbert Hughes, and also in the separate note of Sir Edward Fry, both on page 10 of the Report of the Departmental Committee, it would certainly be an improvement upon the existing law. (See also this Journal, 1900, 477; 1901, 294.)



Section 2.—Repeals section 22 of the Patents Act of 1883. Section 22 of the Patents Act, 1883, emphasises the fundamental principle of the British patent law, *viz.*, that a patent is granted for the establishment of a new manufacture into the United Kingdom. According to this section, the Board of Trade may order a patentee to grant licenses (a) if the patent is not worked in this country, or (b) if the reasonable requirements of the public cannot be supplied, or (c) if any person is prevented from working or using to the best advantage an invention of which he is possessed. This section has been looked upon by all interested as of the greatest importance, but, unfortunately, its language is so ambiguous that for many years no use was made of it, until 1898, when several petitions were lodged. It was then proved that, in consequence of its ambiguity, the legal proceedings required were too protracted and costly.

Now, part of the duty of Sir Edward Fry's committee was to inquire whether any, and, if so, what amendments were necessary in the provisions of section 22. Instead of amendment, the new Bill proposes repeal. According to section 2 of the Bill, the court may order the patentee to grant licenses if it be proved that the reasonable requirements of the public have not been satisfied by reason of the neglect or refusal of the patentee to work the patent or grant licenses on reasonable terms. By subsection 6 it is provided that an appeal shall lie from the order of the court to the Court of Appeal, and by leave of this court to the House of Lords. In other words, by section 2 of Mr. Balfour's Bill the foreign patentee will be allowed to enforce his British monopoly, to employ foreign labour exclusively for the benefit of foreign industries, without contributing one farthing towards our local or imperial taxation. So long as he satisfies the reasonable requirements of the public, no jurisdiction can arise under this Bill. That is to say, the foreign patentee is not to be called upon either to grant licenses or to manufacture in this country a solitary sample of the article for which he has got a British monopoly.

Section 2 not only throws overboard subsection (a), but also the important subsection (c) of section 22 of the Act of 1883.

There is another disastrous change proposed by section 2 of the Bill. Jurisdiction is to be taken away from the Board of Trade and transferred to the High Court. This transfer makes the Bill, even if the other enactments of section 2 were not diametrically opposed to the interests of British industry, absolutely valueless, as no man in his senses would ever make an application to the courts for a license. He would first have to ascertain whether or not the reasonable requirements of the public are satisfied—in itself a formidable task; he must also prove that the patent is not worked in this country. He may then apply for a license to the foreign patentee, who will raise every obstacle to cause delay. At last the foreign patentee refuses to grant a license; now comes the petitioner's chance. He applies to the court. A regular action at law commences, which clever counsel for the patentee may easily spin out for a couple of years, with a cost varying from 2,000*l.* to 4,000*l.* Assume, now, that the petitioner has been successful; of what value will be the victory to him? He would certainly be extremely foolish to make use of the license, or spend a single farthing in the erection of plant or machinery to work the patent, as there is the constant threat before him that after another delay of two years the Court of Appeal may quash the decision of the lower court; or, if he is again successful, the foreign patentee may appeal, by leave, to the House of Lords. Long before that time, in 95 cases out of 100, the patent will have lost its value. This subsection 6 might have been drafted for the express benefit of wealthy foreign syndicates.

Sir Edward Fry, in a separate note attached to the Departmental report, objects to the grant of compulsory licenses, and prefers forfeiture if the patent is not reasonably used by the patentee (see also this *Journal*, 1901, 294). Sir Edward states that there is a close precedent for such a course by a provision which exists in all patents for inventions for their determination, if it be made to appear to six Privy Councillors that the grant is prejudicial or inconvenient to His Majesty's subjects in general. There is an unanimous

opinion in the industrial centres of the United Kingdom that a patent, if not worked in this country, may be revoked. At a recent meeting of the special committee of the Manchester Chamber of Commerce, the following resolution was passed, which is the simplest and most effective remedy for the abuses now possible under section 22: "That a patent 'may' be revoked if it is proved that the article patented in this country is manufactured abroad, but not in the United Kingdom." The onus of proof that the patent is worked *bona fide* in this country should rest on the patentee or licensee. In the following countries or colonies, a patent may be revoked if not worked:—

Austria, Hungary, Germany, France, Belgium, Russia, Switzerland, Japan, Italy, Canada, Malta, Brazil, Bolivia, Chili, Colombia, Costa Rica, Ecuador, Finland, Guatemala, Tasmania, Newfoundland, Norway, Denmark, Peru, Portugal, Spain, Sweden, Tunis, Turkey, Uruguay, and Venezuela.

It is singular that at least section 2 of the Patent Law Amendment Bill is very much at variance with the opinion prevailing at the Board of Trade in the year 1897, when a representative deputation was received by Sir Courtenay Boyle, in the unavoidable absence of Mr. Ritchie. The deputation was introduced by Sir William Houldsworth, for the purpose of urging the President of the Board to remove ambiguity from section 22, especially as to the working of patents in this country. Sir Courtenay Boyle said there were many instances—Mr. Levinstein had mentioned several—in which it was clear that the default of the patentee to work his patent in the United Kingdom and supply the requirements of the public, had been a public injury, alike to the traders and the industrial interests in this country.

SUMMARY.

BILL OF 1902.

Section 2—

Compulsory Licences.

Section twenty-two of the principal Act (relating to the grant of compulsory licences by the Board of Trade) is hereby repealed, and the following provisions shall be substituted therefor:—

(1) If, on the application of any person interested, it is proved to the satisfaction of the court that the reasonable requirements of the public with reference to the invention have not been satisfied by reason of the neglect or refusal of the patentee to work the patent or grant licences on reasonable terms, the court may order the patentee to grant licences on such terms as to the duration of the licence, the amount of royalties, security for payment, or otherwise, as the court, having regard to the nature of the invention and the circumstances of the case, may deem just.

(2) On the hearing of any application under this section the patentee, and any person claiming an interest in the patent as exclusive licensee or otherwise, shall be made parties to the proceeding, and the law officer, or other such counsel as he may appoint, shall be entitled to appear and be heard.

(3) In any proceeding under this section the court may, if it thinks fit, and shall, on the request of any party to the proceeding, call in the aid of an assessor specially qualified, and try and hear the case wholly or partially with his assistance.

(4) An order of the court under this section shall, without prejudice to any other method of enforcement, operate as if it were embodied in a deed made between the parties to the proceeding.

(5) In awarding costs under this section, the court shall

ACT OF 1883.

Section 22—

Compulsory Licences.

If, on the petition of any person interested, it is proved to the Board of Trade that, by reason of the default of a patentee to grant licences on reasonable terms,—

(a) the patent is not being worked in the United Kingdom; or

(b) the reasonable requirements of the public with respect to the invention cannot be supplied; or

(c) any person is prevented from working or using to the best advantage an invention of which he is possessed;

the Board may order the patentee to grant licences on such terms, as to the amounts of royalties, security for payment, or otherwise, as the Board, having regard to the nature of the invention and the circumstances of the case, may deem just, and any such order may be enforced by mandamus.



BILL OF 1902—*cont.*Section 2—*cont.*

have regard to any previous request for, or offer of, a licence made either before or after the application to the court.

(6.) An appeal shall lie from the order of the court to the Court of Appeal; but, except by leave of the Court of Appeal, no appeal shall lie to the House of Lords from any order made by the Court of Appeal.

(7.) If an order granting a licence is subsequently reversed or varied on appeal, the appellate court may impose such terms as they may think just with respect to the validation of things done, and the disposal by sale or otherwise of articles manufactured, under the licence before the order granting it was reversed or varied.

(8.) Subject to the provisions of this section, all matters of practice and procedure in relation to the grant of compulsory licences shall be regulated by rules of court.

(9.) This section shall apply to patents granted before as well as after the commencement of this Act.

(10.) In the application of this section to Scotland, "law officer" means the Lord Advocate, and in the application of this section to Ireland, "law officer" means the Attorney-General or Solicitor-General for Ireland.

CHRONOLOGY.

Patents, Designs, and Trade Marks Act, Aug. 25, 1883.

Deputation to Board of Trade, April 8, 1897. (See also this Journal, 1897, 373.)

Test case: Levinstein, Ltd., and Ivan Levinstein v. Meister, Lucius und Brüning, July 6, 1898. (See also this Journal, 1898, 711.)

Appointment of Board of Trade Committee, May 24, 1900. (See also this Journal, 1900, 477.)

Report of Board of Trade Committee, Jan. 10, 1901. (See also this Journal, 1901, 294.)

Proposed amendment of Patent Act of 1883, Feb. 10, 1902. (See also this Journal, 1902, 287.)

Liverpool Section.

*Meeting held at University College on Wednesday,
January 29th, 1902.*

MR. C. LONGUET HIGGINS IN THE CHAIR.

THE SOLVENT POWER OF PHOSPHORIC ACID.

BY T. H. BYROM.

My attention was directed to the solvent power of phosphoric acid when searching for the best methods of decomposing ferrosilicon and spiegeleisen. These alloys are readily dissolved in the acid, but the silica is left in such a gelatinous condition that filtration is impracticable. Moreover, there was no advantage in using the acid in these cases, as better methods are available. The fact of their solubility, however, is interesting. I next tried the effect of the acid upon ferro-chromium alloys containing amounts of chromium varying from 10 to 50 per cent. In every case complete solution was effected, and after oxidising the chromium by means of permanganate, and titration with standard ferrous sulphate and dichromate, the results were found to agree exactly with those done by the usual methods depending upon fusion or ignition, and the conversion of the chromium into chromate. Not only is the solution effectual, but it is rapid; 0.3 grm. of

the alloy in the finest powder will dissolve in 15 minutes. In the case of chromite (chrome iron ore) also, a complete solution was effected in from 15 to 20 minutes (using 0.3 grm. finely powdered ore). Six c.c. of phosphoric acid syrup, sp. gr. 1.75, are used and a fairly high temperature (about 300° C.) is necessary to bring about decomposition. If the heating be too prolonged, a whitish insoluble substance is formed when glass vessels are used, but this seems to be obviated by adding 2 c.c. of strong sulphuric acid along with the phosphoric acid. If the fusion be effected in platinum vessels, this white deposit is not produced; it is evidently silica obtained from the glass.

SOME OBSERVATIONS ON THE FACTORY AND WORKSHOPS ACT AND THE ALKALI, &c. WORKS REGULATION BILL OF 1901.

BY EUSTACE CAREY.

THE first and principal object of our Society is no doubt the application of chemistry to manufacturing operations, and the investigation and discussion of processes and improvements, but we cannot produce commodities on a manufacturing scale without a manufactory, and with a manufactory or a factory one is at once not only in touch but in serious contact with many subjects of pressing importance. For instance, we employ labour of various kinds, skilled and unskilled. This brings us at once within reach of the Factory Acts and Labour Laws. We wish to sell our commodities, and to sell our commodities we have to send them by land or by sea to our customers. Here we are at once in contact with railway and canal legislation, rates of carriage, and the Board of Trade. If we send our goods over the sea, we do so subject to dues of various kinds, and if to foreign countries, we have to meet opposing and sometimes prohibitive tariffs.

We are also, as a Society, interested in the progress of scientific education. We think, and with good cause, that many proprietors of works, manufacturers, and other leaders of industry require more scientific education than they now possess.

We also, as manufacturers, are perpetually coming in contact with new inventions, either our own or those of other people. In either case we get entangled in the meshes of Patent Law at home and abroad. The absurdities and anomalies of our own Patent Laws, which act so prejudicially upon chemical industry in this country, have been many times exposed by our President, Mr. Levinstein.

I mention these subjects because I have felt for some time that the operations of our Society are too much confined to technology, pure and simple. I admit that technology is our first concern, but we cannot practise technology without being forced to consider other subjects, some of which I have just mentioned. I therefore need not apologise to you for having ventured to bring before you some observations which I propose to make upon the Factory and Workshops Act, 1901, and the Alkali, &c., Works Regulation Bill, 1901.

The Factory and Workshop Acts, 1901.

The author briefly alluded to the history of factory legislation, and drew attention to those parts of the Act of 1901 which are new and which specially affect chemical industry. He pointed out that the definition of a "steam boiler" in the Act is a great improvement upon the absurd definition in the Explosives Act of 1882, and which definition has been repeated so frequently in various Bills brought from time to time before Parliament. He drew attention to the new regulations with regard to the care and registration of steam boilers, and with regard to railway sidings and locomotives in works, and to the tremendous powers entrusted to the Home Secretary for dealing with dangerous trades.

The Alkali, &c. Works Regulation Bill, 1901.

With regard to the Alkali Bill the author went on to say: Soon after the meeting of Parliament in 1901, we were surprised to see that a Bill to amend the Alkali Acts had



been introduced into the House of Lords by the Lord Kenyon, and when we procured a copy of the Bill we found that it seemed to indicate a new departure in principle. I may say, by way of parenthesis, that many members of the alkali trade felt much aggrieved that the Local Government Board had, so to speak, stolen a march upon us, and, instead of conferring with the trade in a friendly way, as hitherto, and informing them of their intentions, they introduced a Bill in the House of Lords, apparently considering that to be the best way to slip it through Parliament unobserved. That this was not the intention of the Department I am bound to admit, and do freely admit, because at the interview which Mr. Long was good enough to give to a deputation from the Alkali Association, he said most emphatically that there was no such intention on the part of the Local Government Board.

Before I speak of the Bill, and what I call "a new departure in principle," allow me to say a few words as to the history and intention of Alkali legislation.

The first Act came into operation on January 1st, 1864, and continued until July 1st, 1868, when it would have lapsed, but that in June 1868 a short Act was passed making it permanent.

Before 1863 a large proportion of the hydrochloric acid evolved in alkali works was not condensed but escaped into the atmosphere, and no doubt did considerable damage to vegetable life. The subject had been a matter of inquiry by a Parliamentary Committee, and much evidence had been given both on the side of the land owners and occupiers and on the side of the manufacturers. The result was the Act of 1863, which begins its preamble by saying:—

"Whereas it is expedient to provide for the better condensation of the muriatic acid evolved in alkali works, be it enacted, &c., &c."

and clause 4 states that—

"every alkali works shall be carried on in such a manner as to secure the condensation to the satisfaction of the inspector of not less than 95 per centum of the muriatic acid evolved therein, provided always, that nothing herein contained shall entitle the inspector to direct any alteration to be made in the process of manufacture or the apparatus used therein."

The object of the Act was clearly to prevent escapes, and the duty of the inspector was to ascertain that not more than 5 per cent. escaped.

In 1874 Parliament found "that it is expedient to amend the Alkali Act of 1863." Wet-process copper works were added, and in addition to the condensation of 95 per cent. of muriatic acid gas, the condensation was to be carried out in such a manner that in each cubic foot of air, smoke, or chimney gases escaping from the works into the atmosphere there is not contained more than one-fifth part of a grain of muriatic acid.

What is known as the "best practicable means" clause is introduced here for the first time. The "best practicable means" were to be used for preventing the discharge into the atmosphere of all other noxious gases arising from such works or of rendering such gases harmless when discharged, and noxious gases for the purposes of this Act mean sulphuric acid, sulphurous acid (except that arising from the combustion of coals), nitric acid, or other noxious oxides of nitrogen, sulphuretted hydrogen, and chlorine.

The object of the legislation so far is, therefore, clearly to prevent the escape of certain gases into the atmosphere.

In 1876 a Royal Commission, with the late Lord Aberdare as Chairman, was appointed to inquire into noxious gases generally, and to recommend further legislation. An enormous amount of evidence was taken, a committee of alkali manufacturers being appointed by the trade to watch the proceedings, and to give evidence on behalf of the Alkali Association, the result of which was seen in the Consolidation and Amendment Act of 1881.

This Act deals with several new matters, for example, the deposit or discharge of alkali waste, prevention of nuisance from old waste heaps, sulphuric acid works, chemical manure works, nitric acid, sulphate of ammonia and chlorine works.

In addition to these industries, provision was made, for the first time, with regard to salt works. It had long been known that the admitted damage to vegetation around salt works is partly due to an evolution of hydrochloric acid from the salt pans. This evolution of hydrochloric acid arises from leakage from the pan of brine which drops into the furnace, and there is decomposed by the silicic acid in the ash of the coal. A very tentative clause (No. 10) was introduced. The alkali inspector was authorised to "make inquiry as to the methods adopted at salt works, and to ascertain what steps, if any, can be taken to reduce escapes."

In this Act (under which we are working to-day) limits are defined for escapes of hydrochloric acid into the atmosphere, and of escapes of sulphur and nitrogen (in other words, sulphuric acid chamber escapes) "into the chimney or into the atmosphere." Limits are not fixed for other escapes, but the "best practicable means" clause is applied to other gases. This, of course, is reasonable and satisfactory.

I understand the "best practicable means" to be those means, or any means, which will furnish the best results that have been found to be reasonably practicable. In support of my contention as to the true interpretation of the "best practicable means" clause, I refer you to clause 17, which reads as follows:—

"The owner of any works to which this Act applies shall, on the demand of the chief inspector, furnish him within a reasonable time with a plan (to be kept secret) of those parts of such works in which any process causing the evolution of any noxious or offensive gas, or any process for the condensation of such gas or preventing the discharge thereof into the atmosphere, or for rendering any such gas harmless when discharged, is carried on."

"The owner of the works shall furnish him (the inspector) with a plan to be kept secret."

Now, it is plain from this that the inspector is not expected to give to one manufacturer information as to how a result is obtained by another manufacturer. His business is not to divulge processes and methods, but to ascertain and control escapes. This point is, I think, very important, for I have heard that it has been argued that an inspector should control processes rather than escapes. If this doctrine were to be acted upon, the intention of the Act, as comprised in this clause, to which I have referred, would be ignored.

Of course, it goes without saying that the inspector frequently obtains permission to divulge methods, and I think that manufacturers, as a whole, are not selfishly and short-sightedly reticent about the apparatus they use for the purpose of complying with the Acts. I must also add that, as far as my experience goes, the inspectors have fully merited the confidence which has been placed in them by the manufacturers, but there would be an end to this happy state of things if it were to be the duty of an inspector to prescribe the special form of apparatus which manufacturers shall use.

I think it is clear that an inspector's duty is to watch for and detect escapes, and I hope that it will never be his duty to control processes.

In 1892 a short Act was passed for the purpose of scheduling further industries, and providing in a very peculiar way that certain salt works should be exempted from the operation of the Act. These salt works, I have been informed, were some salt works in Ireland, where brine is made by dissolving rock salt, and the water evaporated off by waste heat from lime kilns. This waste heat, passing under the pans, would be obviously free from the defect I mentioned just now (with regard to ordinary pans, viz., the leakage of brine into the fireplace where the salt in the brine is decomposed by the silicic acid in the ash of the coal. If I have been correctly informed about the method adopted at these salt works, there evidently was good reason for exempting such works, but why the subject was alluded to in such a mysterious way



I cannot comprehend. Surely, it would have been better to have stated what salt works were to be exempted, viz., salt works where the pans are heated by either waste heat or gaseous fuel. Probably, however, the drafting of the Bill was well considered, and there may be reasons for this remarkable obscurity which are unknown to me.

We have now, in a very brief way, reviewed the history of alkali works legislation, and we have seen how Parliament, beginning with hydrochloric acid, has gradually, cautiously, and after painstaking inquiry, placed escapes emanating from processes other than those of alkali manufacture under the inspector's charge, and I think that I may add that these additions to the laws would not have been effected so easily and satisfactorily as they have been were it not for the fact that all along there has been a full and frank exchange of views on the part of the Government and the manufacturers; the manufacturers having loyally consented, in the public interest, to admit restrictions and regulations that are practicable; and perhaps above all due to the fact that the inspectors have done their work with conspicuous tact, patience, and judgment, having followed faithfully the excellent example set by the first chief inspector, the late Dr. Angus Smith.

Dr. Angus Smith was the pioneer inspector. He had, so to speak, to show the way to his successors, and to think out for himself what the Act really meant, and how it could be best worked in the public interest without vexatious interference with the manufacturer. In his reports presented to Parliament every year, he takes the public into his confidence, and tells them, with great frankness, what his intentions and aims are. His reports show him to have been, what all who were privileged to know him will cordially testify, an exceptionally conscientious man, not anxious to magnify his office; in fact, a stranger to display and officialism, laboriously anxious to avoid laxity on the one hand or harshness on the other. It is particularly important, therefore, and useful for my purpose to-night, to ascertain what his views were as to his duty as an inspector, and as to the object and scope of the Acts, in the administration of which he had so large a share.

The object of the Acts was to prevent damage. The inspector's duty was to control escapes. I will give you a few typical extracts from his reports which, I think, will prove to you that this was Dr. Smith's view, and I think it is also important to note that with regard to the prevention of damage, Dr. Smith laid great stress upon the advantage of dilution, even going so far as to say, in one of his reports, that if these gases were to be sufficiently diluted, no damage would be done.*

With regard to sulphuric acid chamber escapes, it has been the practice, as a matter of convenience, to test them at the exit of the Gay-Lussac tower, the amount of acid gases there not generally differing materially from the amount entering the chimney.

But the wording of the Act is clear, viz.: "Delivered into the chimney or into the atmosphere," and if four grains of SO₂ had been found too difficult at the Gay-Lussac, the manufacturers would have claimed—and rightly claimed—to have the escapes tested where the gases enter the chimney. It was, however, so convenient to test at the Gay-Lussac, and so constantly done there, and for such a length of time, that it seems to have been looked upon by most of the parties concerned—inspectors and manufacturers alike—that the exit of the Gay-Lussac was the spot

appointed by law, whereas we know that, in practice, there may be hundreds of feet between the Gay-Lussac tower and the chimney, and much catching of acid gases between the two places.

I must in fairness say here, that the present chief inspector has pointed out to me that when the Bill brought in by Mr. Selater Booth in 1879 was being discussed, the alkali makers had an interview with him (Mr. Selater Booth), and pointed out that they were unable to assent to be bound under all circumstances to the limitation of acid escapes from vitriol chambers recommended by the "Noxious Vapours commission," but would not object to these limits if excessive escapes arising from unavoidable causes were provided for, the recommendation of the Commission being that the acid gases shall, in each case, be collected from the exit of the chambers before entering the chimney.

Mr. Selater Booth's Bill was, however, dropped, and the Act of 1881 was passed, as before stated, with the words "escaping into the chimney or into the atmosphere."

There is no doubt, as I have before said, that as a matter of convenience, it had been conceded by manufacturers that the escapes from sulphuric acid chambers might be taken at the exit of the Gay-Lussac towers, and I freely admit that this has been done from 1874 onwards.

The limit of four grains of sulphuric anhydride is easily maintained at the exit of the Gay-Lussac, but I venture to affirm that this custom, convenient though it was, would never have been agreed to by the manufacturers had they foreseen that this isolated instance would have been used as a precedent for application to other processes, and for a departure from the object of all noxious vapours legislation, that is, to regulate escapes, and escapes only.

Now then, after this somewhat long preamble, let us consider the "Alkali Works Amendment Bill" of 1901.

Let us look at clause 1. It says:—"Paragraph B, section 3 of the Alkali Works, &c. Act of 1881 is hereby repealed, and the following paragraph shall be substituted therefor:—

"All the acid gases of sulphur or of sulphur and nitrogen which are evolved in the process of manufacturing sulphuric acid or sulphates to such an extent that the total acidity of each cubic foot of residual gases after completion of the process and before admixture with air, smoke, or other gases, does not exceed what is equivalent to four grains of sulphuric anhydride."

Now, I submit that this clause provided for a serious change in the law, and I think you will see this at once. The Act of 1881 provides that these acid gases "escaping into the chimney or into the atmosphere" must not exceed what is equivalent to four grains of sulphuric anhydride. The Bill seeks to provide that these gases must be tested, not where they escape into the chimney or atmosphere, but, as the Bill puts it, "after completion of the process, and before admixture with air, smoke, or other gases."

We have seen that the custom has grown up of testing chamber escapes at the end of the Gay-Lussac, but that, as I have before explained, was done as a matter of convenience but not of law, and I think it must be obvious that such an alteration in the law for other than chamber escapes means a very serious increase of stringency, because we all know from practical experience that in many cases it has been necessary to allow noxious gases to be mixed with air, smoke, and other gases before escaping into the atmosphere, and we also know that dilution, in Dr. Smith's opinion, is a useful factor for the prevention of damage. With regard to some existing processes, the alteration contemplated by the Bill will be onerous and, in some cases, impracticable. Take, for instance, the well-known "Hargreaves" process for the manufacture of sulphate of soda. Suppose this clause 1 of the Bill had been passed, we should have first to inquire, with regard to the "Hargreaves" process, where is the end of this process? Surely, it should be at the end of the apparatus where the sulphate of soda is made. If that view is taken, it would be impracticable to work the "Hargreaves" process, for it is an impossibility to do so without frequently over-stepping the four-grain limit at that point. Why is there this difficulty with the "Hargreaves" process, and why do we not find such a difficulty with the

*Third Annual Report by Dr. Angus Smith, page 44, line 41 to line 46.		
	"	" 64, " 21 " 28.
Fourth	"	" 71, " 28 " 33.
Fifth	"	" 5, " 1 " 4.
Eighth	"	" 6, " 12 " 38.
Eleventh	"	" 3, " 27 " 29.
Fourteenth } & Fifteenth }	"	" 8, " 23 " 30.
	"	" 70, " 24 " 27,
	"	and line 51.
	"	" 71, line 1 to line 5,
	"	and " 19 " 23.
Sixteenth	"	" 38, " 30 " 37.
Seventeenth	"	" 12, " 38 " 50.
Eighteenth	"	" 10, " 35 " 39.
Nineteenth	"	" 6, " 5 " 10.
"	"	" 6, " 15 " 17.
"	"	" 6, " 25 " 32.



"chamber" process? The reason appears to be this (and I am indebted to Mr. Arthur Carey for my information on this point). Vitriol chambers allow very nearly 20 times the space for making sulphuric acid which is allowed by the "Hargreaves" plant. The actual space in the "Hargreaves" plant is from 1 to $1\frac{1}{2}$ cb. ft. per pound of sulphur burnt per 24 hours. The usual space allowed in vitriol chambers is from 20 to 24 cb. ft. per pound of sulphur burnt in 24 hours. With this much smaller space in the "Hargreaves" process, it is obvious that fluctuations in the composition of the exit gases must be much more rapid and more difficult to control than they are in ordinary chambers. Again, the "Hargreaves" process requires much more constant scientific watching as to the oxygen and steam present, the cylinder temperature, the rate of burning pyrites, the mechanical condition of the salt and the quantity of moisture in the salt. These points requiring skilled attention are more numerous than in the case of the chambers, and any failure of skilled attention is more likely to be seen in the escaping gases in the "Hargreaves" process than in the chamber process, probably in the ratio of about 20 to one, and all I desire to say is, that the more points there are in a process requiring constant attention, the more latitude should be allowed for occasional and temporary difficulties.

I may add, also, sulphuric acid concentrating pans. It is not practicable always to keep the escapes from these pans at the end of the process within the four grains, but it is practicable where the gases from these pans escape into the chimney or into the atmosphere where some dilution is practicable.

Serious as these considerations are with regard to existing processes, two only of which I have mentioned, Dr. Mond has pointed out that there are new processes in sight for the manufacture of sulphuric acid, in which there will be no inert gases. The plant for dealing with any given weight of sulphur will be very much smaller than in the case of the chamber process, and the exit gas, though very minute in quantity, may consist of nearly pure sulphuric acid.

If this Bill had become law with no modification of this clause, such a process as Dr. Mond mentions could not be worked, and progress in this direction would be stopped, which would be a public calamity. On the occasion of the visit of the deputation to Mr. Long, to which I have before alluded, Dr. Mond brought this argument forward with great force.

I hope that I have succeeded in making it clear to you that the Bill did provide for increased stringency in the law, a stringency with which we should have no difficulty in complying in the case of sulphuric acid chambers, it having been the practice all along to test these escapes at the "end of the process," but that such increased stringency is not admissible in the case of some other processes now in use, and will delay or prevent the introduction of certain new processes which are contemplated.

I may add that the Local Government Board, with whom, through the chief inspector, we had several very friendly discussions, agreed to modify satisfactorily the clauses in the Bill to which we had shown cause for objection, providing that the "end of the process" phrase should be applied to the ordinary chamber process, but that the "best practicable means" clause should be applied to other and new processes, the possibilities of which cannot be foreseen. The Bill, owing to great pressure of Parliamentary business, was not passed, but we may expect that a new Bill will be brought in this session, which I hope will embody the results of the discussions to which I have alluded.

And now, gentlemen, I fear that I have tried your patience considerably, but it is important, I think, that our great Society, wherever sections may be domiciled, whether in the United Kingdom, United States, in our Dominions beyond the Seas, or elsewhere, should watch Parliamentary proceedings with care and with ever-increasing care, and should take an active interest in all matters, whether technological or otherwise, which affect the progress of chemical industry.

London Section.

Meeting held on Monday, February 3rd, 1902.

MR. OTTO HEHNER IN THE CHAIR.

The CHAIRMAN drew the attention of the members to the bye-law with regard to the nomination of five members of Committee, and stated that nominations must reach the Secretary on or before the 23rd of March.

THE EXPLOSION OF POTASSIUM CHLORATE BY HEAT.

BY A. DUPRÉ, PH.D., F.R.S.

AFTER numerous experiments, Col. Ford and myself came to the conclusion that the St. Helen's disaster was due to the explosive decomposition of the potassium chlorate in the store, brought about by the intense heat produced by the burning of the wooden casks containing it. The experiment which finally led us to this conclusion was the explosion of a bead of chlorate, attached to a thin platinum wire, when introduced into a flame. The flames I had actually used in my experiments were the outer portions of a bunsen flame and of an ordinary gas blowpipe. Col. Ford being out of town, but wishing to see the experiment himself, I, perhaps unfortunately, told him to put the bead into the blue part of an ordinary gas flame.

Some time afterwards, M. Berthelot, in a paper published in the *Comptes Rend.*, Dec. 4, 1899, p. 926, took exception to our explanation on the ground that the explosion of the bead was not, as I had assumed, brought about by heat merely, but was due to, or at least assisted by, the combustible gas present in the flame.

As far as I understand M. Berthelot's explanation, the explosion at St. Helen's was brought about by the combustion of the wood in immediate contact with the chlorate whereby the heat of combustion was directly added to the heat of dissociation, the combined effect being the raising of part of the chlorate to the exploding point. How far, if at all, M. Berthelot, would have altered his opinion, as to the bearing of the experiment with the chlorate bead, had he known that the original experiments were made with a bunsen and gas blowpipe, I do not know, but, from my point of view, it is perfectly immaterial which alternative is adopted. Both explanations assume that some of the chlorate itself, that is, chlorate unmixed with any combustible, exploded. The main difference, it seems to me, between the two explanations is that we left the manner in which the heat was communicated to the chlorate an open question, while M. Berthelot endeavours to supply this deficiency. As far as the St. Helen's explosion is concerned, the main point is, Was some of the chlorate exploded by heat or was it not? and on this both explanations agree.

Before the action against the Alkali Company had been tried, I abstained from any further experiments, as I was very anxious to avoid even the semblance of partisanship. As soon, however, as the trial was over, I resumed my experiments, but have been unable to bring the matter forward before now. My first experiments were on the lines already described, but using an oxygen blowpipe in place of the ordinary air blowpipe. I found that, even when using an enormous excess of oxygen, the bead exploded, if anything even more readily than in the gas flame.

Since, however, anything coming from M. Berthelot, especially on such a subject, naturally requires the highest consideration, I went a step further, and avoiding all flames, heated my wire by means of an electric current, and still the bead exploded.

As the exact method of proceeding is a matter of some importance I will describe it a little more fully. A moderately stout platinum wire (about 0.02 in. thick) was bent into a loop, but without letting the wires touch



where they crossed. This wire was attached to stout copper conductors and heated by an electric current so as to destroy any combustible matter that might be adhering to it. A small piece of potassium chlorate, fused just previously, was then placed on the loop, and the wire gently heated by the current to melt the chlorate. The temperature of the wire was then suddenly raised by increasing the strength of the current, when, after a few seconds, the chlorate almost invariably exploded. It is, however, important to have the wire perfectly clean, as any chloride which may be adhering to it from a previous experiment seriously interferes with the success of the succeeding one. It is, therefore, necessary always to heat the wire by the current until all chloride had been volatilised before proceeding with another experiment. In several of the experiments the platinum wire was surrounded by an atmosphere of pure oxygen. The explosion of the chlorate in this manner is as marked as it is in the gas flame. Indeed, I have not been able to observe any appreciable difference in the readiness with which the chlorate explodes, whatever the manner of heating.

There can, therefore, be no doubt that pure potassium chlorate can be exploded, in the open, by heat alone. All that is necessary to bring about this result is to heat the chlorate rapidly so that it may reach the exploding point before too much of it has been decomposed.

I hope, at some future time, to bring the whole subject of the St. Helen's explosion before the members of this society. To-day I will confine myself to the following remarks concerning it.

In considering this subject it must be borne in mind that the explosion was one of the character of a gunpowder explosion, not a detonation such as would be produced by dynamite or picric acid.* That is, stated shortly, it was characterised by relatively small local effects, combined with very considerable effects at a distance. For example, although the floor of the store consisted of only one course of brick, set in mortar or cement, and was laid on a layer of sand about a foot thick, spread on the top of an old alkali waste heap, by no means a firm foundation, yet this floor was not broken through, or even seriously disturbed in any place. The whole floor had indeed been pressed down, in some places several feet, but no distinct crater had been formed. The bricks of the building itself had been scattered, but not much broken, still less pulverised. The trajectory described by the bricks proved that the explosion had taken place on, or near, the floor, that is in the most favourable position to form a crater.

DISCUSSION.

The CHAIRMAN said that any statement which came from Dr. Dupré on a question of this kind was entitled to the greatest respect. The ingenious experiment which he had devised was an important addition to their knowledge.

Mr. OSCAR GUTTMANN, after expressing regret that Dr. Dupré was not present, said he held no brief for Prof. Berthelot, but he had with him the original of his article, which spoke for itself, and he thought showed that Dr. Dupré had misread Berthelot's statements. He did not think M. Berthelot disputed Dr. Dupré's statements in the list; as a matter of fact, he said distinctly that an explosion of chlorate of potash could take place in the open by heat alone. The original passage is in translation as follows: "I have recognised that one can detonate it (chlorate of potash) under ordinary pressure in an open vessel and an inert gas by operating according to a method or rather a principle which I announced a long time ago as applicable in general to the reactions of exothermic systems." Again he said, "It is quite sufficient to place the chlorate suddenly into an enclosure previously brought and kept at a temperature much higher than that at which decomposition begins in order to get an explosion." He further explained in the same article the mode by which chlorate of potash could be exploded in the open by heat alone. He had no doubt that this experiment was at least

suggested by what Dr. Dupré had done at the time of making his report. Berthelot took a glass tube, heated it below redness, then took a glass rod, dipped it in molten chlorate, and put it into the glass tube about 10 mm. away from the bottom. The hot melted chlorate dropped off, and every drop that fell exploded, but the explosion was not communicated to the chlorate on the glass rod. That was certainly in the absence of a carbonaceous flame. He concluded by saying the explosion at St. Helen's seemed to have realised on a large scale the conditions he had described, but it seemed also to have been facilitated by the combustion of the wood barrels, as is the case by the flame of a combustible gas. It seemed clear, therefore, that Dr. Dupré was under a misapprehension in thinking that M. Berthelot attributed to him something which was not correct. He did not know what had caused the misapprehension on Dr. Dupré's part, because Berthelot stated quite frankly that he thought chlorate of potash could be exploded by itself, though he did not think the explosion at St. Helen's was due to heat alone. He was glad Dr. Dupré had promised to give a further paper dealing with the St. Helen's explosion, as that would relieve him of a task which he had intended to take upon himself, though with some reluctance. He would, therefore, not say more now about that occurrence except this, that there you had a magazine in which there were tiers of casks of chlorate of potash piled up eight and thirteen high, weighing about 2 cwt. each. One side burnt fiercely down to the ground and the chlorate in a molten state ran over the brick floor. The fire was communicated to the tier on the opposite side, and fired it from below. What more natural than that if the lowest row of barrels burnt, the whole would collapse and would fall with a series of violent blows on to the brick floor where the molten chlorate was. He believed that the intense white heat contributed, if not entirely, certainly 99 per cent. to the explosion, but there was that incentive, that priming of the blow on carbonaceous and probably charred matter mixed with chlorate which must have brought about the explosion, and as Berthelot himself said, even a small particle of carbonaceous matter would no doubt assist such an explosion. That was his contention on which he based his experiment in which he succeeded in showing that molten chlorate could be exploded on a hot brick with a broomstick.

Mr. J. W. KYNASTON said he was sorry to have to disagree with the conclusions come to by Dr. Dupré, but he could not accept the statement that chlorate of potash *per se* was explosive under any circumstances whatever, and he spoke after great experience in its manufacture and as a chemist engaged in the study of it. The circumstances of the explosion were not explainable by the theory of Dr. Dupré or by that of Mr. Guttman. Dr. Dupré's statement in the report was that a quantity of five tons of chlorate must have been heated up to the point at which it was caused to explode, but he did not believe that was possible. One must bear in mind that in the first instance the chlorate melted; as soon as it melted it spread itself about on the floor, it did not remain in one place where it could be heated up to the very high temperature suggested. Besides that, the experiments which had been tried with a view to ascertain whether chlorate of potash was explosive or not, had been to his mind conclusive. He might mention one, where the chlorate was heated under varying conditions in contact with thermit, a compound of aluminium metal and ferric oxide in fine powder, which in its reaction when set fire to gave a temperature estimated to be 3,000° C., or about the temperature of the electric arc. Chlorate of potash had been repeatedly treated at that temperature without any trace of explosion. They simply got a puff of the gas which did not exceed in violence or intensity that which they got by heating it over a lamp in an open crucible. That seemed to him conclusive. If it were once accepted that chlorate of potash was explosible by itself it would throw a difficulty in the way of manufacturers which they ought not to be subjected to unless the case were perfectly clear. It had to pass through the hands of dealers, consumers, and others, and if there was a danger of explosion under any circumstances whatever it threw great difficulties in the way of dealing with it. His own

* It is interesting to note that equal weights of gunpowder and potassium chlorate, on decomposition, produce practically equal volumes of gas.



explanation of the genesis of the explosion was this: there was in that store 156 tons of chlorate of potash, about 55 or 60 tons on one side of the central passage, and over 90 tons on the other; the 60-ton pile undoubtedly was seen to burn away, having taken fire at the top. The fire travelled gradually down through the casks and the whole mass of chlorate and the wood at any rate was burnt. When the first lot was burnt through, naturally a large quantity of it melted and ran over the floor of the building. No doubt it ran underneath the pile of casks on the opposite side and in all probability started the fire from the bottom instead of from the top. It was pretty certain that the barrels themselves must have taken fire from the intense heat of the building, but would burn more fiercely at the bottom where they were in contact with the layer of melted chlorate of potash. The only explanation consistent with all the circumstances was that the bottom rows of barrels were consumed and gave way and then the whole mass fell, probably with great violence, to the bottom, and the quantity of carbon in that mass was over five tons. The whole of those barrels were in a charred condition outside, and he believed that when this fall took place, by the attrition caused by the rapid fall, a large quantity of carbon dust was produced which blew into the atmosphere of oxygen which surrounded it. If that were admitted, all the circumstances of the explosion were explained and he could see no other satisfactory explanation. It was not an explosion of chlorate of potash at all, but of carbon in a fine state of division in an atmosphere of oxygen. If that were the true explanation the dangers arising from the handling of chlorate of potash were very much minimised; at any rate you were not dealing with a substance which *per se* was explosive. If that were the true explanation it was almost an impossibility that under any ordinary circumstances such conditions could be produced, and, therefore, this was not the dangerous substance to handle which many persons might be led to believe from what had been said there that evening.

Mr. M. J. HAMMILL said it was quite a new thing in chemistry to state that chlorate of potash was *per se* explodable by heat because, until the affair at St. Helen's, it was at all events undreamt of. It was rather too bad that the article should be branded as explodable on such a meagre experiment as that made by Dr. Dupré with a very small bead of chlorate in a loop of platinum wire. It would be interesting to study the results of some experiments on the effects of suddenly heating chlorate of potash which had been made by submitting it to the intense heat of a furnace produced by the reaction of "thermit" when ignited.

Experiment 1.—One grm. enclosed in platinum foil was placed on the "thermit," which was then ignited. The platinum fused and the chlorate decomposed without explosive suddenness.

Experiment 2.—The chlorate was enclosed in platinum foil and dropped into molten "thermit." Result same as in No. 1.

Experiment 3.—Crystals of chlorate, and small quantities of powdered chlorate, dropped into molten "thermit" produced a like result.

Experiment 4.—Five grms. of chlorate in a porcelain crucible were embedded in "thermit," which was then ignited. The crucible melted away and the chlorate rapidly decomposed, but not suddenly.

Experiment 5.—Molten chlorate was dropped on to fused "thermit." The chlorate decomposed with a puff, a much nearer approach to explosive effects than in experiments 1 to 4.

Experiment 6.—Two grms. of chlorate enclosed in a pill box of cardboard dropped into fusing "thermit" decomposed in a similar fashion to experiments 1 to 4.

Mr. T. ROYLE said "some years ago when he was interested in magic lantern work he used the ordinary mixture of chlorate of potash and manganese in the preparation of oxygen. After that he used a tube of chlorate of potash only, and never had any trouble or accident."

Mr. MACNAB said it was very desirable to keep to the point before the meeting. It was very difficult on the

evidence now brought forward to get away from the conclusion that chlorate of potash would explode by the simple influence of heat, without any carbonaceous matter around it. One gentleman said that under any ordinary circumstances it would not explode, which they would all subscribe to freely; but anyone who had experience of explosives knew that it was generally the extraordinary thing that led to the explosion, and the immense importance of having established once for all that certain things would explode was quite enough to make everyone take care and try to frame legislation and rules with a view to preventing such an accident as happened at St. Helen's. Of course they must not run away with the idea that chlorate of potash by itself was one of the most explosive or sensitive bodies, but they must not neglect the evidence of the experiments which Dr. Dupré and Berthelot had made. The same thing was said once about picric acid. For many years it was looked upon as a perfectly safe thing, but it was now put under the Explosives Act.

The CHAIRMAN said Mr. MacNab had struck the right note when he said that no amount of negative evidence could get round a positive experiment. The circumstances that led to a positive result might be subject to criticism, and it might be said that they would not occur in practice, but no one who had listened to Dr. Dupré's paper could get away from the fact that under some conditions chlorate of potash was *per se* an explosive. It was not a satisfactory argument to say that the bead was such a small one. No doubt if it were necessary a larger bead might be employed, but it was not every day that an experiment could be made on the explodability of a bead of 156 tons weight. It was well to bear in mind that substances of that kind under conditions which no doubt had never happened before, would explode, and the sooner manufacturers who made potassium chlorate recognised that, the better. It was no use saying it was hard on an article that had hitherto borne a blameless reputation that it should now be put under a cloud. It was much better to recognise all the facts. He was sure the members would all join in a vote of thanks to Dr. Dupré.

ERRATUM.—This Journal, 1902, p. 101, col. 2, line 9 from bottom, for "any" read "amyl."

Manchester Section.

Meeting held on Friday, February 7th, 1902.

DR. GROSSMANN IN THE CHAIR.

THE CHEMICAL CHANGES IN THE RIPENING OF CHEESE.

BY WALTER F. SUTHERST, Ph.D., A.I.C.

CHEESE is that portion of milk coagulated by rennet which has undergone more or less decomposition by the combined action of microbes and ferments.

According to the latest investigations, milk consists of water, fat, milk sugar, casein, lactalbumin, lactoglobulin, and mineral matter, this last composed largely of calcium phosphate. When rennet is added to milk the casein undergoes a change, one portion being precipitated and another remaining dissolved. The name given by Hammarsten to the first is paracasein, to the second whey-protein. This paracasein, with the fat and lactoglobulin which are held in the precipitated mass, together with a small amount of milk sugar, constitute the curd or basis of cheese; in the serum or whey remain the whey-protein, lactalbumin, and some of the milk sugar and salts. Since the curd has practically the same composition, no matter from what animal the milk is derived, or at all events contains the same constituents, the question might easily arise, "How is it possible that from the same basis such a number of varieties of cheese can be produced?" It is evident, then, that, during the after-treatment of the curd, some particular flavour-giving microbe is more favoured than others, and by its peculiar action, the taste and appearance of the particular cheese is obtained.



The freshly prepared curd is opaque, practically tasteless, insoluble in water, and whitish in appearance; whilst the ripe cheese is semi-transparent, has usually a strong taste and smell, is partly soluble in water, and yellow in colour. The cheese has undergone some fundamental change, and the passage of the fresh curd to the finished cheese is called the ripening process.

A final explanation of the ripening process is still wanting. Two agencies appear to be the chief causes of the ripening, viz., microbes and enzymes. Of these, the microbial action is the most varied, and on it probably depends the peculiar taste of different cheeses. In cheese ripening, the lactic acid bacilli, the cause of sour milk, play a part, but more important than these are the digestive or peptonising bacteria, which act on the nitrogenous substances of the milk, like the digestive enzyme pepsin. This class has been investigated thoroughly by Duclaux, who isolated them from Cantal cheese, and gave them the general name of tyrothrix. According to him these were the most active agents in breaking up the paracasein. A new phase in the study of the causes of cheese ripening was opened up by the discovery, in 1897, by Babcock and Russell, of an inherent milk ferment, which possesses the property of digesting paracasein without the aid of micro-organisms. This ferment, which they named galactase, shows strong resemblance to the pancreatic enzyme trypsin, as well as to the digestive bacteria usually found in cheese, so that these widely different agents together produce the same result. It had been suggested by Duclaux that a ferment similar to galactase, which he called casease, was present in cheese, but that it was of bacterial origin, being produced by a variety of the tyrothrix group. Babcock and Russell, however, proved that the new ferment was not produced by bacteria, and that, moreover, cheese could be ripened by its action alone, without the aid of micro-organisms. They succeeded in ripening, in chloroform, a cheese previously treated with galactase. That the micro-organisms take no part in the actual ripening process is, of course, absurd; and it must be admitted that, although certain substances exist naturally in milk, which are capable of peptonising the casein, it is the combined action of microbes, ferments, and light which bring about this change. It may happen that most of the peptonising action can be brought about by galactase alone, e.g., when the digestive bacteria are not present in large quantities; Frendenreich recently found that ordinary Swiss cheese did not contain many digestive microbes, their growth being retarded by the enormous quantities of lactic acid bacilli present.

Another agent in the ripening process, especially in soft cheeses, is the mould. Johan-Olsen, who has paid particular attention to these, finds that they are capable of ripening cheese alone, and he succeeded in obtaining good qualities of Gorgonzola and Roquefort by inoculating sterilised curd with various pure cultures of moulds obtained from these kinds. The moulds or fungi need air for their growth and find a favourable medium in the soft cheeses, which are not pressed and are often made flat so as to allow the air to act over a large surface. The quantity of lactic acid in these unpressed cheeses greatly assist the rapid growth of the moulds. The most important function of these fungi is the oxidation of the lactic acid to carbonic acid and water, thus destroying the acidity and giving more scope to the digestive bacteria.

It is the micro-organisms, present naturally in, or intentionally introduced into, the curd which determine the numerous varieties of cheeses. Every variety of cheese has its special bacteria and can be prepared by isolating certain dominant bacteria and placing them in the milk before renneting and then allowing to ripen under the conditions peculiar to the variety.

In the ripening the first constituent of the curd attacked is the milk sugar. The lactic acid bacilli begin as soon as the curd is moulded, and in a few hours completely transform the sugar into lactic acid, which remains as such during the rest of the time, excepting a portion which is neutralised by the ammonia formed. The amount of acidity at this stage has much influence on the final quality of the cheese.

There is very little change in the nitrogenous matter of the curd until the lactic acid fermentation is over, when by the united action of the agents already mentioned, it splits up into crystalline substances soluble in water. Duclaux was the first to isolate the various substances formed, and he showed that first of all an albumose intermediate between the paracasein and peptones—which he named caseone—was formed; this is next split up into peptones, which are later changed into crystallisable bodies, chiefly amido-acids from which leucine, tyrosine, glutaminic acid, diamino-acetic acid, phenylamido-propionic acid have been isolated. The final product of decomposition is ammonia, which is easily detected in ripe cheese. The milk fat does not change perceptibly, but it is supposed that a partial saponification takes place, by which fatty acids, especially butyric, and glycerin are set free. Although glycerin has never been isolated in cheese, still a larger amount of volatile free acids are found in cheese than in milk. These acids must have come chiefly from the butter fat present, though it is possible for butyric acid to be formed by fermentation from lactic acid. One hears occasionally that the total amount of fat is greater in the cheese than in the fresh curd, and the reason generally given is that fat is one of the decomposition products of the albuminoids. But although some fatty acids are formed by the decomposition of paracasein, it is hardly possible for true fats to be formed. It is probable that an error in the analysis gave too high figures, and the ether used in the fat estimation also dissolved some substances other than fat.

Whether the mineral constituents of cheese undergo any radical change during the ripening or not, is not known, and it is evident that their action would be very limited, and only of use during renneting.

The best explanation of the changes which the constituents of cheese undergo during ripening is by comparing the composition of fresh curd with that of ripe cheese. With this object in view a cheese was prepared for me at the Dairy Institute, Worleston, and from this samples were taken from time to time and analysed at the laboratories of the Agricultural College, Holmes Chapel.

The methods employed in the analysis were those suggested by Stutzer (*Zeitschr. Analyt. Chem.* 1896, p. 493), as follows:—The ash was determined by incinerating 10 grms. of the cheese in a platinum dish over the free flame till constant weight. For the remaining constituents Stutzer recommends grinding up the cheese with pure sand, so that a homogeneous sample can be taken. Moreover, the finely divided state of the cheese allows of its being more easily acted upon by the various reagents. I then mixed intimately 50 grms. of cheese with 200 grms. of washed and ignited sand, and from this portions were taken for the various estimations.

The water was found by heating 15 grms. of the sand mixture in a water oven till constant weight.

The dried residue from the water estimation was then extracted with anhydrous ether in a Soxhlet's apparatus, and the fat dried at 105° C. and weighed.

The lactic acid was determined by macerating 15 grms. with cold water and filtering, and titrating the filtrate with N/10 NaOH.

The total nitrogen was found by Kjeldahl's method, using 10 grms., the oxidation being carried out with a mixture of 100 parts of conc. sulphuric acid and 20 parts of phosphoric anhydride, together with a little mercury.

For the separation of the nitrogenous decomposition products, several methods have been suggested, none, however, based on purely chemical lines, owing to the lack of knowledge of the albuminoids, and each one merely consists in precipitating them in groups and estimating the total nitrogen in each. There are methods for isolating a few of these compounds, but till they can all be completely separated it is as well to leave them in their respective groups. The general scheme of separation is as follows:—The paracasein being insoluble in water, and the albumin rendered insoluble by boiling water, to remove these the cheese is treated first with boiling water and filtered. In the filtrate are the remaining nitrogen compounds, the albumoses, peptones, amido acids, ammonia, &c. Although the albumose and peptones dissolve in water, they are easily



rendered insoluble by the addition of various substances, among which tannic acid, phospho-molybdic acid, phospho-tungstic acid, trichloroacetic acid, have been tried with success. In the precipitate obtained in this way the nitrogen is estimated. The filtrate from this group contains the amido acids and ammonia compounds, and in this the total nitrogen is determined, and the amount found for ammonia deducted from this.

I used a solution of 120 grms. sodium phosphate, 200 grms. sodium tungstate, 100 c.c. dilute sulphuric acid (1:3) in one litre of water, being the one recommended by Stutzer and others. The nitrogen existing as albumose and peptones was determined by mixing 20 grms. of the sand mixture with 100 c.c. water, boiling in a porcelain dish for half-an-hour, and pouring off the supernatant liquid into a 500-c.c. flask, the same process being repeated with the same amount of water till 500 c.c. of liquid was obtained. After cooling, the flask was filled up to the mark, filtered, 200 c.c. of the filtrate taken, and, after adding an equal volume of dilute sulphuric acid, precipitated with 50 c.c. of the phospho-tungstic acid solution. The liquid was then filtered, the residu well washed with dilute sulphuric acid, and then estimated for nitrogen by Kjeldahl's method.

The amido-nitrogen could of course be estimated in the filtrate from the last experiment, but a safer way is as follows:—20 grms. were mixed with 150 c.c. water and well shaken in a bottle for 15 minutes, then allowed to stand for 15 hours, after which 100 c.c. dilute sulphuric acid were added, then 50 c.c. phospho-tungstic acid solution. The mixture was filtered and washed as before, and in an aliquot part of the filtrate the nitrogen was estimated in the usual way. From the nitrogen found the quantity existing as ammonia was deducted.

The ammonia-nitrogen was determined in 20 grms. of the sand mixture by distilling with barium carbonate (other alkalis, such as magnesia, caustic soda, baryta, cannot be used here, since they decompose the albuminoids present, setting free ammonia), the ammonia being collected in N/10 sulphuric acid.

By subtracting the amount of nitrogen found as ammonia, amides, albumose, and peptones from the total nitrogen, the nitrogen existing as casein and albumin is obtained.

The following tables give the rate of decomposition of the various ingredients, and the various changes during the ripening process of the cheese, beginning with the fresh curd:—

TABLE I.

	Date of Analysis.		
	July 10th.	August 23rd.	October 16th.
Water	Per Cent. 38·07	Per Cent. 37·36	Per Cent. 36·54
Acid.....	1·818	1·246	1·116
Fat.....	31·18	32·08	33·06

TABLE II.
Nitrogenous Decomposition Products as Nitrogen.

	Date of Analysis.		
	July 10th.	August 23rd.	October 16th.
Total N.....	Per Cent. 4·824	Per Cent. 4·916	Per Cent. 5·021
Casein and albumin	2·203	1·850
Albumose and peptones	..	1·586	1·288
Amides.....	..	1·120	1·848
Ammonia	0·007	0·025

In conclusion, I wish to express my best thanks to Miss Forster, Lady Principal of the Dairy Institute, Worleston, and Mr. F. H. Billington, one of my students, who helped me considerably in the experimental part of the work.

DISCUSSION.

Dr. HEWITT said that he had been asked at a meeting of the county council by an influential Cheshire agriculturist how it was that in Cheshire the old long-keeping cheese was no longer made to any extent, and that quick-ripening cheese had become so popular. At that time he (Dr. Hewitt) recommended the agricultural committee of the county council to appoint an expert at the Holmes Chapel College to investigate these matters systematically and report to the council, and Dr. Sutherst had availed himself largely of the opportunities afforded him for original research at the College. He looked forward with great interest to the results of Dr. Sutherst's work as likely to prove an immense gain to the cheese industry throughout England. It was absolutely necessary that science should, if possible, aid the farmer in any way by establishing with certainty the different flavours of cheese and its ripening qualities, and he hoped that Dr. Sutherst's investigations might lead to some such results which would be of great commercial value to this country.

The CHAIRMAN remarked that Dr. Sutherst was right in examining the intermediary products in the process of cheese-making. No industry could be carried out satisfactorily without adopting some scientific means of ascertaining what action was taking place during the intermediary stages and what was the final condition of the product. There was no reason why, by the application of scientific methods, it should not be possible to produce cheese in this country similar to foreign cheeses.

Newcastle Section.

Meeting held at the Durham College of Science on
January 30th, 1902.

MR. W. L. RENNOLDSON IN THE CHAIR.

THE ABSORPTION OF ARSENIC BY BARLEY.

BY S. H. COLLINS, F.I.C.

This investigation was originally designed to observe in what forms and in what way arsenic was absorbed by plants, and what influence, if any, the supply of phosphates had on this absorption; but the investigation had to be modified during its course owing to the unexpected occurrence of arsenic in the soil used. Whilst the experiment must, therefore, be considered in some respects a failure, yet many points of interest have occurred worth noting.

I propose repeating these experiments this season; one of the reasons for reading this preliminary note being to raise a discussion on the subject and obtain suggestions as to the future carrying out of this experiment.

A set of six 10-inch pots were used, being manured respectively with (1) Nothing; (2) Arsenious acid; (3) Arsenic acid; (4) Superphosphate; (5) Superphosphate and arsenious acid; (6) Superphosphate and arsenic acid. The arsenic being in all cases equal to 11 lb. of arsenic (As_2O_3) per acre, and the superphosphate equal to 170 lb. of phosphoric acid (P_2O_5) per acre. The pots were planted with tares and barley, the former reaped green and the latter thinned in July; the barley gathered in September and divided into (1) bottom half of straw; (2) top half of straw; (3) ears and chaff; (4) grain. Samples of soil being also taken after the close of the experiment. All were then examined by Reinsch's test, using all the crop and 100 grms. of soil, subliming the arsenic and comparing the crystals so formed with a set of standards which had been prepared from varying amounts of from nothing up to 5 grms. of arsenic, treated in exactly the same way as the crop.

The distribution of the arsenic in the plant was found to be as follows:—

In the six cases of green stuff there were four cases without arsenic and two cases with arsenic, viz., 0·4 and



0.5 mgrm. of white arsenic per pot. In the lower half of straw, five cases without and one case with 0.5 mgrm. In the upper half of straw, five cases without and one case with 0.7 mgrm.

In the threshed ears, five cases without and one with 0.7 mgrm. In the barley grain, all the six cases contained arsenic varying from 0.5 to 3 mgrm. of white arsenic per pot. All the six samples of soil contained arsenic (7 to 22 parts per million), there being no particular agreement between the amounts artificially added and actually found.

Averaging all the results, the soil contained 30 lb. of arsenic per acre to the depth of 8 inches, the grain contained 4 oz. per acre, and the rest of the plants $1\frac{1}{4}$ oz. per acre.

The superphosphate did not appear to have any definite action.

After these experiments were finished, another sample of the College garden soil was examined for arsenic and yielded amounts equal to 50 lb. of white arsenic per acre (to 8").

Pending the repetition of these experiments under better conditions, I propose to draw no conclusions, but that (1) soil may contain large amounts of arsenic without any suspicion of that fact; (2) barley grown on such soil may also contain large amounts of arsenic.

New York Section.

Meeting held at Chemists' Club on January 24th, 1902.

MR. CLIFFORD RICHARDSON IN THE CHAIR.

ON THE INFLUENCE OF INDIGO-RED IN INDIGO DYEING.

BY J. MERRITT MATTHEWS, Ph.D.

In view of the many differing opinions that appear to be current at the present time, concerning the relative values of natural and synthetic indigos in regard to their dyeing qualities, it becomes a question of considerable interest, both to the chemist and to the practical dyer, to investigate the differences, if any, which may exist between the two. Chemically considered, no distinction can be made between synthetic indigo, as prepared from coal-tar derivatives, and natural indigo, which is obtained from the raw vegetable product by processes of refining. These two bodies are identical in every respect, and hence must be classified together, but the unrefined natural indigo presents a somewhat different character, for, in addition to the pure indigo or indigotin which it contains as a chief constituent, there are also to be found several other substances ordinarily classified as impurities. As the claim has been made that these associated bodies have considerable influence on the dyeing properties of the indigo, it is worthy of careful consideration, for should such be the case, the present methods of using synthetic and refined indigo would have to undergo considerable alteration, in order to make them conform with the most advantageous conditions of dyeing.

Zaenker (Leip. Farb. Ztg., 1899), assuming the attitude of a practical indigo dyer, rather than that of a chemical theorist or experimenter, claims that synthetic indigo presents several disadvantages in its dyeing qualities over the natural indigo, and that many establishments, after a short trial, have abandoned the artificial product to return to the old method. He claims that these disadvantages are due to the great purity of the synthetic compound, a statement which would appear rather anomalous to a chemist. But we must bear in mind that the natural indigo contains three bodies, already alluded to, in addition to the indigotin; these are indigo gluten, indigo brown, and indigo red, and though they occur in only small quantities, it may be possible that their presence adds somewhat to the

good qualities of the indigo. This question, however, appears to be an old one, and extensive scientific researches have been made on this very point by chemists of acknowledged ability, at a period long before any comparison with synthetic indigo was thought of. Zaenker was evidently unaware of these researches, for he leads on to the statement that good results in indigo dyeing are only to be obtained when a certain amount of indigo red is present in the vat. He also makes the statement, to support this claim, that very pure qualities of Java indigo often fall below the dyeing standard of more impure varieties, and that the experienced indigo dyer will pick out those indigos, containing the highest amount of indigo red, as being the best; in fact, a well fixed indigo dye is not considered to be possible without the agency of indigo red. In the face of this statement, however, we have the contrary fact that, for several years past, it has been the aim of indigo dealers to refine their crude product as far as possible, in order to enhance its quality and value, and the indigo red is abstracted from the material at considerable pains and expense, being cast aside as an almost worthless impurity. This practice of refining is growing, showing thereby that the purified indigo is held in good favour. Schwartzberg and Schwartz, in 1837, in response to a prize offered by the Société Industrielle de Mulhouse, made a thorough study of this very question, and carefully examined the influence of the three substances above mentioned on the dyeings obtained in the indigo vat. Their experiments were of a very practical nature, and their results were decisive and final. It was demonstrated that both indigo gluten and indigo brown played no part in the dyeing process, acting in neither a beneficial nor detrimental manner; in fact, they were altogether indifferent substances in their influence on indigo blue. The indigo red, it appears, is a true dyestuff, being reduced along with the indigotin to a soluble form, and being subsequently fixed on the fibre in conjunction with the blue; but it was found that the beauty of the shade, instead of being enhanced by the presence of this red colouring matter, was deteriorated in proportion to the amount present, the blue colour becoming dull and cloudy as the quantity of indigo red was increased. Zaenker, in fact, admits that in properly dyed indigo, the red dyestuff is mostly removed from the fibre by the acid and rinsing baths to which the goods are subjected after being removed from the vat, and that the majority of this colouring matter can be recovered as a precipitate in these baths, and thus be used over and over again in replenishing the amount of indigo red in the original vat. This fact is hardly in keeping with the statement that the beautiful tone of the blue on goods dyed with the natural indigo is due entirely to the presence of the indigo red in the colour. As far as the fixing qualities of indigo red are concerned, Schwartzberg and Schwartz, from an extensive series of experiments, both in the laboratory and in the dyehouse, came to the positive conclusion that the presence of indigo red did not increase the fastness of the dyed colour. This question has been studied by other chemists at a later date, and all appear to come to the same conclusion. The assertion that dyeings, produced from indigo not containing any indigo red, possess the disadvantages of being uneven and badly crocking, appears to be either a mistaken conclusion or an unwarranted statement. From the very fact that the indigo red is mostly fixed on the fibre in such a loose condition as to cause it to be removed in the washing processes, is sufficient to demonstrate the absurdity of the idea that its presence renders indigo blue faster. As to the difference in tone obtained by dyeing with different qualities of indigo, it does not appear that the presence of indigo red is at all essential to the production of the highly valued shade of blue given by the most approved qualities of indigo, as chemical analyses of such samples have shown. The value of any indigo appears to be dependent upon its content of indigotin alone; so true is this, and so well has it become recognised by dealers in indigo, that analyses of this dyestuff, which do not differentiate between the indigotin and the indigo red, are considered as unsatisfactory as a basis for comparison of relative values. For one example containing more indigo red and less indigotin might be reported as of higher value than another, if both of these



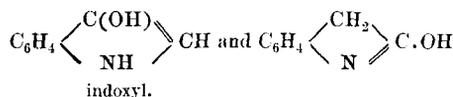
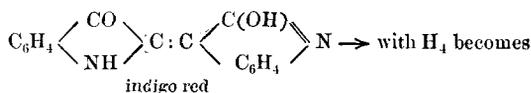
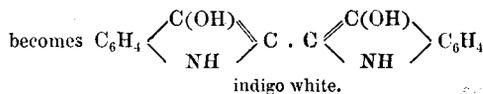
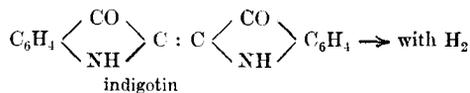
colouring matters are figured together, whereas a lower value as a dyestuff would actually be the case. It is also well known that some very inferior qualities of indigo contain a relatively high percentage of indigo red; some low grade African indigos, for example, contain as high as 8 per cent. of the red colouring matter; whereas the best qualities of Java and Bengal indigo rarely contain more than 2—3 per cent., and in some cases, even much lower. A comparison of such analyses, together with analyses of refined indigos, where the impurities (including indigo red) have been wholly or partially removed, leads us to the conclusion that the presence of the red colouring matter is in no wise essential to the good quality of a sample of indigo.

It has been stated that indigo red, beyond its mere colouring and fixing powers, has a distinct influence on the proper working of the vat itself. The fact is, indigo red is much more difficult to reduce than indigotin, and it is highly probable, in consequence, that most of the red body remains in the sediment in the vat, and does not come into action at all; and the idea that it may serve as a regulator in the vat has no foundation either in theory or practice. On the other hand, it has actually been noticed by several observers that under certain conditions the red dye is apparently converted to some extent into indigotin through the operation of the vat; though this conversion is by no means complete, the majority of the indigo red being transformed into brownish substances in the vat, the influence of which appears to be far from beneficial in regard to the beauty of the colour obtained. These observations have only been noticed with respect to certain vats, chiefly those which have been prepared for the dyeing of wool. In the ordinary cold vat, as used for dyeing cotton, there does not appear to be any marked conversion of the indigo red into indigotin. Another point to be observed in this connection is, that the indigo which is recovered from the acid and wash waters, and which is largely contaminated with indigo red (for it has already been mentioned that the indigo red is mostly removed from the fibre by these washings), yields a very inferior vat, and requires to be purified before it is advisable to add it to the vat again.

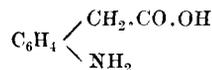
The fact that superior brands of indigo exhibit a peculiar reddish cast on the surface has been erroneously attributed by some writers to the presence of indigo red. A careful investigation of this phenomenon has led to the conclusion that the reddish or bronze-like appearance is due to a certain crystalline form of the particles of indigo, and consequently, is to be taken as a mark of high purity, and not as an indication of any red colour-matter. We may point out an analogous instance among the artificial dye-stuffs; many blue and violet dyes, when in a pure crystalline condition, exhibit a bronze-like metallic appearance on the surface; whereas impure brands, being amorphous in character, do not possess this peculiarity. The bronze reflection is brought about by the action of the crystals on the light falling upon them, and is a well known and thoroughly understood optical phenomenon, capable of the same explanation in the case of indigo as in the case of other dyestuffs. This same peculiarity to be noticed in the appearance of the dyestuff on the fibre is to be attributed to the same cause, that is, the crystalline structure of the particles of dyestuff held in the interstices of the fibre. As is well known, a crystalline structure is one of the best criterions of the chemical purity of a substance; hence, we would expect that the purest indigos (other conditions favouring crystallisation being the same) would exhibit this appearance most strongly. And this is indeed the case, for refined indigo and the synthetic product yield shades which are much redder in appearance than those obtained with the raw indigos, irrespective of their content of indigo red. In this connection it is interesting to note that the presence of indigo red is considered as detrimental in the preparation of soluble indigo extracts, and the manufacturer is careful to select only those brands known to contain a minimum quantity of indigo red.

As a crucial test, perhaps, in order to determine the influence of indigo red in indigo dyeing, we might refer to the facts to be observed in the dyings obtained with indigo red alone. The shades obtained with this colouring matter

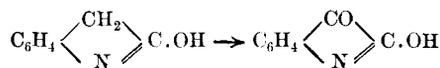
are far from pleasing, and instead of being bright and full, are dull and greyish in appearance, the actual shade varying from a reddish to a bluish violet. As to the fastness of this colour on the fibre, the shades obtained from the natural product do not appear to equal indigotin in permanence to washing; this defect, however, may be due to the large amount of other impurities necessarily present in these samples, as shades obtained from chemically pure indigo red prepared synthetically, showed a high degree of fastness perfectly comparable with that of indigo. A remarkable fact, however, is to be noticed in the operation of the indigo red vat. As time passes, it appears to undergo a change, and the colours dyed in it gradually become bluer in tone, evidently indicating the presence of indigotin. A greenish fluorescence in the vat is also to be noticed, and this, together with the fact that the colour is developed but slowly on exposure to the air, has led chemists to the conclusion that indoxyl is formed in the vat instead of indigo white, such as might ordinarily be supposed. In fact, Fasal (of the Gewerbemuseums, Vienna) has put forward the idea that indigo red, when subjected to the same conditions as indigotin, instead of being converted entirely into a leuco-derivative, is reduced to indoxyl; and from this fact, he concludes that the presence of indigo red has no effect on the dyeing of indigo blue. From a study of the structural constitution of indigo red, I am inclined to agree with the view advocated by Fasal; for we may compare the reactions of indigotin and indigo red towards reducing agents in the following manner:—



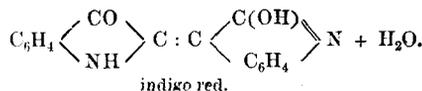
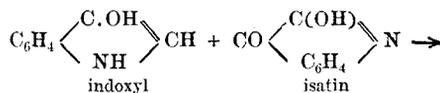
This latter substance is an inner anhydride of amido-phenyl-acetic acid:



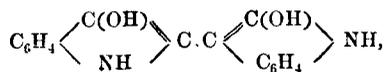
It may be more probable that this body suffers subsequent oxidation, and is converted thereby into isatin:



This appears to be directly in accordance with the observed fact that indigo red may be synthetically prepared from indoxyl and isatin, the combination between the two molecules being effected through the elimination of a molecule of water by means of a solution of caustic alkali, a reaction which can readily be understood by a reference to the following structural scheme:—



By reference to the above formulæ and reactions, it will at once be apparent why the reduction of indigo red is effected with so much more difficulty than that of indigotin. In the case of indigo red, there is required double the amount of hydrogen for the reaction; and the molecule is split into two separate and distinct portions, whereas with indigotin the only work which is done is the change of a double unsaturated linking to a single bond by the direct addition of two hydrogen atoms, a reaction which is known by all chemists to be comparatively easy, as far as the force of chemical affinity is concerned. There is no alteration in the type of the molecule, but in the reduction of indigo red above given there is a complete rupture between two of the carbon atoms. That portion of the indigo red which is reduced to a leuco-body, and is subsequently re-oxidised to the violet dyestuff, probably undergoes a reduction similar to that of indigotin, and the leuco-body may have the formula :



or possibly the tautomeric formula :—



which would correspond to the tautomeric form of indigo white. Which of these formulæ is the proper one to be assigned to indigo red could no doubt be determined through a study of their acetyl derivatives; the former one would yield derivatives containing two and four acetyl groups, whereas the latter would yield derivatives containing only one and two. However this may be, the leuco compound of indigo red appears to differ from that of indigo blue by its instability in solution, in the presence of reducing agents, and is further decomposed into indoxyl and isatin as above indicated.

From a consideration of these reactions we would naturally expect to find that indigo red would differ very materially from indigotin in its behaviour towards sulphuric acid, in the preparation of sulphonated derivatives. As is well known, indigotin itself is readily converted into a sulphonated product, which forms a soluble dyestuff known as indigo carmine; I have already remarked that for the preparation of this material, it is endeavoured to select those varieties of indigo which contain the least quantity of indigo red, as better results are so obtained. If the sulphonic acid of indigo red itself is prepared, it will be found that the colours which may be dyed with it are not at all permanent, being mostly removed from the fibre by a mere washing with water; hence we can readily understand why the manufacturer tries to avoid as far as possible the presence of indigo red in the material from which the indigo carmine is to be made.

The conclusion which is inevitably forced upon us by a consideration of all the facts above stated is, that the point which has frequently been made in opposition to the use of synthetic indigo instead of natural indigo, viz., that the former does not contain any indigo red, has evidently not been well established. Even if the presence of indigo red were essential to the production of good and fast colours, its absence in the synthetic product could easily be remedied by introducing it in any amount desired, for indigo red can be obtained in large quantities as a by-product from the refining of natural indigo. It is also to be recovered from the acid wash waters in indigo dyeing, mixed with varying quantities of indigotin. And even in addition to this, it has been prepared synthetically in a pure condition, and may be purchased as such in commerce. I fear that the indifferent results obtained by several experimenters in their comparison of natural indigo with pure indigotin (either synthetic or that prepared by refining the natural dye, as I can see no appreciable distinction between the two) has been due more to a lack of the proper conditions of dyeing than to a deficiency in the quantity of indigo red. If there is any appreciable difference between the dyeing qualities of the pure and

raw indigos in favour of the latter, the cause, I am certain, will be found to be something quite different than the presence of indigo red in the vat.

THE PRESENCE OF COPPER IN POWDERED DRUGS AND CHEMICALS.

BY E. H. GANE.

From time to time, the author has been somewhat puzzled over the origin of small amounts of copper which have been detected in various powdered drugs and chemicals. Traces of copper have been found by investigators in the ash of various drugs, and have generally been attributed to absorption of copper by the plant from the soil, notwithstanding the fact that the place of growth of the drug may have been far removed from any known source of copper.

That this is not the source of the copper in all cases is shown by the fact that the metal could not be detected in the whole drug, and in the case of chemicals, the process of manufacture precluded copper contamination. As the amount of metal found was extremely small, and its occurrence quite casual, no detailed effort was made for some time to trace the source of the contamination, it being attributed either to careless handling or to the use of copper utensils for transferring the powder from the grinding mill.

The rejection, however, of several consignments of powdered ammonium carbonate, which had developed a blue mottled appearance, rendered it necessary to ascertain definitely the origin of the copper, so as to avoid further trouble from this cause. The search was not without difficulties. Every possible source of copper was eliminated, such as brass work around the mill, and close watch was kept over the grinding and sifting, so as to avoid contamination during these processes. The use of brass sieves and copper or tinned copper scoops was also abandoned in the milling room.

In spite of these precautions the same trouble would crop up at intervals, and it was not until attention was drawn to the driving belts that the source of the copper contamination was definitely located.

The various sections of a driving belt are riveted with copper rivets or stitched together with copper wire, and as the leather wears down from constant passage over the pulleys, the rivet heads are gradually raised flush with the surface of the belt, and are slowly ground down by passing over the pulleys, minute particles and sometimes fair-sized fragments of copper being thrown off from time to time.

The casual occurrence of the copper in the powders is easily explicable when the small size of the hopper feeding the mill is taken into account. Replacing the leather belt by one made of rubber has obviated further trouble.

This note is presented in the hope that it may save some manufacturers from similar trouble, and prevent inaccuracies on the part of investigators, particularly when examining the constituents of the ash of vegetable drugs.

SULPHUR BLACKS, AND THEIR ACTION UPON CELLULOSE.

BY LOUIS J. MATOS.

The discovery of the sulphur colouring matters dates from the success, in 1873, of Croissant and Bretonneus, who produced what is now known commercially as Cachou de Laval, and which discovery has been regarded as the prime starting point from which the subsequent sulphur colouring matters have been developed. It is not my purpose to review the details of the several important discoveries made along that line of research, as such has been very fully recorded in the pages of our journal, but to draw attention to a few main points, bearing upon the practical application of this now extremely important group of cotton colours.

The manufacture of all the sulphur colours is carried out on generally the same principle, that of making a "melt" of certain nitrogenous organic substances with caustic soda, sodium sulphide, and free sulphur. This fusion is conducted in large cast-iron pots, supported in



brickwork, and suitably inserted over a fire. The duration of the fusion depends upon the nature of the raw product, but in nearly all cases it is stopped when a test sample of the melt is found to dissolve completely in water. Some of the commercial products are ready for the market without further treatment, while others are subjected to a subsequent baking in large pans suspended one above the other in a large externally heated oven.

Depending upon the particular process of treatment, and governed by the raw materials, the finished product may be dense and tough, sometimes hygroscopic, whilst, in other cases, it may be porous and brittle, resembling coke.

The technical importance of these new Blacks to the textile industry is their great value in producing shades of the utmost intensity and with a minimum of expense, and combining to a remarkable degree the qualities of extreme fastness to exposure to weather, light, ordinary washing, soaping, acids, and alkalis. Of course these qualities are relative, as all the black sulphur products are not exactly alike in their several properties.

Compared with the ordinary types of Blacks for cotton (excluding those obtained from logwood or other similar sources), we find that, in the sulphur Blacks, we have products yielding shades that more nearly approach those obtained from aniline, and which are, in many respects, equally as fast. We further find that the practical details for producing a high grade black are much simpler than for the same depth of black by the aniline process.

In comparison with the ordinary direct dyeing Blacks, it is found in practice that the dyeings obtained from the sulphur products are always superior in point of fastness; and that when compared with the so-called diazotizing and developing Blacks, there are a number of details in connection with the latter to be carefully watched, in order to guard against off shades, unevenness, and lastly, tendering of the fibres, defects not prominent with the Sulphur Blacks.

This latter complaint has been also made in reference to the Sulphur Blacks, however, and the present paper is intended to direct particular attention to this subject.

As Sulphur Blacks are of importance only to the cotton dyer, the general details as followed in practice will be briefly outlined. The dye bath is made up with a sufficient volume of water, to which dissolved dyestuff is added, together with sodium sulphide—in some cases caustic soda also—and always common salt or Glaubers salt, to increase the density of the dye bath. The material to be dyed is then immersed, the temperature gradually brought to the boiling point, and maintained for about one hour, during which time the cotton is worked, in order to ensure level or even shades.

Other classes of the Sulphur Blacks do not require the addition of sodium sulphide to the dye bath, but the addition of a small quantity of soda ash is regarded as an advantage.

Thus, we are likely to find in the dye bath, besides the dyestuff, one or more of the following substances:—Sodium chloride; sodium sulphate; sodium sulphide; caustic soda (sodium hydrate); sodium carbonate; regarding the action of which, upon cellulose, in the form of chemically cleaned cotton threads the subjoined notes may be of interest. All the experiments were made parallel, and under strictly the same conditions, and upon the same material. Test samples were frequently taken and subjected to tension in the dynamometer, to ensure regularity and uniformity throughout each series.

*Action of boiling aqueous solutions on Sulphur Black (St. Denis Black, B).—*Ten grms. of fine cotton was boiled for one hour in a simple 1 per cent. solution of the black, loss of water prevented by means of a reflex condenser. After boiling and washing the yarn, drying under normal conditions without the aid of heat, no loss of strength was noticed in an average of 30 tests.

*Action of dilute solutions of sodium chloride.—*Same apparatus, strength of solution, time, &c.:—27 tests; loss 0.47.

*Action of dilute solution of neutral sodium sulphate.—*Only 5 tests were made with this salt, the results of which showed no action on the thread.

*Action of dilute solution of sodium sulphide.—*The commercial crystallised article was used for this series of tests. Solution, 1 per cent. strength. 24 tests were made. Normal yarn, 100; average of 24 tests, 94.2. Maximum, 98.3; minimum, 88.56.

*Action of dilute solution of caustic soda.—*One per cent. solution. One hour boil. Yarn washed and dried at normal temperature. Average of 21 tests; no practical loss.

*Action of dilute solutions of sodium carbonate.—*One per cent. solution. One hour boil. Average of 14 tests; no loss.

From these tests we are led to conclude that there is some slight loss in strength of the material dyed, but then it must also be remembered that the treatment received by similar material in actual practice would not be nearly so severe, and that the loss of strength of the dyed material would be very much less.

Operations subsequent to dyeing, as applied to the Sulphur Blacks, may be only washing and soaping, or a "fixing" in a special bath containing certain metallic salts in solution, usually in the presence of some acid. The object of fixing as applied to those sulphur colours that require it is to cause a deposition of the black colour base on the fibre substance. When such dyed and "fixed" fibres are examined under the microscope, however, no evidence of insoluble particles are discernible, but we are safe in assuming that such deposition is the case in view of the well-known reactions of the Sulphur Blacks when in solution.

The fixing baths, as usually made up, contain as a maximum, five per cent. of bichromate of potassium or sulphate of copper; sometimes mixtures of these two salts are employed, in which case the combined amount rarely exceeds six per cent. As a rule, one and one half per cent. to four per cent. of sulphuric acid, or three to six per cent. of acetic acid is used, according to circumstances, all calculations being upon the weight of the cotton. The temperature of the bath is usually kept at 75° C., and the duration of the immersion from one quarter to one half hour.

The influence of this fixing bath upon the black as dyed is to cause it to become almost absolutely fast to the most severe milling, and unless insufficiently washed before fixing will in no instance stain adjacent white material.

The action of the fixing bath upon the fibre substance is of importance. Owing to the character of the ingredients used, we might infer that some distinctive action would take place, but this does not happen.

A series of tests were made upon clean cotton yarn; same yarn, dyed; same yarn, dyed and fixed; and the loss in strength, due to the subsequent fixing, was inappreciable.

The action of the chrome fixing bath, however, when allowed to act for several hours upon either dyed or undyed cotton, has a marked influence upon the strength, but when the immersion is only one half hour at most, and at a moderate temperature, no loss was recorded.

When objections have been raised to the loss of strength suffered by the dyed yarn in cases where it has been "fixed" in the manner described, this loss has been traced directly to insufficient washing after fixing, and then when sulphuric acid was used.

Summing up the observations, we note that the several components of the dye bath, either alone or in combination, have no appreciable effect upon the cotton fibre; that the subsequent "fixing" bath, or its several constituents, is likewise free from action, when used at the usual temperature of 75° C.; that failure to wash the dyed and fixed material thoroughly, thereby allowing traces of acid to remain in the fibre, is a cause of fibre weakness; and it has been practically demonstrated, upon large scale tests, that where ample washing was done, the dyed and finished material had lost none of its original strength.



Nottingham Section.

Meeting held at Burton-on-Trent on Wednesday,
January 29th, 1902.

MR. LEONARD ARCHBUTT IN THE CHAIR.

EMERGENCIES IN VITRIOL WORKS.

BY F. J. R. CARULLA.

The subject of accidents deserves very careful attention on the part of all who have charge of works if they wish to carry them on with economy. One man, who has the knowledge of some small detail, that in actual practice has proved to be of great importance, may keep a works going that another man without that knowledge would have brought to a standstill.

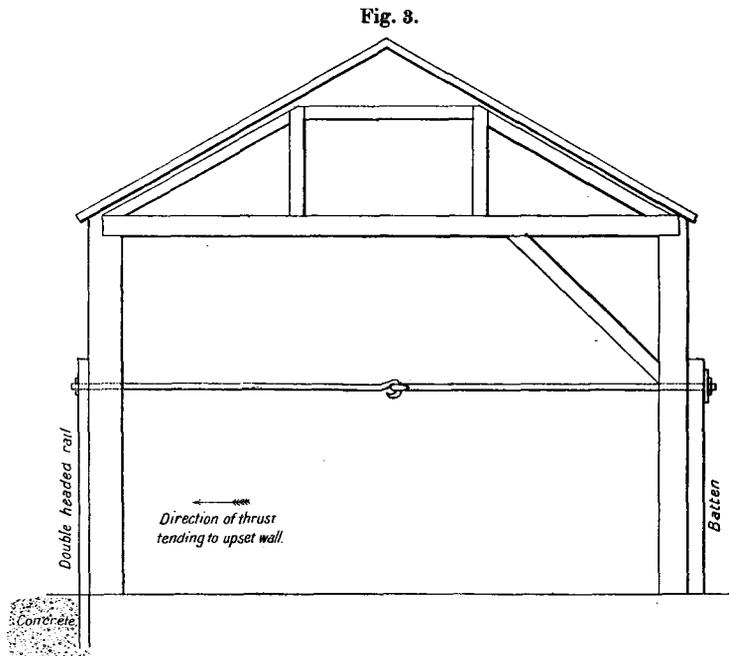
In the manufacture of oil of vitriol by the chamber process, when conducted on a small scale, much ingenuity is needed to diminish the ruinous cost of repairs and renewals. These cannot be avoided, but the periods between their recurrence may be lengthened by constant watchfulness and skill.

A chamber, which on one occasion seemed destined to come down because several of the joists that carried the bottom began to crack, was very quickly made safe and stronger than it was originally by means of a simple device. Jury joists were put by the side of the defective ones, and iron tie rods as shown in Fig. 1 were fixed through holes bored in the side bearers or baulks, a sufficient number being used so as to allow of one set to be taken down at any time without danger to the structure. These rods could thus be examined at intervals, and any found worn replaced by new ones. It will be readily perceived that iron would be acted upon very rapidly by moisture so near a vitriol chamber. This corrosive action is well illustrated by an iron rod passing through a mass of brickwork, and on

so arranged that one can at any time be taken out for examination without danger.

The subject of the corrosion of iron by sulphuric acid is also of interest in other respects. An iron tank used for carrying about oil of vitriol must not be left with the dregs of the last load in it if it is to remain idle for any length of time.

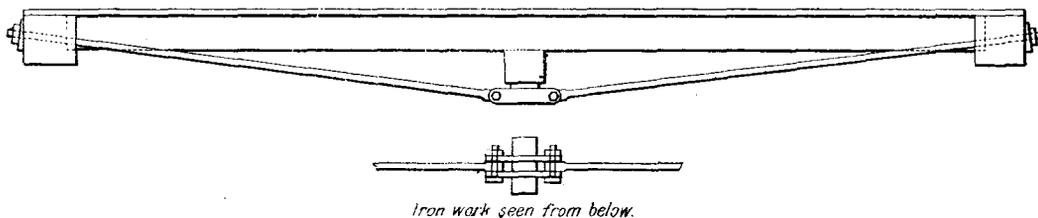
The action of acid on the foundations of a retort house made it necessary to renew a wall very frequently. At a



time when it was inconvenient to build a new one, it was very successfully kept within bounds by means of a number of double-headed rails, each held in position by a tie rod going through the building (Fig. 3). The arrangement acted so perfectly that it was left standing for many years.

Concrete walls, as recommended in a recent issue of the "Journal of Gaslighting,"* might be frequently employed with advantage in chemical works. At any rate, the lower

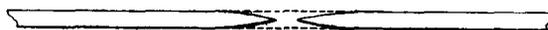
Fig. 1.



which some reliance had been placed, whose continuity was completely destroyed in the manner shown in Fig. 2.

From such facts it will be seen how necessary it is, when designing any structures, whose stability depends on iron stays or rods passing through brickwork or through wood

Fig. 2.



if there is the possibility of their ever coming in contact, with acid, to have them always in duplicate, or at any rate,

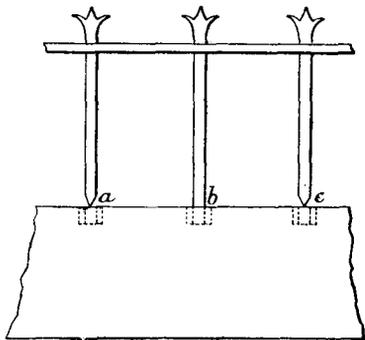
part of cast-iron columns might often be effectively protected by so casing them. The use of lead for this purpose is only permissible where space forbids the more massive concrete covering, and especially is it undesirable to use lead if the column is likely to be subjected to the action of moisture or weak acid. How powerful an action is set up may be seen in iron railings that have been fixed to stone walls by means of lead. Such railings become completely worn through at the junction of the two metals, unless indeed they have been carefully protected by frequent painting.

* Jan. 14, 1902, pp. 88-9, article "Reinforced Concrete Construction."



A consideration of this circumstance might seem to condemn the practice of dipping the heads of iron nails in molten lead when required for fastening the projecting lugs from the chamber sides to the wooden uprights. No doubt corrosion of the iron is set up within the wood, but it is probably not so active as it would be if the naked iron head of the nail were exposed to air and moisture when in contact with the leaden lug that it holds.

Fig. 4.



The experience with ordinary brick walls certainly condemns them for vitriol works. Blue bricks, although more costly to begin with, are far and away cheaper in the long run. Good blue bricks will stand such actions as those mentioned and be none the worse after 30 or 40 years' time. The only thing is the question of the joints. Ordinary mortar will be equally acted on whether it is placed between common or between blue bricks. A mortar or cement made of boiled tar and sand if used with blue bricks makes a wall that will stand any such corrosive actions as those that we are considering.

Ordinary mortar seems to be much affected by the gases given off from ammoniacal liquor, *i.e.*, gas liquor during a storm.

A chamber that was threatening to lean over was very effectively kept vertical by means of long rick poles. Such a device should not be despised because of its simplicity.

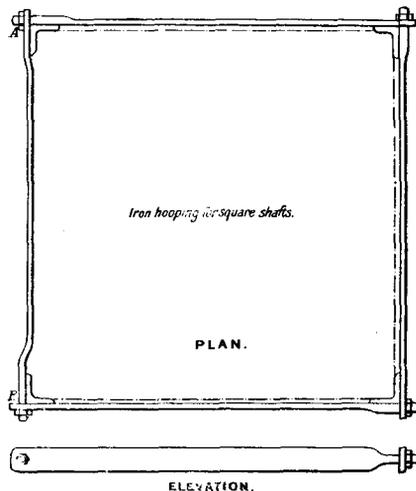
The occasional shaky condition of chimney shafts is one to which those in vitriol works must be liable, especially where the escaping gases from the chambers are sent into them. One may therefore refer to the subject of binding or hooping such shafts, which is sometimes done on incorrect principles. For square shafts the method shown in Fig. 5 is the best to employ. It will be seen that the hoops are made up of four flat bars, each having a hole at one end, and the other end being drawn out so as to form a bolt, which is fastened to the next bar by a nut. Such a hoop can be tightened up better than if made in two halves. With angle irons at the corners running up a considerable height, such hooping will make an old chimney almost better than it was originally, assuming that it has remained perpendicular. The angle irons at the corners, of course, keep away the hoops, if made of straight bars from the face of the chimney. It may be desirable that they should lie against the brickwork, in which case the component bars should be bent as shown at A B (Fig. 5). When this is done the bars should be stronger in proportion than if made straight.

Chambers that are exposed to all weathers may have to resist the whole force of a storm, and except when very new, not always successfully.

Considerable gaps in the chamber sides may be closed temporarily by so simple a means as pieces of half-inch board held against the face of the lead and nailed to the uprights by strips of wood. A repair like this, however, can only serve a very temporary purpose, but one that will stand a longer time may be effected by covering the wood, before putting in place, with thin lead sheet, say, 3 or 4 lb. to the square foot. This might be kept up for a comparatively long period if properly luted.

The subject of lutes and cements that will stand the action of acids is one of great importance. Mortar or any other binding material that happens to be handy will be sometimes used in the most undesirable places. The bricks that protected the sides of a square leaden tunnel to carry

Fig. 5.

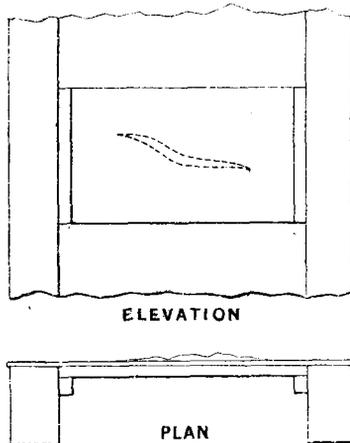


away the gases from a kiln would not hold together when it was found that fireclay was used to lay them with. Plaster of Paris was thought of, and it made a more stable joint than any cement previously tried.

This success led the writer further to extend the use of an insoluble sulphate on another occasion when a chamber began leaking at the bottom. Sulphate of baryta, which can be obtained very finely ground and at very little cost, was tried, a few handfuls being thrown into the chamber; the leak was readily stopped.

Having found sulphate of baryta thus useful, it was further applied for stopping leaks from concentrating pans when such occurred, although its employment to be successful in these cases requires great discretion, or clearly if too large a quantity of the material is thrown

Fig. 6.



into the acid lead concentrating pan, the bottom of which is in contact with hot iron plates, the lead may quickly be melted if a large heap of "barytes" has accumulated in any place, and instead of mending matters they may be made very much worse. Evidently it depends on the cause of the leak, whether such a method of ever temporarily stopping it is applicable or not. Nevertheless, in most



cases the flow of acid through a crack will be sufficiently arrested to make it worth while always to have a supply of sulphate of baryta in case of accident.

It is very difficult to say beforehand how a lead pan is going to fail. One of the most recent cases that the author has had occasion to observe was due to a crack in the side wall, which allowed some nitrous gas to get to the outside of the pan. Its action made quite a groove in the lead that soon brought the usefulness of the pan to an end.

In connection with this matter of lead pans for the concentration of chamber acid to B.O.V., it may be noted that very thick lead is still sometimes employed, reaching the thickness of 30 lb. to the square foot. Pan after pan has been known to rapidly fail when using such lead, blame being thrown on the manufacturers of the sheets. Such blame may have been falsely directed.

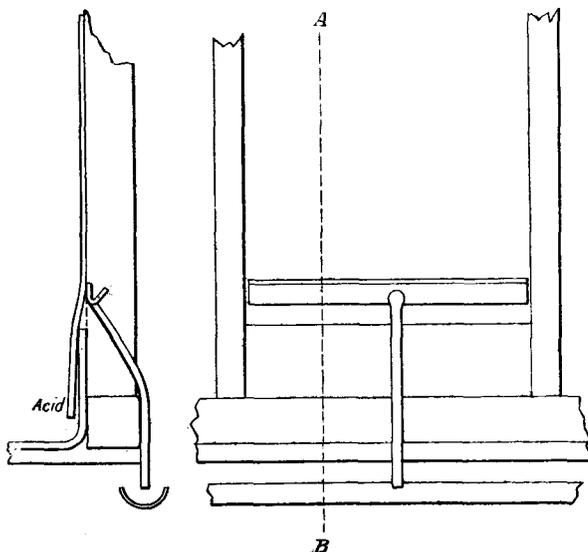
It is obvious that with a poorly conducting metal like lead, and one melting at so low a temperature, the heat may not always get conducted away from a thick sheet with sufficient rapidity to ensure its safety from fusion. At any rate, experience proves that pans of 10-lb. lead are quite thick enough for all necessary purposes. They last longer than the thicker ones, and are altogether easier to manipulate and put into place.

There is one respect, however, in which the thicker pans have the advantage. This is that the sides hold up better; they keep up of their own accord. Men accustomed to the putting up of such pans, when changing to thin ones are apt to overlook the ready means at hand for providing for the falling over of the thinner lead under unforeseen pressure. Thus the side may gradually fall in, perhaps in some dark corner, the acid flowing out, and the pan being declared leaky when really perfectly sound. This precaution is taken by simply attaching lead strips here and there to the top of the pan and bringing them over the supporting walls.

Some extraordinary results are produced by very small pinholes in the bottom of a leaden concentrating pan. Such a hole may just allow the acid to weep through, which will, nevertheless, act on the iron plate underneath. This action being continued, a hillock of sulphate of iron sometimes forms that gradually lifts the lead up, enlarging the hole, the leak then being discovered. A formation of this character was noticed a short time ago that had a diameter of six inches, and was not less than one inch in height at the centre.

Reference has been made to chambers that are exposed to all weathers. It may be thought that such chambers should have their sides and ends burnt to the bottom lead, and, theoretically, it would no doubt be the best

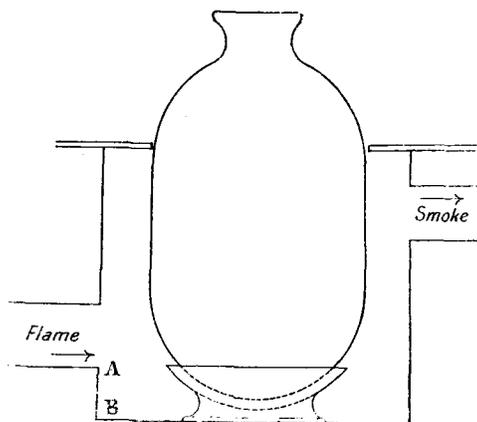
Fig. 7.



thing to do. Probably experience would prove that this supposition is wrong, for no doubt the shaking of the sides by the wind would be communicated to the bottom if all were soldered together, and leakages of the acid would be more frequent than is now the case.

The consequence of the usual arrangement, however, is that the rain that falls against a side or end of the chamber gets into the bottom acid, usually not a very serious matter. During a period of excessive rain, however, the author has known a most provoking fall in the strength of the acid to occur. To prevent the recurrence of this he has devised an arrangement of channels as shown in the figure which should answer the desired purpose. A channel made of thin lead is placed between each pair of

Fig. 8.



uprights, and extending from one to the other is burnt to the side of the chamber just above the top of the dish containing the acid. From the centre of the channels, which are closed at each end, a pipe, also of lead, leads away the water that comes down the sides. An iron gutter into which the various pipes flow carries the water to a convenient place.

Where comparatively small quantities of oil of vitriol have to be rectified the method is still employed of using retorts, against the naked sides of which a coal flame is allowed to play. It is almost incredible that such a process can be conducted with safety, and yet there is very little danger when the furnaces are constructed on correct principles. The retorts are placed on cast-iron saucers, each in its own compartment of brickwork, which is connected by a flue with its furnace so that the retort is exposed on all sides to the heat. Now in the event of a breakage, the space from the floor of the compartment to the top of the furnace flue must first fill with acid to the height A B before any can come out in the liquid form by way of the flue through the furnace door. This gives the attendant time to get out of the way, as fumes, of course, come out immediately when a breakage occurs and give him warning. When the acid reaches the point A it flows out along the flue, then on to the hearth, and into a gutter running along the front of the furnaces, by which it is led away into a sunk cistern. But everyone will ask what becomes of the acid left in the compartment and that does not run out in the way just now described? Well, it is simply absorbed by the brickwork, with which it plays havoc.

This is the weakest spot in the whole arrangement, and the author has thought that a cast-iron pan to form the bottom of the compartment from which the acid could eventually be siphoned would be the true solution of the difficulty, which he offers knowing that the process as described is still in use.

Before concluding, he would urge the importance of having everything in a works as much as possible of standard sizes, as a means of quick repair in case of accident. This is a point of such importance in this connection that it



cannot be too often repeated. A flange from the scrap heap may save the situation in a works conducted on this principle, when the very same accident might cause a serious delay in another works where it is disregarded, although the store might be full of new flanges of many kinds and sizes. The manager will frequently have cause to be thankful even if he only follows the rule partially.

The chief object of this paper has been to show how vigilant everyone should be, who is in any way responsible for the stability of structures of whatever kind they may be. The recent case at Belfast shows what can happen in a textile factory, but the vigilance necessary in such places is small by comparison with what is required in chemical works where corrosive actions of the nature described may be set up. The sword of Damocles indeed impends over the chemical manager under such circumstances, and it is well now and then to be reminded of possible danger so that it may be averted.

DISCUSSION.

Mr. W. G. TIMMANS concurred with Mr. Carulla in recommending blue bricks; common bricks were of very little use in chemical works. In regard to chimney shafts he had seen one about 80 ft. high that was 14 ins. out of the perpendicular straightened very easily by steeplejacks in a few hours. He had found lead sulphate a good thing for stopping leaks in lead acid containers. Sulphate of baryta as recommended by Mr. Carulla was probably also good. The leakage of acid concentrating pans was a very troublesome thing. A pan would fail and when cleaned out no defect would be apparent until the plumber would locate a pin-hole so small that it seemed insufficient to account for the damage done. He had expected some reference in the paper to personal accidents. The remedies used in works are not always those approved by the doctors. A case in point was when once he had occasion to send two men to the infirmary, who through the bursting of a retort had been splashed with oil of vitriol of 1.8 sp. gr. He used lime water and oil, but at the infirmary they applied a weak solution of carbonate of soda to the wounds. Again there were the occasional cases of suffocation by gases, against which it was so easy to be prepared. He thought it would be a good thing if a code of rules were drawn up by competent persons for use in all such emergencies.

Mr. J. O'SULLIVAN asked if lead in the chambers gets affected locally. He asked this because some years ago in connection with a lead water-cistern pinholes appeared in various places, which he was disposed to attribute to electro-chemical action due to impurities in the solder or in the lead itself. He had cut pieces out of this lead, having drops of solder upon them, and kept them in a closet cistern for two and a half years, but he could not see that the long immersion had produced any effect. The question why acid attacks lead in any special place is one of much interest to all who have to do with this metal.

Mr. F. E. LOTT commented upon the general importance of Mr. Carulla's paper to all interested in manufactures—breweries as well as chemical works. Reference had been made by Mr. O'Sullivan to the local action of lead. He could give an instance of the copper lining of a tank reacting with an inferior solder that contained too much lead and too little tin. The tank was filled with ordinary brewing water and the electro-chemical action set up was such that in 48 hours so much sulphate of lead was produced that 3 oz. were scraped off from a space 12 ft. long by 2 in. wide. In regard to what had been said about accidents, he thought the Society of Chemical Industry might, with great advantage, form a committee and draw up a short series of immediate remedies for use in the various works in which the Society was interested. Such a code, printed and hung up in a conspicuous place in the particular works, would be of the greatest value. He referred to the St. John's Ambulance Classes as having been of immense advantage in Burton and elsewhere.

Mr. ARTHUR SHEARER said he should like to support the last speaker's statement in regard to accidents. Men so rely upon the managers for instructions that it should be upon their conscience to be able to aid them in cases of

need. He also agreed with Mr. Timmans in his statement as to the value of compressed oxygen for suffocation cases. He had seen a man overcome by CO₂ in a carbonator brought round in a marvellous way by such means, a cylinder of oxygen being ready at hand. Olive oil and lime water, made into an emulsion, in cases of burns, and soap suds, in cases of scalds, he had found to be useful remedies.

Mr. JOHN WHITE said, in regard to the question of burns with acids, that an emulsion of equal parts of linseed oil and lime water, a remedy well known as Carron oil, was the best to apply. He always kept it in stock.

Mr. W. A. S. CALDER said he thought that either linseed or olive oil might be used. He had tried with beneficial effect the addition of a small quantity of ammonia, about $\frac{1}{2}$ per cent., a quantity that allowed the emulsion even to be applied to the eye. The linseed oil should be raw. Compressed oxygen was useful in cases of "gassing" by H₂S and CO, as well as CO₂, in fact, in accidents with almost any gas. The oxygen seems to bring the sufferer round in an incredible way. He would also emphasise the necessity for only considering an emergency remedy to the plant as a temporary and not a permanent one.

The CHAIRMAN said the discussion seemed to have turned on the question of personal accidents. It appeared to him that the best way of dealing with an accident from sulphuric acid would be in the first place to use water in large quantities, so as to wash away the acid as quickly as possible. Still better, if this could be done with lime water. It seemed lamentable that there is not in every works a code of rules hung up, as suggested by Mr. Lott. He thought that such codes were already obtainable.

Mr. CARULLA, in his reply, said that it would be very gratifying to him if the discussion should lead to the preparation of special rules for the different works, as suggested. What was applicable to one works was needless in another, and the quicker an instruction could be found the more likely it would be to prove of value. In regard to the localisation of corrosion in lead, there is no doubt that it does occur, and it can only be due to impurities. Notwithstanding what has been said about getting the best results with lead containing a certain admixture of other metals, it seemed to him that, if lead could be got absolutely pure, it would be the most lasting for chemical use.

Scottish Section.

Meeting held at Glasgow, on Tuesday,
January 28th, 1902.

DR. WM. FREW IN THE CHAIR.

PEROXIDE OF HYDROGEN: ITS MANUFACTURE, PROPERTIES, AND USES.

BY CHARLES A. FAWSITT, F.R.S.E., F.C.S.

PEROXIDE of hydrogen (H₂O₂) is a chemical product of considerable importance in the arts and manufactures, and it has come into use because it possesses properties which enable results to be achieved, quite impossible with other reagents. For instance, in the bleaching of ivory, bones, silk, and feathers it could not be replaced. It may be regarded as a "Fine" chemical, as its preparation demands great care, and cannot be conducted except under the superintendence of a competent chemist. Several methods have been proposed for its preparation, but those in use consist in dissolving a metallic peroxide in a mineral acid.

Within the last few years, persulphates, percarbonates, and perborates prepared electrolytically, have been proposed as a convenient source of H₂O₂, as when dissolved in acidulated water it is readily produced. The expense, however, of this mode of preparation quite precludes the possibility of competition with the methods now in use, at any rate for a considerable time.



Peroxides used in the Manufacture of H₂O₂.—Barium, sodium, and calcium peroxides are used for the preparation of H₂O₂, but the first named has been the most generally adopted.

When sodium peroxide was introduced, it was thought by some that it would supersede barium peroxide, but it has been found more expensive, and dangerous to use. The use of CaO₂ has never got beyond the experimental stage so far as I am aware.

In selecting a barium peroxide it is of importance to procure a quality containing a high percentage of BaO₂ as free as possible from iron and alumina, and very finely ground.

With a BaO₂ of high percentage there is less waste of acid less unnecessary heat evolved when dissolving in acid, and it is possible to get up the strength of the solution more quickly.

Iron and alumina are always present in commercial BaO₂, but it is advantageous to select a quality containing as low a percentage as possible.

Resulting Product.	Charcoal, 12 Grms.	Lamp Black, 12 Grms.	Coal, 18 Grms.	Mineral Oil, 50 Grms.	Charcoal, 12 Grms. Mineral Oil, 25 Grms.	Charcoal, 12 Grms. Pitch, 12 Grms.
BaCO ₃	51·9	32·0	13·6	97·0	16·8	29·5
BaO	48·1	68·0	86·4	3·0	83·2	70·5

From the above numbers it will be seen that a considerable quantity of the carbonate was decomposed; and following up these trials a supply of barium oxide was made by reducing the carbonate with coal in the proportion of two parts of the former to one of the latter, which had been found to give the best results.

After the reduction, dried and purified air was passed over the mixture at a temperature of 350° C. to 400° C., but no BaO₂ was found, evidently all the BaO had been reconverted into carbonate owing to the carbon in the coke burning to CO₂. Another trial with the same mixture was made, but in this case passing the air over at a lower temperature, with the result that 18 per cent. of BaO₂ was produced, but these results were unsatisfactory. The product contained a little barium cyanide, which was a dangerous impurity.

Another set of trials was made differing from those just mentioned, in that no carbonaceous matter was used. Dittmar has shown that Barium carbonate when heated strongly in hydrogen gas loses its CO₂ and gives BaO. In order to test this a quantity of finely powdered BaCO₃ was placed in an iron tube, heated to a full red heat for three hours, in a current of hydrogen gas; but the resulting mixture gave 89 per cent. of undecomposed of BaCO₃. This experiment was repeated, but coal gas substituted for the hydrogen; 87 per cent. of BaCO₃ remained undecomposed, the balance being barium hydrate and a little barium sulphide. The mixture had fused into a solid mass, owing to the heat not having been sufficiently high to prevent the formation of hydrate. Experiments were made adding lime to the mixture to keep it from fusing, but the results were not encouraging, and the trials in this direction abandoned as, unless a product containing at least 50 per cent. of BaO₂ could be obtained it would be of no use in the preparation of H₂O₂. It was, finally, resolved to adopt a BaO₂ made in the ordinary way by decomposing the nitrate by heat, and converting the resulting oxide into BaO₂ by passing over it dry and purified air.

At one time the author's firm made their own BaO₂, but as the quantities used were small, it was subsequently found more economical to buy it, and a supply was procured testing about 90 per cent. of BaO₂, containing a smaller amount of iron and alumina than usual, and also very finely ground. The impurities in BaO₂ are BaO, Ba(OH)₂, BaCO₃, Al₂O₃, Fe₂O₃, SeO₂. The combined percentage of Fe₂O₃ and Al₂O₃ varied from 1 to 2 per cent., and was an impurity derived from the clay pots in which the oxide was made, and which had to be got rid of in the subsequent operations,

The fineness of the BaO₂ is important because its solution takes place more easily, and so allows of the process proceeding more rapidly and with less chance of decomposition.

The usual method employed for the preparation of BaO₂ is to decompose barium nitrate at a full red heat, in fire-clay vessels, into barium oxide, which is afterwards converted into the peroxide by passing over it dry and purified air at a temperature of 300° C. to 350° C., preferably under a slight pressure. As barium nitrate is a fairly expensive salt and yields only a little more than one half its weight of oxide, it follows that BaO₂ is a dear chemical especially when 1 ton of 90 per cent. yields only 381 lbs. of oxygen available for making H₂O₂. To ascertain if a cheaper method for its preparation could be devised a series of trials were made with barium carbonate and also with barium hydrate.

Experiments to prepare BaO₂ from BaCO₃ and Ba(OH)₂.—100 grms. of finely ground carbonate were mixed with the following substances and heated in an iron tube to a strong red heat for five hours:—

or the keeping properties of the finished H₂O₂ would have been unsatisfactory.

The BaO₂ could be used as received, or after slaking with water, or after precipitation.

Slaked Barium Peroxide.—In order to render the barium peroxide more easily soluble, it was for a considerable time slaked with two or three times its weight of water in large wooden trays. During this treatment it swells considerably, and must be well stirred to keep it from caking. The water must be cold, or the BaO₂ decomposes. When using this product it was brushed through sieves to ensure a fine state of division. The hydrated barium peroxide thus prepared was found to carry in too much water, and so make it difficult to get the solution of H₂O₂ up to the required strength. Besides, it added too much to the cost of manufacture.

Precipitated Barium Peroxide.—This was made by dissolving the commercial BaO₂ in HCl, and adding the requisite amount of NaHO solution to effect the precipitation, and then pumping the whole through a filter-press. This product is very well suited for the process, as it dissolves very readily in the acid. But although it was used for special purposes, it was rejected for ordinary use on account of its expense, and also because it carried in too much water, the pressed cake containing 50 per cent. of water.

For ordinary work the BaO₂ was used as received.

Possible Acids.—There are several possible acids, H₂SO₄, HF, H₃PO₄, HCl, and HBF₄, and mixtures of one or more of these. The first three are not very suitable when used alone, as the particles of BaO₂ become coated with insoluble sulphate, fluoride, or phosphate of barium, and the reaction, which commences, very quickly slows down. That it is quite possible, however, to use these acids is shown by an almost complete reaction taking place between them and BaO₂ when they are ground together in a mortar. If these decompositions could be readily brought about, it would render the preparation of H₂O₂ easier, and in other respects possess certain advantages which will be mentioned later on.

The other acids are HCl and HBF₄, and they are both suitable as regards the dissolving of the BaO₂, but the former possesses the all-important advantage of cheapness, whilst the H₂O₂ produced by the latter was the more stable.

For some time a mixture of HCl and HBF₄ was used, and the results, as regards the finished H₂O₂, very satisfactory, but to save expense the HBF₄ was latterly replaced by HCl.



The HCl should be commercially pure and contain no arsenic.

Preparation of Hydrogen Peroxide.—Several earthenware vessels of about 50 galls. capacity were used for dissolving the BaO₂, and hand-stirring was adopted.

Into each vessel, 25 ozs. of commercially-pure HCl, 10 galls. of wash water from a previous charge, and 40 lbs. of ice were placed, and into this liquid were sprinkled 3½ lbs. of BaO₂ during constant stirring. The stirring is an important part of the operation, as, if insufficient, the BaO₂ collects at the bottom of the vessel, locally causing an alkaline reaction which brings about decomposition of H₂O₂. The BaO₂ which falls to the bottom should be ground between the end of the stirrer and the bottom of the vessel, which greatly assists solution, especially if there are any coarse particles of BaO₂ contained in the quality being used. It is for this reason that a BaO₂, which is finely ground, is to be desired.

When the 3½ lbs. of BaO₂ are dissolved, 3 pints of dilute H₂SO₄ are added to precipitate the barium. This acid is made by diluting 1½ galls. of vitriol with 2 galls. of H₂O, and allowing to become quite cold. There is now in solution HCl and H₂O₂ and BaSO₄ in suspension, and the above operation is repeated until 54 lbs. of BaO₂ have been added to each vessel. During the charging it is important that the heat evolved from the reaction, i.e., between the HCl and the BaO₂, should not raise the temperature of the liquid above 15° C.—it was very rarely above 13° C.—and for this purpose ice is added, the amount varying from 80 lbs. in the winter, when the temperature of the air was about 0° C., to 200 lbs. in the hottest part of the summer. The fifth and tenth instalments of BaO₂ were somewhat larger than the others, so as to ensure of the liquid being made slightly alkaline. This was rendered necessary to make certain that there was not an undue excess of H₂SO₄ present in the liquid, which might easily occur if the BaO₂ were not being completely dissolved, and in which case the solution of the BaO₂ would be retarded. When all the BaO₂, i.e., 54 lb., had been added, the liquid was slightly acid.

The process should be pushed on as quickly as possible consistent with complete solution of each instalment, as there is from the commencement a slight decomposition going on. The next stage, which embraces the precipitation of the Fe₂O₃ and Al₂O₃, and the pumping of the liquor, which is slightly alkaline, through a filter press, has to be very expeditiously carried through.

To remove the Fe₂O₃ and Al₂O₃, ¾ lb. of sodium phosphate is added in solution, then sufficient BaO₂ or waste BaO to make the solution neutral, and lastly ammonia to make the reaction decidedly alkaline. Then the liquor is pumped through a filter-press as quickly as possible, and the H₂O₂ solution as it comes from the press run into an earthenware vessel in which has been placed a small quantity of H₂SO₄, enough to make the entire filtrate slightly acid. Sodium sulphate (free from iron) is now added to remove all traces of barium, and the H₂O₂ solution allowed to stand overnight to settle when it should be ready for running off into carboys. If a purer H₂O₂ is desired special care is necessary in each stage of the preparation. But H₂O₂ prepared by the method just described is fairly pure. It should not contain above 15 to 20 grms. of solids and 5 to 10 grms. of free acid per gallon. The strength of the solution should be 12 vol. All the BaSO₄ precipitate is contained in the filter press, and as it holds a considerable amount of H₂O₂, it is washed by pumping water through the press. The wash water usually tests about 4 vol., and serves for diluting the HCl in the next charge. It is made slightly acid.

An iron filter-press was used, the plates of which were coated from time to time with black varnish, but no doubt a press with wooden or enamelled plates would be preferable.

The loss of H₂O₂ in going through the press was 0·5 vol., i.e., if the strength was 12½ vol. in the vessel before pumping it was 12 vol. when finished and ready for sending out.

The Yield of Hydrogen Peroxide.—The yield of 12 vol. of H₂O₂ for each vessel was 24 galls., besides 130 lb. of BaSO₄

paste, containing 50 per cent. of water, and to produce this there was used—

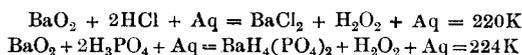
54 lb. of BaO₂ (87 to 90 per cent.),
25 oz. of HCl (34½° T.),
32½ lb. of vitriol,
¾ lb. of sodium phosphate,
¼ lb. of Glauber's salts,
Ice depending on the time of the year.

The actual, as compared with the theoretical, yield was as follows:—50 lb. of BaO₂ (90 per cent.) should give 24 galls. of 12 vol. H₂O₂, but in practice it required 54 lbs.

Although the HCl was fairly strong when commencing a charge, it gradually became weaker as each fresh instalment of BaO₂, H₂SO₄ and HCl and ice was added, until the liquid measured about 3½ times its original volume, but the time for dissolving the first and last instalment of BaO₂ was very little different.

The Use of H₂SO₄ and H₃PO₄.—If H₂SO₄ and H₃PO₄ had dissolved BaO₂ easily, the process would have been simplified, as very much larger instalments could have been added, and at the same time the solids would have been low.

H₂O₂ is sold, the solids of which consist almost entirely of phosphate, leading to the belief that it has been prepared from H₃PO₄, but the price of such is prohibitive for ordinary uses. It has the advantage, however, of being specially stable. It has been stated that H₃PO₄ is preferable to use, as it evolves less heat in dissolving BaO₂ than in the case of HCl, but this is only true under certain conditions. From the equations—



from which it is seen that H₃PO₄ gives out 224 calories as compared with 220 calories for HCl; but if, say, 100 lb. of 90 per cent. BaO₂ are dissolved in 20 per cent. HCl the rise in temperature of the liquid would be 61° C.; whereas, in the case of 20 per cent. H₃PO₄, it would only be 25° C., which difference is accounted for by the very much larger volume of liquid in the case of H₃PO₄ (20 per cent.), but in this latter case more ice would be required to keep the temperature of the solution at 15° C.

Possibility of increasing the Size of the Apparatus.—Although in the mode of preparation just described small vessels of about 50 gals. capacity were used, no difficulty should arise if vessels of, say, 500 gals. capacity, were employed, if suitable stirring and cooling arrangements could be devised. Of course, hand stirring would be inadmissible. Artificial cooling would also be necessary, and the charges of acid and BaO₂ increased in proportion.

The most Economical Strength.—To save expense in carriage, cost of handling, &c. it may be thought that it would be more economical to make 20 or 30 vol. H₂O₂ instead of 10 and 12 vol., but although it can be prepared at these strengths by taking special precautions, yet it has been found by experience that 12 vol. is the most economical strength both for buyer and seller, as the loss from decomposition and the cost of production is higher in proportion for the higher strengths. There is not much 20 or 30 vol. H₂O₂ sold. 20 vol. H₂O₂ cannot be prepared by the above method, as the addition of ice would make it impossible to get up the strength, and outside cooling must be adopted.

As a 12 vol. H₂O₂ contains, approximately, 96·5 per cent. of water and 3·5 per cent. of H₂O₂, it can be readily understood that carriage from one place to another influences the price, and how difficult it is for makers at a distance to compete with those whose works are situated in close proximity to the users.

Cost of Manufacturing H₂O₂.—In order to ascertain if the process were profitable, careful trials were made from time to time, and below are the full details of two which were made when a mixture of HCl and HBF₄ was used.

In these cost sheets no charge was made for chemist's salary, carriage, or depreciation, and no value was placed on the BaSO₄ paste. These trials were confirmed by the annual balance sheet, which sometimes showed a small profit, but oftener a loss.



PROFIT AND LOSS ACCOUNT.

Trial No. 1.—From August 4th to October 13th, 1894.

		£	s.	d.			£	s.	d.	£	s.	d.	
By 2,000 gals. of 10 volume peroxide of hydrogen at 1s. 4d. per gal.		133	6	8	To chemicals used:—								
					Barium peroxide, 4,226 lb.		80	9	8				
					Hydrochloric acid, 444 lb.		7	17	11				
					Oil of vitriol, 1,812 lb.		2	13	9				
					Boracic and hydrofluoric acids, ammonia, Glauber salts, sodium phosphate.		2	12	0				
					Ice, 10,328 lb.		7	9	9	102	13	4	
					Wages		13	0	0				
					Rent and taxes		0	16	0				
					Sundries		1	16	0				
										23	1	9	
					Profit					125	15	1	
										7	11	7	
		£	133	6	8					£	133	6	8

Trial No. 2.—From March 13th to April 16th, 1896.

		£	s.	d.			£	s.	d.	£	s.	d.	
By 827 gals. of 12 volume peroxide of hydrogen at 1s. 6d. per gal.		62	0	6	To chemicals used:—								
					Barium peroxide, 2,296 lb., at 38l. 16s. per ton		39	15	0				
					Oil of vitriol, 1,200 lb., at 3s. 6d., less 5% per cwt..		1	15	8				
					Hydrochloric acid, 7 gals., at 4s., less 5% per gal.		0	2	6				
					Ammonia, 1½ gals., at 1½d. per lb.		0	2	0				
					Glauber salts, 20 lb., at 3s. per cwt.		0	0	8				
					Sodium phosphate, 91 lb., at 14s. per cwt.		0	11	3				
					Hydrofluoric acid, 20½ lb., at 6d. per lb.		0	10	3				
					Boracic acid, 6 lb., at 31s. 6d. per cwt.		0	1	6	42	18	10	
					Ice, 3,056 lb., at 23s. 6d. per ton		1	12	0				
					Rent and taxes		0	16	0				
					Sundries		1	6	0				
					Wages		8	15	0	12	9	0	
					Profit					55	7	10	
										6	12	8	
		£	62	0	6					£	62	0	6

In trial No. 1 chemicals cost 1s. 0½d. per gal. H₂O₂ (10 vol.).

" " wages " 1½d. " " "

" " ice " 1d. " " "

In trial No. 2 chemicals cost 1s. 0½d. per gal. H₂O₂ (12 vol.).

" " wages " 2½d. " " "

" " ice " 0½d. " " "

With a larger apparatus fitted with improved method for stirring and cooling, no doubt a considerable saving could be effected in wages, ice, and taking into account that there is now a ready sale for the BaSO₄ paste, it could no doubt be worked to better advantage, especially if the manufacture were carried on within reasonable distance of the localities where H₂O₂ is used.

As viewed now, the West of Scotland was not a good locality in which to start operations, but it was expected that several firms might be persuaded to adopt H₂O₂ for bleaching purposes, but such was not the case; after carrying on the process for 10 years it was given up, as the output only amounted to 1,200 gals. per month; value, about 75l. To have carried on an active competition in districts far removed would have been ruinous.

The Requirements of H₂O₂.—The chief requirement of a solution of H₂O₂ is that it should be stable, and to ensure this great care is required in its preparation. It is important to remove all the Fe₂O₃ and Al₂O₃, to have sufficient free acid present, and to keep the solids low. It does not follow that H₂O₂ with high solids will necessarily decompose more quickly than one with low solids; it depends more on the method of preparation. But two samples of H₂O₂ prepared by the same method, but one having twice the proportion of solids, decomposition will take place more rapidly in the solution containing the most solid matter.

Stability of H₂O₂.—A series of trials were made in order to arrive at some idea as regards the stability of H₂O₂.

1st. When evaporated under ordinary and reduced pressure.

2nd. When agitated violently.

3rd. When exposed to sunlight.

	I.	II.	III.	IV.
Original strength.....	Vol. 7·8	Vol. 7·0	Vol. 7·3	Vol. 8·1
Strength evaporated 20 c.c.	19·6	16·2	18·0	18·8
Calculated strength.....	19·6	16·2	18·3	20·3

1st. Took 50 c.c. of four different makes of H₂O₂, and evaporated on a water-bath to 20 c.c.

The loss, except in case of sample IV., was trifling.

Took 4,250 c.c. of 4·8 vol. H₂O₂, solids 5·6 grms. per gal., evaporated on a water-bath to 1,200 c.c., the temperature of the liquid being 78° C.—

Strength found	Vols. 15·2
" calculated	17·0
Loss	1·8

Continued the evaporation to 400 c.c.—

Strength found	Vols. 30
" calculated	57
Loss	21

A set of trials by boiling under reduced pressure was made.

Took 120 c.c. of 3·4 vol. and distilled under a reduced pressure of 25 ins. of mercury to 9·4 c.c.—

Strength found	Vols. 36·6
" calculated	40·5
Loss	3·9

Took 1,900 c.c. of 4·45 vol. H₂O₂ and distilled under same reduced pressure to 700 c.c.—

Strength found	Vols. 12
" calculated	12·1

The strength of the distillate was found to be 0·19 vol. Again took 1,000 c.c. of 10 vol. distilled under same reduced pressure to 85 c.c.—

Strength found	Vols. 80
" calculated	117·5

The distillate (915 c.c.) tested 0·1 vol.

Agitation of H₂O₂.—As it was generally supposed that agitation caused H₂O₂ to decompose, a few trials were made with a view of ascertaining if such were the case.



A bottle containing half a gallon of 7·8 vol. H₂O₂ was placed in a box, which was fastened to the flywheel of a small engine, which revolved rapidly, for six hours; there was no loss. After revolving for 24 hours it tested 7·77 vol.; after 120 hours, 7·7 vols. Another bottle containing the same quantity of 33·4 vol. H₂O₂, which had been prepared by evaporating 10 vol. on a water-bath, and in which the solids would, consequently, be high, was agitated for 120 hours in the same manner as before, and found to be 32·7 vols.; loss = 0·7 vol. In order to gain some idea as to what the keeping properties of H₂O₂ would be in a warm climate, half a gallon of 10 vol. H₂O₂ was kept at a temperature of 30 to 35° C. for one week: loss = 0·1 vol.

As regards the keeping properties of H₂O₂ when in ordinary use, the following will serve as a good example:— 3 carboys of 10 vol. H₂O₂ which had been returned by a bleacher after standing 18 months tested 8 vol., and considering they had passed through two summers and might have been exposed to direct sunlight, the result was considered fairly good for a commercial article.

Decomposition of H₂O₂ by Sunlight.—Sunlight is a very potent factor in the decomposition of H₂O₂ solution, and int Table I. are the results of a series of trials, with three samples prepared by different methods.

The composition of the samples as regards strength, solids, and acidity was as follows:—

No.	Strength.	Solids.	Corrected Solids.	Acidity.
	Vols.	Grms. per Gall.	Grms.	Grms. HCl. per Gall. (5·9 Al ₂ Cl ₆ 10·0 HCl)
1	9	18	27·8	9·8
2	9	7·25	12·9	5·6
3	9	18·3	28·3	10·0 HCl

The acidity was high in order to favour stability. Six similar 16 oz. bottles of clear glass were filled about three-quarters full with equal quantities of the H₂O₂ solution, i.e., two bottles each of I., II., and III., and these were placed close to a window facing the south-east. One bottle of each sample was left exposed to the light, whilst one bottle of each was shaded from direct sunlight by placing a thick board between them and the window. A cork was fitted into each bottle through which a very small hole was bored, with a needle, to allow of the O₂ escaping. Similar bottles filled with same quantity of water, and into which dipped a thermometer, were placed in sun and shade.

The temperature was read every day at the same time when the heat effect produced by the sun was at its maximum. The bottles remained in position for 457 days, and were never moved except whilst drawing a sample for testing purposes.

TABLE I.
Sun.

Date.	No. I.			No. II.			No. III.		
	Vol.	Loss.	Monthly Loss.	Vol.	Loss.	Monthly Loss.	Vol.	Loss.	Monthly Loss.
1895.		Per Cent.	Per Cent.		Per Cent.	Per Cent.		Per Cent.	Per Cent.
10th June	9·00	..	..	9·00	..	..	9·00	..	..
10th July	7·02	22·0	22·0	5·02	44·4	44·4	7·40	17·7	17·7
10th August	5·20	42·2	20·2	2·10	76·6	32·2	6·50	27·7	10·0
10th September	4·30	52·2	10·0	0·70	92·2	15·6	5·60	37·7	10·0
10th October	3·80	57·7	5·5	0·14	98·4	6·2	5·10	43·3	5·6
10th November	3·40	62·2	4·5	0·00	100·0	1·6	4·80	46·6	3·3
10th December	3·18	64·7	2·5	..	..	..	4·50	49·8	3·2
1896.									
10th January	3·00	66·7	2·0	..	..	..	4·50	49·8	0·0
10th February	2·70	70·0	3·3	..	..	..	4·40	51·1	1·3
10th March	2·64	70·6	0·6	..	..	..	4·38	51·3	0·2
10th April	2·35	73·8	3·2	..	..	..	4·07	54·7	3·4
10th May	1·40	54·4	10·6	..	..	..	3·20	64·4	9·7
10th June	0·90	90·0	5·6	..	..	..	2·80	68·8	4·4
10th July	0·70	92·2	2·2	..	..	..	2·50	72·2	3·4
10th August	0·65	92·7	0·5	..	..	..	2·26	74·8	2·6
10th September	0·53	94·1	1·4	..	..	..	1·92	78·6	3·8

Shade.

Date.	No. I.			No. II.			No. III.		
	Vol.	Loss.	Monthly Loss.	Vol.	Loss.	Monthly Loss.	Vol.	Loss.	Monthly Loss.
1895.		Per Cent.	Per Cent.		Per Cent.	Per Cent.		Per Cent.	Per Cent.
10th June	9·00	..	..	9·00	..	..	9·00	..	..
10th July	8·90	1·1	1·1	6·80	24·4	24·4	8·96	0·4	0·4
10th August	8·70	2·9	1·8	4·90	45·5	21·1	8·93	0·7	0·3
10th September	8·60	4·4	1·5	3·50	61·1	15·6	8·90	1·1	0·4
10th October	8·55	5·0	0·6	3·20	64·4	3·3	8·88	1·3	0·2
10th November	8·50	5·5	0·5	2·70	70·0	5·6	8·86	1·5	4·2
10th December	8·45	5·6	0·1	2·50	72·2	2·2	8·85	1·6	0·1
1896.									
10th January	8·42	6·4	0·8	2·40	73·3	1·1	8·84	1·6	0·0
10th February	8·40	6·6	0·2	2·20	75·5	2·2	8·80	2·2	0·6
10th March	8·25	8·3	1·7	1·85	79·4	3·9	8·70	3·3	1·1
10th April	8·20	8·8	0·5	1·75	80·5	1·1	8·70	3·3	0·0
10th May	7·90	12·2	3·4	1·20	86·6	6·1	8·65	3·9	0·6
10th June	7·80	13·3	1·1	0·79	91·2	4·6	8·65	3·9	0·0
10th July	7·50	16·6	3·3	0·60	93·3	2·1	8·65	3·9	0·0
10th August	7·30	18·8	2·2	0·51	94·3	1·0	8·65	3·9	0·0
10th September	6·79	24·5	5·7	0·12	98·6	4·3	8·56	4·9	1·0



From Table I. it will be noticed that the results are striking, and serve to show that H_2O_2 , if carefully prepared, will, under conditions easily attainable, keep its strength for a considerable time.

The samples exposed to the sun gave a very different decomposition rate; for whilst No. II. was entirely decomposed in five months, Nos. I. and III., after standing 15 months, had only lost 94.1 per cent. and 78.6 per cent. respectively. The samples in the shade also showed very different rates of decomposition. No. II., in 15 months, lost 98.6 per cent. of its H_2O_2 , whilst I. and III. only lost 24.5 per cent. and 4.9 per cent. respectively. No. III. was shown to be a very stable H_2O_2 , and its stability was entirely due to its method of preparation. That the amount of solids did not accelerate the rate of decomposition is shown very forcibly in these trials, as No. II., which decomposed more quickly than I. and III., contained only one-half of the solids.

It will be noticed that, April—May, the loss of H_2O_2 increased very rapidly, especially samples I. and III. in the sun, and this cannot be accounted for by the increase in the temperature, as the heat was greater, May—June, when the decomposition rate was lower. These trials prove that H_2O_2 should be kept out of direct sunlight.

The sun, when shining, commenced to strike the bottles about 8.30 a.m., and passed off the window about 12 o'clock. Directly it shone on the bottles the temperature rose quickly, and gas bells were seen rising to the surface. The maximum time the sun could shine on the window was about 3½ hours. The greatest difference in temperature noticed between the bottles in sun and shade was 10° C., i.e., on same day.

The Uses of H_2O_2 .—The most important uses to which H_2O_2 has been applied, are the following:—For the bleaching of wool, silk-straw, bones, ivory, feathers, and hair; also for medicinal purposes. For bleaching purposes it has supplied a distinct want, as it was formerly impossible to get the results now obtained with this reagent.

When bleaching with H_2O_2 , the bath is, with very few exceptions, made alkaline, rendered necessary in order to help the decomposition of the H_2O_2 , and at the same time accelerate the bleaching process. The bath is also heated. The decomposition is quite visible to the naked eye, and it is therefore of much importance for economical working to make full use of the bath with the least possible delay; and failure in this respect has led a number of firms, who have made trials with H_2O_2 , to discontinue its use. They state that compared with the old sulphur bleach, it is much more expensive; whilst if they had used up the H_2O_2 to the best advantage, the result might have been more satisfactory.

The alkali used for the bath, in the case of wool, straw, and silk, is silicate of soda; whilst for feathers, bone, ivory, and hair, it is ammonia.

Bleaching of Wool.—This constitutes one, if not the most important, use of H_2O_2 , and it is claimed that by this process—

- 1st. A purer white can be obtained.
- 2nd. That the fibre of the wool is not "tendered" to the same extent as with the sulphur bleach.
- 3rd. That H_2O_2 bleached wool does not turn yellow on soaping.
- 4th. That H_2O_2 bleached wool does not emit an unpleasant odour when in contact with perspiration.

I wrote to one of the partners in a large firm who have had a long and varied experience in this method of bleaching, asking him if he could confirm the above points of advantage. He replied in the affirmative, and stated that he considered the method more convenient to use, more pleasant for the workpeople, and not corrosive on the machinery; also that this process was used to a certain extent for bleaching previous to dyeing pale clear colours, and it had the advantage of not leaving streaks, which sometimes cause trouble in dyeing goods which have been sulphur bleached. I also wrote another firm who have a special experience in H_2O_2 bleaching, and they replied stating that they considered a very important point in its favour to be that, owing to H_2O_2 bleached wool having less affinity for colour than that bleached by the sulphur process, purer tones could be obtained.

For the bleaching of wool two methods are practicable.

First Method.—The scoured wool is first of all immersed in a dilute solution of silicate of soda (2 lb. to 10 galls. of water), and allowed to remain until it is thoroughly soaked. This allows of the alkali getting thoroughly into the fibre, which assists the bleaching.

When thoroughly saturated the wool is taken out of the alkali bath, wrung out, and thrown into the peroxide of hydrogen bath, which is prepared by adding 3½ galls. of 10 vol. peroxide of hydrogen to 6½ galls. of water, in which has been dissolved ½ lb. of silicate of soda (102° T.). This is a 3½-vol. bath, but the water in the wool and the subsequent addition of alkali reduces the strength to about 3 vol. The wool is kept in the bath for 24 hours at a temperature of 80° F., and during this time the wool is occasionally turned over, and the bath is tested to find out if it is alkaline. This is rendered necessary, as the wool takes up alkali out of the bath gradually, and when once the bath is neutral it does not bleach satisfactorily, and to make it strongly alkaline at the commencement would spoil the wool. Sometimes the wool is kept in the bath a longer time than 24 hours, sometimes shorter; this depends on the quality of the wool and the whiteness aimed at. But when sufficiently bleached it is taken out of the bath, the excess of H_2O_2 solution wrung out, and hung up on frames in warm room until completely dry. This is an important point, as the bleaching action is intensified as the water evaporates. When quite dry the wool is well washed and redried.

This method produces a well-bleached wool, but it has the disadvantage that the H_2O_2 bath gradually becomes too dirty to use owing to the solution which is wrung out of the wool, when taking it out of the bleaching bath, and therefore there is a loss of material.

In the *second method* this is obviated. Into the H_2O_2 bath, made up of 3½ galls. of 10 vol. H_2O_2 , 6½ galls. of water, and ½ lb. of silicate of soda, 28 lb. of wool, which have previously been soaked in a dilute solution of silicate of soda and wrung out, are packed, and after standing for one hour, during which time it is turned over occasionally, it is taken out, wrung, and placed in a suitable vessel, then another 28 lb. of wool, which has had the same preliminary treatment as above described, are put in the bath, and this quantity of wool should be sufficient to absorb practically all the solution. The whole 56 lb. of wool are now put into a suitable vessel in a warm room or stove, and kept at 80° F. for 24 hours, when the wool is taken out, completely dried in, washed, and redried. By this method 10 oz. of 10 vol. H_2O_2 are used up for 1 lb. of wool, whilst 12 oz. of 10 vol. are used up for 1 lb. of wool by the first method.

The cost of bleaching 1 lb. of wool in a well-conducted establishment should not amount to more than ¾d., i.e., by H_2O_2 method, and if a manufacturer used a large quantity of H_2O_2 it would be considerably reduced if he prepared his own H_2O_2 , as in that case less care would be required in its preparation, as it could be used up when made. A user of H_2O_2 , whose works are situated at a considerable distance from the source of supply, is paying 2d. or 3d. per gallon of carriage on an article that only costs about 1s. 3d. per gallon. The H_2O_2 bleach for wool has not been largely used in Scotland, but in England and on the Continent considerable quantities are consumed.

Bleaching of Silk.—The principal use to which H_2O_2 has been applied in the silk industry is the bleaching of "Tussah" silk, which has a strong brown colour.

In the first place the "Tussah" silk must be well scoured to remove all gum, grease, and dirt. It is then immersed in a bath made up by adding 1 part of 10 vol. H_2O_2 to 2 parts of water, and for every 1 gal. of 10 vol. H_2O_2 there is added 4 oz. of caustic soda, and 6 oz. of silicate of soda (102° T.). The silk is kept in the bath at a temperature of about 120° F., until sufficiently bleached. It is impossible to give anything like an exact time, as the qualities vary so much. In some cases a second bath is required to produce the desired whiteness. Bleached "Tussah" silk is never a pure white, it always has a very pale straw colour, which is very much covered when the silk is tinted with blue or violet. Bleached "Tussah" silk is used mostly for dyed goods.



Silk, like wool, withdraws alkali from the bath, but it is possible in this instance to use such an excess of alkali, at the commencement, as will prevent the bath from becoming neutral, as silk is not so easily affected as wool.

Bleaching Straw.—A large quantity of H_2O_2 is used in the districts where straw hats are made, and for bleaching straw a bath is made up of 1 part of 10 vol. H_2O_2 , 2 parts of water, and 4 oz. of silicate of soda ($102^\circ F.$) for every gallon of 10 vol. H_2O_2 .

The bundles of plaited straw are packed closely into the bath, which is kept at $95^\circ F.$ for about 20 hours. During the operation the straw is moved about occasionally, and the liquid drawn off from the bottom of the bath and poured on to the top of the straw. The straw is then washed and dried.

During the operation the alkalinity of the bath should be tested as the straw removes alkali from the bath.

Bleaching of Bone and Ivory.—The bones or ivory must be first cleansed from fat by a treatment in petroleum spirit or other solvent. Sometimes ammonia is used.

The bath is made up of 1 part of 10 vol. H_2O_2 , and 2 parts of water, made slightly alkaline with ammonia, and kept at a temperature of $122^\circ F.$ until the bones are bleached sufficiently, the time varying with the quality of the bone.

Caustic soda must not be used on any account in the bath as by it the bones are destroyed. Good results were obtained by using a bath of 10 vol. H_2O_2 neutral, and kept at $122^\circ F.$

Bleaching of Feathers.—The feathers are first cleaned by a treatment in soap solution and afterwards with ammonia (dilute). The bath is one of 10 vol. H_2O_2 , made slightly alkaline with ammonia. The feathers are kept in the bath for 12 hours at $95^\circ F.$ or until sufficiently bleached. They are then removed and washed with water containing 1 oz. of vitriol to 5 or 6 galls. of water. The acid is necessary to stiffen the quill, which has become soft owing to immersion in the H_2O_2 bath. After $1\frac{1}{2}$ hours in this bath they are washed and dried.

Bleaching of Hair.—The outlet for H_2O_2 for this purpose is small, but it is essential to produce good results.

The experience gained in this direction does not warrant any specific instructions; but no doubt the same strength of bath as is used for wool, and using ammonia as the alkali would be serviceable.

At one time, when auburn hair was fashionable, H_2O_2 was largely used by hairdressers and chemists. It was mixed with rose water or other perfume and sold under various names. When using it for this purpose the H_2O_2 was mixed in a saucer with a few drops of ammonia, then sponged on the hair which was allowed to dry, by preference in sunlight, and the operation repeated day by day until the desired shade was reached.

The Use of H_2O_2 as an Antiseptic.—Peroxide of hydrogen was brought prominently into notice about 1860 by Dr., afterwards, Sir Benjamin Richardson, who did much valuable work in testing its use, and upon which the conclusions detailed in his *Asclepaid*, 2nd Series, 1891, Vol. VIII., were based.

He found it very serviceable both for internal and external use and at that time it was thought its usefulness would be much extended, but such has not been the case chiefly on account of its irritability and instability.

Irritability of H_2O_2 .—If a solution of H_2O_2 , even although very dilute, is applied, say, to an ulcer, irritation is set up, and the question arises as to what is the cause. It may be due to the acidity, or the solids, or the contained oxygen, or all these causes combined.

As regards the acidity; as before mentioned H_2O_2 is acid by intention, as the solution would not keep if neutral or alkaline. The amount of free acid varies, but is usually small. Its action can, however, under certain conditions become intensified. An example will explain this. If a towel is wrung out in a 2 or 3 vol. solution of H_2O_2 , and hung up in a sick room to purify the atmosphere it becomes rotten after it has been repeated a few times, and the explanation is that the water gradually evaporates, and finally leaves the acid and solids in a concentrated form, and these, especially the former, exert a corrosive action on

the fibre of the towel. The same action must take place when a solution of H_2O_2 is applied to the skin, the water evaporates, and irritation naturally arises from the acid and solids remaining behind, and if the free acid were H_2SO_4 or H_3PO_4 , it would be more marked.

As no reliable data as regards the acidity in H_2O_2 was available, it was determined in a few samples of qualities made by the leading firms.

Estimation of the Acidity in H_2O_2 .—The following was the method, which was found to give satisfactory results:—

As some of the samples contained salts of alumina, an ordinary titration was not applicable, besides the contained H_2O_2 interfered with the indicators, litmus, and methyl orange. Fifty c.c. of the H_2O_2 solution were taken, excess of ammonia added, the solution then boiled to get rid of the excess, the Al_2O_3 filtered off, washed, dried, and weighed. To the filtrate excess (about 20 c.c.) of 1/10 normal KHO solution added, and the liquid evaporated to dryness to completely expel the ammonia. The residue was dissolved in water and the excess of KHO titrated with 1/10 HCl, using litmus as the indicator. The free acid was for sake of comparison expressed in grms. of HCl per gallon. The HCl corresponding to the Al_2O_3 was allowed for, and the remainder called free acid. If no Al_2O_3 were present, the addition of ammonia was omitted, and 20 c.c. of KHO solution added, the solution evaporated to remove the O_2 , and the excess of KHO titrated with HCl as above. The acidity of H_2O_2 is sometimes due entirely to an acid salt, such as Al_2Cl_6 , but usually there is free acid present in addition.

In Table II. the free acid is expressed in grms. of HCl per gallon, and where Al_2O_3 was found in grms. of Al_2Cl_6 per gallon.

TABLE II.

—	Strength.	Free Acid in Grms. HCl Per Gallon.		Acidity corresponding to Al_2O_3 found in Grms. Al_2Cl_6 Per Gallon.	
		Vol.	Grms.	Grms.	None.
A	10	4.1	None.		
B	10	0.3	8.62		
C	10	0.0	3.66		
D	10	1.47	None.		
E	10	6.05	8.08		
F	20	1.23	None.		
G	30	4.25	Not determined.		

It will be noticed from the above numbers that H_2O_2 differs very much as regards acidity, and it is quite reasonable to assume that if solutions of D. and E. were used as antiseptics, that the irritability set up would differ, and in the latter be very marked. But this seems to be a point which is quite lost sight of by ordinary practitioners.

Solids in H_2O_2 .—As regards the solids which H_2O_2 contains, and which consist of the salts in solution and also the free acid, the amounts were determined in the same samples as in Table II. The method adopted was to evaporate to dryness on a water-bath, and dry the residue at $120^\circ C.$, at which temperature it was found Al_2Cl_6 did not decompose. It must be quite well understood that if the H_2O_2 solution contained volatile acid, the solids would be low by the amount of acid lost, and accordingly a correction was made as shown in the last column.

TABLE III.

—	Strength.	Grms. of Solids per Gallon.		Corrected Solids in Grms. per Gallon.	
		Vol.	Grms.	Grms.	Grms.
A	10	12.7	16.8		
B	10	11.0	11.3		
C	10	16.0	16.0		
D	10	3.6	3.6		
E	10	11.4	12.2		
F	20	19.1	20.3		
G	30	32.0	32.0		



The solids usually consist of a mixture of alumina, soda, potash and ammonia salts, occasionally are found traces of barium and iron salts. The combined and free acids are usually H_2SO_4 , HCl , and H_3PO_4 .

It has often been stated by medical men that if H_2O_2 could be prepared "solid free" it would fill a want in the list of antiseptics.

Accordingly a quantity was prepared. Two methods were tried.

Preparation of Solid Free H_2O_2 by distillation under reduced pressure.—A few trials were made to ascertain if a pure H_2O_2 could be prepared by this method.

To 1,000 c.c. of 10 vol. H_2O_2 were added 200 c.c. of oil of vitriol, thinking that such a non-volatile diluent might retain the H_2O_2 until a part of the water had distilled off. The distillation was carried on under a reduced pressure of 25 inches of mercury, but the result was not satisfactory. The distillate was only 1.6 vol.

Another trial was made substituting glycerin for H_2SO_4 with a like result the distillate testing only 1.5 vol.

In the next trial a volatile liquid non-miscible with the H_2O_2 solution was tried with the idea that in distilling it might carry over the H_2O_2 .

To 500 c.c. of 10 vol. H_2O_2 were added 500 c.c. of benzoline or petroleum spirit, and the distillation under a reduced pressure of 25 inches of mercury carried to dryness. The strength of the distillate was 4.3 vol. This was considered so promising that an apparatus to distil 50 gallons was erected, but the distillate only tested 0.3 vol. and further work on these lines was discontinued.

Preparation of Solid Free H_2O_2 by Precipitation with Silver Sulphate.— BaO_2 was dissolved in HCl as before described, and H_2SO_4 added to precipitate the barium after each instalment of BaO_2 had been dissolved. When the solution had reached the desired strength, sulphate of silver in exact proportion to the barium chloride present was added, thereby getting rid of the HCl and the barium. After finishing carefully the solids were found to be 1 gm. per gallon, and consisted of phosphoric acid and phosphate. No correction was required in this case for the solids, as the acid was non-volatile. This H_2O_2 was called No. 1 in trials about to be described. This specially prepared sample, along with two samples of what were considered the best makes of H_2O_2 , were tested as to their irritability by the author's brother, who had previously had considerable experience in the use of H_2O_2 , both in private and hospital practice.

The following are the particulars of the three samples :—

—	Strength.		Solids per Gallon.		Acidity.	
	Vol.		Grms.		Grm.	
1	7		1.0		0.5	
2	7		9.8		0.3	
3	7		10.0		0.3	

It will be noticed from the above data that the solids in No. 1 were as low as some drinking waters, and all the samples were made practically neutral, so that any beneficial result which might arise from the reduction in the amount of solids might not be obscured by the irritability arising from acidity.

The trials lasted for six months, *i.e.*, two months for each sample, and the H_2O_2 was used in the treatment of ulcers and abscesses, as a throat gargle, nasal douche, and for other purposes which were suitable for the trials. For external use it was diluted with six times, and for nasal douche with 15 times, its volume of water.

The result of the trials was that no difference could be detected between the action of the samples, but all were found to be less irritating than that which had been used formerly, pointing to the effect of the low percentage of free acid.

The result was unexpected, but, when examined more closely, is not surprising, as the difference in composition when in actual use was not striking. For instance, in the case of No. 1, when diluted with six times its volume of

water, the solids would not be reduced in the same proportion as in 2 and 3, because the water contains solids. The proportion of solids, instead of being 1 to 10, as in the original H_2O_2 would be about 1 to 3 in the diluted samples, and it is difficult to believe that a solution of H_2O_2 containing 1 to 2 grms. of solids per gallon could be distinguished in its properties from one having a smaller amount. The next point which presented itself was whether or not the O_2 , which is in a specially active form in H_2O_2 , could produce an irritating effect, and the following trial was made in order to ascertain this:—A sample of 10 vol. H_2O_2 , containing 20.3 grms. of solids (corrected), and acidity equal to 1.21 grms. HCl , per gallon was taken, and one-half kept for after use. The other half was boiled until entirely decomposed, *i.e.*, until it contained no H_2O_2 . It was then made up to its original volume. The two samples were now identical, except that the latter contained no H_2O_2 . They were carefully tested in similar cases as before mentioned. The unboiled sample was found to be more efficient than the one which had been boiled out. The boiled sample caused less irritation, but the difference was very slight. They were used, 1 part to 3 parts of water, which was much stronger than usual. To sum up as regards irritability, it would appear that it is due, not so much to the H_2O_2 , or salts in solution, as to the free acid.

Instability of H_2O_2 .—As regards the instability of H_2O_2 ; this property has very much diminished its use because a practitioner may obtain very beneficial results when the H_2O_2 is fresh, but after standing some time he may find that it has lost its effect, and naturally he loses confidence in its use. As the solution is colourless it is not possible to judge as to its strength by the eye, nor yet by the smell as it is odourless, and as very few medical men have the requisite knowledge or time to test it chemically they, after a disappointment or two, give it up in disgust. It has been mentioned previously that low solids do not necessarily mean a stable H_2O_2 , and this was forcibly brought out in the three samples which were tested as to their irritability. Sample No. 1 which contained 1 gm. of solids per gal., after standing for a few months had lost 2 vol., whilst samples 2 and 3 which contained 10 grms. of solids per gal. lost only 0.7 vol.

For medical men and druggists it is a mistake to buy 20 or 30 vol. H_2O_2 unless it is diluted on receipt, as it is not so stable as 10 or 12 vol., and they are unconscious when it is losing strength. A large firm of wholesale druggists who had bought a quantity of 20 vol. sent a sample to ascertain if it was as represented. It contained 14.4 vol. H_2O_2 and 78 grms. of solids per gal., so it is quite easy to understand how poor results are obtained.

It may be asked as to what would be a safe H_2O_2 to use for medicinal purposes, and as regards acidity it should not be above 1.5 to 2 grms. of HCl per gal., which quantity is sufficient to render the solution stable if it has been carefully prepared. The solids should not amount to above 10 grms. per gal. These numbers are for 10 vol. H_2O_2 . For 20 vol. the acidity might be 2 to 3 grms. of HCl and the solids double those for 10 vol. H_2O_2 .

A solution of H_2O_2 should be kept by preference in stoneware bottles, or, if in glass, shaded from direct sunlight. The H_2O_2 should also be diluted when received by a medical man to about the strength at which it is to be used. This will increase its stability very much.

Finally, my very best thanks are due to Dr. Fawsitt for the care he bestowed on the trials he made and also to Mr. Anderson, who had charge of all the work detailed in this paper and which he carried through with much ability.

DISCUSSION.

Dr. T. GRAY referred to the recent work of Brühl on the preparation of pure hydrogen peroxide and asked the author if he had made any experiments with the object of determining the influence of the nature of the dissolved salts on the stability of the product.

The CHAIRMAN suggested that the rapid decomposition of the hydrogen peroxide during April and May referred to by the author was probably explained by the observation



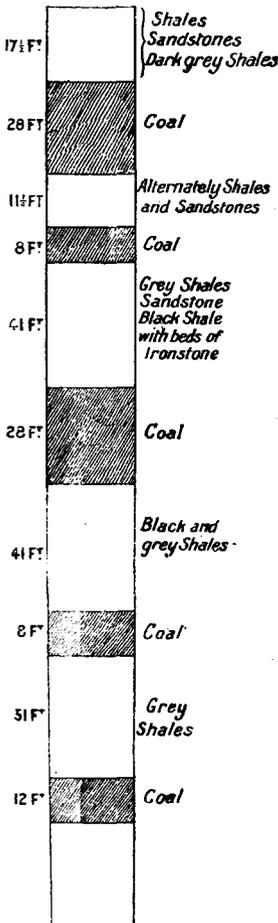
that the actinic power of the sun's rays reached a maximum at that period of the year.

Mr. C. A. FAWCETT, in reply, said that he had little experience as to the influence of the different salts in solution on the stability of hydrogen peroxide. He knew that iron salts favoured decomposition.

He was pleased to hear from Dr. Frew that the actinic rays of the sun were at their maximum, April to May, as the decomposition numbers in sunlight would otherwise have been difficult to explain.

THE COALS OF BENGAL AND JAPAN.

BY W. CARRICK ANDERSON, M.A., D.Sc., AND J. A. RUSSELL HENDERSON, B.Sc.



SECTION OF COAL-BEARING STRATA.

The coals of India and Japan have, at the present time, a commercial interest over and above the purely scientific one. This reason justifies the publication of the results given in the present paper which have been obtained in the Glasgow University Laboratory, in pursuance of a scheme the ultimate object of which is to increase the stock of facts regarding the composition and structure of this class of minerals.

For much information regarding the Indian coalfields in general, and those of Bengal in particular, we are indebted to Prof. W. R. Dunstan, F.R.S., Director of the Scientific Department of the Imperial Institute, whose "report on the coal supply of India," published in 1898 contains figures showing the calorific values and the proximate analyses of a large number of samples drawn from the various localities in which coal is known to occur throughout the Indian Empire. The statements made regarding the Japanese fields are based partly on the authority of a recent official report of the Japanese Government, kindly translated and abstracted for us by Mr. Kouji Satow, for-

merly a student in the University Laboratory, and partly on private information.

I. *Bengal Coal.*—Coal is found widely throughout India and Burmah, but by far the most important fields in the empire up to the present are those of Bengal, which produce the bulk of the coal raised. During the last five years, these have undergone a very rapid development. In 1896 there were 154 collieries at work in Bengal, which produced 3,037,920 tons, the remaining 18 collieries in India having an aggregate production of 809,093 tons. In 1900 the total output for the Indian Empire had risen to over six million tons, and of this Bengal supplied about five-sixths. The average selling price of Bengal coal in that year is given as 4s. 5d. per ton. In 1895 India shipped altogether 53,565 tons of native coal; in 1900 Bengal sent to Bombay 864,000 tons; to Colombo 369,000 tons; to Singapore 66,000 tons; to Aden 53,000 tons, and 53,000 tons to other ports.

LOCALITIES.—The principal coal districts of the province are the following:—

Karkharbari, 200 miles from Calcutta; extent, 8 square miles; estimated to contain 136 million tons.

Raniganj and Barakar, about 130 miles from Calcutta; extent at least 500 square miles; estimated to contain 14,000 million tons.

Jheria, a few miles west of Raniganj; extent, 200 square miles; estimated to contain 465 million tons.

Bokaro, close to Jheria; extent, 220 square miles; in thick seams; estimated to contain 1,500 million tons.

North Karanpura, west of Jheria; extent, 472 square miles; estimated to contain 8,750 million tons.

South Karanpura, estimated to contain about 75 million tons.

Daltonganj, extent, 200 square miles; estimated to contain about 11 million tons.

Ramgahr, a small field south of Bokaro; extent, about 40 square miles; estimated to contain about 5 million tons.

Other fields of lesser account for the time being are Talehir, Rajmahal and Darjeeling, in the last of which there occurs a narrow seam of graphitic coal.

A striking feature of the Bengal coal deposits is the thickness of the seams, which is at times enormous. Those which are worked are rarely less than 8 to 10 ft. thick, and in the Liakdee Mine of the Bengal Coal Company in the Barakar district a bed 80 ft. in thickness is said to have been discovered. The general nature of the deposits may be indicated by the subjoined section disclosed in a bore on the property of the Lodna Coal Company in the Jheria district.

Just as Bengal is the principal coal-producing province of India, so the district comprised within the Raniganj-Barakar-Jheria field is the principal coal-mining area of the province. The district is traversed by the Chord line of the East Indian Railway, and with it the collieries are connected by sidings and branch lines on either side.

Samples.—The samples examined were selected from various parts of this area, along a line about 42 miles in length from west to east. A and B are from the Jheria section; C, D, E, and F from Barakar; and G and H from Raniganj. According to T. H. Ward (Prof. Dunstan's Report) the coal in the eastern part of the field is generally non-caking, while from Belrooi, near Siterampore, westward, caking coals prevail.

TABLE I. Ultimate Analyses of Samples.

	A. Lodna.	B. Kussinda.	C. Barakar Begonia.	D. Dezeraghur.	E. Chotdama.	F. Garanghi.	G. Mooshepara.	H. Ghoosick.
	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Hydrogen	4.77	4.43	4.96	5.23	5.20	5.77	3.43	4.87
Carbon	75.53	72.23	74.13	71.89	72.66	68.13	61.13	74.82
Oxygen and organic sulphur	5.61	4.81	7.95	10.00	5.68	7.66	6.27	4.43
Nitrogen	1.85	1.86	2.21	1.20	1.95	1.05	1.38	1.66
Moisture	1.40	1.46	1.92	2.64	3.30	2.15	1.61	1.35
Ash	11.44	15.21	8.83	9.04	11.21	17.24	26.18	12.82
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

terminated by Kjeldahl method.



TABLE II.
Ultimate Analyses of Dry Organic Matter.

	A. Lodna.	B. Kussinda.	C. Barakar Begonia.	D. Dezeraghur.	E. Chotdama.	F. Garanghi.	G. Mooshepara.	H. Ghoosick.
	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Hydrogen	5.47	5.32	5.55	5.92	6.08	4.67	4.76	5.67
Carbon	86.67	86.68	83.06	81.40	84.99	84.51	84.65	87.17
Oxygen and organic sulphur	5.74	5.77	8.91	11.32	6.65	9.52	8.68	5.22
Nitrogen	2.12	2.23	2.48	1.36	2.23	1.30	1.91	1.94
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

TABLE III.
Proximate Analyses of the above Coals.

	A. Lodna.	B. Kussinda.	C. Barakar Begonia.	D. Dezeraghur.	E. Chotdama.	F. Garanghi.	G. Mooshepara.	H. Ghoosick.
	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Moisture.....	1.40	1.46	1.92	2.64	3.30	2.15	1.61	1.35
Ash.....	11.44	15.21	8.83	9.04	11.21	17.24	26.18	12.82
Volatile matter.....	27.88	26.16	31.98	37.37	37.00	26.10	25.95	24.11
Fixed carbon.....	59.28	57.17	57.27	50.75	48.49	54.51	46.26	61.72
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

TABLE IV.

	A. Lodna.	B. Kussinda.	C. Barakar Begonia.	D. Dezeraghur.	E. Chotdama.	F. Garanghi.	G. Mooshepara.	H. Ghoosick.
Calorific value (Thompson's calorimeter).	Cal. 7,260	Cal. 6,955	Cal. 7,150	Cal. 6,847.5	Cal. 6,735	Cal. 6,270	Cal. 5,912.5	Cal. 6,875
Do. (calculated from formula $H = 8080c + 3460 \times (h - \frac{1}{8}o)$).	7,529.5	7,156	7,353	7,180	7,418	6,473	5,852.5	6,473
Calorimeter value stated as percentage of theoretical.	96.4	97.2	97.2	95.4	90.8	96.9	101	94.1

Mean = 96.1 per cent. of theoretical.

Appearance of coal.....	Slaty-looking.	Soft.	Hard.	Hard and bright.	Hard and bright.	Hard and slaty-looking.	Hard, dull, and slaty-looking.	Hard and bright.
Appearance of the residue after ignition.	Much swollen, coherent and hard.	Slightly swollen, but firmly coherent.	Much swollen, coherent and fairly hard.	Slightly swollen, bright and metallic-looking.	Slightly swollen, bright and metallic-looking.	Not swollen; soft and black.	Not much swollen, but coherent; black-looking.	Much swollen; dull grey in colour.
Colour of ash.....	Grey.	Grey.	Grey.	Light brown.	Light brown.	Light grey.	Light grey.	Grey.

To illustrate the variation in composition of the Bengal coal within still narrower geographical limits, we quote the following figures for coal from different parts of the Lodna property, on the authority of analysts of repute. These figures, as well as our samples, we owe to the courtesy of Captain Wm. Corkhill and the Asiatic Steam Navigation Company Limited, to whom we would express our indebtedness.

TABLE V.
Samples of Lodna Coal. Ultimate Analyses.

	(i.)	(ii.)	(iii.)
	Per Cent.	Per Cent.	Per Cent.
Hydrogen	3.82	5.06	5.43
Carbon	75.85	74.60	71.31
Oxygen	7.98	9.34	8.29
Nitrogen	1.81	1.73	2.05
Ash.....	10.04	9.27	12.92
	99.50	100.00	100.00
Sulphur	0.50		
	100.00		

Evaporative power... 13.52 lb. 13.12 lb. of water at 212° F.
Equivalent to.... 7,260 cal. 7,055.5 cal.

Proximate Analyses of Lodna Coal.

	(iv.)	(v.)	(vi.)
	Per Cent.	Per Cent.	Per Cent.
Moisture.....	1.50	1.40	1.72
Ash.....	7.80	5.60	10.35
Volatile matter.....	25.60	28.80	29.08
Fixed carbon.....	65.10	64.20	58.85
	100.00	100.00	100.00
Sulphur.....	0.47	0.45	0.50
Coke.....	72.90	69.80	69.20

The coke is fairly hard. Caking index of the coal, about 11.5. Ash white in all cases.

Calorific power (calorimeter test) varies from 11 to 13½ lb. of water per lb. of coal, and the calorific power



under boilers is said to be from 7.5 to 9 lb. of water per lb. of coal.

Regarding these coals as a group, we note the following points:—

(i.) The proportion of moisture varies within narrow limits, 1.35—3.30 per cent., and is always low.

(ii.) The percentage of ash is invariably fairly high and sometimes large. When present in normal quantity it does not appear to be capable of much reduction by washing, a large part of it being in, and not merely associated with, the coal.

(iii.) The calorific value varies, but is never high. As determined by experiment with the Thompson calorimeter, it is almost always very much less than that obtained by calculation. Prof. Dunstan's results in this connection are in agreement with our own, as shown by the following figures, in which underneath the results obtained at the Imperial Institute Laboratory we place those calculated from ultimate analyses recorded in the report (p. 24).

TABLE VI.

Name.	Liakdee.	Sode-pore.	Kumar-dubhi.	Karbar-bari (Lower Seam).	Karbar-bari (Upper Seam).
Calorific value found (Thompson's calorimeter)	6,721	6,655	6,567	6,644	6,985
Do. calculated ..	7,246	7,065.4	6,941.6	7,758	8,124
Ratio of experimental to calculated result.	94.1%	94.2%	94.6%	85.6%	86%

Mean, 90.9 per cent.

(iv.) In caking power the coal shows considerable variation. In sample F it is *nil*; the maximum caking index found is 11—12.

(v.) The nitrogen content, when calculated on the dry organic matter, is very constant. It is lowest in samples D and F which belong to the southern part of the field. The same two samples contain a high percentage of oxygen.

II. *Japan Coal*.—As in India, the coal industry in Japan has advanced rapidly during recent years. In 1875 the output was a little over 560,000 tons; in 1895 it was estimated at about 3½ million tons, and is now probably well over 4 million tons per annum.* Outside the Empire the principal markets are China ports, which in 1899 took 949,000 tons; Hong Kong, which in the same year took 660,000 tons; Singapore and British India, which took nearly 300,000 tons each. Smaller quantities were sent to Eastern Russia, the United States, the Philippines, and Tonquin. Bunker coal was exported in the same year to the extent of 473,919 tons. Coal is found in Japan in the three principal islands, but by far the largest quantity which comes into the market at the present time is raised in Kinshu, the most southerly of the group. That island in 1900 furnished about 3,000,000 tons out of a total output for the Empire of a little over 4,000,000. Coal is known to exist over a large part of the island, but the principal coal district lies in the basin of the river Onga, which enters the sea at the port of Wakamatsu. In the upper part of the basin, the coal is usually of superior quality, but the seams nearer the mouth are, for the most part, of lower grade. In the neighbourhood of Nagasaki are the Takashima deposits, which produce some of the best coal in Japan. The mine is situated in Hizen county, Kumamoto prefecture, and was the first in the Empire to be developed on European lines. The enterprise of the proprietor, Baron Iwasaki, set an example which many other coal owners in time followed. The seams here are 13 in number, of which five are worked. The inclination is generally 15°—20°, but at times as much as 40°—50°. Coal is now being extracted at a depth of 1,000—1,200 ft.

under sea level. The system followed is pillar and stall. The seams worked have the following thickness:—Top seam, 8 ft.; 2nd, 5 ft.; 3rd, 5 ft.; 4th, 18 ft.; and lowest, 3 ft. The last only is of inferior quality; the others are equal to the best in Japan. The annual output (1900) is 237,506 tons. Electricity is used both for lighting and cutting.

To the Takashima coal the official report of the Japanese Government assigns the following composition:—

Ultimate Analysis.

	Per Cent.
Hydrogen	4.65
Carbon	76.84
Oxygen	13.03
Nitrogen	1.47
Sulphur	0.15
Moisture	0.84
Ash	3.02
	100.00

Proximate Analysis.

	Per Cent.
Moisture	0.84
Ash	3.02
Volatile matter	42.71
Fixed carbon	53.43
	100.00

In the adjoining Higo county are the Hiro-Yama mines, the property of the Kinshu Coal and Railway Company. The bed here is said to be somewhat deep and narrow. The Japanese report gives the following analyses of the product:—

Ultimate Analysis.

	Per Cent.
Hydrogen	3.07
Carbon	64.93
Oxygen	9.82
Nitrogen	0.35
Sulphur	4.07
Moisture	1.21
Ash	16.55
	100.00

Proximate Analysis.

	Per Cent.
Moisture	1.21
Ash	16.55
Volatile matter	9.16
Fixed carbon	73.08
	100.00

The Kanada mine is situated in the same county, and has seams 8 ft. and 4 ft. in thickness. Much of the 8-ft. mineral from this district is "blind coal," but that from the Kanada is bituminous. Inclined shafts are used. The daily output is from 200 to 250 tons.

In the county of Chikugo, to the north of Hizen, lies the famous Miike deposit, the property of Messrs. Mitsu and Co., of Tokio, which has an area of 25 square miles. One of the seams in this deposit has a thickness of from 8 to 20 ft., and a second of from 6 to 10 ft. The beds are inclined at an angle of from 5° to 10°, and access is had by six shafts, 240, 500, and 1,000 ft. in depth. Next to Takashima, the product ranks as the best Japanese coal. Mixed with American anthracite it is employed for marine purposes as well as on the principal railways. A large quantity of "smalls" and dust is obtained, and this is now being converted into briquettes. The system of mining is the British one. Electricity is used for all purposes, including traction.

Miike coal presents peculiarities that have already made it the subject of study. Watson Smith and Chorley (this Journal, 1892, p. 591; and 1893, p. 221) have shown that a considerable proportion of it is soluble in benzene, namely 9.5 per cent., as compared with from 0.6 to 1.6 per cent. in most coals.

We subjoin analyses made by these investigators, as well as that of the Japanese authority (see next page).

To the north-east of Chikugo lies the county of Chikuzen, in which several mines of importance are at work. In the village of Nakama is the Ohtsuji colliery, at which operations were begun about seven years ago. The seams are four in number, two of them having only recently been

*The following figures have been supplied since the above was written:—

Export of Coal from Japan—

In 1900,—4,630,903 tons, valued at 13,703,655 yen.

In 1901,—8,697,705 tons, valued at 17,499,094 yen.

The latter export was abnormal, owing to the extra requirements arising out of the Chinese trouble.



Ultimate Analyses.

	Watson Smith and Chorley.	Japanese Authority.
	Per Cent.	Per Cent.
Hydrogen	5.84	5.05
Carbon	74.22	72.33
Oxygen	5.61	10.28
Nitrogen	1.11	
Sulphur	3.15	0.50
Moisture	0.62	9.13
Ash	9.45	
	100.00	97.29

Proximate Analysis.

	Watson Smith and Chorley.	Japanese Authority.
	Per Cent.	Per Cent.
Moisture.....	0.62	0.50
Ash.....	9.45	9.13
Volatile matter.....	38.88	40.70
Fixed carbon.....	51.95	49.67
	100.00	100.00

opened up. Access is obtained by an inclined shaft. The product of the mine is used for general industrial purposes, and is also exported to Chinese and other foreign ports.

The Japanese authority gives the following composition:—

Proximate Analyses.

	Per Cent.	Per Cent.
Moisture.....	from 4.00 to 6.04	
Ash.....	5.80	3.06
Volatile matter.....	46.70	41.66
Fixed carbon.....	45.50	49.24

The sulphur is said to vary from 0.05 per cent. to 2.53 per cent.; sp. gr., 1.33. Coke, coherent and swollen; ash, grey or reddish-grey in colour.

From the same county comes the coal known as Yamano, which is the product of a colliery situated at the village of the same name. Other mines working in this field, which has a total area of 1,000 square miles, are Togawa, Nuri,

Onoura, Owachi, Nemeta, Katsuma, Togakumi, and Otoku. The Otoku (Taku?) coal is obtained from a mine at the village of the same name. The seam worked is 3—5 ft. in thickness, and the annual output 43,683 tons (1900).

Outside the island of Kiushu the principal coal area in Japan is in the north island, Hokkaido or Yezo. In the main or Japan island, coal is found at two points—Nagato county in the south, and Ibariki, or Iwani, in the east. In the former of these districts the Onodo colliery is at work, and in 1900 had an output of 200,000 tons. The product is however, compared with much of the Kiushu coal, of inferior quality. The seam is from 2 to 3 ft. in thickness. The Ibariki field is in Ibariki prefecture, and the seam has a thickness of from 4 to 8 ft. The coal is used for general industrial purposes.

The Hokkaido coalfield is officially estimated to contain 600 million tons, and coal is worked at present on an extensive scale by the Hokkaido Coal Mines and Railways Company. The company operates four mines, namely, Poronai, Sorachi, Ikusumbetru, and Yubari. The Poronai mine is at the village of that name in Ishikari county, and was opened up about 25 years ago. There are four seams, of from 5 to 10 ft. in thickness. The production is at the rate of about 170,000 tons per annum. The coal is largely used for railway and marine purposes. The Ikusumbetru mine, in Sorachi county, has a 5-ft. seam. The output is about 50,000 tons per annum. The Sorachi mine property of the Company was opened up in 1890, and has 10 seams of from 4 to 9 ft. in thickness.

The Yubari colliery, situated at the village of Nobari-kawa in Ishikari county, started operations in 1890, and is at present worked both above and below the drainage level. Two seams of coal are met with, the upper one 25 ft. and the lower 4 ft. in thickness. The annual production has recently been greatly increased, and now exceeds 1,650,000 tons. The dip of the beds is steep, and much trouble has been occasioned at times through the presence of fire-damp in the workings. The product is an excellent bunker coal.

For the samples of some of these coals which we have examined we are indebted to the courtesy of Oliver Brooks, Esq., of the "Japan Daily Herald," to whom we take this opportunity of expressing our thanks. The following figures show the ultimate analyses and proximate composition.

TABLE VII.

	Kiushu Island.						Japan Island.		Hokkaido Island.	
	I.	J.	K.	L.	M.	N.	O.	P.	Q.	R.
	Kanada (Higo).	Miike. (Chikugo).	Ohtsuji (Chikuzen).	Yamano (Chikuzen).	Taku (Chikuzen).	Kiushu (Anthracite) (?).	Onodo (Nagato).	Ibariki (Ibariki).	Poronai (Ishikari).	Yubari (Ishikari).
	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Hydrogen	5.41	5.91	4.55	5.96	6.19	1.96	4.41	4.27	4.56	5.77
Carbon	76.10	75.62	64.34	77.16	70.11	72.92	58.61	54.98	71.30	77.16
Oxygen and organic sulphur.	7.66	5.16	10.23	7.33	9.54	1.24	16.99	15.61	11.19	7.54
Nitrogen*	2.85	2.54	2.45	3.30	2.75	.65	2.17	.64	1.37	3.40
Moisture	3.40	1.78	4.83	3.46	2.01	4.27	6.33	16.82	6.44	1.87
Ash	4.58	9.59	13.60	3.09	9.60	18.96	11.49	7.68	5.14	4.26
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

* Determined by Dumas method.

TABLE VIII.

Ultimate Analyses of Dry Organic Matter.

	I.	J.	K.	L.	M.	N.	O.	P.	Q.	R.
	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Hydrogen	5.88	6.62	5.58	6.06	7.00	2.55	5.37	5.65	5.16	6.15
Carbon	82.70	84.75	78.88	82.57	79.32	94.99	71.32	72.83	80.63	82.20
Oxygen and organic sulphur.	8.32	5.78	12.54	7.84	10.57	1.61	20.67	20.67	12.66	8.03
Nitrogen	3.10	2.85	3.00	3.53	3.10	.85	2.64	.85	1.55	3.62
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00



TABLE IX.
Proximate Analyses of above Coals.

	I. Kanada (Higo).	J. Miike. (Chikugo).	K. Ohtsuji (Chikuzen).	L. Yamano (Chikuzen).	M. Taku (Chikuzen).	N. Kiushu (Anthracite) (?).	O. Onodo (Nagato).	P. Ibariki (Ibariki).	Q. Poronai (Ishikari).	R. Yubari (Ishikari).
Moisture	Per Cent. 3.43	Per Cent. 1.18	Per Cent. 4.83	Per Cent. 3.46	Per Cent. 2.01	Per Cent. 4.27	Per Cent. 6.33	Per Cent. 16.82	Per Cent. 6.44	Per Cent. 1.87
Ash	4.58	9.59	13.60	3.09	9.60	18.96	11.49	7.68	5.14	4.26
Volatile matter	41.00	39.92	41.97	42.92	46.79	9.20	47.51	42.40	39.89	46.59
Fixed carbon	51.02	49.31	39.60	50.53	41.60	67.57	34.67	33.10	48.53	47.28
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

TABLE X.

	I.	J.	K.	L.	M.	N.	O.	P.	Q.	R.
Calorific value (Thompson's calorimeter).	Cal. 7,450	Cal. 7,770	Cal. 6,297	Cal. 7,835	Cal. 7,342.5	Cal. 5,670	Cal. 5,650	Cal. 5,395	Cal. 6,750	Cal. 8,030
Do. (calculated from formula $H = 8080c + 34.46(a - \frac{1}{2}o)$).	7,682	7,923	6,325.5	7,563	7,395	6,516	5,525	5,242	6,850	7,899
Calorimeter value stated as percentage of theoretical.	97	98	99.55	99.58	99.29	87	102.26	102.92	98.54	101.66

Mean (omitting the anthracite), 99.86 per cent.

Appearance of the Coal.

I.	J.	K.	L.	M.	N.	O.	P.	Q.	R.
Bright and shining. Burns with strong smoky flame.	Peculiar, almost waxy appearance. Very soft. Brown when finely powdered. Burns with a strong bright smoky flame.	Hard and shaly, breaking with uneven surfaces. Brown when in powder. Contains translucent flakes of calcium carbonate. Burns with bright smoky flame.	Bright, soft coal, containing crystals of pyrites and also of calcium carbonate. "Mother of Coal" present in leaves of a brown colour. Strong smoky flame.	A bright, soft coal, containing resin in lumps. Chocolate brown when finely powdered. Burns with bright smoky flame.	An anthracite, parts having almost the appearance of graphite. Burns without smoke or flame.	A bright brittle coal, containing leaves of both calcium carbonate and calcium sulphate, as well as pyrites and resin. In powder has a dark brown colour. Burns with a very bright smoky flame.	A clean, brittle coal, breaking with even surfaces. Contains resin in lumps and also pyrites in laminae. Brown when in powder. Burns with a bright flame but with little smoke.	Contains calcium carbonate in thin leaves, also resin in lumps. Burns with a smoky flame.	A bright and brittle coal, containing calcium carbonate in leaves and also pyrites. Brown when powdered. Burns with a very bright smoky flame.

Residue after Ignition.

A hard strong grey coke.	A grey coke, very much swollen and spongy.	A soft, black mass, scarcely coherent.	Hard and metallic looking coke, only slightly swollen.	A hard metallic looking coke.	Loose black powder.	Black, scarcely coherent.	Does not cohere.	Soft and friable coke, grey in colour.	A hard metallic looking coke, slightly swollen.
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Colour of Ash.

Light brown.	Reddish grey.	Light brown.	Light brown.	Grey.	Buff.	Greyish brown.	Buff.	Light brown.	Light brown.
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There are several points in connection with these coals which are worthy of comment.

(1.) The presence in many of the samples of a clear, bright resin, in pieces sometimes the size of peas or beans. Such masses are present in the Taku coal from Kiushu Island, the Onodo and Ibariki coals from Japan Island, and the Poronai coal from Hokkaido, so that it would appear to be a widespread accompaniment of the coals of the Empire.

(2.) The nitrogen content is variable, but in most cases exceptionally high, ranging up to 3.60 per cent., reckoned on the dry ashless sample, in the case of Yubari coal. This nitrogen does not appear to be in a form that admits of being accurately estimated by the Kjeldahl method. For

the samples described above, results were obtained by the Kjeldahl method, ranging from nil to 1.90 per cent. of nitrogen. Thus:—

Nitrogen by Kjeldahl Method.

	I.	J.	K.	L.	M.
Mean of two closely agreeing experiments.	Per Cent. 1.16	Per Cent. Nil.	Per Cent. .08	Per Cent. 1.49	Per Cent. 1.35



—	N.	O.	P.	Q.	R.
Mean of two closely agreeing experiments.	Per Cent. Trace	Per Cent. '93	Per Cent. Trace	Per Cent. '10	Per Cent. 1'90

For Miike coal, our results obtained by the Dumas method are 2·56 per cent. and 2·52 per cent. For the same coal, Watson Smith and Chorley (*supra*) give nitrogen = 1·11 per cent. This result, Mr. Watson Smith informs us, was almost certainly obtained by the Kjeldahl method. The low figures, 1·47 per cent. and ·35 per cent., quoted by the Japanese authority for Takashima and Hirayama coals, may have been got by the same process, but of this we have no assurance. The Indian coals, so far as examined, gave concordant results by the two methods of nitrogen determination.

(3.) The sulphur contents would appear to be frequently high also. Watson Smith and Chorley's figure for Miike is 3·15 per cent. of sulphur, and the result obtained in our own laboratory agrees with this. Systematic determinations of the total sulphur were omitted as likely to contribute little to our knowledge of the composition of the coal itself.

(4.) The close agreement between the experimentally determined calorific values, as fixed by the Thompson's calorimeter, and the calculated values is noticeable. It is the case even where the values are very low. The experimental result is in several instances slightly higher than that calculated from the formula given. This may be ascribed in part at least to the oxidation of the sulphur.

(5.) Our examination of these typical Japanese coals goes to show that the coal from both the north and south islands of the Empire is frequently of high quality, while

that from the two coal-bearing districts of the middle island is of inferior value only.

III. *Pyridine as a solvent for Coal.*—A year ago it was suggested to one of us by Prof. P. Phillips Bedson that the effect of pyridine as a solvent might be tried on some of the coals on which experiments had already been made in the Glasgow University Laboratory. Bedson had already shown (*Trans. N. of Eng. Inst. of Min. and Mech. Engin.*, 1899, 48, [3], 82—87; this *Journal*, 1899, pp. 738, 739) that from Durham coal this reagent extracts from 16 to 18 per cent., and from New Zealand coal 10 to 13 per cent., and since then his results have been confirmed and extended by Baker (*ibid.*, 1901, 50, [2], 23—26; this *Journal*, 1901, p. 789). The experiments of the latter indicate that the removal of certain constituents by pyridine results in a lessening and in some cases complete disappearance of the caking property of the coal.

From the series of Indian and Japanese coals described above we selected the samples from Barakar (Bengal), Poronai and Yubari (Japan), and for comparison chose two well-known Scotch coals, Linrigg Lower Drumgray and Bannockburn Main. The two latter were the samples marked J and N, described in a previous paper (Carrick Anderson and Roberts, this *Journal*, 1898, p. 1015), the former being a caking coal of low caking index (4·5), and the latter a strong caking coal (index, 15·5).

In each case 12—15 grms. of the coal, finely powdered, was treated in a Soxhlet with commercial pyridine boiling about 110°—120° C. The pyridine was distilled off and the residue digested with hot hydrochloric acid, then filtered and washed with hot water till free from chlorides. It was finally dried at 110° C.

From all the samples pyridine extracted a considerable amount of a dark brown substance with a greenish fluorescence when in solution. After removal of the pyridine this remained as a black lustrous body resembling bitumen.

TABLE XI.

—	Barakar (India).	Poronai (Japan).	Yubari (Japan).	Linrigg (Scotland).	Bannockburn Main (Scotland).
Percentage of original coal extracted.	Per Cent. 10·8	Per Cent. 7·0	Per Cent. 21·7	Per Cent. 12·8	Per Cent. 14·5
Effect of removal on caking property.	Ignited residue just cohered and no more. Loss = 39·26 per cent.	Residue did not cohere. Loss = 44·14 per cent.	Residue cohered fairly firmly, but was dull in color. Loss = 49·14 per cent.	Residue a loose non-coherent powder. Loss = 43·02 per cent.	Residue still a firm, hard coke, but not so strong as the original. Part remained as a loose powder. Loss = 29·6 per cent.

Some of these extracts were analysed and the composition found to be as follows:—

TABLE XII.

—	Barakar (India).	Poronai (Japan).	Yubari (Japan).	Linrigg (Scotland).	Bannockburn (Scotland).
Hydrogen.....	Per Cent. 5·82	Per Cent. ?	Per Cent. 6·12	Per Cent. 5·68	Per Cent. 6·05
Carbon.....	82·91	?	81·51	79·93	83·39
Oxygen.....	8·73	?	10·00	?	7·30
Nitrogen*.....	2·24	1·62	2·17	?	2·86
Sulphur.....	·30	·60	·20	?	·40
	100·00		100·00		100·00

* Determined by Dumas method.

These extracts are similar in appearance and seem to be of like character. They all contain both nitrogen and sulphur, as well as a small amount of inorganic matter (up to ·7 per cent.). The presence of organic sulphur in all the samples confirms the discovery of it by the method of nitric acid oxidation of the coal (Carrick Anderson and Roberts, this *Journal*, 1898, p. 1018). Comparison of the acid body described there as got from Bannockburn Main

coal with the above extract from the same sample shows the same amount of organic sulphur in each. Both that part of coal which dissolves in pyridine and that which remains insoluble yield similar brown acid bodies by nitric acid oxidation, conducted as described in the paper quoted above. Analyses of these have not yet been made.

These pyridine extracts are mixtures, and a partial separation at least may be made by suitable solvents.

From the Linrigg coal amyl acetate, among other solvents tried, extracted a reddish brown resin, which in solution gave a green fluorescence.

The conclusion drawn is that pyridine as a solvent extracts a larger amount from coal than any other reagent hitherto used. In the extracted matter the proportions of carbon, hydrogen, and nitrogen are not unlike those in the dry organic matter of the original coal, but the percentage of carbon in the extract is generally less and sometimes markedly lower than in the original, so that bodies richer in carbon would appear to form the bulk of the insoluble portion. In the case of inferior caking coals, the treatment with pyridine removes the caking property completely, but in strong caking coals a fusible constituent is left undissolved, so that the caking power, though impaired, is not altogether destroyed.

DISCUSSION.

Mr. SATOW said he had been greatly interested, and had gained a great deal of information from his former



Professor, Dr. Anderson's paper, and he could add nothing on the subject, except a few things which he saw in a recent Japanese Government report on coals. As regards the Miike coalfield, it had been known to the Japanese for about three hundred years. It runs from north-west to south-east, with an inclination of about 10°. In 1875, it was transferred to the Government, and consequently every recent Western practice was introduced into the mine. After 16 years the Mitsui firm obtained possession of it from the Government, and since that time much improvement has been made, 2,500 tons being the daily output at the present time. The mine is lighted throughout by electricity, and such operations as hoisting and ventilation are likewise performed by electrical power. The largest pump used has a diameter of 90 ins., with 12-ft. stroke; there is also a double-acting steam pump of 250 B.H.P., which is one of the largest pumps in use in such mines; indeed, this mine, from the point of general equipment, is one of the model mines of the world. One thing that struck the speaker when he visited collieries at Hamilton was the fact that the miners of that district were still sticking to the old methods of working. As regards the future of the Japanese coalfield, they had the prospect of discovering some other fields. Although it had no direct connection with the paper, he might mention that recently they had discovered a well of petroleum in the centre of Nippon (Japan) Island, which is said to be not only of such enormous capacity as to supply the internal consumption, but also to contain sufficient for exportation.

Dorsetshire Section.

ERRATUM.—This Journal, 1902, p. 160, col. 1, bottom line, for "A catechu," read "A. catechu."

Obituary.

WILLIAM MARTINDALE.

MEMBER OF THE SOCIETY OF CHEMICAL INDUSTRY.
FORMERLY PRESIDENT OF THE PHARMACEUTICAL SOCIETY.

AUTHOR OF THE "EXTRA PHARMACOPOEIA," &c.

On Sunday, February 2nd, the death took place of Mr. William Martindale, one of the most prominent of English pharmacists. In connection with the Pharmaceutical Society he was for ten years an examiner, and since his resignation has been a member of the council of that body. He was treasurer in 1898, and president in 1899—1900. Mr. Martindale was twice president of the British Pharmaceutical Conference, 1891—1896. He was a Fellow of the Chemical Society, of the Linnean Society, and other scientific bodies. In 1893 he was one of the British delegates to the International Congress of Pharmacy held in Chicago during the time of the Exhibition. In the same year he was Mayor of the quaint old town of Winchelsea, and a Baron of the Cinque Ports. In conjunction with Dr. Wynn Westcott he was author of the "Extra Pharmacopœia," a work which attained great popularity with physicians and pharmacists, and passed through nine editions, and was altogether a work which has attained a unique position in the history of pharmaceutical literature. At the time of his death Mr. Martindale was serving on the committee appointed by the Privy Council last year to inquire into the conditions governing the sale of poisons.

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ENGLISH PATENT SPECIFICATIONS may be obtained by post by remitting 8d. each—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.

I.—PLANT, APPARATUS, AND MACHINERY.

ENGLISH PATENTS.

Filtering Liquids, and Apparatus therefor; Method of
— E. Füllner, Herischdorf, Silesia. Eng. Pat.
22,852, Nov. 12, 1901.

A drum with open end is rotated in a tank, its extremities being tightly packed, by means of rims or flanges, against the ends of the tank. The drum is perforated, and a band

of network or permeable felt passes round it and stretching rollers. On this band is a filtering layer. The liquid to be filtered or clarified is introduced into the tank, and by hydrostatic pressure passes through this filtering layer, which retains the impurities, into the interior of the drum, and runs off in a filtered and clarified condition from the open ends of the drum. When the filtering layer has become charged with impurities, it may be removed by means of scrapers or brushes, and the uppermost layer may then be made up by introducing disintegrated fibrous material into the liquid under treatment.—J. A. B.



Separating Solid Particles of Superior Specific Gravity from Fluids containing them; Apparatus for —. W. P. Thompson, Liverpool. Eng. Pat. 22,957, Dec. 15, 1900.

A MODIFIED cyclone dust separator. Dusty air or other fluid enters tangentially a vertical cylindrical chamber; the base of the chamber contains a flat vertical plate, which supports above it a vertical hollow truncated cone; the dust falls through the annulus formed between this cone and the chamber itself, and is removed by means of a double valve. The air, free from dust, leaves the apparatus by means of a central pipe in the upper cover.—J. W. H.

Refrigeration, and Apparatus therefor; Ammonia Absorption-Producing Process of —. W. Brothers, Prestwich. Eng. Pat. 4012, Feb. 25, 1901.

A VESSEL containing ammonia is connected, through a condenser, by a pipe with another vessel containing water; a vacuum is always present in one or other of these vessels, and no pressure above that of the atmosphere is permitted in either; both vessels are jacketed, and that containing water also has a suitable vessel in contact, in which the ice is formed. By heating the first vessel, the ammonia is driven off and absorbed by the water in the second; the flame is then removed and cooling water circulated, with the result that the rapid evaporation from the second vessel produces the desired refrigeration. A regulator of the gas for the heating burner is also claimed.—J. W. H.

UNITED STATES PATENTS.

Centrifugal Extraction; Process of —. J. J. Berrigan, East Orange, New Jersey, U.S.A. U.S. Pat. 689,570, Dec. 24, 1901.

THE centrifugal machine claimed, is intended to separate solids in a dry form from liquids with which they are associated.

A circular drum revolves eccentrically on a vertical axis, so that its contents separate in layers in crescent form; two holes are pierced in its walls to remove the liquid at places where the liquid layers would accumulate, and scrapers carry the separated solids round the walls of the drum, where they become freed from moisture, and are finally discharged through an opening in the wall nearest the axis of rotation.—J. W. H.

Centrifugal Machine. J. J. Berrigan, East Orange, New Jersey, U.S.A. U.S. Pat. 689,571, Dec. 24, 1901.

THIS invention relates to a modification of the machine described in U.S. Pat. 689,570, Dec. 24, 1901 (see preceding abstract). To prevent the holes through which the liquid passes becoming clogged with solid material, tubes are employed which project into the liquid layer; the mechanical arrangement of the scrapers is also simplified.—J. W. H.

Centrifugal Machine. J. J. Berrigan, East Orange, New Jersey, U.S.A. U.S. Pat. 689,572, Dec. 24, 1901.

A SERIES of separating chambers revolve together on a vertical axis and separately on their own axes, which are inclined outwardly to the main axis. A liquid containing solids being introduced into the separating chambers by means of a central vertical pipe, meets a series of baffle plates in the upper part of each separating chamber, which retain the solids; the separated liquid flows out of the chambers through a ring of holes in each separator, and the solids are driven out of suitable openings in the upper cover by centrifugal force.—J. W. H.

Centrifugal Separator Drum. F. O. Nilsson, Waxholm, Sweden. U.S. Pat. 689,620, Dec. 24, 1901.

THE upper edges of separator drums of the type which have journals both above and below, are screwed on the outside and made conical on the inside; the covers screw on the drum, and are provided with lugs, which, when screwed tightly against the conical surfaces, expand the edges of the drums and make a very secure connection.

—J. W. H.

II.—FUEL, GAS, AND LIGHT.

Lignite-Gas; Firing with —, for Pottery and Earthenware Kilns. Baier. Thonind.-Zeit., 25, [146], 2125—2127.

THE generator consists of a bricked shaft with arched cover, generally rectangular in section, and of an area of about 3 sq. m. The front side is fitted with flat and step grates, on to which the coal is fed through a hopper above. The temperature of the gas in the main is rarely higher than 150° C., falling to 80°—60° C. at the entrance to the combustion chamber of the kiln. To ensure perfect combustion, the air has to be heated, and care taken to effect an intimate mixture of the gas and air, the best results being obtained by allowing them to impinge at right angles. For uniform distribution, the gas is led in from below, and passes through a number of upright firebrick pipes, perforated with small circular equidistant apertures, and extending to the top of the chamber. The author has also introduced a form of burner, consisting of short vertical perforated pipes, connected by hollow horizontal blocks, so that the gas is discharged both horizontally between the individual pipes, and vertically through the cover of the burner.

The heating of annular kilns with gas, possesses certain advantages over the employment of heating walls, viz., greater rapidity of heating, reduced outlay on material (the gas pipes representing a weight only about one-tenth that of the heating walls), and a saving in the expense of fuel, and care in firing.—C. S.

ENGLISH PATENTS.

Spirit; Solidified —. R. C. Wild, Eltham, Kent. Eng. Pat. 5404, March 14, 1901.

SOLIDIFIED spirit is generally prepared by mixing "alcohol or other spirit" with a soap-like mass. "The solid substance thus formed, when ignited, melts, and if the vessel containing it be upset while the material is burning, the ignited mass escapes," and may be dangerous. At present such solidified spirit is supplied in tins, &c. The inventor places in the containing vessel some absorbent material such as one of cotton wool, cellulose, or slag wool, &c., and thus, provision is made for such possible liquefaction and escape of spirit as that referred to.—J. F. B.

Gas in Gas Producers, and its Treatment and Utilisation in Internal Combustion Engines; Production of —. P. Naef, New York. Eng. Pat. 781, Jan. 11, 1901. (Under Internat. Conv., June 14, 1900.)

THE specification describes a number of combinations, with a gas- or oil-engine, of a series of tubular "temperature interchangers" (heat economisers), whereby the gas and air supplied to the cylinder of the engine are pre-heated by the gases from the exhaust. If the combustible gas be delivered to the engine in a hot state from a producer, the exhaust gases are used to heat the air supplied to the engine, and also to heat the blast supplied to the producer. By introducing water along with the air blast into the economiser, steam is evolved, which is utilised in the producer. The gases from the producer may be cooled in an economiser, and then washed for the recovery of by-products, prior to use in the engine. To remove the smell from the exhaust gases, they may be passed through a revolving washer in which they are sprinkled with oil.

A suitable form of gas producer is also described.—H. B.

Hydrocarbon Burners for Heating Purposes. J. A. Mason, Philadelphia, and C. J. Wilson, New York. Eng. Pat. 18,978, Sept. 23, 1901.

A HYDROCARBON burner, adapted for locomobiles, is described, in which the oil is vaporised by passing it through a serpentine chamber, heated by the flame of the burner itself. The vapour, on its way to the burner, has to pass through a "self-cleaning strainer," which consists of a device filled with shot, the jolting of the vehicle causing a continuous agitation of the shot, and thus preventing any clogging of the strainer.—H. B.



Carbide of Calcium. J. W. Woodall and F. Windham, both of London. Eng. Pat. 524, Jan. 8, 1901.

CALCIUM carbide, which may or may not have been previously treated with petroleum, is impregnated with naphthalene, by being immersed, whilst hot, in molten naphthalene. This impregnation is said to retard the unduly vigorous action of water on carbide, whilst the heat evolved by that action is utilised in volatilising the naphthalene, which, in the gaseous form, mixes with the acetylene. The illuminating power of the acetylene is stated to be thereby improved.—J. A. B.

Acetylene Gas; Process or Method for Treating and Purifying —. J. A. Burgess, Bradford, Canada. Eng. Pat. 241, Jan. 3, 1901.

WITH the object of removing from the gas the matter which fouls the pipes and burners, the gas, after leaving a condenser, is caused to traverse purifiers containing, in order, charcoal permeated with a dry metallic salt (preferably sulphate of iron), calcium carbide, and lava or similar material. The charcoal is saturated with a solution of the salt, and dried. The inventor states that the occlusive property of the charcoal brings the impurities into intimate contact with the metallic salt in the pores; also that he believes that the calcium carbide, in addition to removing moisture, has a purifying action on the gas. The purifier containing lava, is preferably kept at a temperature slightly below the decomposition point of acetylene. The lava is said to remove vesicles of the oily hydrocarbons, otherwise absorbed by the lava tips of the burners, which would thus become fouled. The prepared charcoal and calcium carbide purifiers may be applied both anterior and posterior to the storage gas-holder.—J. A. B.

Acetylene Gas for Household Lighting or other Purposes; Apparatus for Generating —. T. Rauthmell, Holme, via Carnforth, Westmoreland. Eng. Pat. 4915, March 8, 1901.

AN improved carbide holder for use with the apparatus protected under Eng. Pat. 21,511 of 1900 (this Journal, 1902, 34.) is described. It comprises a number of superposed semi-cylindrical chambers with perforated bottoms, arranged round a central pipe, by which the gas evolved passes away.—J. A. B.

Calcium Carbide; Smelting and Reducing Metals, and Producing —. C. Diesler. Eng. Pat. 930, Jan. 14, 1901

See under XI. B., page 261.

Incandescent Electric Lamps; Glow-Bodies for Nernst —. B. M. Drake, M. Solomon, and Nernst Electric Light, Ltd., Westminster. Eng. Pat. 5042, March 9, 1901.

IN preparing the rods of refractory substance, rods in fairly long lengths are passed through an electric arc at a uniform rate, and are then cut into suitable pieces. The material for making the paste for mounting the rods is either fused in an electric furnace, or the oxides are formed into a thick rod, which is passed slowly through a large arc, so that it melts. The fused material is then ground to an impalpable powder, which serves as the mounting paste.

—H. B.

Arc Lamps; Electrodes for —. [Metallic Salt.] H. Bremer, Neheim - on - the - Ruhr, Germany. Eng. Pat. 18,335, Sept. 11, 1899.

A LUMINIFEROUS metallic salt, or other substance adapted to lengthen the arc, is mixed with the carbon serving as raw material for the electrodes. This reduces the noise caused by the re-ignition of the arc, and also prevents the frequent jumping of the arc from one spot of the electrode to another, which occurs with the employment of plate-shaped or other arc-lamp electrodes having a comparatively large sectional area.—G. H. R.

UNITED STATES PATENTS.

Coke Oven. R. D. Martin, Alderson, Indian Territory, U.S.A. U.S. Pat. 690,748, Jan. 7, 1902.

THE object of this invention is, in a series of coke ovens, to maintain the heat in a drawn oven until it can be recharged, and thus assist in igniting the coal in a newly-charged oven. Each oven is connected with its two neighbours on its opposite sides by two V-shaped passages, opening into the ovens just above the normal level of the coal, while the point of the V extends either horizontally or vertically through the wall in such a position that a damper may be easily worked so as to open or close the passage. If an oven has cooled down before recharging, the gases from its neighbours are directed into it; or the gases may be thus admitted thereto directly after that oven is charged. In either case, the ordinary gas outlet in the neighbours is closed by a tightly fitting stopper, while the outlet in the oven under notice is open.—R. S.

Artificial Fuel; Manufacture of —. E. Springborn, London. U.S. Pat. 690,888, Jan. 7, 1902.

CARBONACEOUS material of poor combustible quality is impregnated with sugar, then immersed in "a solution of coal-tar, petroleum, and resin," to which is afterwards added an alkaline solution. The product is afterwards allowed to dry, and is then compressed.—R. S.

Coke-making; Plant for —. W. Kennedy, Alleghany, Penn., U.S.A. U.S. Pat. 691,148, Jan. 14, 1902.

TWO lines of hearths and two or more series of removable ovens are employed. The coal is discharged from cars down a chute to a bucket, which is suspended from a trolley running on overhead rails. The bucket has a discharge opening in the bottom, and by this means the coal is discharged into an oven. Each oven is connected with the gas main, special removable connections being provided. The gas may be washed or otherwise treated, or may be utilised directly for heating purposes, tubular connections being provided for leading it to combustion chambers and flues beneath the hearths. When the fuel is coked in any oven, that oven is connected to an overhead traveller, and bodily shifted or slid on to a car, running on rails, the sides of the car being let down to form a bridge. When the oven and coke are in position on the car, the sides of the latter are raised, and the oven is then lifted off and carried back to a hearth for another coking operation. A cover, carried by another overhead traveller, may be placed over the coke in the car, and the coke quenched by steam introduced through nozzles passing through the sides of the car; or the car may be shifted to discharge the coke into water. The coke may finally be discharged down a chute, from which it may be raised by an endless chain of buckets to elevated store bins.—R. S.

Gas Producer. H. Hyatt, Cleveland, Ohio, U.S.A. U.S. Pat. 689,673, Dec. 24, 1901.

THE object of the invention is to provide for the effective agitation of all portions of the mass of incandescent fuel in a gas producer, so as to prevent the formation of clinkers, and insure a uniform flow of air throughout all portions of the mass. The producer is provided above the fuel level with a rock-shaft, extending across it, and composed of a series of sections connected together, each section carrying a poker. The shaft is laterally reciprocated as well as rocked. The shaft and pokers are hollow, and cold water is continuously passed through them.—R. S.

Gas Producer. W. Swindell, Alleghany, Penn., U.S.A. U.S. Pat. 689,660, Dec. 24, 1901.

THE gas producer is an improvement on that described in a former patent by the same inventor (U.S. Pat. 674,104, 1901). The producer is rectangular, and the internal side walls begin to slope inwardly and downwardly at about half the height of the producer, and are continued by two side grates, which do not, however, meet at the centre. Longitudinal steam



blast-pipes extend along the lower edges of the grates. Parallel to the level walls, and reaching down from the roof to the level where these walls begin to slope, are two internal walls, forming two side compartments. These compartments are again divided by cross walls into four chambers. The latter form the charging and gas-generating chambers. They are charged alternately, so that a different kind of gas is developed at any moment in the several compartments. The central space between these two parallel walls is divided by a transverse wall. Openings are provided, so that the gas may pass either directly or indirectly from each of the gas-generating chambers to one of these central compartments, from which it escapes below the dividing wall to the other central compartment, and thence passes away to the usual outlet, within which is placed a damper. The arrangement of the two central chambers causes the gases to thoroughly mix before they escape.—R. S.

Smoke or Vapour Condenser. S. G. Merrick, Philadelphia, Penn., U.S.A. U.S. Pat. 689,682, Dec. 24, 1901.

THE smoke or vapour is led into one chamber of a box divided by a wall into two compartments. This wall extends from the top of the chamber to about half the depth, its lower end dipping in water. Within the box there is mounted, upon a horizontal rotating shaft, a conical vessel, the inside of which is formed into a series of spiral passages, by means of metal ribbon secured to the shaft and to the periphery. The open end of the vessel within the smoke-receiving chamber is the larger, and its edge is notched. The narrower end is placed within the second or outlet chamber, and is provided with a perforated end plate, while its sides may also be perforated near the end plate. The conical vessel, as it rotates, draws in "alternate portions of smoke or gas as the mouth is above water, and of water as the mouth is below water." The water and smoke are passed onwards, and are thoroughly mixed together, especially as the space becomes smaller in consequence of the conical form, the result being that "acid, alkaline, or oleaginous vapours" are absorbed by the water, and may be recovered by distillation, while the purified smoke is allowed to escape from the outlet chamber.—R. S.

III.—DESTRUCTIVE DISTILLATION. TAR PRODUCTS, PETROLEUM.

Naphtha from Baku and Grosny; Decomposition Products of —. K. W. Charitschkow. Westn. shirow. weschtsch., 1901, 2, 183. Chem.-Zeit., 1902, 26, [2], Rep. 7.

DESTRUCTIVE distillation of the naphtha residue, with the object of obtaining new products and increasing the yield of illuminating oil, proved unsuccessful in the case of Baku naphtha, the kerosene so obtained being of little value. On the other hand, the process appeared promising as a means of working up the residues in the Grosny naphtha industry, where it is very difficult to obtain more than 20 per cent. of kerosene without leaving resinoid residues, which are difficult to work up subsequently. Part of these products might be subjected to destructive distillation and the decomposition products added to the residual part. This would yield a liquid fuel resembling Baku *masut* in its consistency, ignition point, and other properties. The distillation process could be continued till the residue is either coked, or until a hard resinous mass is obtained. The first method would be disadvantageous, owing to the difficulty of ultimately clearing the still of coke, but the latter method, wherein the coking stage is not reached, could be employed with advantage.

The experiments showed that Grosny naphtha yielded more coke than Baku naphtha on complete decomposition, which pointed to the former containing a higher proportion of substances dissociated by heating. It was also found that the distillates of the decomposition products of both kinds of naphtha consisted of practically identical fractions from a technical point of view. The residues from these distillations might be used to improve the naphtha residues from the ordinary distillation.—C. A. M.

UNITED STATES PATENTS.

Sawdust; Apparatus for Distilling —. E. S. Hutchinson, Washington, Columbia. U.S. Pat. 689,723, June 24, 1901.

THE apparatus claimed, is for the continuous distillation of sawdust and the recovery of by-products, and consists of an externally heated retort, which comprises (1) a drying section, heated to a comparatively low temperature to remove aqueous vapours, which are not further treated; (2) a distilling section, located below the drying section, in which the material is subjected to a relatively higher temperature to expel the lighter vapours, which are condensed and suitably recovered; (3) a lower distilling section, heated to a temperature sufficiently high to remove and recover the heavy by-products; and (4) preferably using a part of the fixed gases passing from the condensers, as a means for furnishing heat to carry on the distillation after the retort has been started, and sufficient gas is generated for that purpose. Each section is divided into a plurality of horizontally arranged passages, through which the sawdust is conveyed, and during its passage the distillation is accomplished. Means are provided for circulating heat and producing a uniform temperature in the different sections, thereby preventing loss by decomposition, so common in externally heated retorts. The charcoal on leaving the final section is fed into an exit chamber of special construction, which admits of its continuous removal from the retort without loss of by-products and vapours. 28 claims.—D. B.

Distilling Apparatus. J. S. Roake, Brooklyn, New York. U.S. Pat. 690,611, May 18, 1901.

IN certain processes of distillation, notably in the destructive distillation of wood, inflammable hydrocarbon gas is carried over in considerable quantity from the retort with the other products to the receiver. The proposed method of disposal of the gas in such a manner that it may at all times escape freely and safely from the receiver, is claimed, all danger of accident by fire being reduced to a minimum or entirely avoided. The receiver is provided with two escape pipes, one communicating with a heating burner or receiver, in which the gas may be either economically utilised or else stored, if desired, and the other leading to the open air, where the gas may be safely ignited and burned, and a single controlling device so constructed that the flow of gas may be directed through either pipe or divided between them.

—D. B.

Wax; Manufacture of Mineral —. E von Boyen, Hamburg-Steinwarden, Germany. U.S. Pat. 689,381, April 30, 1900.

THE process claimed, consists in producing from bituminous brown coal (lignite), a wax-like substance consisting of an acid and an unsaturated hydrocarbon, by treating the coal with hot petroleum spirit, benzene, or other suitable solvent, and converting the extract into mineral wax by subjecting it to distillation with superheated steam, under diminished pressure. The purified product is a white, hard, crystalline substance, melting at 70° C., which, unlike paraffin, is partly saponified by alkali and completely carbonised by concentrated sulphuric acid.—D. B.

Wax from Bituminous Brown Coal; Manufacture of Mineral —. E. von Boyen, Hamburg, Germany. U.S. Pat. 690,693, Jan. 3, 1901.

THIS process differs from that described in the preceding abstract in that the extraction by means of costly solvents is avoided. The lignite is subjected to destructive distillation in the presence of superheated steam, and the product redistilled in the presence of superheated steam under reduced pressure.—D. B.

Acetone; Process for Making —. J. L. Hawliczek, Liverpool, England. U.S. Pat. 690,724, Jan. 7, 1902.

SEE Eng. Pat. 1898, 15,907 (this Journal, 1899, 824).

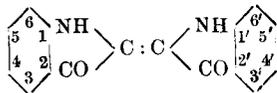
—A. C. W.



IV.—COLOURING MATTERS AND DYE STUFFS.

Indigo; Methyl Derivatives of — M. Kuhara and M. Chikashigé. Amer. Chem. J., **27**, [1], 1—15. (See also this Journal, 1900, 890—891.)

The authors have prepared homologues of indigo by fusing homologues of chloro-acetanilide with caustic potash, in the manner that ordinary indigo may be obtained from chloro-acetanilide (this Journal, 1890, 281 and 1121). The following system of numeration is adopted:—



6.6'-*Dimethyl indigo* is obtained by fusing 100 parts of chloro-acet-*o*-toluide with 175 parts of dry powdered caustic potash and 25 parts of potassium carbonate. It is purified by sublimation or by precipitation from a chloroform solution. The sublimed product crystallises in prisms very closely resembling ordinary indigo in appearance. Characteristic is the solubility in alcohol (1 : 2,000), and in chloroform (1 : 500).

5.5'-*Dimethyl indigo* is similarly prepared from chloro-acet-*m*-toluide, m. pt. 141° C., but potassium carbonate is not added to the melt.

4.4'-*Dimethyl indigo*, which is formed, under similar conditions to the above, from chloro-acet-*p*-toluide, is identical with the dimethyl indigo already known (this Journal, 1890, 281; 1891, 758; also Ber., **33**, 2648). The so-called *m*-methyl indigo (Ber., **16**, 817) obtained from *o*-nitro-*m* methylbenzaldehyde is not identical with any of these isomers.

4.6.4'6'-*Tetramethyl indigo* was prepared by fusing chloro-acet-*unsym*-metaxylyde, m. pt. 143° C., with caustic potash; and similarly 3.4.6.3'4'6'-*hexamethyl indigo* was obtained from chloro-acet-*pseudocumidide*, m. pt. 158.5° C., but only in small quantity.

The methyl derivatives of indigo are all more soluble in organic solvents than ordinary indigo. The best means of characterising them appears to be the observation of the absorption bands in a chloroform solution (Ber., **16**, 2051).

Position of the Maximum Darkness in the Absorption Bands of the Methyl Indigos (Chloroform Solution).

	λ_1	λ_2	$\frac{\lambda_1 + \lambda_2}{2}$
Ordinary indigo	622.7	587.6	605.1
6.6'-dimethylindigo.....	643.6	615.7	629.7
5.5'-"	619.2	598.1	608.6
4.4'-"	643.7	622.7	633.2
4.6.4'6'-tetramethyl indigo	662.7	631.7	647.2

With regard to the mechanism of the reaction between chloro-acetanilide and potash, the authors bring a considerable amount of fresh experimental evidence to uphold their view (Amer. Chem. J., **24**, 167), that the reaction depends for its success on the intermediate formation of diphenyldiketopiperazine, and the subsequent transformation of this substance into indigo by more complicated changes.

—H. L.

Diazo Compounds; Action of Hypophosphorous Acid on — [Diphenyl and Benzene Hydrocarbons, &c.] J. Mai. Ber., 1902, **35**, [1], 162—163.

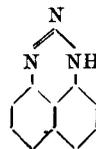
The author finds that, by the action of hypophosphorous acid, diazo compounds are converted mainly into the hydrocarbons, the other decomposition products being formed only in small amount. The commercial acid (sp. gr. 1.15) may be employed, or the calcium salt mixed with the equivalent quantity of sulphuric acid. Thus, *p*-diazotoluene chloride with hypophosphorous acid gives 67 per cent. of the theoretical proportion of toluene; diazobenzene

chloride yields 1 grm. of benzene and 0.5 grm. of diphenyl for 3 grms. of aniline diazotised, a dyestuff of the Indophenol type being also formed; tetrazodiphenyl gives 6) per cent. of the theoretical yield of diphenyl, which may be advantageously prepared by this method; α -diazonaphthalene, when treated with hypophosphorous acid, yields naphthalene but slowly, the reaction being hastened by gentle heating.—T. H. P.

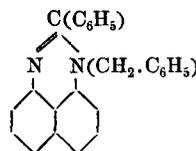
Naphthalene; peri-Derivatives of — [Benzimidazole Dyestuffs]; Ring Formation from. E. Noelting. Chem.-Zeit., 1902, **26**, [1], 5.

It was shown by Terrisse many years ago that naphthalic anhydride yields with resorcinol a product resembling ordinary fluorescein in all respects. The author has found that the phenol and pyrogallol derivatives of naphthalic acid can also be readily prepared, but all his attempts to obtain oxynaphthantraquinone have been unsuccessful, the formation of a ring with seven bonds, being apparently impossible.

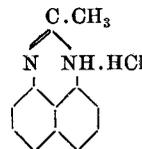
peri-Naphthylenediamine closely resembles the ortho derivative. Thus, on treatment with nitrous acid, it yields an azo-imino compound:—



According to Ladenburg, its hydrochloride, when heated with benzaldehyde, yields hydrochloric acid—a reaction which points to the formation of an aldehyde:—



It does not react, however, with benzil or phenanthraquinone, which again shows its disinclination to form a ring with seven bonds. On the other hand, it readily forms anhydro bases (imidazoles). Thus, on heating finely-pulverised acet-*peri*-nitronaphthylamine (m. pt. 191° C.) for a short time on the water-bath with a mixture of tin chloride and concentrated hydrochloric acid, a yellow granular reduction product is obtained, which, when recrystallised from water containing hydrochloric acid, forms long yellow needles with the composition, $C_{12}H_{11}N_2Cl$. The properties of the compound also correspond with what might be expected from the imidazole hydrochloride:—



The salt is readily soluble in hot water, but only dissolves with difficulty in cold water. It is insoluble in ether and benzene, but readily soluble in alcohol. The free base is precipitated by the addition of alkali or an acetate, but cannot be obtained in a crystalline condition.

On treatment with phthalic anhydride and zinc chloride, it gives a yellow colour—a reaction characteristic of the group $N:C(CH_3)N.R$.

Benzoyl-*peri*-naphthylamine yields an analogous benzenyl derivative on reduction. The methylimidazole (the ethenyl derivative) forms yellow salts, which, however, have no tinctorial power, whereas the phenylimidazole (the benzenyl derivative) dyes silk and cotton a yellow colour.

On treating *peri*-naphthylenediamine with 2 mols. of dimethyl-*p*-aminobenzaldehyde or protocatechuic aldehyde in alcoholic solution, together with a little hydrochloric acid, compounds are obtained, which must be regarded as the



Colouring Matter [Anthracene Dyestuffs], and Derivatives thereof, and the Employment thereof in Dyeing; Manufacture and Production of New — J. Y. Johnson, London. From The Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. Eng. Pat. 3239, Feb. 14, 1901.
SEE Fr. Pat. 309,503 (this Journal, 1902, 42).—T. A. L.

Blue Colouring Matters [Sulphide Dyestuffs] and Intermediate Products; Manufacture and Production of — J. Y. Johnson, London. From The Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. Eng. Pat. 4024, Feb. 25, 1901.
SEE Fr. Pat. 308,557 (this Journal, 1902, 43).—T. A. L.

Colouring Matters [Sulphide Dyestuffs] containing Sulphur. J. Y. Johnson, London. From The Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. Eng. Pat. 6545, March 28, 1901.

If 2.4.1 dinitro-acetanilide (obtained by nitrating acetanilide) be heated with sulphur and sodium sulphide, dyestuffs are formed which give brown shades on cotton from an alkaline sulphide bath. The shades produced are fast to acids, washing, and light, so that a subsequent treatment with chrome compounds or with oxidising agents is unnecessary. Treatment with copper sulphate gives a pure brown shade, whilst the action of chromates turns the shade somewhat yellower, although the fastness to washing is not increased. The shade varies to a certain extent from reddish-brown to pure brown according to the quantity of alkali sulphide employed.—T. A. L.

Black Colouring Matter [Sulphide Dyestuff], and of a Material for use therein; Manufacture and Production of a New — J. Y. Johnson, London. From The Badische Anilin und Soda Fabrik, Ludwigshafen, Germany. Eng. Pat. 6546, March 28, 1901.

SUPPLEMENTARY to Eng. Pat. 20,232 of 1899 (this Journal, 1900, 818). See Fr. Pat. 293,138 (this Journal, 1902, 43).—T. A. L.

Brown Sulphurised Dyestuff [Sulphide Dyestuff], from 2.4-dinitro-para-oxydiphenylamine or 2.4-nitro-anido-oxydiphenylamine; Manufacture of a — O. Imray, London. From The Farbwerke, Hoechst a/Main, Germany. Eng. Pat. 4568, March 4, 1901.

SEE Fr. Pat. 308,735 (this Journal, 1902, 44).—T. A. L.

Colour Lakes; Manufacture of Fast Double — O. Imray, London. From The Farbwerke, Hoechst a/Main, Germany. Eng. Pat. 5167, March 11, 1901.

WHEN the hydroxide of an alkaline earth, of lead, or of zinc, is added, together with aluminium hydroxide, to the solution of a nitro-, azo-, acid-, or resorcinol-dyestuff, combination takes place, and an insoluble lake is obtained fast to water and spirit. The hydroxides of lead and zinc give the best results; lime also works satisfactorily, whereas the hydroxides of magnesium, strontium, and barium do not yield such fast lakes. For example, 146 kilos. of freshly slaked lime and 750 litres of water are mixed with a solution of 50 kilos. of Ponceau 3 R dissolved in 2,000 litres of water, and 52 kilos. of aluminium hydroxide suspended in 200 litres of water are run in. The whole is then heated nearly to boiling, with continual agitation, and, when cold, the lake is separated in the usual manner.—T. A. L.

Black Sulphurised Dyestuffs Directly Dyeing Cotton [Sulphide Dyestuff]; Manufacture of — O. Imray, London. From The Farbwerke, Hoechst a/Main, Germany. Eng. Pat. 5880, March 20, 1901.

SEE Fr. Pat. 309,322 (this Journal, 1902, 44).—T. A. L.

Dyestuffs [Sulphide]; Manufacture of — R. B. Ransford, Upper Norwood. From L. Cassella and Co., Frankfurt-on-Main, Germany. Eng. Pat. 5580, March 16, 1901.

SUPPLEMENTARY to Eng. Pat. 16,247 of 1900 (this Journal, 1901, 889). See Fr. Pat. 303,524 (this Journal, 1902, 41).

Dyestuffs belonging to the Diphenylmethane Series; Manufacture of Acid — C. D. Abel, London. From The Actiengesellschaft für Anilinfabrikation, Berlin. Eng. Pat. 5654, March 18, 1901.

SEE Fr. Pat. 309,104 (this Journal, 1902, 45).—T. A. L.

Colouring Matters [Acridine Dyestuffs] belonging to the Naphthacridine Series; Manufacture of — C. D. Abel, London. From The Actiengesellschaft für Anilinfabrikation, Berlin. Eng. Pat. 6651, March 29, 1901.

SUPPLEMENTARY to Eng. Pat. 16,474 of 1898 (this Journal, 1899, 826; see also Eng. Pat. 1820 of 1900, this Journal, 1901, 37). See Fr. Pat. 280,164; this Journal, 1902, 45.—T. A. L.

Anthracene Derivatives [Anthracene Dyestuffs]; Manufacture or Production of New — H. E. Newton, London. From The Farbfabriken vormals F. Bayer and Co., Elberfeld, Germany. Eng. Pat. 5811, March 19, 1901.

SEE Fr. Pat. 243,315 (this Journal, 1902, 40).—T. A. L.

Nitro Compounds; Reduction of Aromatic —, to the Corresponding Amines. C. F. Bochringer und Soehne. Eng. Pat. 25,100, Dec. 9, 1901.

See under XI. A., page 260.

ERRATUM.—This Journal, 1902, 169, col. 2, line 11 from top. For "are prepared for" read "are prepared by," &c.

V.—PREPARING, BLEACHING, DYEING, PRINTING AND FINISHING TEXTILES, YARNS, AND FIBRES.

Ramie Fibre, and its Importance in the India-Rubber Industry Gummi-Zeit., 1902, 16, [16], 275—277.

The author recapitulates the valuable properties of ramie, and points out that the machine-extracted fibre is admirably suited for employment in the rubber industry, although it requires further expensive treatment to fit it for the highest textile purposes.—R. L. J.

Artificial Hair. K. Süvern. Färber-Zeit., 1902, 13, [1], 1—2.

The artificial horsehair manufactured by the Vereinigte Kunstseidefabriken Actiengesellschaft, of Frankfurt-on-Main, is a smooth fibre which can be made of any desired length. As commonly produced, its lustre resembles that of artificial silk, but it can be rendered slightly less lustrous than horsehair. It is probably obtained by the method described in Ger. Pat. 125,309, by combining together several thinner fibres. Under the microscope it presents in section a characteristic appearance (see Fig. 1). Most of the fibres are more or less rounded as *a*, very few of

Fig. 1.



Fig 2.



them being flattened as *b*. The portions of the fibres cut off in the figure by the dotted lines are similar in appearance to the artificial silk fibres of Chardonnet and Lehner.



Another fibre produced by the same firm is also made in several qualities with various degrees of lustre. A non-lustrous quality has the microscopical appearance shown in section in Fig. 2.

A method for producing a substitute for horsehair has recently been patented by Lehner (Eng. Pat. 17,759 of 1900; this Journal, 1901, 1109).—E. B.

Mercerising Cotton; Employment of Refrigeration in —. C. Kurz. Rev. Gén. des Mat. Col., 1902, 6, [61], 1—2.

A REPLY to Lefèvre (Rev. Gén. des Mat. Col., 1901, 5, [59], 253), who considers refrigeration in mercerising cotton unnecessary. It is unnecessary to cool the caustic soda lye when the cotton fabrics to be mercerised have previously been bleached, since the heat of reaction between cellulose and caustic soda is slight, and the temperature of the lye does not rise appreciably. When, however, fabrics are treated in the unbleached state, as is commonly the case, the fatty, starchy, and other impurities present in them are decomposed by the alkali with the evolution of much heat. It is, consequently, necessary in such a case to employ cooling apparatus, to prevent the temperature of the lye from rising excessively, as, although almost identical results are obtained with caustic soda lye at 0° C. and at 15°—20° C., a different and inferior result is obtained when the temperature of this is 50°—60° C. The addition of cold caustic soda lye to the mercerising bath, for the purpose of renewing the latter, is not in itself sufficient to prevent the rise in temperature, the quantity so added in practice being too small to have much effect.—E. B.

Mercerising Cotton; Employment of Refrigeration in —. (Comments on the preceding article.) L. Lefèvre. Rev. Gén. des Mat. Col., 1902, 6, [61], 2—3.

In the case mentioned by Kurz (see preceding abstract), the object of refrigerating is not to cool the lye, but to maintain it at a constant temperature; for instance, at 15°—20° C. It is not likely, however, that a high degree of lustre can be produced upon cotton which is mercerised in an unpurified condition. If the concentration of the lye used were only 15°—20° B., it would be necessary to employ apparatus to cool it. Whether, in general, cooling of the lye is advantageous or not, is a question which can easily be decided by comparing the cost of caustic soda lye at, say, 15° B. and 0° C. with that of the lye at 35° B. and 15°—20° C.—E. B.

Diazo Compounds; Action of Silk on —. C. Rossi. Rev. génér. Chim. pure et appl., 1901, 4, 670; Chem.-Zeit., 1902, 26, [2], Rep. 7—8.

The author's experiments show that silk acts as a reducing substance upon diazo compounds, in the same way as wool and other organic substances, e.g., albumin. The diazo compounds form diazo-amino- or azo-amino compounds upon the silk, according as the diazotised amine yields stable or unstable diazo-amino compounds. The fibres mechanically retain the colour thus produced.—C. A. M.

Aniline Black; Immedial Blacks as Grey Reserves under —. E. Justin-Müller. Rev. Gén. des Mat. Col., 1902, 6, [61], 3.

THE various brands of Immedial Black, namely, V, G extra, F F extra, N B, N G, and N R, after being transformed into bisulphite compounds, can be employed in the production of reserves under Aniline Black. Along with these, the Immedial Blues C and C R and Immedial Brown B, as well as Galloeyanine, Alizarin Blue, Anthracene Acid Brown G, &c., can be used for shading purposes. The greys thus obtained lose in intensity in the operation of chroming, especially when this is performed at or near the temperature of boiling point, but the loss may be prevented by adding a small quantity of tannic acid to the printing mixture. The bisulphite compounds are prepared by gradually adding 3 litres of sodium bisulphite solution at 36°—38° B. to 1 kilo. of the Immedial dyestuff, and allowing the mixture to stand for about 12 hours. A printing mixture is made, for instance, from 3 litres of thickening, $\frac{1}{2}$ litre of a sodium bisulphite solution of Immedial Black V,

8 grms. of Prune dissolved in 200 c.c. of water, 800 grms. of sodium acetate, 300 c.c. of chromium acetate at 18° B., and 23 grms. of tannic acid dissolved in 46 c.c. of water. This is printed upon a tissue padded with a prussiate Aniline Black mixture, and dried at a low temperature. The tissue is then dried, steamed in a Mather and Platt steam-ageing machine, chromed, washed, and dried.—E. B.

ENGLISH PATENTS.

Washing Calico Printers' Blanketing; Method and Means for —. S. Bradbury, Rochdale. Eng. Pat. 24,069, Nov. 27, 1901.

A PRELIMINARY washing arrangement is interposed between the bowl of a printing machine and the drying chests, for the purpose of removing most of the colour from the blanketing, while it is in a completely undried state. The small amount of it which remains on the blanket, instead of becoming fixed, is softened and rendered more easily removable subsequently, by the heat from the drying chests, close to which the blanket next passes. The latter is then taken through a second washing arrangement, consisting of a light casing arranged below one or more revolving brushes and a cylinder, which serves as a support for the blanket while it is being brushed, and which may also be heated, and then act, like the cylinders, as a drying cylinder.—E. B.

Calico Printing [Imitation Indigo Prints]; Impts. in —. H. A. Costobadie, Broadbottom, and The Calico Printers' Association Ltd., Manchester. Eng. Pat. 4839, March 7, 1901.

WITH the object of producing, economically and expeditiously, the style of two blue and white calico print, which is commonly produced entirely with Indigo as the dyestuff, a reserve or a discharge for Indigo is printed along with a mordanting compound—for instance, ordinary iron liquor. After printing the reserve, the tissue is dipped a pale shade of Indigo Blue, and is then dyed, in the mordanted parts, a dark blue, with an Alizarin or other suitable dyestuff. When the discharge method is employed, the tissue, before printing, is dyed a pale Indigo Blue, and after printing and steaming, it is dyed a dark blue, as in the previous case.

Claim is made for the combined operations of Indigo dyeing, reserve or discharge printing in connection therewith, and printing mordants, and dyeing these with dyestuffs other than Indigo.—E. B.

VI.—COLOURING WOOD, PAPER, LEATHER, Etc.

UNITED STATES PATENT.

Copying Ink. E. P. Lawton, Charleston, South Carolina, U.S.A. U.S. Pat. 690,862, Jan. 7, 1902.

A WRITING ink is described from which a copy can be made on tissue paper without the aid of moisture or of a letter-press, by merely placing it in contact with the paper, and rubbing with the fingers. The ink can be prepared by adding about 120 grains of ammonium chloride to the fluid ounce of any commercial ink which contains sugar or some equivalent ingredient; but it is preferably composed by mixing together infusion of nutgalls, 30 c.c.; ferrous sulphate, "20 c.c."; ammonium chloride, 120 grains; sugar, 100 grains; phenol, 3 drops. Mucilage or glycerin may replace, or be employed in addition to the sugar, and 20 grains of common salt may be added if desired.

—F. H. L.

VII.—ACIDS, ALKALIS, AND SALTS.

Hydrofluoric Acid; Action of —, upon Lead, with reference to the Manufacture of Sulphuric Acid. Prost. Assoc. belge des Chim., Dec. 12, 1901. Chem.-Zeit., 1902, 26, [1], 12—13.

THE presence of fluorine compounds in the gases obtained by roasting blends containing fluorine is very injurious to the leaden chambers used in sulphuric acid manufacture. In whatever form the fluorine is present when the gases

leave the stove, it is in all probability converted into hydrofluoric acid when the hot gases come into contact with the sulphuric acid in the Glover tower. The injury caused by the fluorine does not stand in any relation to the small proportion of fluorine in the ore; for small quantities of hydrofluoric acid have not only an injurious effect in themselves upon the lead, but also accelerate the corrosion of the metal by the sulphuric acid and the nitrogen compounds. The author considers that this point has not yet been taken into account, since blends containing fluorine are still widely used; and although most of these contain only traces, yet others contain several per cent. In one sample the author found 7 per cent.

The results of a series of experiments are given, in which the action of hydrofluoric acid upon lead was determined, both by itself and in conjunction with sulphuric acid and with nitric acid. The lead used was the ordinary metal of the leaden chambers, cut into strips, and purified before and after each experiment with ammonium tartrate. In no case did the temperature exceed the ordinary temperature of the leaden chambers. From these results the following conclusions were arrived at:—In the case of hydrofluoric acid of from 0.5 to 2.5 per cent. strength, the most dilute acid has the strongest action at the ordinary temperature, whilst at 60° C. there appears to be no difference between the action of acids of 0.5, 1.0, and 2.5 per cent. strength. The addition of 2.5 per cent. of hydrofluoric acid to concentrated sulphuric acid increases by about 50 per cent. the corrosive action of the latter upon lead, when the liquid is kept quiet. On the other hand, when the bath is shaken, the sulphuric acid containing fluorine attacks the lead less than the pure sulphuric acid. The presence of 2.5 per cent. of hydrofluoric acid in sulphuric acid of 60° B. does not change the corrosive power of the latter at the ordinary temperature; but at 60° C. about 45 per cent. more lead is dissolved by the mixture than by the pure sulphuric acid. Concentrated sulphuric acid (66° B.) containing 2.5 per cent. of hydrofluoric acid and 2 per cent. of nitric acid produces much more corrosion of the lead than the mixed acids without nitric acid; in the case of sulphuric acid of 60° B. the action is much weaker. In practice, sulphuric acid of 66° B. is obtained by concentrating acid of 60° B., the concentration to about 62° B. being carried out in leaden vessels. The following results of experiments show the action of sulphuric acid of 60° B., containing fluorine, upon these leaden concentration vessels. The loss in lead per square metre was:—

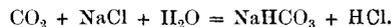
Sulphuric Acid, 60° B.	Hydrofluoric Acid.	Nitric Acid.	Lead.
	Per Cent.	Per Cent.	Grms.
Acid alone .....	..	..	27
	0.5	..	30
	1.0	..	27
	0.5	0.5	18
	1.0	0.5	22.5

Action of Gaseous Hydrofluoric Acid on Lead.—In order to obtain an approximate measurement, the author employed a small apparatus in which he brought about the reactions of the leaden chambers, and into which he admitted a measured quantity of gaseous hydrofluoric acid. Before the admission of the latter, the loss of lead was 7.825 grms. per square metre; whilst, after the introduction of 2.05 grms. of gaseous hydrofluoric acid (i.e., a very small quantity in proportion to the total volume of gases), the loss increased to 141.58 grms., and with a larger amount of hydrofluoric acid to 185.191 grms.—C. A. M.

Hydrochloric and Nitric Acids; Relative Strengths of
— G. Bodländer. Ber. 35, [1], 99—102.

The author, with P. Breull, has shown that carbonic acid is a stronger acid in salt solutions than in pure water at the same pressure. Working on solutions of chlorides and nitrates which had oxides of heavy metals in suspension, O. Kühling has shown that these oxides change to neutral or basic salts more readily in presence of chloride than of nitrate; from that he concluded that nitric acid was a

stronger acid than hydrochloric acid. The author contends that this conclusion is false, and he considers that the phenomenon observed depends upon the slight solubility or dissociation of the neutral or basic chlorides of the metals investigated. The first action of carbonic acid may be represented by the equation—



The free acid acts on basic oxides present. The author derives the equation $\text{Pb} \times (\text{NaHCO}_3)^2 = \text{constant}$, from which it is evident that the amount of NaHCO_3 , and therefore of acid set free, depends inversely on the lead-ion concentration. This is smaller with chloride than with nitrate, which is due to the low solubility of lead chloride, or basic salt, and also to lead in these solutions being chiefly in the form of complex ions, e.g., PbCl_4 . With other heavy metals, the lower solubility of the chloride, compared with the nitrate, points to lower electro-affinity, and the formation of basic chlorides again lowers the concentration of the metal ion, with consequent increase of formation of NaHCO_3 and of acid in the case of chloride.—A. M.

Potash Industry (Stassfurt); Disposal of Waste Liquors from the —. C. Przibylla. Zeits. angew. Chem., 15, [4], 74—78.

THE waste liquors of the Stassfurt potash industry, contain about 30 per cent. of magnesium chloride, with small amounts of potassium and sodium chlorides and magnesium sulphate.

The author's suggestion for the disposal of these liquors is to fill the excavated cavities in the rock-salt beds below the potash beds with them. Taking the carnallite, as mined, to contain 18 per cent. of potassium chloride and 26 per cent. of magnesium chloride, and assuming that 15 per cent. of the total potash salts mined are lost in the processes of working up, then a work turning out daily 100 tons of 80 per cent. potassium chloride must mine 522.2 tons of carnallite, containing 137.5 tons of magnesium chloride, which will produce 452.7 tons, or (at 1.30 sp. gr.) 348 cb. m. of waste liquors. The volume of the carnallite excavated will be (at 1.8 sp. gr.) 290 cb. m., and that of an equal weight of the rougher salts excavated for manure (at 2.2 sp. gr.) 237 cb. m. This excavation of 527 cb. m., less, say, 10 per cent. allowed for galleries which must be kept open, or 474 cb. m., will require to fill it by the usual process of throwing into it lump rock-salt mined from the beds beneath, thus preventing the "creep" or collapse of the cavities in the potash beds, the excavation of 190 cb. m. of rock-salt. If 3 per cent. of this must similarly be kept open, we have a cavity in the rock-salt which will engulf 184 cb. m. of waste liquors, leaving 164 cb. m. to be dealt with. As, however, the volume of final-liquors given, is a maximum (for the salt will often contain more potassium chloride without any more magnesium chloride), and that of the cavity in the rock-salt a minimum (for the salt may be worked for other purposes, and sometimes the cavities in the potash-beds must be more solidly filled with dry-wall work in rock-salt), the process will usually be capable of dealing with a larger proportion of the final-liquors than is above shown.

Nahnsen evaporates the waste liquors so far that on cooling they completely solidify. The hot liquors are run into the empty excavations, where, on cooling, they set to a firm and consistent mass, and where, during cooling, their heat can be utilised as a motive power for the ventilating air-current.

The author suggests a combination of his plan and Nahnsen's, by which the volume of the liquor to be evaporated is reduced. Instead of dealing with the whole 348 cb. m., in the example above, he carries out the process exactly as above described, then concentrates, according to Nahnsen's proposal, the 164 cb. m. of liquor yet undisposed of, and pours this into the chambers already filled with loose rock-salt. As the interstices of this filling afford in all a volume of 474—190, or 284 cb. m., and as the evaporation reduces the volume of the liquor from 164 to 110 cb. m., there is evidently ample room thus to dispose of the whole of the remaining liquor, which cements, consolidates, and

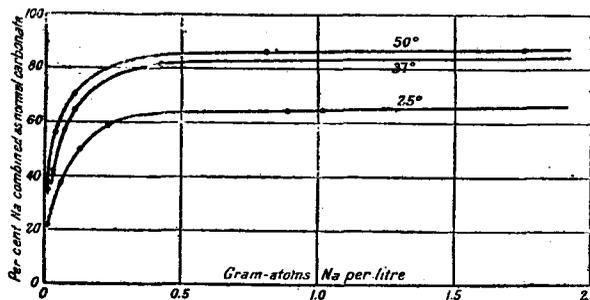


renders much more stable and firm the mass in the chamber. The cost of evaporation is worked out at 1·10 M. per cb. m. of the evaporated liquor; but where this takes the place of excavated rock-salt, the cost of mining and transport of the latter, 1·00 to 1·20 M., is to be set on the other side.

—J. T. D.

Carbonates and Bicarbonates in Aqueous Solution; Equilibrium between —. F. K. Cameron and L. J. Briggs. *J. Phys. Chem. (U.S.A.)*, Nov. 1901, 537—555.

THE authors have examined solutions of sodium, potassium, and magnesium carbonates, which were in a state of equilibrium in contact with air, with a view of ascertaining the proportions of the base present as carbonate and bicarbonate respectively. The solutions under examination were arranged in flasks placed in a water-bath, and connected together by a system of stoppers and tubing. Air was aspirated through the flasks until equilibrium was established, and then the contents of the flasks were



titrated with standard potassium bisulphate solution, first with phenolphthalein and finally with Methyl Orange as indicators. The results obtained were similar with all three compounds, the results with sodium carbonate being shown in the accompanying diagram.—A. S.

Sodium Sulphate and Sodium Chloride; Solubility of Mixtures of —. A. Seidell. *Amer. Chem. J.* 27, [1], 52—62.

THE solubility in water of mixtures of sodium sulphate and sodium chloride in various proportions and at temperatures ranging from 10° C. to 35° C. is given, both in tabular form and in the form of curves. It appears from the latter that the transformation of the decahydrate to anhydrous sodium sulphate at temperatures below 33° C. is quite possible when the crystals are in contact with concentrated solutions of sodium chloride.—H. L.

Alkali Hypochlorite and Chlorate; Attainable Current and Energy Efficiency during the Electrolytic Manufacture of —. F. Foerster and E. Müller. *Zeits. für Elektrochem.* 1902, 8, [1], 8—17.

Hypochlorite.—In order to reduce the evolution of oxygen at the anode to a minimum, and to obtain the maximum yield of hypochlorite, the neutral alkali chloride solution should contain some potassium chromate, and should be electrolysed at low temperatures between platinised electrodes. The subjoined table gives the results which were obtained when a solution containing 280 grms. of sodium chloride and 2 grms. of potassium chromate per litre was electrolysed in this way. The last experiment refers to an electrolyte containing only 100 grms. of sodium chloride per litre:—

Temperature. ° C.	Anodic Current Density. Amp./sq. cm.	E.M.F. V.	The Electrolysed Solution contained		Current Efficiency. Per Cent.	Watt-Hours consumed per Grm. of Hypochlorite Oxygen.
			Hypochlorite Oxygen per Litre.	Bleaching Chlorine per Litre.		
			Grms.	Grms.		
13	0·017	2·40	4·20	13·6	96	8·4
13	0·017	2·40	5·24	23·2	90	8·95
10	0·07	3·10	6·8	30·1	86	10·84
13	0·17	3·6	5·28	28·4	99	12·2
13	0·17	3·6	8·7	38·5	87	13·5
14	0·17	4·7	5·20	28·0	95	16·6

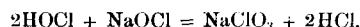
It is noteworthy that in the fifth experiment 38·5 grms. of bleaching chlorine were obtained per litre, whilst the current efficiency was satisfactory. This is the best result on record, and is in the neighbourhood of the limiting value. An attempt to push the electrolysis much further would result in the hypochlorite already formed taking part in conveying the current, with the simultaneous evolution of oxygen at the anode and the formation of chlorate.

As regards the energy-efficiency, the authors found that an E.M.F. of 2·2 volts was sufficient to decompose the strong salt solution; hence the minimum quantity of electric energy required to produce 1 gm. of hypochlorite oxygen is 7·2 watt-hours. In the case of the experiments in which the lowest current density was employed, the energy used was only about 1·8 times that corresponding to the theoretical minimum.

Compared with the best results obtained on the commercial scale (this Journal, 1901, 130—132), in which 25·5 and 40·9 watt-hours were consumed per gramme of hypochlorite oxygen (the finished liquor containing only about 2·9 grms. of hypochlorite oxygen, or 13 grms. of active chlorine, whilst the original electrolytes contained 18·35 and 10 per cent. of NaCl), it will be observed that the bleaching value of the liquors is only about one-third of the attainable value, whilst the energy consumed is 3·4—5·5 times that corresponding to the theoretical minimum. There is thus a considerable margin between the results of these laboratory experiments and those obtained on the technical scale. The chief difficulties that have to be overcome before the laboratory results can be realised on the large scale, are the removal of

the chromate from the bleaching liquor, and the difficulty connected with the platinising, or, rather, of keeping platinised, the anodes. The removal of the chromate can be effected by careful precipitation with barium chloride. The anodes, however, only remain platinised when very low current densities are employed. When attempts are made to work with increased densities, the platinum black gradually becomes detached from the anode, which means a corresponding increase in the E.M.F. required. The anodes were platinised in the Lummer and Kurlbaum solution. Grey platinising and the mechanical roughening of the surface of the anode by a sand blast were found to be ineffectual.

Chlorate.—Similarly, improved yields of chlorate may be obtained by the use of platinised anodes, by the addition of a small quantity of potassium chromate, and by the further addition from time to time of small quantities of hydrochloric acid. Meanwhile, the addition of the acid has been covered by a French patent by P. Corbin. According to the authors, the production of chlorate is represented by the equation—



The velocity of this reaction, according to the law of mass action, is proportional to the square of the concentration of the hypochlorous acid, and to the first power of the concentration of the anions of the hypochlorite. The concentration of the hypochlorous acid is therefore of the greatest importance. Full details of the experiments are given. In one of these the authors obtained 1 gm. of chlorate



oxygen for an expenditure of 12.5 watt-hours, instead of the theoretical figure 7.4 watt-hours, the current efficiency being 98 per cent., the E.M.F. 3.66 volts, the current density 1,170 ampères per square metre, and the temperature 13° C.—J. S.

Pseudo-catalytic Oxidation Processes [Metals]. C. Engler and L. Wöhler.

See under X., page 257.

ENGLISH PATENTS.

Sulphuric Acid and other Liquids; Apparatus for Concentrating—T. G. Webb, Pendleton, and Webb's Patents, Limited, Manchester. Eng. Pat. 1516, Jan. 23, 1901.

THIS invention relates to the stepped beaker type of apparatus. Each beaker contains an auxiliary vertical vessel, slightly higher than the lip of the former, and it may be bottomless, or provided with ports near the bottom, the inflowing liquid being thus divided into two columns. The liquid is conveyed from one beaker to another by a removable spout, flowing first into the auxiliary vessel and thence, through the ports, into the beaker. The vessels may be arranged in a heated chamber, or upon a furnace, hoods being provided to the beakers in the latter case, connected by elbow pipes to the trunk.—E. S.

Sulphuric Anhydride; Manufacture or Production of—G. W. Johnson, London. From the Firm of Verein Chemischer Fabriken, and A. Clemm, both of Mannheim, Germany. Eng. Pat. 4610, March 4, 1901.

THIS is an improvement on Eng. Pat. 24,748, 1899 (this Journal, 1900, 1014), consisting in substituting for the ferric oxide there directed to be used, copper oxide, chrome oxide, manganese oxide, or a mixture of these, or of the sulphates of the same. These oxides, or the sulphates, can be used both as filtering and contact substances for the hot roaster gases.—E. S.

Noxious Vapours and Sulphurous Fumes; Apparatus for Exhausting and Condensing—T. G. Webb, Pendleton, and Webb's Patents, Limited, Manchester. Eng. Pat. 1515, Jan. 23, 1901.

A LONG, rectangular tank, having a water supply and an overflow, is provided with a box at each end, the boxes being connected by a great number of horizontal tubes, furnished with contracting nozzles at the delivery ends. The box into which the fumes are admitted has a number of pipes, set crosswise, for circulation of the cold water. The second box is connected at the top to the chimney flue, whereby the necessary exhaustion is obtained. The fumes are thus cooled, first in the box in which the cooling tubes are set, and then by passage through the tubes surrounded by the cold water in the body of the tank, on their way to the second box. Each box is provided with an outlet for the products of condensation.—E. S.

Sodium Bichromate; Manufacture of—F. M. Spence, D. D. Spence, and H. Spence, all of Manchester; J. J. Hood, London; and T. J. I. Craig, Manchester. Eng. Pat. 5015, March 9, 1901.

SODIUM chromate solution, of about 1.30 sp. gr., is treated, with agitation, in a closed vessel, with carbon dioxide and ammonia (or ammonium carbonate) in such proportion as to precipitate about one-half of the sodium present as bicarbonate, and to form ammonium chromate with about one-half of the total chromic acid. The cleared solution is boiled in a suitable vessel, to expel free and combined ammonia, which is collected for re-use, and the solution of sodium bichromate is concentrated to any desired strength. The sodium bicarbonate, obtained as described, is heated to obtain sodium carbonate and carbon dioxide, the former being available in producing the frit from chrome ore, yielding sodium chromate solution for repeating the operation, in which the CO₂ is also utilised.—E. S.

Cyanide of Sodium and of Potassium; Production of Anhydrous—W. P. Thompson, London. From Stassfurter Chemische Fabrik vormals Vorster and Grüneberg, Stassfurt, Germany. Eng. Pat. 23,124, Nov. 15, 1901.

IT is stated that, although sodium cyanide crystallises from aqueous solution as a hydrated salt, it may be obtained anhydrous by concentration of the solution in presence of potassium cyanide. According to one modification, sodium cyanide solution may be evaporated over solid potassium cyanide, the mixed cyanides obtained being anhydrous. Or hydrated crystals of sodium cyanide may be dried with powdered potassium cyanide. By using the two cyanides in certain stated proportions, an anhydrous mixture is obtained containing 40 per cent. of cyanogen.—E. S.

Cyanide of Potassium and Cyanide of Sodium; Making Briquettes of a Mixture of—W. P. Thompson, London. From Stassfurter Chemische Fabrik vormals Vorster and Grüneberg, Stassfurt, Germany. Eng. Pat. 23,125, Nov. 15, 1901.

IT is found that briquettes compressed from pure potassium cyanide do not possess the necessary firmness, but that when a mixture of potassium cyanide and sodium cyanide is used to form briquettes under great compression, the needful firmness is attained, and the material does not adhere to the moulds. "Anhydrous sodium cyanide," obtained as described in Eng. Pat. 23,124, 1901 (see preceding abstract), is preferably used in making the mixture.—E. S.

Nickel Ammonium Compound; Process for Producing a—H. A. Frasch, Hamilton, Canada. Eng. Pat. 19,035, Sept. 24, 1901.

A SOLUTION containing nickel, and, it may be, copper and other metals, is treated with calcium hydrate or an alkali to precipitate nickel hydroxide, &c. The hydroxides are collected and treated with a solution of ammonia or of ammonium chloride or sulphate; the solution thus obtained is filtered, and sodium chloride added, which causes separation of a nickel-ammonium salt to which the formula Ni(NH₃)₂Cl₂ + 4NH₃ + 2NH₄Cl is assigned. This salt differs somewhat from that described in Eng. Pat. 284, 1901 (this Journal, 1901, 580), to which patent reference is made.—E. S.

UNITED STATES PATENTS.

Sulphuric Anhydride; Method of Making—R. Knietzsch, Ludwigshafen, Germany. U.S. Pat. 690,062, Dec. 31, 1901.

THE apparatus in its simplest form consists of a pipe charged, as to its lower portion, with contact material, and set within another iron pipe, or in a brickwork chamber, so as to form an annular space about the enclosed pipe. The portion of the latter containing the contact material may differ from the other portion in length and diameter. The apparatus being heated to the requisite temperature, the gases containing sulphur dioxide and oxygen are admitted to the upper part of the enclosed pipe, while cold air enters the annular space by a channel near the bottom, the current being regulated by means of the exit valve at the top. The heat evolved in the reaction is thus controlled, and the excess heat is transferred to the upper part of the pipe. The sulphuric anhydride formed issues from the bottom of the pipe. The invention is also shown applied to an installation of a series of contact tubes, such as that described, set in a chamber in connection by tube plates and covers, above and below, air being admitted, as in the previous case, to the intermediate spaces, so as to flow in opposite direction to the flow of the gases. Means are provided for heating the apparatus during the working, as, when gases poor in SO₂ are used, may be needful. The claims include the use of a "fluid" flowing in a direction contrary to the gases, as well as of air specifically, as a means of regulating the temperature of reaction. (See also this Journal, 1902, 172.)—E. S.



Sulphuric Anhydride; Process of Making — A. Clemm and W. Hasenbach, both of Mannheim, Germany. U.S. Pat. 690,133, Dec. 31, 1901.

THE pyrites roaster is so constructed that the dried air supplied to it passes, with the sulphurous fumes, through a chamber containing already roasted iron pyrites, heated by the gases from the burners. The sulphurous fumes are thus filtered, and in part converted into sulphuric anhydride, and any arsenic present is stated to be retained by the iron oxide. The gases, after passing up the chamber, and imparting heat to a flue and contact apparatus, leave the furnace near the top, and are conducted to a vertical cylinder, cooled externally by rinsing with water, whence they pass into an absorbing column, down which sulphuric acid flows to absorb the anhydride. The gases are next passed through a vessel charged with pumice stone, asbestos, or the like, and when thus filtered, are conducted back to the furnace, into cast-iron vessels, there heated as described, and thence enter a contact apparatus set in a chamber in the brickwork, and pass therein through screen-like fabrics of platinum, whereby the final conversion is effected. The gases are then passed successively through another set of cooling and absorbing vessels, whence the residual gases are aspirated by a ventilator and escape into the atmosphere.—E. S.

Sulphates and Chlorine, Method of Making — A. Clemm, Mannheim, Germany. U.S. Pat. 689,461, Dec. 24, 1901.

A CHLORIDE—for instance, sodium chloride—is made into a plastic mass with clay and water, which is formed into balls; these are dried, and heated to redness in a suitable vessel, in a slow current of sulphur dioxide and of oxygen or air. The chlorine formed is passed through concentrated sulphuric acid “or even through water,” to remove any sulphur oxychloride that may be present. According to the second claim, the process may be modified by substituting sulphuric anhydride for SO_2 . In either case, a sulphate remains in the retort.—E. S.

Hydrogen Sulphide; Method of Making — H. H. Wing, Buffalo, U.S.A. U.S. Pat. 690,502, Jan. 7, 1902.

THE gases from a pyrites burner, or other source of SO_2 , are passed through a dust chamber and cooler into a coke-packed tower for absorption by water. The sulphurous acid solution is pumped into a “generator,” in which it is agitated with an emulsion of calcium carbonate. Insoluble calcium monosulphite is formed, and the carbon dioxide evolved “in a concentrated state” is collected in a gas-holder. When the reaction is completed, the contents of the generator are discharged into a filter-tank, and the liquid, withdrawn by a vacuum pump, is used over again in the coke-absorbing tower. The separated calcium monosulphite is then mixed with coke, and furnace to reduce it to sulphide. [Magnesium sulphite, if present, is reduced to oxide.] The powdered sulphide is mixed with water to a cream and charged into a pair of “carbonators.” The carbon dioxide, produced as described, is then passed into the bottom of one of the vessels to produce calcium carbonate and highly concentrated H_2S , which is stored. The calcium carbonate is used in the “generator” in the first part of the process. The two or more carbonators are worked partly alternately and partly in combination, the effluent gases from one being at a certain stage of the process passed into the contents of the other, so as to obtain the H_2S free from or with a minimum of CO_2 . “Inst. ad of using lime salts, any other alkaline earth metal or alkali metal can be used,” and also alkali waste.—E. S.

Ammonia; Method of Making —, from Waste Products [from Beet-Sugar Factories]. E. R. Besemfelder, Charlottenburg, Germany. U.S. Pat. 689,780, Dec. 24, 1901.

THE invention is particularly described in reference to obtaining ammonia and other products from the waste lyes of beet-sugar factories. These are concentrated and mixed with bauxite or alumina and coke. The mixture is supplied to the uppermost of a series of horizontal superposed retorts, connected at alternate ends, moderately

heated, in which conveyors impel the mixture in a contrary direction to the flow of the gases, which latter are taken through a tube having a siphon bend and trap for tar, into a set of heated “decomposition retorts.” These are charged with alkaline earth oxides or aluminates, but preferably with slag derived from water-gas generators obtained as afterwards described. The nitrogenous gases are thus decomposed with formation of hydrocarbons and ammonia. The gases are then conducted through a seal chamber for collection of the tar, into a tower down which cold brown alkaline waste lye drips, into the seal chamber, where the mixture of tar and lye is boiled, the ammonia thus evolved passing also into the washing tower. Caustic potash is preferably added to the lye, to absorb cyanogen compounds from the gases, which then, after passage through a separating apparatus, are led up a tower down which superphosphate ($\text{CaH}_4(\text{PO}_4)_2$) solution is streamered, whereby the ammonia is absorbed. The effluent heating gases are stored. The heated material remaining in the distillation retorts is mixed with coke in water-gas generators of a type described in U.S. Pat. 666,257, 1901, in which superheated steam and air are alternately blown through the mass, whereby the excess of alkali combines with alumina to produce an aluminate, and the remaining nitrogen forms ammonia. Also, the oxygen salts present are converted into carbonates. The water-gas, after conduction through the tower connecting the lower retort with the generators, is utilised in heating the apparatus. The residue in the water-gas generators is received in drums for treatment with water, and the solution is filtered from the insoluble alkaline earth aluminate or alumina, which is calcined, and, after being mixed with broken fireclay, is used in the decomposition retorts. The solution, containing soluble aluminates, is freed from iron by an air-blast, and alumina is precipitated by CO_2 , preferably by passage through it of the gases issuing from the chamber in which ammonia is absorbed by superphosphate. Potassium carbonate and strontia are recovered as by-products.—E. S.

Magnesium Sulphite; Process of Making — H. H. Wing, New Brighton, U.S.A. U.S. Pat. 690,503, Jan. 7, 1902.

FUMES containing sulphur dioxide, after passage through a dust settling chamber, are drawn with air into an absorbing apparatus, fitted with an agitator, nearly filled with a cream of magnesium hydroxide and water. When the transformation into insoluble sulphite and soluble sulphate is complete, the contents of the absorber are discharged into a filter tank, and the magnesium sulphite collected is dried. The solution is crystallised in a suitable tank, the mother-liquor is withdrawn for re-use, and the crystals of magnesium sulphate are dissolved, and the solution mixed with calcium chloride, whereby calcium sulphate is precipitated, and magnesium chloride is found in solution. The calcium sulphate, constituting one of the by-products, is collected. The MgCl_2 solution is treated with lime or milk of lime (dolomitic lime is also claimed alternatively), to obtain a precipitate of magnesium hydroxide, available in the first stage of the process, or otherwise, and calcium chloride is regenerated in solution.—E. S.

Aluminium Hydrate; Method of Making — H. W. Jordan, Syracuse, U.S.A. U.S. Pat. 691,470, Jan. 21, 1902.

SODIUM aluminate solution, contained in a vessel fitted with an agitator, is treated with carbon dioxide, previously heated to above 200°F ., and preferably to about 400°F . The aluminium hydroxide precipitated by the gas at the latter temperature is stated to contain only about 0.43 per cent. of insoluble sodium carbonate.—E. S.

Nickel Salts; Producing — H. A. Frasch, Hamilton, Canada. U.S. Pat. 689,391, Dec. 24, 1901.

SEE Eng. Pat. 19,035, Sept. 24, 1901 (page 253).—E. S.

Potassium - Magnesium Carbonate; Method of Making — H. Precht, Neustassfurt, Germany. U.S. Pat. 689,907, Dec. 31, 1901.

SEE Eng. Pat. 2342, 1901 (this Journal, 1902, 117).



Alum; Method of Making — E. Everhart, Atlanta, Georgia, U.S.A. U.S. Pat. 690,257, Dec. 31, 1901.

BAUXITE or other aluminous substance is stirred in a strong solution of nitre cake (sodium bisulphate) heated by a steam coil. Water, and milk of lime to neutralise free acid, are added after the reaction, and the cleared solution is set for the sodium sulphate to crystallise. The solution of soda alum is drained off, and heated with potassium chloride or sulphate, to obtain potash alum. A second crop of alum crystals is obtained by concentrating the mother-liquors. The residual mother-liquors are used to dissolve the sodium sulphate previously obtained, and the solution, after purification by milk of lime, is crystallised to obtain pure Glauber salts.—E. S.

Alkali Chlorides; Apparatus for the Continuous Electrolysis of — W. Gintl. U.S. Pats. 690,365 and 690,141, Dec. 31, 1901.

See under XI, A., page 260.

VIII.—GLASS, POTTERY, ENAMELS.

[Pottery] **Fusible Tell-tales.** J. Salt. Ceram. 4, [144], 139—140.

IN dealing with certain defects exhibited by the Seger cones, the author mentions the presence of iron in the series 01 to 010 as unfavourable, owing to the ease with which it is influenced by furnace gases of different composition. The boric acid employed as flux is volatile, and is attacked by the sulphuric acid vapours from the fuel; and the same vapours also act on part of the calcium carbonate in the cones, with the result that the fusibility of the other constituents of the latter is affected in an irregular manner. Again, it has been found that the fusibility of the Seger cones is liable to vary in accordance with the size of the kiln and the duration of the baking process. For example, the author has observed that cone 04 does not commence to fuse below 40° of the Vieillard pyrometer when used in a small glaze kiln 1½ metres in diameter, whereas it fuses at 30° Vieillard in the large biscuit kiln. Now, as the time required to fire glaze may vary—for some unexplained reason—between 18 and 24 hours, this behaviour of the cones may lead to erroneous indications.

Another somewhat important defect is that the behaviour of the cones at the moment of fusion depends on the manner in which they have been placed in the kiln; cone 06, for instance, set perfectly vertical, fusing after 05, that has been placed in a sloping position. The author, believing in the utility of these cones, notwithstanding the defects mentioned, has endeavoured to obviate the last-named inconvenience, and has succeeded in doing so in the following manner:—The three or four cones used are embedded, by their bases, in a piece of plastic clay, which is provided with a foot at one end, and is then set upright so that the cones are perfectly horizontal, the least fusible of the series being at the top. The whole should be dried several hours before insertion in the saggar. Mounted in this manner, the cones will fuse in regular order, but not at the same temperatures as when set upright, the fusing temperature of cone 1 being reduced from 1,130° C. to 1,110° C., i.e., the fusing point of cone 2 in the vertical position. Another method of setting the cones is by suspending them, point downwards, from a clay support, the fusion being then indicated by elongation instead of bending over; but the author considers the horizontal position the best.—C. S.

Ceramics and Glass Manufacture; Fusibility of Silicates and Borates used in — A. Granger. Monit. Scient. 1902, 16, [722], 81—88.

THE relationship between chemical composition and fusibility is by no means simple, and it is thus difficult to select typical silicates for use as pyrometers. This is shown by the following series of typical samples of silicates and borosilicates:—

0.5 Na ₂ O } 0.5 PbO }	..... { 2 SiO ₂ } { 1 B ₂ O ₃} }	.....	° C 590
0.5 Na ₂ O } 0.5 PbO }	x Al ₂ O ₃ { y SiO ₂ } { 1 B ₂ O ₃} }	.....	520—920
x varies from 0.1 to 0.8; y from 2.2 to 3.6; B ₂ O ₃ constant.			
0.3 K ₂ O } 0.7 CaO }	0.2 Fe ₂ O ₃ { y SiO ₂ } { 0.8 Al ₂ O ₃ } { z B ₂ O ₃} }	.....	950—1190
y varies from 3.5 to 3.95; z is bound by the relationship y + z = 4.			
0.3 K ₂ O } 0.7 CaO }	t Fe ₂ O ₃ } 4 SiO ₂ { u Al ₂ O ₃} }	.....	1150—1190
t varies from 0.2 to 0.05; u is bound by the relationship t + u = 0.5.			
0.3 K ₂ O } 0.7 CaO }	u Al ₂ O ₃ y SiO ₂	.....	1210—1670
u varies from 0.5 to 20, and y from 4 to 200.			
Al ₂ O ₃ y SiO ₂			1690—1850
y varies from 10 to 2.			

Each of these types can only be used within certain intervals, and the largest division of the scale (1210—1670) is occupied by an aluminous silicate, in which, as the author shows, the alumina and silica stand in a different ratio to each other at higher and lower fusing-points.

Bischof was one of the first to propose a formula for calculating the fusibility of clays from their chemical composition. Taking a, b, and c to represent respectively the alumina, silica, and fluxing oxides, in molecular quantities; A to represent $\frac{a}{c}$ and B to represent $\frac{b}{a}$, he termed the ratio $\frac{A}{B}$ the "fire-stability quotient" (*Feuerfestigkeitsquotient*). Bischof's formula was strongly criticised by Seger, who proposed the following formula as more correct:—

Fire-stability quotient = $x \left((a + b) + y \frac{b}{a} \right)$, where a and b represent the ratio of alumina and silica respectively to the fluxing oxides taken as unity; x is a coefficient representing the influence of the number and nature of the compounds in the flux, and y is another coefficient representing more exactly the influence of alumina. Koehs and Seyfert (this Journal, 1901, 989) have pointed out that Seger's "fusible cones" do not show a regular ratio between the proportion of alumina and the fusibility quotients at different temperatures, and the author confirms their statements. According to Koehs and Seyfert, the following formula gives satisfactory results:—

$$q = \frac{T^2}{173.4 F K}$$

where q represents the stability quotient, K the amount of silica, T the amount of alumina, and F the sum of the molecular proportions of the fluxing substances. Thus, in order to determine what quantity, x, of alumina must be added to bring a silicate to a required fusibility, the following formula could be used:—

$$x = \pm \sqrt{173.4 q F K - T}$$

whilst the necessary silica could be found by the formula—

$$y = \frac{T^2}{173.4 q F} - K$$

For the simultaneous addition of silica and alumina, the following equations are given:—

$$x = 102 q v (F - T),$$

$$y = 60 q v^2 (F - K),$$

v in this case representing the ratio of alumina to silica (corresponding to a molecular weight M_z). Lastly, the quantity of fluxing oxides, z, to be added to a silicate of known composition in order to obtain a required degree of fusibility, can be calculated as follows:—

$$z = M_z \left(\frac{T^2}{173.4 q K} - F \right)$$



In the author's opinion, the objections offered by Seger to Bischof's formula might also be brought against these formulæ of Kochs and Seyfert. He also considers that the physical state of the material has been too much neglected in all these calculations; for it is unlikely that a compressed argillaceous schist should possess the same degree of fusibility as a soft clay of the same composition.

—C. A. M.

Lignite-Gas; Firing with —, for Pottery Kilns, &c.
Baier.

See under II., page 244.

UNITED STATES PATENTS.

Glass; Apparatus for Silvering —. C. Laval,
Allegheny, Penn., U.S.A. U.S. Pat. 689,732, Dec. 24,
1901.

In this apparatus the silvering material is fed from a hopper to a distributor, the starting, extent, and stopping of the flow of material being automatically controlled by the movement of the sheet of glass, as it approaches, and passes out of contact with the distributor.—W. C. H.

Enamelling Metal Ware. W. Jankowsky, St. Louis,
Miss., U.S.A. U.S. Pat. 691,268, Jan. 14, 1902.

The process consists essentially in applying to the cleaned metal surface, a priming coat of an alkali carbonate, on which is spread a layer of the enamel containing a suitable proportion of potassium bisulphate, which decomposes the priming coat in places, thus producing a mottled effect, where the metallic surface is attacked.—W. C. H.

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

Mortars; Testing the Adhesive Power of —. R. Feret.
Thonind.-Zeit., 25, [153], 2,213—2,215.

The result of Feret's tests with regard to the adhesive powers of mortar are as follows:

A.—The adhesive power of a given mortar varies with the substance to which it is applied. When the substance consists of sand mortar that has been hardened a long time, the variations in the adhesive power are but small. In the case of stone, the adhesion depends on the fineness of grain, and varies directly with the porosity of the stone; but, with soft stone, the fracture is transmitted through the mass, and the result is the same as with a low adhesive power. The latter seems independent of the dimensions of the inequalities in the surface of the stone, the total breaking load being almost the same whether the surface be smooth or contain irregularities 1 cm. in size. With iron, on the contrary, the adhesive power of the mortar is greater on a roughened surface than a smooth one.

B.—The adhesive power is much lower when the surface of the stone is dirty, or has been insufficiently moistened before the application of the mortar. Only a slight improvement can be effected in the case of plastic mortar by ramming.

C.—In all cases little variation is exhibited when a given mortar is mixed with Portland cement; sometimes the adhesive power is greater with bad cements than with better qualities; for one and the same cement, it is greater the finer the grinding. Taken in the same proportions, quick-setting and hydraulic cements give inferior results to Portland cement. Two samples of Grappier cement gave a higher adhesion than Portland cement.

D.—The fineness of the sand influences the adhesive power, the latter being generally greater as the proportion of coarse grains increases. The maximum, however, seems to be attained when a certain ratio (varying with the conditions of the mixture) obtains between the coarse and fine grains of sand, those of medium size being absent.

E.—The adhesive power does not seem to be proportional to the amount of cement in the mortar, and it does not appear advisable to exceed a certain percentage. In the

case of slag cements, little variation is found in mixtures containing the proportions usual in practice.

F.—The influence of the mixing water is insignificant so far as quality is concerned; but the quantity has a great effect, the adhesive power attaining its maximum when the mortar is plastic and inclined to be sloppy, though beyond this point diminution occurs. The maximum of adhesion almost always corresponds with a rather softer consistence than the maximum of resistance, which in turn corresponds to a somewhat stiffer consistence than the maximum of compactness.

G.—On stone the adhesive power, especially in the earlier stages, increases more slowly than the resistance to compression; on iron the increase is nearly parallel with that of the resistance.

H.—In water and moist air, the adhesive power on iron is about the same, and apparently rather lower than in dry air.

I.—On iron the adhesive power of a concrete is smaller than that of the mortar from which it is prepared, and is nearly proportional to the weight of cement present per unit volume of the concrete, other conditions being equal. The increase is, however, slower when the proportion of cement is larger. All concretes prepared from variable proportions of the same cement, sand, and gravel, so as to have an equal compression strength, also exhibit nearly the same adhesive power. The influence of the amount of water used seems to be similar to the case of mortar.—C. S.

Portland Cement; Constitution of —. T. Ludwig.
Thonind.-Zeit., 25, [142], 2084—2085; [145], 2112—2114.

REFERRING to the attempts made to set up a constitutional formula for Portland cement, the author expresses the opinion that it is preferable to ascertain, by the examination of good cements, what limits of the various constituents should be maintained in practice. As an objection to existing formulæ, he points out that it is erroneous to assume that alumina can be replaced by ferric oxide. This latter is never found in combination with silica, except in very complex silicates; and these furnish, on decomposition, ferric oxide or hydroxide, but not ferric silicate. Neither are the imaginary calcium compounds termed "calcium ferrate" by Meyer, known to exist, since ferric oxide never plays the part of an acid, and therefore does not combine with alkalis or alkaline earths. Meyer's "calcium ferrate" must be merely a mechanical mixture of free lime and ferric oxide. The compound in question is more probably tricalcium silicate containing an inert admixture of iron, perhaps in the form of Fe_2O_3 . In view of the colour change to greyish green, it is more probable that the iron in the finished cement is in the form of ferrous silicate; and though the latter cannot be detected as such by titration, this circumstance may be attributed to oxidation during the gradual process of dissolving the ferrous compound in acids.

The chief point in practice is to aim at as large a proportion as possible of $SiO_2 \cdot 3CaO$ and avoidance of free lime. Pure tricalcium silicate can only be obtained by the use of fluxes to effect the combination of lime and silica. From economical considerations alumina and ferric oxide are the only two fluxes that can be used, the former facilitating the formation of clinker, and combining the excess of lime as aluminates, which assist the hardening of the cement when not too abundant. On the other hand, ferric oxide has the advantage of combining with alumina to form a fusible glass, and thus preventing disintegration; but ferric oxide cannot combine with the excess of lime, nor does it contribute to the hardening of the cement. The most favourable results are therefore obtained by using both fluxes, e.g., in the form of a clay poor in alumina, rich in iron, and free from sand. Such a material is found in washed brick earth.

As a convenient means of expressing the composition of cement, the author recommends that the percentages of the constituents should be divided by their molecular weights, in order to obtain molecular values, Fe_2O_3 and Mn_2O_3 being considered as two molecules of FeO and MnO respectively, and therefore divided by one half their molecular weights.

The resulting values should then be divided by the silica coefficient, which will furnish values showing the ratio between the principal components, and greatly facilitate the comparison of different cements.

An example is given showing how, by the aid of this method, a cement with either a high, medium, or low content of lime, may be produced by varying the proportions of two raw materials—limestone and marl—of known composition.—C. S.

Cement; Magnesia ——. L. Preussner. *Thonind.-Zeit.*, **25**, [145], 2, 115.

To remove the sulphuric acid present in commercial hydrochloric acid, magnesium chloride, and in the superphosphate also employed in the manufacture of artificial stone, which acid and its compounds spoil the appearance and durability of the product, Preussner treats the materials with barium hydrate or barium carbonate (witherite), and siphons off the liquid after the precipitate has settled down. In the case of magnesium chloride, the salt is dissolved in water to form a solution of 20–25° B., and the barium hydrate or witherite is added by degrees until the precipitate ceases to increase. The amount of reagent generally required is between 3 and 5 kilos. per centner (50 kilos.). The best method of adding the barium compound is by strewing it over the surface of a board, which is then submerged in the solution, this procedure ensuring a better reaction in the upper layer of the liquid. Finally, the whole should be well stirred.—C. S.

Cements; Action of Sulphate of Lime on ——. L. Deval. *Bull. de la Soc. d'Encouragement pour l'Ind. Nat.*, **101**, [6], Dec. 31, 1901, 784—787.

CEMENTS prepared in the laboratory with compositions similar to ordinary Portland cements, had fixed, at the end of two months, more sulphate of lime than their compositions would indicate as necessary to form sulpho-aluminate. Those cements which gave good results in saline solutions, at the end of four months, had not retained sufficient sulphate of lime to convert the whole of the aluminium into sulpho-aluminate. Cements in which aluminium is replaced by iron do not react with sulphate of lime.

—J. W. H.

Gypsum; Solubility of ——. in *Aqueous Solutions of Sodium Chloride at Different Temperatures*. F. K. Cameron. *J. Phys. Chem.*, Nov. 1901, 556—576.

THE solvent action of water on gypsum is greatly increased by the addition of sodium chloride, thus at 26° C. 100 grms. of water will dissolve 0.2126 gm. of gypsum, but if 15.2 grms. of sodium chloride be added, 0.76 gm. of gypsum is dissolved. At temperatures below 37.5° C. the influence of sodium chloride on the solubility of gypsum increases to a maximum (with an addition of 135–140 grms. per litre), but at higher temperatures, the existence of this maximum is doubtful.

It is stated that at 26° C., 1 part of gypsum is soluble in 372 parts of pure water.—A. S.

ENGLISH PATENTS.

Bricks, Tiles, and the like; Manufacture of ——. A. J. Keeble, Peterborough. Eng. Pat. 10,160, May 16, 1901.

In order to prevent discoloration or "scum" after firing, in bricks, &c., the articles are when moulded, coated, wholly or partially, with a solution of glue or other animal colloid substance, and then dried and fired. The solution is used warm, and may be prepared by dissolving 25 lb. of glue in 20 gallons of water.—E. S.

Conglomerates for Building and other Purposes. G. Cuel, Paris. Eng. Pat. 22,952, Dec. 15, 1900.

THE conglomerates are made by mixing mother-of-pearl waste, previously sorted and washed in acid and water, with cement or the like, and polishing the hardened mass thus obtained.—W. C. H.

Artificial Stone; Manufacture of ——. G. C. F. Boivie, Sodertelje, Sweden. Eng. Pat. 24,923, Dec. 6, 1901.

SLATE waste is finely powdered, and moistened with dilute hydrochloric and nitric acids, or with either, with or without a small proportion of alum or water glass, or the like, in the acid solution. The mass is steamed, and compressed into bricks or other forms, which are dried, and then hardened by subjection to the action of steam under high pressure. To obtain facing-bricks, tiles, &c., lime is added to the powdered slate before treatment with the binding solution, the hardness being thereby increased.—E. S.

Portland Cement from Blast Furnace Slag or Cinder; Preparation of ——. C. von Forell, Hamburg. Eng. Pat. 22,314, Nov. 5, 1901.

By this process, Portland cement is made by mixing together liquid blast furnace slag and powdered lime, the apparatus used being a horizontal or slightly inclined rotary furnace or mixing chamber, provided with a fire-resisting lining, and heated internally or externally to keep the slag fluid, and into which heated air or gas can be blown to promote homogeneity of the product, and the fused mass issuing from which can be granulated by steam-blasts forced from jets in the same direction as the issuing fused mass.—W. C. H.

Elastic Plaster for Walls and Ceilings. H. L. Carter, New York. Eng. Pat. 24,475, Dec. 2, 1901.

THE plaster is made by thoroughly mixing calcined gypsum, or its equivalent, as lime, marble, &c. with marsh-mallow root (althæa) and dextrin, with addition of gelatin, if necessary. The product is said to be hard enough to take a good polish, and to be elastic, owing to the althæa exerting a retarding, and the dextrin an accelerating effect on the setting of the plaster.—W. C. H.

UNITED STATES PATENTS.

Roofing Fabric, and Method of Preparing same. C. S. Bird, Walpole, Mass., U.S.A. U.S. Pat. 690,348, Dec. 31, 1901.

It is stated that the "buckling" frequently observed with roofing-paper, &c. is caused by absorption of moisture, and the object of the present invention is to overcome this defect. The improved roofing paper is made by first waterproofing the paper and then passing it through a bath of water, in order to take up and retain a certain amount of moisture.—W. C. H.

Granite; Artificial ——. McKenzie Arnn, Virginia, U.S.A. U.S. Pat. 691,711, Jan. 21, 1902.

THE granite is made by mixing borax, powdered charcoal, black lead, common salt, washed sand, rosin, and powdered baryta, and incorporating this with liquid slag.—W. C. H.

X.—METALLURGY.

Pseudo-catalytic Oxidation Processes. [Metals.] C. Engler and L. Wöhler. *Zeits. anorg. Chem.*, **29**, 1—21. *Chem. Centr.*, 1902, **1**, [4], 239—241.

UNDER the above name the authors class those catalytic processes of oxidation with oxygen or other oxidising agents, in which the active auto-oxidiser or catalytic agent, (A), in consequence of the instability of the oxide formed, is regenerated, the oxygen being taken up by the acceptor (B). This form of reaction may be represented by the equation:— $AO_2 + 2B = A + 2BO$. Oxygen carriers of this kind may be divided into three classes: 1. The noble and semi-noble metals and their oxides formed as intermediate products. 2. The oxides and salts of such elements, (metals) as are capable, by change of valency of taking up molecules of oxygen. 3. Oxidising ferments of animal and vegetable organisms. The authors then give a large amount of evidence in favour of the view that with finely-divided platinum and oxygen or oxidising agents, an oxygen compound of the platinum is formed, and that in catalytic reactions, alternate oxidation and reduction of this



oxide takes place; they are of the opinion that the oxidised compound of platinum which acts in a catalytic process is probably a hydrated peroxide, PtO_3H_2 or $\text{Pt}_2\text{O}_3\text{H}_2$.

In the solution of gold by potassium cyanide in contact with air, the formation of gold peroxide appears to be of the greatest importance. The authors give the following reaction, somewhat differing from that of Bodländer (this Journal, 1897, 45):— $\text{Au}_2\text{O}_3 + 4\text{KCN} = 2\text{KAu}(\text{CN})_2 + \text{K}_2\text{O}_2$.

To the second class of pseudocatalytic agents belong certain oxides and salts of Cr, Mn, Fe, Co, Ni, Cu, and Hg, and the less active oxides of Ti, Zr, Ce, Th, Sn and Mo; also P, C, and NO. In catalytic reactions effected by these, also, the formation of peroxides plays an important part.

—A. S.

Graphite; Temperature Limits for the Separation of —, from Martensite in Pure Cast Iron. H. P. Tiemann. Metallographist, Oct. 1901, 313—332.

The author draws attention to the great influence of silicon in determining the separation of graphite from cast iron, and states that a large number of the experimental results published, are valueless, owing to this factor having been overlooked. A sample of iron containing no silicon, 0.031 per cent. of phosphorus, 0.002 per cent. of sulphur, 0.040 per cent. of manganese, and 0.030 per cent. of combined carbon, was carburised with sugar charcoal in crucibles free from silica, until it contained 4.271 per cent. of combined carbon and 0.255 per cent. of graphite. With this specimen, the proportion of graphite was quite unchanged by heating up to temperatures as high as $1,116^\circ\text{C}$., and then quenching in iced brine at -5°C .; by heating to $1,300^\circ\text{C}$., and allowing to cool to $1,040^\circ\text{C}$., before quenching, the proportion of graphite was raised to 0.677 per cent. According to Roozeboom's views (this Journal 1900, 1016, 1154), cementite (combined carbon) should be entirely converted into graphite at any temperature above $1,000^\circ\text{C}$., but from the author's results, it appears that this change does not readily take place in a pure cast iron, unless the temperature be raised far above the "transition point." If, however, the iron contain silicon, not only is the formation of graphite at temperatures above the transition point facilitated, but the transition point is lowered, so that the formation of graphite may take place below $1,000^\circ\text{C}$. An iron containing 0.75 per cent. of silicon, 3.438 per cent. of combined carbon, and 0.938 per cent. of graphite was found to contain 2.795 per cent. of graphite, after being heated to $1,125^\circ\text{C}$., and quenched at -5°C ., whilst the proportion of graphite was increased to 1.690 per cent., when the iron was heated only to 975°C ., a temperature 25° below the transition point.—A. S.

Copper and its Alloys; Refining —, with Magnesium. Rev. Prod. Chim., 4, [22], 339.

The proportion of copper-magnesium (1:1) alloy generally sufficient for the operation is 50 grms. per 100 kilos. of copper. In experimenting, however, it is advisable to commence with 20 grms., and increase the quantity until the desired effect is produced. An increase in the amount of alloy to 100 grms. and even more, has a very favourable effect on the density and solidity of the copper, the latter becoming harder, and therefore more resistant.—C. S.

Alloys of Aluminium and Magnesium. O. Boudouard. Bull. de la Soc. d'Encouragement pour l'Ind. Nat., 101, [6], Dec. 31st, 1901, 773—780.

The form of the melting point curve of alloys of magnesium and aluminium points to the formation of two definite combinations of aluminium and magnesium, AlMg_2 and AlMg . Alloys containing over 15 per cent. of either metal are brittle, the maximum of brittleness being reached by the alloy 50 Al—50 Mg, which may be crushed between the fingers and powdered in a porcelain mortar. The author has isolated the definite combinations which occur in the alloys. AlMg_2 was obtained by treating a 30 Al—70 Mg alloy with a 10 per cent. solution of ammonium chloride; a crystalline powder remained behind, which on analysis yielded almost theoretical numbers. AlMg was obtained in a similar way from the alloys 40 Al—60 Mg, and

50 Al—50 Mg. Al_2Mg was left behind after attacking the alloy 70 Al—30 Mg, with a 10 per cent. solution of hydrochloric acid.—J. W. H.

Alloys of Aluminium with Iron and with Manganese. L. Guillet. Comptes Rend., 134, [4], 236—238.

By reducing the oxides of iron and of manganese by combustion with metallic aluminium, in varied proportions, the author has obtained the alloys Fe_2Al_3 , FeAl_3 , Mn_2Al_3 , MnAl_3 , and MnAl_4 . In the reaction with iron there is no loss, but with manganese the losses of material are very great, much of the oxide being reduced only to MnO .

—J. T. D.

Strontium; Metallic — and its Hydride. Guntz. Comptes Rend., 1901, 133, [26], 1209—1210.

When strontium amalgam, formed by electrolysis of an aqueous solution of strontium chloride with a mercury cathode, is slowly and carefully heated in a vacuum to full redness, practically all of the mercury is volatilised, and metallic strontium remains. It is very like barium, but does not so easily react with liquid ammonia to form a metall-ammonium.

If the amalgam be heated in a stream of hydrogen, the gas is absorbed (at a temperature above that at which barium absorbs it), and the white fusible hydride SrH_2 is formed; but as this compound coats the remaining amalgam and prevents the escape of the mercury, it is better, if the pure hydride be wanted, to prepare in the first place metallic strontium from the amalgam, as above, and then to react on this with hydrogen.—J. T. D.

Barium; Preparation of —. E. Stansfield. Mem. and Proc. of the Manchester Lit. and Phil. Soc., 1901—1902, 46, [4].

The author attempted to prepare pure barium by means of the Goldschmidt process (see this Journal, 1898, 543, 584), according to which oxides are reduced by means of finely divided aluminium intimately mixed with them. The best results were obtained with a charge consisting of 100 parts of barium peroxide and 21 parts of aluminium (corresponding to the equation: $3\text{BaO}_2 + 4\text{Al} = 3\text{Ba} + 2\text{Al}_2\text{O}_3$), together with 25 parts of the product of a previous experiment; the reaction, however, appears to be reversible, as in no case was pure barium obtained, but only alloys of barium and aluminium containing up to about 60 per cent. of barium.

—A. S.

Manganese in Spiegel; Determination of —. T. F. Hildreth.

See under XXIII., page 279.

Sulphur in Pig Iron; Colorimetric Method for the Determination of —. W. G. Lindsay.

See under XXIII., page 279.

Gold and Iridium; Separation of —. Mietzschke.

See under XXIII., page 279.

ENGLISH PATENTS.

Iron and Steel; Treatment of Slag resulting from the Manufacture of —. S. F. Prest, London, and J. W. Cabot, Johnstown, U.S.A. Eng. Pat. 5234, March 12, 1901.

The slag is finely ground, the magnetic portion separated therefrom, and the non-magnetic portion digested with dilute acid, such as sulphuric acid, and the soluble salts so obtained crystallised for use for various purposes. The soluble silica may be separated by evaporation and heat previous to the crystallisation of the salts by water. The γ -products so obtained from the non-magnetic portion of the slag, are claimed, and may consist of salts of manganese, iron, aluminium, magnesium and, if the slag is a basic process one, phosphoric acid.—A. W.



Steel; Hardening and Tempering of — H. H. Lake. From W. R. Bennett, New Britain, U.S.A. Eng. Pat. 18,230, Sept. 12, 1901.

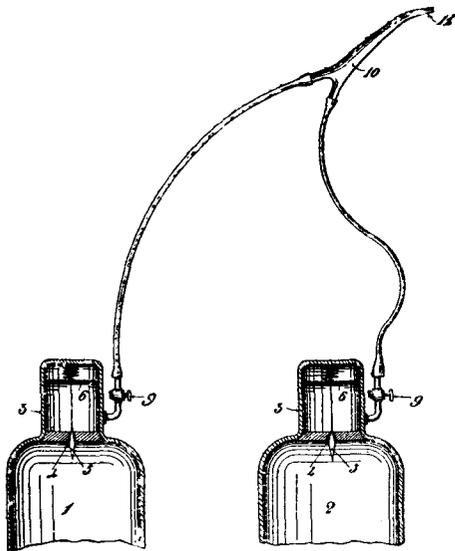
THE stock is first heated in any suitable manner, and then cooled in a bath which is kept in motion at its points of contact with the stock by means of freshly inflowing streams, a mode of effecting which is described and illustrated. The stock is then suddenly withdrawn from the bath and immersed in a tank of oil until the oil and the stock are practically of even temperature, after which they are heated together to a higher degree.—G. H. R.

Antimony Ores containing Gold; Process for Treating — A. S. Plews, London. Eng. Pat. 5440, March 14, 1901.

THE crushed antimony ore is heated in an oxidising atmosphere, in a furnace, preferably of the revolving cylinder type, with smokeless fuel as long as antimony fumes are evolved. The flame is then made reducing, and afterwards alternately oxidising and reducing, until the antimony is completely volatilised, the residue being then in a condition to be crushed and treated with cyanide for gold extraction. The antimony fumes from the oxidising and reducing operations are condensed in separate chambers, preferably provided with a strong induced draught, the oxidising product being fairly pure white oxide and the reducing product an oxide mixed with other substances.—A. W.

Soldering; Process of —, with *Oxy-hydrogen Gas*. P. Garuti and R. Pompili, both of Tivoli, Italy. Eng. Pat. 14,306, July 13, 1901.

THE process is applicable on a large scale, and effects, without danger of explosion, the mixture of the two gases, before they reach the flame, by submitting them to a sufficiently high pressure to blow them out of the blow-pipe with a velocity superior or at least equal to the velocity of the propagation of the flame to the mixture. The mixture of the gases is in the proportion of 3 or 4 parts of hydrogen to 1 part of oxygen so as to ensure perfect diffusion of the oxygen with the hydrogen, and thus avoid oxidation of the metal to be soldered.



The special apparatus claimed for the said purpose, is shown in the accompanying drawing. It contains a chamber of conical or other adapted shape 10, to which the separate gases are conducted, and in which they are mixed under compression previous to passing through the opening 11 at the necessary velocity to prevent explosion. The pressure of the gases is maintained equal throughout by means of flexible regulators 3 and micrometric screw taps 9, which regulate the outflow and proportion of the gases. The regulators are of the usual form, and have an opening of

conical section 4 for the passage of the gases from the separate reservoirs 1 and 2, the said opening in each case being regulated by a needle 5, fixed on a flexible membrane 6, regulated by a spiral spring. The pressure, which should not be less than 30 centimetres of water, and might be 80 for strong jets, is thus maintained equally, the rate of outflow being regulated by the screw taps.—A. W.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

(A.)—ELECTRO-CHEMISTRY.

Alkali Hypochlorite and Chlorate; Attainable Current and Energy Efficiency during the Electrolytic Manufacture of — F. Foerster and E. Müller.

See under VII., page 252.

Magnesium in Electrolytic Rectifiers. A. Campetti. Accad. Sci. Torino, Atti, 1901, 36, [7A], 251—256.

WHEN magnesium is used as anode to a cathode of platinum in a voltmeter containing caustic potash or soda, there is a marked diminution in the strength of the current passing, which is not due entirely to the opposing E.M.F. of polarisation, but mainly, according to the author, to the formation of a thin badly-conducting layer of oxide on the surface of the magnesium. The phenomena are similar to those observed in the case of aluminium, and the cell, when inserted in an alternating-current circuit, acts as an electrolytic valve. With voltages varying from 18 to 60, and with a frequency of 15, calorimetric measurements show that under the most favourable conditions, the loss in the cell does not exceed from 10 to 15 per cent. of the energy developed.—A. S.

Aluminium; Polarisation of — A. Naccari. Accad. Sci. Torino, Atti, 1901, 36, [12A], 468—481.

IN the author's experiments, the aluminium plate which was to form the electrode was placed in a vessel containing dilute sulphuric acid, and this vessel was joined by means of three wide glass siphons with another containing the same liquid and an aluminium electrode. The first vessel was also connected by means of a siphon with another which contained the same liquid and a plate of aluminium. At a certain moment, the latter was connected with an electrometer for measuring the potential of the liquid surrounding the aluminium electrode, whilst the electrode itself was connected to earth. From the results it appears that the polarisation gradually increases, reaching a maximum of 10 volts in about 8 minutes, and then decreasing in about half an hour to about half that amount, at which point it remains constant. This, however, only applies to fresh plates, for on repeating the experiment with the same plate the next day, the final polarisation value was reached almost at once. The author is of the opinion that the resistance created by a thin coating of aluminium oxide is the determining factor in the phenomena described, and this view is supported by the fact that the polarisation diminishes on increasing the concentration of the sulphuric acid, which would facilitate the solution of the oxide or hydrate.—A. S.

ENGLISH PATENTS.

Electric Accumulator [Aluminium Electrode]. R. Hills, Handsworth. Eng. Pat. 14,501, July 14, 1899.

THE negative electrode is formed of a thin plate of aluminium immersed in a solution of zinc sulphate and water, the positive element being an ordinary perforated lead plate pasted with red lead and litharge.—G. H. R.

Electric Insulating Material, and the Application of the same in the Construction of Commutators for Dynamo Electric Machines. The British Thomson-Houston Co., London. From W. Le R. Emmet, Schenectady, New York, U.S.A. Eng. Pat. 17,030, Aug. 24, 1901.

THE 17 claims refer to the manufacture of an insulating material by soaking an absorbent refractory substance, such as asbestos paper, in a vegetable varnish, preferably boiled



linseed oil, and gum copal thinned down with "benzine," &c., the sheets being air-dried, pressed together, and "baked to a refractory hardness"; also for the employment of this material between the metallic segments of the commutators of dynamo-electric machines.—W. C. H.

Electric Lead-Zinc Batteries. L. M. G. Rosée
D'Infrville, New York, U.S.A. Eng. Pat. 24,627,
Dec. 3, 1901.

THE zinc electrode, which may be formed of zinc and mercury, or other metal carrying zinc is suspended in the upper strata of a solution of sulphuric acid with its active surfaces approximately perpendicular to the surface of the electrolyte. An electrode carrying peroxide of lead is placed beneath in the lower strata of the solution, a clear horizontal stratum being left between the electrodes, which each have interstices approximately perpendicular to the surface of the electrolyte.—G. H. R.

Aromatic Nitro Compounds; Reduction of—, to the Corresponding Amines. G. W. Johnson, London. From
C. F. Boehringer und Soehne, Waldhof, Germany. Eng.
Pat. 25,100, Dec. 9, 1901.

AROMATIC nitro-compounds are reduced to the corresponding amines by subjecting them to the action of an electric current in a cathode bath containing an alkali, or an alkali earth, or any of their salts, with or without an organic solvent, "the cathode being of copper, or of copper, or other material, in the presence of finely powdered copper, or of a copper salt."—G. H. R.

Ropes, Hose, Cork, Asbestos, and Textile Fabrics of all kinds; Process and Apparatus for Electrically Treating
— H. W. Schlomann and A. De Castro, Berlin.
Eng. Pat. 2703, Feb. 10, 1900.

TEXTILE materials and the like are electrolytically impregnated by passing them through a bath of any desired metallic salts which produce electrolytic deposits in the materials, and render them more durable and also waterproof and incombustible, by filling the spaces between the fibres of the fabric with the electrolyte. The material is then pressed between broad heavy plates or parts serving as anodes and cathodes, and constructed to correspond to the shape or configuration of the material to be impregnated. After being submitted for a suitable time to the action of an electric current from a source connected with the electrodes, the material is pressed between rollers and automatically drawn forwards along the pressing-table to allow of the following length of material being impregnated, the hydrogen generated by the electrolytic action being blown off by compressed air from a tube arranged near the pressing-table.—G. H. R.

UNITED STATES PATENTS.

Electrical Conductor and Anode. L. Hargreaves and
W. Stubbs, Widnes. U.S. Pat. 689,877, Dec. 31, 1901.

SEE this Journal, 1899, 1029.—G. H. R.

Electric Accumulator. A. Pouteaux and A. Wolff, Dijon,
France. U.S. Pat. 690,181, Dec. 31, 1901.

THE secondary battery consists of an exterior casing containing an electrolyte in which a plurality of positive and negative elements are immersed. Each element is composed of two perforated parallel plates, between which, and connected to both, are placed partition bars which divide the space between them into several compartments. The partition bars are each composed of two parallel strips, perforated in the direction of the plates, so as to afford communication with the compartments, and separated from each other by cross pieces. The active material is charged into the compartments, but not into the spaces between the strips of the partition bars. A horizontal core of any suitable conducting material is arranged in the centre of each compartment, the cores of each element being connected by a collecting bar to a terminal, and there are two terminal bars, one connecting all the terminals of the

positive, and the other all those of the negative elements of the battery. The portions containing the active material are made of celluloid coated with a layer of pure caoutchouc.
—G. H. R.

Electric Storage Battery. A. De Dion and G. Bouton,
Puteaux, France. U.S. Pat. 691,611, Jan. 21, 1902.

THE depolarising body consists of a strip of copper which forms the positive electrode, and is embedded in a compressed block of pure oxide of copper which is covered with a piece of copper gauze to facilitate its insertion into a zinc vessel which constitutes the negative electrode, and contains the electrolyte, and which is of a similar shape to the block, gauze, and strip, the latter being of such a size that they conform closely to its inner surface.—G. H. R.

Alkali Chlorides; Apparatus for the Continuous Electrolysis of—. W. Gintl, Aussegg, Austria-Hungary.
U.S. Pat. 690,365, Dec. 31, 1901.

IN apparatus of the type having means for holding the liquids present, and a gas-collecting chamber containing the anode, the cathode being outside the chamber, the patentee claims the improvement that the anode is supported, and proportioned to approximately fit the chamber horizontally and divide the space above the anode from that below it, the passage or means of circulation from above to below the anode being restricted to prevent free or rapid circulation. A distributing supply device is arranged to deliver the inflowing electrolyte into the space above the anode, and partly downward over a large area of it, so that the stratification of the electrolytic liquids may be undisturbed.—G. H. R.

Alkali Chlorides; Continuously Electrolysing—.
[Gravity.] W. Gintl, Aussegg, Austria - Hungary.
U.S. Pat. 690,141, Dec. 31, 1901.

THE continuous electrolysis of sodium chloride or of "gas-producing" salts, such as fluorides and some carbonates, is effected by passing a current from anode to cathode through the electrolyte, and gently introducing the fresh electrolytic solution into a space or chamber above the anode in its immediate vicinity and separate from the cathode. A gradual movement of liquid towards the latter is produced by drawing off that in its immediate proximity at a level above the highest level of connection between the cathode and the chamber. The level of the solution is maintained above the anode, and by restricting the downflow of the electrolyte in the vicinity, and causing it to meet and be intimately mixed by the rising bubbles of gas, the rapid downpour and dissemination of the electrolyte in the lower portions of the bath are prevented, and a substantially constant stratification of the solutions is produced and maintained, the solution above the anode being richest in the electrolyte to be decomposed. The process is preferably carried out with the apparatus already described (see preceding abstract).—G. H. R.

Water Purifier and Filter (Electrolytic); Portable—.
C. E. Holland. U.S. Pat. 691,545, Jan. 21, 1902.

See under XVIII., B., page 270.

(B.)—ELECTRO-METALLURGY.

Aluminium; Experiments on the Manufacture of—.
F. Haber and R. Geipert. Zeits. für Elektrochem., 1902,
8, [1], 1-8, and [2], 26-33.

A DETAILED description with drawings, is given of an experimental electric furnace, the use of which has enabled the authors to produce aluminium on a small scale, the current used being 300-400 ampères.

The furnace consists essentially of a block of artificial carbon in which a bath of the proper dimensions is cut. That employed by the authors is circular and is 70 mm. deep. The diameter at the bottom is 113 mm., and at the top, 138 mm. Into this bath is lowered, by means of fine adjustments, a cylindrical carbon anode 66 mm. in diameter. Both carbons were of the best quality, and were made from materials as free as possible from ash.



Two samples of cryolite (artificial and natural) were used, whilst the alumina was a good commercial sample.

In the first experiment, 1,000 grms. of finely powdered cryolite and 200 grms. of alumina were fused in the bath by means of the electric arc. The anode was then lowered to within $\frac{1}{2}$ —1 cm. of the bottom of the carbon trough, and the electrolysis started with 7 volts and 409 ampères. The experiment lasted 290 minutes, the current strength being noted every five minutes. During the run, an additional 885 grms. of cryolite and 927 grms. of alumina were added. The average current strength was 310 ampères. 270 grms. of aluminium were obtained, the current efficiency being 51.3 per cent. The E.M.F. was 7 volts at the beginning and gradually rose to 10 volts at the finish, the mean value being 8.5 volts. Consequently the consumption of energy was 63 electrical horse-power-hours per kilogram of aluminium, whilst the published figures vary between 40—45.

The authors consider that the electrolysis can be quite well conducted with a mean voltage of 7.5, the higher figure obtained by them being due to the rounding off of the carbon anode. This would reduce the energy required to 55.6 electrical horse-power hours, which is capable of being still further reduced, as in the above experiment, a considerable quantity of aluminium was oxidised.

The purity of the aluminium obtained and its mechanical properties were satisfactory. In concluding, the authors summarise the results obtained as follows:—

The preparation of pure aluminium, from a mixture of cryolite, aluminium fluoride, and alumina, may be easily accomplished in a furnace as above, using a current of 300—400 ampères at 7—10 volts, the cathode current density (referred to the cross section of the bottom of the trough) being 3 ampères per square cm. In order to obtain a good product, it is most important to start with the raw materials as pure as possible. The electrolysis itself proceeds quietly and uniformly, as is the case with an electrolytic deposition, provided that the dimensions of the furnace are properly chosen and that the position of the anode is carefully and systematically controlled by means of the necessary fine adjustments. The composition of the electrolyte in the neighbourhood of the zone of precipitation, and in the case of the preparation of the purest metal, was found to be in round numbers, one-third sodium fluoride, one-third aluminium fluoride, and one-third alumina. The high percentage of aluminium fluoride facilitates the electrolysis, since the bath is thereby rendered more fluid, the temperature being bright red-heat.

From the results obtained, the authors are of opinion that the modern successful electro-chemical manufacture of aluminium is not due to secret alterations in the electrolytic process, but in the employment of purer raw materials and in the use of anodes containing as little ash as possible.

—J. S.

Tin, Spongy and Crystalline; Electrolytic Formation of —. W. Pfanhauser. *Zeits. für Elektrochem.*, 1902, 8, [3], 41—43.

The author describes the conditions which appear to favour the electrolytic production of spongy and crystalline tin. The precipitation of tin in thick deposits is only possible in the presence of highly concentrated tin salt solutions, which contain no cations which can give rise to strongly dissociated solutions in the neighbourhood of the cathode. Further, provision must be made for the presence of a sufficiency of tin ions, or tin salt, near the cathode. This condition is naturally fulfilled by applying low current densities and by circulating the electrolyte or rotating the cathode. —J. S.

Tin; Electrolytic Treatment of —. P. Nauhardt. *Chem.-Zeit.*, 1902, 26, [5], 50—51.

A process (Ger. Pat. 118,358) has been discovered by which the well-known difficulties met with in the electrolytic treatment of tin are overcome. It is intended primarily for the recovery of tin from tin-scrap and tinned copper goods, but may also be used for electro-tinning, especially for the tin-plating of objects such as fine copper or brass wire or narrow metal tubes, which cannot well be covered by immersion in melted tin. The tin-scrap to be stripped, is placed in a drum made of reed or

osiers, half-immersed in the electrolyte, and provided with leaden plates on the inner end-surfaces, connected with the positive pole of the electrical generator, so that the scrap thus forms the anode in the solution. The drum is rotated slowly within a lead-lined trough-shaped vat, of which the lead lining (joined by autogenous soldering) forms the cathode. The electrolyte consists of 10 parts of sulphuric acid (66° B.) mixed with 100 parts of water, and with a sufficient quantity of an ammonium salt, preferably the sulphate, to prevent the acid attacking the iron or other metal of the objects from which the tin is to be removed. The potential difference used should be 1.7 volt, but should not greatly exceed this, and the current density should lie between 25 and 35 ampères per square metre (about 2 to 3 ampères per square foot). In a very short time the tin will dissolve from the scrap under treatment, and after the solution is saturated, will deposit in the form of a chemically pure crystalline powder. Should any spongy deposit appear, a small quantity of ammonium sulphate must be added to the bath. After the drum containing the stripped scrap has been removed, objects of copper or iron may be tinned satisfactorily in about 10 minutes, by suspending them in the solution, and reversing the connections, i.e., connecting the lead-lining of the vat to the positive, and the suspended objects to the negative pole of the generator. —W. G. M.

Lithium and Antimony; Compound of —; and *Preparation of Lithium Alloys*. P. Lebeau. *Comptes Rend.*, 134, [4], 231—233.

ANTIMONY and lithium, heated together, unite readily with evolution of heat, but the violence of the action prevents a definite compound from being obtained. On electrolysing a fused mixture of equal weights of lithium and potassium chlorides, using an antimony cathode, however, a definite, crystallised, slate-grey compound of the formula $SbLi_3$ is obtained. This compound has a melting point much above that of either of its constituents, and decomposes water rapidly in the cold. By a similar electrolytic method, the author has prepared alloys of lithium with tin and with lead. —J. T. D.

ENGLISH PATENTS.

Electric (Arc) Furnaces. R. C. Contardo, Sèvres, France. Eng. Pat. 4576, March 4, 1901.

THE body of the furnace is carried on hollow trunnions, resting on supports, and provided with stuffing glands, through which fixed, longitudinally adjustable electrodes pass into the heating chamber, which has an inclined portion connected at one end with the horizontally arranged bed for the charge, and at the other with a charging opening. Means are provided for closing the opening, and the chamber is oscillated on its trunnions by a segment carried on it, with which a pinion engages. The furnace has two vertical side walls, and an end one with a tap hole which can be closed. There is a closed roof above the bed for the charge, and the electrodes, which pass through the side walls, project above the bed and below the roof in proximity to the tap-hole, so that while the charge on the bed is being heated by radiation alone, the roof, the end, and the tap-hole, are also raised to a high temperature, and on tilting the furnace, the charge runs over these superheated surfaces and pours out at the tap-hole without any re-cooling. —G. H. R.

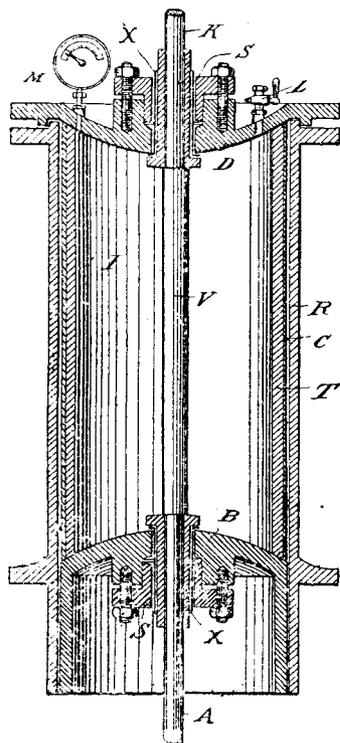
Metals [Fe, &c.]; Process of Smelting and Reducing —, including the Production of Calcium Carbide. C. Diesler, Coblenz, Germany. Eng. Pat. 930, Jan. 14, 1901.

THE process of smelting and reducing metals, and simultaneously producing oxides of carbon, is carried out by heating with a strong galvanic current, and a resistance inserted in the circuit, metallic oxides or acid compounds and carbon, compressed into airtight retorts in which a vacuum is made, whereby the reducing gases formed in the reaction produce such a pressure that the reductions and combinations are quickly effected at a low temperature.

For carrying out the process, an oven is claimed constructed according to the accompanying sectional drawing. It consists essentially of a cylindrical reservoir R, having



arched top and removable bottom plates D and B, secured thereto, and with central openings for the insertion of stuffing boxes S, provided with an insulating material, so



that the reservoir can be perfectly closed; and of an inner cylinder C with a clay tube T for the purpose of receiving the molten material, and insulating the outer reservoir. K and A are the two electrodes, V the resistance, Xasbestos sleeves, M a manometer, and L a gas exhaust cock. The space between the two cylinders R and C is preferably filled with asbestos. The apparatus can be used for the reduction of iron and other metals, and for the manufacture of calcium carbide, &c.

—A. W.

Metal Coatings or Deposits; Process for obtaining —.
[Bath.] E. Mies and A. H.

Mies, Budesheim am Scharlachberg, Germany. Eng. Pat. 18,518, Sept. 13, 1899.

METAL coatings can be obtained on metals without external supply of current, by the use of boiling baths which contain in solution the salts of the metals to be deposited or obtained by electrolysis, such as lead, zinc, tin, nickel, antimony, iron, and the like, in combination with a salt of the electro-positive metals, iron, zinc, manganese, uranium, zirconium, aluminium, beryllium, magnesium, calcium, and antimony, so far as the latter have the property of producing an electric current between them and the immersed metal, so that the latter forms the negative, and the bath itself the positive pole, whilst an external application of electric current may take place in the ordinary manner, if it be desired to assist the process.—G. H. R.

UNITED STATES PATENT.

Electrolytic Solution (for Electro-galvanising). [Zinc and Magnesium Salts.] O. Meyer, Richmond, U.S.A. U.S. Pat. 691,158, Jan. 14, 1902.

The solution may consist of six parts each of sulphate of zinc and sulphate of magnesia, and one part of dextrin, dissolved in such a quantity of water that the solution has a specific gravity of about 18° B.; or an aluminium salt may be substituted for a part of the magnesium salt, but the inventor does not limit himself to any proportions.

—G. H. R.

XII.—FATS, OILS, AND SOAP.

Linseed; Ground —, Adulterated with Mineral Oil. Lyman F. Kebler. Amer. J. Pharm., 74, [1], 39—41.

THE author finds that the fraudulent admixture of mineral oil with powdered linseed still prevails in American commerce. A specimen recently examined was found to contain 35.5 per cent. of oil, which, when extracted by pressure, was dark-coloured, fluorescent, and abnormal in odour.

It had the sp. gr. 0.9055 (as compared with 0.930 to 0.940 for linseed oil), the free acid value 61 and saponification value 99.7, the ester value of linseed oil being between 157 and 200. The oil extracted by ether had the sp. gr. 0.9039; acid value 8.6; and ester value 104.1, figures which would be equivalent to the presence of 14 per cent. of mineral oil in the linseed powder. The fixed oil from another sample of powdered linseed, although the percentage was normal, had the abnormal sp. gr. 0.921; acid value 106; and ester value 155.—J. O. B.

Cotton-seed Oil; Chemistry of Halphen's Reaction for —
P. N. Raikow.

See under XXIII., page 273.

Glycerins, Industrial and Commercial; Analysis of —
J. Gailhat.

See under XXIII., page 280.

ENGLISH PATENTS.

Vegetable Fat; Edible —. Method of Manufacture. G. C. Warr, London, and W. T. Wright, Wraybury, Bucks. Eng. Pat. 22,602, Dec. 11, 1900.

THE process claimed, consists in pulverising the kernel of a suitable nut, such as cocoanut, heating it at a temperature varying with the age of the nut, and then subjecting it to pressure. The resulting oil is washed with water, and, after the precipitation of impurities by means of sodium chloride or other suitable reagent, it is passed through a filter-press, flavoured, and coloured as desired.—C. A. M.

Fish Waste, Fish, and other Material; Apparatus for Reducing or Rendering —. H. J. Haddan, London. From E. R. Edson, Cleveland, Ohio, U.S.A. Eng. Pat. 24,602, Dec. 3, 1900.

SEE p. 263, col. 1, U.S. Pat. (E. R. Edson) 682,471, 1901.
—C. A. M.

Fish Waste, or Fish and other Oil Yieldable Material; Process of Reducing or Rendering — to obtain Oil. H. J. Haddan, London. From E. R. Edson, Cleveland, Ohio, U.S.A. Eng. Pat. 24,603, Dec. 3, 1901.

SEE p. 263, col. 1, U.S. Pat. (E. R. Edson) 689,472, 1901.
—C. A. M.

Whale and Seal Oil; Bleaching of —. W. P. Thompson, Liverpool and London. From A. N. Nielsen, St. John's, Newfoundland. Eng. Pat. 24,821, Dec. 5, 1901.

THE process claimed, consists in forming the oil and the oxidising chemicals into an emulsion before the liberation of the oxygen, thus insuring a more intimate contact between the gas and particles of oil. In order to retain the oxygen in the mixture for as long a time as possible, the temperature is kept low, and is not raised until the bleaching is complete. Suitable oxidising agents mentioned, are solutions of potassium bichromate or permanganate, with the subsequent addition of an acid.—C. A. M.

Chinese Wood Oil; Process for Thickening —; and Manufacturing Substitutes for Hard Resins therefrom. A. Kronstein. Eng. Pat. 1387, Jan. 31, 1901.

See under XIII., B., page 264.

Fats; Saponification of —. H. Delarue, Paris. Eng. Pat. 6622, March 29, 1901.

THE object of this patent is to obtain a larger yield of solid fatty acid in the treatment of oleic acid with sulphuric acid of 66° B. This is said to be effected by using sulphuric acid of that strength instead of dilute acid for the decomposition of the lime soap first formed in the treatment of fats, for the production of candle material. The oleic acid is thus subjected to the action of the concentrated sulphuric acid at the moment of its liberation, or whilst in the nascent condition.—C. A. M.

UNITED STATES PATENTS.

Rendering Apparatus. E. R. Edson, Cleveland, Ohio. U.S. Pat. 689,471, Dec. 24, 1901.

THIS apparatus, for the various parts of which 13 claims are made, consists essentially of a closed receptacle provided with means of heating, and containing a reservoir for gas or vapour under sufficient pressure to prevent the ebullition of the material treated. The apparatus is primarily intended for obtaining oil and gelatin from fish waste, and it is stated that emulsification is prevented by thus introducing a gas or vapour under pressure on to the surface. Means are also provided for filtering the gelatin solution from the residual matter in the discharge pipe, and for heating it during filtration so as to prevent fermentation.—C. A. M.

Oil from Fish or other Material; Process of Extracting — E. R. Edson, Cleveland, Ohio. U.S. Pat. 689,472, Dec. 24, 1901.

PART of the apparatus here described is essentially the same as that described in the preceding patent, the mass being heated in a closed receptacle under sufficient pneumatic pressure to prevent ebullition. In this case, however, no claim is made for the means of filtering the gelatin solution obtained from the residue.—C. A. M.

[*Lard*] *Rendering Tank.* W. C. Marshall, Chicago. U.S. Pat. 690,525, Jan. 7, 1902.

THIS invention is an improvement on the apparatus described in U.S. patent 137,698, April 8, 1873. The rendering-tank in the present patent has an opening at the top, so that high-pressure steam is condensed after contact with the mass, and the lard does not acquire an unpleasant flavour, such as is produced by long-continued contact of the fat with steam under pressure. Separate claims are also made for various combinations of different parts of a special apparatus for carrying out this process.—C. A. M.

Grease from Garbage; Process of Extracting — S. H. Brown, Washington. U.S. Pat. 689,535, Dec. 24, 1901.

IN the process claimed the garbage is first heated in a suitable digester with an alkaline salt, such as a solution of soda ash, in insufficient proportion to effect complete saponification. The contents of the vessel are then forced into a tank half filled with water containing a small proportion of sulphuric acid (0.5 per cent.), where the oils and fats rise to the surface, whilst all ammonia present is obtained as crystalline ammonium sulphate. After this the temperature in the digester is raised so as to expel moisture and gas, and leave a carbonised residue suitable for fertilising purposes. The inflammable gas driven off during the final two hours is passed through oil and collected for the purpose of illumination.—C. A. M.

Oil from Cotton Seed; Process of Extracting — E. van Winkle, Atlanta, Georgia. U.S. Pat. 690,331, Dec. 31, 1901.

THE seed is broken up, the hulls separated, and the mass "tempered" by being heated either with or without the addition of moisture, before being passed through the crushing rolls. The addition of water is stated to facilitate the extraction of oil from old or dried seed.—C. A. M.

Cotton Seed Oil; Process of Extracting — E. L. Johnson, Memphis, Tennessee. U.S. Pat. 691,342, Jan. 14, 1902.

ACCORDING to this invention, a suitable proportion (preferably 10 per cent) of cotton-seed bran is added before or after the cooking process, and the mixture is formed into cakes and pressed. It is stated that owing to the increased porosity of the cake, a higher yield (about 1.5 per cent. more) of oil is obtained than by the ordinary methods of expression.—C. A. M.

Detergent, and Process of making the same. F. N. Pease and M. E. McDonnell, Altoona, Pennsylvania. U.S. Pat. 690,458, Jan. 7, 1902.

CLAIM is made for a preparation obtained by treating a proteid-containing substance, such as linseed meal or white of egg, with an acid, such as hydrochloric, sulphuric, acetic, or oxalic acid, at a suitable temperature, and diluting the viscid product of the reaction with water. A typical preparation consists of 2.3 lb. of linseed or cotton-seed meal treated with $4\frac{1}{2}$ pints of commercial hydrochloric acid (sp. gr. 1.16), and mixed with sufficient water to form a gallon; the surface to be cleansed is treated with this liquid for at least three to five minutes.—C. A. M.

Toilet Cream. J. C. Fleming, Summit, New Jersey, U.S.A. U.S. Pat. 690,848, Jan. 7, 1902.

THE animal or vegetable fat is heated to a temperature not much above 120° F., and treated with a solution of whey and potash, and the resulting soap solution is boiled with an additional quantity of whey. The soap thus prepared is said to be of finer quality than that manufactured by the ordinary methods.—C. A. M.

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

(A.)—PIGMENTS, PAINTS.

ENGLISH PATENT.

Paint Composition particularly applicable for use in Renovating Cane and other Furniture. G. Tüschel, Odessa, Russia. Eng. Pat. 23,155, Nov. 15, 1901.

THE composition claimed, is prepared by mixing pure white lead (1,000 grms.) and 1 and 2 grms. of soluble Aniline Yellow (or French ochre), with 1,500 grms. of water, and boiling the whole together with 125 grms. of white Russian glue. The paint is used in a hot condition.

An alcoholic solution can be prepared by dissolving 360 grms. of a hard resin, 40 grms. of Venice turpentine, and 5 grms. of ether in 800 grms. of alcohol (95—96 per cent.), and adding 1,000 grms. of pure white lead, and 96 grms. of Aniline Yellow (or clear French ochre) to the solution.—C. A. M.

UNITED STATES PATENTS.

Pigment, and Process of making same. C. B. Jacobs, East Orange, New Jersey, U.S.A. U.S. Pat. 689,882, Dec. 31, 1901.

SOLUTIONS of barium hydroxide and zinc sulphate are mixed together in molecular proportions, so as to produce a precipitate stated to have the composition $Zn(OH)_2 + BaSO_4$. This is stated to form a pigment of a pure white colour, great body, and extreme fineness, resembling "lithopone" (zinc sulphide and barium sulphate), but being more permanent, and capable of admixture with lead paints. —F. H. L.

Pigment [Ferric Oxide], and the Production thereof from Ferrous Liquors. A. S. Ramage, Cleveland, Ohio, U.S.A. U.S. Pat. 691,324, Jan. 14, 1902.

SEE Eng. Pat. 23,858, 1900; this Journal, 1901, 910.

—F. H. L.

Pigment [White, Barium Sulphate]. C. D. Vreeland, Chicago Heights, Ill., U.S.A. U.S. Pat. 691,421, Jan. 21, 1902.

WHEN aluminium sulphate is manufactured from bauxite by treating that mineral with sulphuric acid, an acid sludge is left in the settling tanks, &c. composed largely of silica and ferric oxide. This material is treated with barium oxide or carbonate to produce barium sulphate, and the white mass is dried and then ground with oil for paint.

—F. H. L.



Pigment [White] and Paint Composition. C. D. Vreeland, Chicago Heights, Ill., U.S.A. U.S. Pat. 691,422, Jan. 21, 1902.

SEE preceding abstract. The sludge therein referred to has its free acid eliminated either by copious washing or by treatment with milk of lime; and the resulting material is dried, ground into oil, and tinted if desired.—F. H. L.

Pigment [White]. C. D. Vreeland, Upper Montclair, N.J., U.S.A. U.S. Pat. 691,423, Jan. 21, 1902.

SEE two preceding abstracts. The acid sludge therein mentioned is neutralised with milk of lime, and then mixed with from 15 to 50 per cent. of zinc oxide, calculated on the weight of the dry material. The whole is dried and used as a white pigment. It is stated that the formation of the calcium sulphate in the sludge reduces its opacity as a colouring matter, but that the subsequent addition of the zinc oxide restores this property, and makes it a "meritorious" pigment.—F. H. L.

(B.)—RESINS, VARNISHES.

ENGLISH PATENT.

Chinese Wood-Oil; Process for Thickening —; and Manufacturing Substitutes for Hard Resins therefrom. A. Kronstein, Karlsruhe, Germany. Eng. Pat. 1387, Jan. 21, 1901.

IF wood-oil be heated, preferably with exclusion of air, for a certain time to a temperature of about 200° or 250° C. with a certain proportion of some resin such as dammar, the mixture eventually becomes viscid and solidifies even while hot; and it finally forms a material which is insoluble in ordinary resin-solvents until after it has been melted at a higher temperature (about 300° C.), resembling copal and amber in this particular, and being a perfect substitute for them. If, however, a proportion of the resin larger than is required to induce solidification at 200° C. be added to the wood-oil, or if the heat be too low or not sufficiently prolonged, the mixture remains liquid and does not solidify till it is cold, when it is still soluble in turpentine, benzene, and oil of camphor, and is distinguished by a high degree of elasticity. Thus the solidified products may be employed in the manufacture of varnishes in place of the usual expensive hard resins; while the non-solidified products can be used to prepare commoner varnishes and japans, or in the manufacture of linoleum. The proportion of resin needed to determine insolubility varies according to the nature of the resin adopted, being about 50 per cent. in the case of dammar, Venice turpentine, amber, gutta-percha, and asphaltum; 70 per cent. in the case of copal; and only 30 per cent. in that of colophony. For certain purposes, mixtures of resins, or of resins and linseed or other drying oils, may be added to the wood oil. Presence of air during the process causes oxidation and decomposition, and renders the finished material dark in colour. Eng. Pat. 17,378, 1900, is referred to (this Journal, 1901, 1123).—F. H. L.

UNITED STATES PATENT.

Matter [Bottle-Wax]; Composition of —. H. A. Hughes, Philadelphia, Penn., U.S.A. U.S. Pat. 691,383, Jan. 21, 1902.

THIS composition consists of an acid solution (preferably acetic acid), 2 to 5 oz.; gluten, dissolved in the same acid solution, 2 to 4 oz.; gelatin, 1 to 3 oz.; glucose, 2 to 4 oz.; kaolin, or similar earth, 1 to 4 oz.; 40 per cent. solution of formaldehyde, 1 to 5 grains; oil of wintergreen, to deodorise; water, to dilute to the consistency of thick paint. The product is suitable for use as a "sealing-closure" for jars or bottles; after drying, it becomes hard, tough, insoluble, and infusible, but is resilient or rubber-like in presence of moisture.—F. H. L.

(C.)—INDIA-RUBBER, &c.

India Rubber Industry; Importance of Ramie Fibre in the —. Gummi-Zeit., 1902, 16, [16], 275.

See under V., page 249.

ENGLISH PATENTS.

India-Rubber; Manufacture of Compounded —. C. O. Weber, Manchester, and A. Cairns, Glasgow. Eng. Pat. 50, Jan. 1901.

MIXTURES of cellulose and rubber are claimed, made by incorporating the cellulose in the form of viscose emulsions with the rubber. Plastic emulsions of viscose are prepared by mixing it with either a liquid or solid hydrocarbon, coal tar, fatty oil, boiled, blown, or vulcanised fatty oil, grease, cholesterol, stearine pitch, or any of the soft and pliable resins obtained from various sources, or with any of the terpenes, essential oils, or esters of the fatty series. The above plastic emulsions are seasoned and then washed or purified. The crude or the washed emulsions may be employed in rubber mixings of every description for the production of soft or hard rubber goods. In mixing viscose directly with india-rubber doughs containing hydrocarbons, it is preferable to dissolve the viscose in a little water and add powdered zinc sulphate after mixing.—J. F. B.

"Woodite"; Manufacture of —. W. Wood and H. Bartlett, Mitcham, Surrey. Eng. Pat. 17,431, Aug. 30, 1901.

THIS is a composition of washed Para rubber, *fucus vesiculosus*, wood pulp, mastic or resin, and sulphur, mixed together in the manner and proportions specified.

—F. H. L.

UNITED STATES PATENTS.

De-vulcanizing Vulcanized Rubber Scrap. G. E. Heyl-Dia, Warrington, England. U.S. Pat. 689,616, Dec. 24, 1901.

THE scrap is treated in a closed tank fitted with an inverted condenser at a temperature not exceeding 50° C. with some liquid such as naphtha, benzene, turpentine, &c., which is capable of dissolving sulphur but not india-rubber, at the temperature employed. When the sulphur is all dissolved, the solvent is withdrawn and distilled off. The devulcanised rubber can then be brought into solution while still in the tank by raising the temperature to about 176° C., and the pressure to not exceeding 45 lb. per square inch, using the same solvent as before. The dissolved india-rubber is then ready for use; but, if it be required in the solid state, it is first exposed to a temperature above the volatilising point of the solvent, till the bulk of the latter has passed off, and is next freed from the last portions thereof by being kneaded under hot water in a machine. The plant may be arranged so that the whole process can be worked continuously.

—F. H. L.

Plastics; Machine for Mixing —. J. H. Pearce, New Haven, Conn., U.S.A. U.S. Pat. 690,374, Dec. 31, 1901.

APPARATUS is claimed for mixing such substances as rubber with "bodying-up" materials like sulphur, resin, whiting, &c., and with binding agents automatically, uniformly, and in the proportions desired. Above the usual pair of rollers stands a box of two compartments fitted with Archimedean screws, sliding inlets and outlets, &c., operated by mechanism in the manner shown.—F. H. L.

XIV.—TANNING; LEATHER, GLUE, SIZE.

Gallic Acid in Tanning Materials; Detection and Determination of —. M. Spica.

See under XXIII., page 281.

ENGLISH PATENTS.

Casein or other like Material; Manufacture of Buttons Combs, and other like Articles of —. G. C. Dymond, London. From G. Miglioretti, Milan, and G. Maffei, Casalpusterlengo, Italy. Eng. Pat. 1221, Jan. 18, 1901.

A MATERIAL capable of being turned or moulded is produced by washing casein, curdled milk, &c., squeezing them, and then treating them in a bath with glycerin or like hygroscopic substances at a temperature of about 90° C.



whereby a plastic paste is produced, which may be mixed with colouring matter, and either pressed in moulds heated to about 140°—150° C., or turned in a lathe when solid. A process for hardening such materials is also claimed by either subjecting them to the action of formaldehyde vapour, or immersing them in a bath of fatty acids, aldehydes and spirits of turpentine, in about equal proportions.—J. F. B.

Fish Waste, Fish, or other Material; Apparatus for Reducing or Rendering — E. R. Edson. Eng. Pat. 24,602, Dec. 3, 1901.

See under XII., page 262.

UNITED STATES PATENTS.

Depilating Process. C. Burkhalter, Hosensack, Pennsylvania. U.S.A. U.S. Pat. 690,357, Dec. 31, 1901.

THE hides are placed in a lime liquor at 55° F., which is gradually raised to 80° F.; they are agitated therein for about 12 hours and then allowed to cool very slowly over a long period of time (up to four days).—R. L. J.

Tanning; Process of — B. Allen and B. Allen, junr., Buford, Georgia, U.S.A. U.S. Pat. 689,773, Dec. 24, 1901.

THE hides or skins are placed in a comparatively weak tan-liquor contained in a drum or other suitable vessel, and sufficient tanning material to complete the process is added in the form of a solid extract, soluble only with difficulty. The latter dissolves gradually and automatically keeps up the barkometer strength as fast as the hides remove tannin from solution.—R. L. J.

Beating Engines [Scrap Leather]. A. W. Case, Highland Park, Connecticut, U.S.A. U.S. Pat. 690,097, Dec. 31, 1901.

THIS machine automatically discharges finished stock and returns unfinished stock to the tub by means of the following contrivances:—In combination with a beating engine, a pick-up cylinder with fine teeth submerged in the stock, a break-up cylinder with fine teeth, and an endless apron with cleats passing round rolls.—R. L. J.

Gelatin-yielding Liquid; Process of obtaining a — from Fish or other Material. E. R. Edson, Cleveland, Ohio, U.S.A. U.S. Pat. 689,473, Dec. 24, 1901.

SEE Eng. Pat. 21,467, 1900; this Journal, 1901, 140.

Rendering Apparatus. E. R. Edson. U.S. Pat. 689,471, Dec. 24, 1901.

See under XII., page 263.

XV.—MANURES, Etc.

UNITED STATES PATENTS.

Natural Phosphates; Process of treating — L. Cheeseman, sen., Alexandria, Virginia, U.S.A. U.S. Pat. 690,048, Dec. 31, 1901.

NATURALLY occurring phosphates are finely-divided, and after mixture with water and an acid salt, such as nitro-cake, a current of electricity is passed through for a suitable period, and the water is then removed by evaporation. The product is stated to contain "available" phosphoric acid.—E. S.

Phosphates; Method of making Water-soluble — L. Cheeseman, sen., Alexandria, Virginia, U.S.A. U.S. Pat. 690,040, Dec. 31, 1901.

FINELY-divided naturally occurring phosphates are mixed with water and so much sulphuric acid as may be needed to convert into sulphates, the carbonates and fluoride present; sodium bisulphate is then added, so that after evaporation, the residue may contain mono- and dicalcium orthophosphates and thus be available as a fertiliser.—E. S.

XVI.—SUGAR, STARCH, GUM, Etc.

Carbohydrates; Method of Drying and Determination of the Water of Crystallisation of — E. Schulze.

See under XXIII., page 281.

Syrups; Nitrites, and the Foaming of — K. Andrlík and V. Stanek. Zeits. Zuckerind. Böhmen, 1902, 26, [5], 228–236.

THE characteristic features of molasses and massecuites which foam, were found to be high acidity, a considerable amount of nitrites, caramelisation products and a low degree of purity, and a high content of substances containing nitrogen. They contained 0.03—0.04 per cent of nitrogen as nitrites. The phenomenon of nitrite foaming, in the opinion of the authors, may occur when the beetroots worked up, in case they come from virgin soil rich in nitrogen, have putrefied, or during storage were "scalded," or if the juice has been acted on by micro-organisms, or further, when a large quantity of nitrates were present in the beetroots, and these by the action of bacteria have been reduced to nitrites. Juices from decomposed beetroots are usually rich in invert sugar and give by precipitation with lime, a juice which becomes acid on boiling. In the presence of nitrites, this causes a development of oxide of nitrogen and a swelling and foaming of the massecuite.

In normal non-foaming molasses, neither nitrites nor nitrates were found in notable quantity. The figures obtained were 0.004—0.010 per cent of nitrogen as nitrites and 0.021—0.056 per cent. as nitrates.

Nitrogen dioxide was recognised both by its smell and the action on potassium iodide and starch paper. The analysis of the gas obtained by boiling a diluted massecuite with weak acetic acid gave 52.3 per cent. of carbon dioxide and 32.3 per cent. of nitrogen dioxide.—L. J. de W.

Starch Syrup; Density of — O. Saare. Zeits. Spiritusind., 1902, 25, [5], 44–45.

FOR a long time starch syrup has appeared in commerce in two concentrations termed respectively syrup of 44° and 42° Baume.

There appears to be no general understanding as to how the density is to be determined. In some cases it is determined in the warm syrup at 44° R. (55° C.), and in others in the cold syrup at 14° R. (17.5° C.). The author prefers to determine the specific gravity at 14° R. of a 10 per cent. solution of the syrup, as is sometimes done in the case of molasses.

The German manufacturers plead for a latitude of 0.5° Baume on either side of 44° and 42°, since it is impossible to regulate the density of separate boilings within these limits. Using a Baume hydrometer graduated at 14° R., the author's experience shows that the readings obtained in warm syrups at 40°—50° R. are practically identical with those calculated from the specific gravity (by weight) at 14° R. Thus the error introduced by the viscosity of the syrup compensates for that due to the difference of temperature.

There are, moreover, four different Baume scales, two of which, the "old" Baume and the "new" Baume, are in general use, such that 44° "old" Baume correspond to 44.8° "new." Since all these variations actually occur in the present state of affairs, the author proposes to have the question settled on a uniform basis at a meeting of those interested in the trade.—J. F. B.

Saccharine Syrup or Molasses obtained from Light-coloured Peat; Composition of — H. Bornträger. Zeits. anal. Chem., 1901, 40, [12], 787–789.

THE syrups obtained by the saccharification of peat (see Classen's process, this Journal, 1900, 364 and 1028), are far inferior to beet-molasses. Peat syrups differ from beet-molasses in the fact that they contain mere traces of potash salts, and also far less sugar and more gummy matters. Peat syrup is always of a brownish-black colour owing to the presence of caramel and salts of humic acid; it is a lustrous, sticky, non-hygroscopic mass, the hygroscopic



nature of beet-molasses being attributable to the potash salts.

The following analyses of peat syrups are recorded :—

	On the Syrup.	On the Dry Substance.
	Per Cent.	Per Cent.
Water	35.39	..
Organic matters	61.51	95.20
Nitrogen	0.45	0.70
Corresponding to nitrogenous compounds	2.82	4.33
Directly reducing sugar (calculated as glucose)	14.80	22.91
Other non-nitrogenous extractive matters	41.67	64.47
Crude fibre	2.22	3.44
Ash	3.10	4.80

Another sample showed :—

	On the Syrup.
	Per Cent.
Water.....	2.56
Total nitrogen.....	1.55
Ammoniacal nitrogen.....	0.095
Sugar (calculated as glucose).....	21.12
Crude fibre.....	1.33
Ethereal extract.....	Nil.
Ash.....	9.15
Carbon.....	1.90
Humic acid.....	7.87
Pectic matter, gum, extractive matter, &c.....	54.52

—J. F. B.

ENGLISH PATENTS.

Saccharine Juices; Process of Obtaining very Pure Concentrated —, and Nutritious Foodstuffs Poor in Water, from Beetroots without the use of Water, and of Obtaining Syrups, Alcohol and Pressed Yeast from the Juices. C. Steffen, Vienna. Eng. Pat., 10,884, May 25, 1901.

BETROOT pulp, chips or roughly crushed beets are subjected to the action of undiluted heated beetroot raw juice (heating juice), no diffusion process, so far as the extraction of sugar is concerned, taking place, until the mass has reached a temperature of 60°–100° C. (preferably 85° C.), whereupon it is separated into expressed residue and juice in the usual manner. The expressed juice is repeatedly used as heating juice, and the fibres passing from the presses into the juice may be separated indirectly by the beetroot masses to be heated, the juice being discharged from them without or with only a slight pressure. The process is carried out in a diffusion battery with the interposition of tubular heating bodies, the diffusion being carried out systematically. The expressed juice may also be heated with the beetroot masses by external heating arrangements with internal stirrers. The heating juice used for extraction may previously be evaporated to a concentration exceeding that of the normal expressed juice. The process may be carried out at the ordinary temperature or below 60° C. in combination with the lime defecating process, a quantity of the juice equivalent to the beets treated being run off to the defecators, whilst the remainder is pressed out of the mass and used for extracting a further quantity of beets.

—J. F. B.

UNITED STATES PATENTS.

Diffusion Process [Sugar Cane]. E. B. Williams, Memphis, U.S.A. U.S. Pat. 689,838, Dec. 24, 1901.

THE inventor claims the method for extracting sugar from "bagasse" which consists in reducing the bagasse to a finely-divided state, dividing this into separate bulks or masses, supplying water to one of the said masses, subjecting the water-charged mass to centrifugal action, supplying the solution thus obtained to another of the said masses, subjecting this mass also to centrifugal action and repeating the operation throughout the whole number of the separate bulks.—J. F. B.

Sugar; Process of Crystallising —. H. Classen, Dormagen, Germany. U.S. Pat. 690,014, Dec. 31, 1901.

THE claim relates to the method of crystallising sugar from a saccharine solution of a massecuite produced from impure saccharine solutions, which consists in slowly cooling the solution under motion, and gradually adding thereto an increasing proportion of water in such amount as to keep the quotient of supersaturation between 1.05 and 1.25. The apparatus is the usual jacketted cylinder provided with stirrer blades. In the specification the quotient of saturation at any particular temperature is defined as the quotient of the parts of sugar dissolved in one part of water in the impure massecuite as compared with the parts of sugar which would be dissolved in one part of water in pure saturated solutions. For a given massecuite, the quotient tends to decrease as the massecuite cools, but it increases as the purity of the molasses is reduced by the separation of sugar. The limits of supersaturation specified in the claim are such that no new crystals are formed during the cooling, and all the sugar is deposited on the crystals already existing.—J. F. B.

Ammonia from Waste Products [from Beet-Sugar Factories]; Method of Making —. E. R. Besenfelder. U.S. Pat. 689,780, Dec. 24, 1901.

See under VII., page 254.

XVII.—BREWING, WINES, SPIRITS, Etc.

Enzymes; Action of —, One on Another. A. Wróblewski, B. Bednarski, and M. Wojczynski. Beitr. z. chem. Physiol. u. Pathol., 1, 290–303. Chem. Centr., 1902, 1, [4], 272.

THE authors obtained the following results :—1. Pepsin has a prejudicial influence on trypsin, as it assists the injurious action of acids. 2. Trypsin weakens the effect of pepsin by favouring the prejudicial influence of alkalis. 3. Pepsin has no influence on the enzyme of rennet. 4. Pepsin, trypsin, and diastase have no action on invertase. 5. Trypsin and invertase have no action on diastase; pepsin has a slight injurious influence, as it favours the prejudicial effect of acids. 6. Pepsin and trypsin have no action on emulsin.

In general, it may be stated that the action of enzymes on one another is a very limited one. Zymase, however, is rapidly destroyed by the proteolytic enzyme of yeast juice. The authors confirm E. Fischer's statement, which has been questioned by Duclaux, that emulsin decomposes milk sugar.—A. S.

Yeast; Presence of Oleolytic Enzymes in —. Delbrück. Woch. für Brau., 1902, 19, [3], 25.

THE hydrolysis of butter fat by enzymes secreted by micro-organisms has been studied by O. Laxa (see page 268), who found that *Odium*, *Penicillium*, *Mucor*, and *B. fluorescens liquefaciens* possessed this property in a marked degree, as also did yeast to a less extent. The author discusses these observations in regard to yeast as applied to the fermentation industries. All mashing materials contain fat; in the case of distillery mashes this fat would come into direct contact with the yeast and would be hydrolysed. In bread making also the same action would take place. But in the case of brewery mashes, most of the fat would be left behind in the spent grains, and little if any would appear in the wort. Some, however, might get through, especially lecithin, if not in the dissolved state, perhaps in emulsion, and Berlin "Weissbier" wort certainly contains traces of fat. The presence of fat in the beer would be very injurious to the head-retaining qualities, and it might be worth while taking the oleolytic power of a yeast into account when selecting races for industrial pure-cultivation.

The author suggests that the presence of oleolytic enzymes in yeast may account for the production of glycerin during fermentation, owing to the hydrolysis of the fat which is known to be stored up during the life of the yeast cell.—J. F. B.



Yeast ; Trial of Bücheler's Sulphuric Acid Process for the Preparation of Distillery Seed — A. Hesse. Zeits. Spiritusind., 1902, 25, [5], 45—47.

The author has conducted trials on the large scale with Bücheler's process of preparing the seed yeast in mashers acidified with sulphuric acid, instead of by lactic acid fermentation (see this Journal, 1901, 1128). The yeast mash is prepared as follows:—In a yeast tub of about 260 litres capacity, 15 kilos. of malt are mashed with 15 litres of hot water, 150 litres of potato mash are then added, and the mixture allowed to saccharify at a temperature of 62.5° C. for ½—1 hour; 350—400 c.c. of pure sulphuric acid diluted with 3 litres of water are then added, and the mash is cooled to the incubating temperature of 16° C., the mother yeast being added when it is at about 29° C. The usual degree of acidity ranges from 1.5 to 1.7, but even at 1.8° no free sulphuric acid can be detected. The sulphuric acid yeast mash requires to be incubated at a temperature about 2° C. higher than the lactic acid mash, a circumstance which tends to show that the sulphuric acid mash is a less favourable medium for the growth of the yeast. The yeast in the sulphuric acid mash does not look so well and vigorous in the tub as the lactic acid yeast. In the yeast tub, the fermenting mash rises very slowly, and then suddenly falls down with an audible sound. This rising and falling fermentation makes it necessary to provide a greater space above the level of the mash and the same also applies to the main fermenting vats. The preparation of the pitching yeast by this process is very simple, and only requires 24 hours as against 48 hours by the lactic acid method. But the treatment in the fermentation room is not so simple. The pitching temperature of 26° C. is higher, and fermentation sets in earlier and more energetically; great trouble was encountered by the author owing to the frothing over of the vats, especially in mashers to which the saccharifying malt had been added whilst they were warm. On this account it was necessary for the operator to attend to the vats all night and to add petroleum in large quantities and not always with success. The first experiments were made with distillery yeast race II., but subsequently some special yeast was obtained from Bücheler which did not tend to froth so badly. The mashers were pitched at a temperature of 26° C., but they are so sensitive to rise of temperature that it was found that they must never be allowed to get hotter than 29° C., which means a large expenditure of cooling water and constant attention. The high temperatures employed also weaken the zymase of the yeast, so that, although primary fermentation is rapid, the secondary fermentation is very slow. The claim that the whole of the starch in the mash can be attenuated in 48 hours was not confirmed. The mashers were free from bacteria and the rise in acidity was as small as with lactic acid yeast. The conclusion drawn by the author is that, although this process may be of advantage in small distilleries where the lactic acidification of the yeast mash presents difficulties, the disadvantages of night work, frothing and regulation of temperature, which it entails, will prevent its general adoption.—J. F. B.

Yeast ; Determination of Potato-starch in — A. Hebebrand.

See under XXIII., page 281.

Bottom-Fermentation Yeasts ; Separation of High and Low Attenuating Types of — F. Schönfeld. Woch. für Brau., 1902, 19, [4], 42—43.

The author gives details of a method he adopted for separating a mixture of high and low attenuating yeasts [Frohberg and Saaz types] by suitable treatment in the fermenting room. The original mixture contained 60 per cent. of the Saaz low-attenuating type, and it required nine successive vat-fermentations to obtain this type in the pure state. The first two fermentations were conducted for fourteen days each, the third for seven days and the fourth for eight days. Up to this point each succeeding vat was pitched with the sediment left in the preceding one. From the fifth vat onwards, fermentation was conducted for five to seven days, and the beer was pumped off whilst still fermenting, the sowings being made from the yeast left behind at the bottom. In spite of the fact that fermentation was not quite complete, very little further attenuation took place after pumping off the beer.

Up to the sixth vat the proportions of the low attenuating yeast in the sediments decreased irregularly, falling as low as 32 per cent. in the sediment from the sixth fermentation. In the seventh fermentation the proportion of Saaz yeast suddenly rose to 90 per cent., and in the ninth it was quite pure. The eighth and ninth fermentations were done in duplicate.—J. F. B.

Beer ; Chemical Diagnosis of Pasteurised — A. Bau. Woch. für Brau., 1902, 19, [4], 44—45.

In order to detect whether a sample of beer has been pasteurised, the author proposes to examine it for the presence of invertase, an enzyme which is a normal constituent of unpasteurised beer. Invertase is destroyed at high temperatures, but no definite limit can be fixed, since the temperature necessary for its destruction depends on the conditions. In concentrated solutions and in presence of large quantities of other extractive matters, the temperature required is relatively high; the presence of alcohol, on the other hand, lowers the temperature at which it is destroyed. Consequently the wide variations in the percentage of alcohol and extract in different beers cause variations in the behaviour of the invertase during pasteurisation. The methods for the detection of invertase in beer consist in digesting equal volumes of beer and cane sugar solution, either for 1 hour at 55° C. or for 24 hours at the ordinary temperature, clarifying, making up to a known volume, and determining the invert sugar produced, by polarisation or cupric reduction. It is always necessary to conduct a control experiment under identical conditions with a portion of the beer in which the invertase has been destroyed by boiling. In many cases a qualitative test with 1 c.c. of the solution and 5 c.c. of Fehling's solution will serve to indicate whether invert sugar has been produced during the digestion.

In experiments made at ordinary temperatures for 24 hours, the author found that the polarisation was reduced from + 13.5° in the case of the boiled sample to 0° in the unboiled sample when unpasteurised beers were tested. The results obtained with three different beers, which were pasteurised at various temperatures, are shown in the following table:—

Beer A.			Beer B.			Beer C.		
Temperature of Pasteurisation.	Polarisation.		Temperature of Pasteurisation.	Polarisation.		Temperature of Pasteurisation.	Polarisation.	
	Boiled Test.	Unboiled Test.		Boiled Test.	Unboiled Test.		Boiled Test.	Unboiled Test.
° C.	°	°	° C.	°	°	° C.	°	°
57.5	+ 20.74	+ 16.65	50.0	+ 19.33	+ 8.65	57.5	+ 18.24	+ 17.66
60.0	20.83	20.90	57.5	19.36	18.00	60.0	18.30	18.26
63.0	20.85	20.85	60.0	19.40	19.36	62.5	18.30	18.33
66.0	20.85	20.85	62.5	19.33	19.30	65.0	18.60	18.56
Unpasteurised	20.85	1.33	67.5	19.33	19.36	67.5	18.60	18.66
			Unpasteurised	19.36	0.10	Unpasteurised	18.60	0.00



From the above results it will be seen that pasteurising temperatures of from 50° to 57·5° C. are not sufficient to destroy the invertase, but weaken its action considerably. Since the beers examined were of very different composition, it may be safely concluded that this method can be relied on to show whether a beer has been pasteurised at temperatures exceeding 57·5° C. The best method of carrying out the test is as follows:—Two portions of 20 c.c. of beer are measured out, and one is boiled and the other not; they are each mixed with 20 c.c. of a 20 per cent. solution of cane sugar, and kept for 24 hours at the ordinary temperature; 0·5 c.c. of basic lead acetate is then added to each, and they are made up to 50 c.c., filtered and polarised. If there is a considerable difference between the two readings, the beer is not pasteurised, but if the readings are the same, or only slightly different, it may be concluded that the beer has been pasteurised, probably at a temperature exceeding 57·5° C.—J. F. B.

Fig-Must; Alcoholic Fermentation of Indian — G. Ulpiani and L. Sarcoli. *Gaz. chim. ital.*, **31**, [2], 395—413. *Chem. Centr.*, 1902, **1**, [2], 144.

AFTER an extensive series of experiments, the authors arrived at the following conclusions:—The spontaneous fermentation of Indian fig-must under the ordinary conditions is not suited for the industrial preparation of alcohol. By sterilisation of the must and subsequent inoculation with suitable pure cultures, almost theoretical yields can be obtained, but this method will not answer in practice, on account of the great cost of effective sterilisation. Inoculation of the unsterilised must with *Sacch. Pastorianus II* is also not satisfactory, as the latter is soon overwhelmed by *Sacch. Opuntia*. The authors hope to find a ferment which will give a good yield of alcohol and be capable of holding its own against *Sacch. Opuntia*.—A. S.

Invertase; Action of — V. Henri. *Zeits. physik. Chem.*, **39**, 194—216. *Chem. Centr.*, 1902, **1**, [2], 92.

THE author examined the course of the inversion of cane sugar at 25° C. by invertase, obtained from yeast. The usual logarithmic formula does not hold good for the inversion, which can be much better expressed by the empirical formula— $\left(\frac{d^2x}{dt^2} = k_1 \left(1 + \frac{x}{a}\right)\right)$. ($a - x$), where a is the original quantity of cane sugar, and x the amount of sugar which has been inverted after the time t . The experiments showed that during 24 hours, the action of the invertase is quite constant, and is independent of the invertive action already accomplished. Thus, at any moment of the reaction, the velocity is dependent only upon the concentration of the cane sugar and of the invert sugar, and not upon the condition of the ferment. —A. S.

ENGLISH PATENTS.

Malt and other Substances; Purification of Furnace Gases for Drying — E. S. Heaven, Warminster, Wilts. Eng. Pat. 4263, Feb. 28, 1901.

IN the drying of malt or other substances to be used for food, or in the preparation of food or drink, where the furnace gases come in contact with the material which is being dried, curtains of woven wire, or any other material having numerous small openings, are suspended vertically from the dispersers of the kilns or other drying apparatus, or otherwise placed in the path of the furnace gases so as to arrest mechanically and separate the arsenical fumes or particles of dust from the latter. It is stated that the dust of the furnace gases, having a basic reaction, materially assists the fixation of the arsenic on the screens. —J. F. B.

Pasteurisation of Liquids, [Beer]. A. M. Clark, London. From O. Fromme, Frankfurt-on-Main, Germany. Eng. Pat. 1913, Jan. 28, 1901.

THIS is a process for pasteurising liquids in bottles. The bottles are carried in wicker baskets through a closed chamber by means of an endless chain, in such a manner that they are first gradually heated by a stream of warm

water, then exposed to a steam atmosphere, and afterwards passed through a bath of hot water, the heat gradually increasing from one end of the bath to the other. The bottles are finally cooled by passing through the upper part of the chamber, and by being sprayed with cold water; the spray being so arranged that on falling from the hot bottles, it passes on to the bottles freshly introduced into the chamber and gradually warms them.—W. P. S.

Solidified Spirit; Improvements in connection with — R. C. Wild. Eng. Pat. 5404, March 14, 1901. See under II., page 244.

UNITED STATES PATENTS.

Brewing Operations; Construction of Union Casks used in — W. Cutler, Birmingham. U.S. Pat. 690,240, Dec. 31, 1901.

SEE Eng. Pat. 24,253, 1898 (this Journal, 1900, 64).—J. F. B.

Malt Drum. F. Knüttel, Charlottenburg, Germany. U.S. Pat. 691,471, Jan. 21, 1902.

A REVOLVING drum for malting and drying grain is claimed, comprising an outer shell, a central perforated tube closed at one end of the drum, perforated ventilating tubes closed at the opposite ends of the drum and communicating with the air chamber, and means for supplying the ventilating tubes with moist or heated air, the perforations of the ventilating tubes increasing in number in proportion to their distance from the central tube.—J. F. B.

Beer Vats and Pipes; Process of Cleaning — S. A. Sjöo and R. V. Tornell, Stockholm, Sweden. U.S. Pat. 691,671, Jan. 21, 1902.

SEE Eng. Pat. 21,911; this Journal, 1901, 1131.—J. F. B.

XVIII.—FOODS; SANITATION; WATER PURIFICATION, & DISINFECTANTS.

(A).—FOODS.

Fungi, Edible; Composition of — A. Zega. *Chem.-Zeit.*, 1902, **26**, [1], 10.

THE following table gives the average composition of four kinds of edible fungi:—

	<i>Agaricus esculentus.</i>	<i>Agaricus arvensis.</i>	<i>Lactarius piperatus.</i>	<i>Coprinus comatus.</i>
Water	Per Cent. 93·71	Per Cent. 89·54	Per Cent. 85·70	Per Cent. 94·31
Nitrogenous substances.	1·71	6·68	6·41	2·01
Fat	0·10	0·16	1·07	0·09
N-free extractives	3·29	2·09	2·51	2·95
Crude fibre	0·40	0·81	3·33	0·15
Ash	0·78	0·69	0·98	0·49

—C. A. M.

Butter Fat; Decomposition of —, by *Micro-organisms*. O. Laxa. *Arch. Hyg.*, **41**, 119—151. *Chem. Centr.* 1902, **1**, [2], 128.

THE author finds that lactic acid bacteria and the different varieties of tyrotox have no action on butter fat. *Idium*, *penicillium*, *mucor*, and *Bac. fluoresc. liquefac.*, however, effect hydrolysis of the fat, as do also, although to a less extent, the yeasts. The decomposition does not proceed uniformly in the case of all glycerides of butter fat. This is mainly due to two circumstances:—On the one hand, the destructive action of the soluble fatty acids set free, towards the mould fungi increases with rising molecular weight, and, on the other hand, the glycerides of those insoluble fatty acids, which have a high molecular weight, are more readily attacked by the mould fungi. The volatile fatty acids set free are further decomposed by the mould fungi. The cause of the decomposition of the glycerides was found to be due, in the case of *penicillium* and *mucor*, to the



presence of an enzyme. The presence of ammonia had no perceptible influence on the decomposition of the non-volatile acids at the ordinary temperature.—A. S.

Apples, and some of their Products; Analysis of —
C. A. Brown, jun.

See under XXIII., page 282.

ENGLISH PATENTS.

Coffee; Treatment of —, and *Production of Coffee Substitutes*. Sir H. S. Maxim, London. Eng. Pat. 3129, Feb. 13, 1901.

COFFEE berries are heated in a chamber until the moisture contained in them is driven off; the chamber is then closed, and the heating is continued until the required pressure is attained; the heating is then stopped, and the berries are discharged into another chamber connected with the coffee chamber and containing raw coffee berries, or prepared grains serving as the coffee substitute, which absorb the aroma given off from the roasted coffee during cooling. The preparation of the grains or other coffee substitute consists in heating them in a chamber to drive off most of their moisture, closing the chamber and continuing the heating until the pressure rises to 200—250 lb. per sq. in., then stopping the heating, blowing off the steam, and exposing the grains to the air, until their temperature reaches 150° C., then exhausting the chamber and preserving the grains *in vacuo* until required for use. The point at which the coffee-roasting chamber must be closed is determined by condensing the steam given off and noting the character of the gases. The pressure in the coffee-roasting chamber may be increased artificially by the vaporisation of alcohol placed in the chamber. In certain cases it is advantageous to force a current of air through the roasting chamber after connecting it with the substitute chamber. The apparatus is also described and claimed.—J. F. B.

Wheat and other Grain, or the Hulled Products thereof; Sterilising and Bleaching previously Cleaned —. C. H. Buchenau, Mannheim, Germany. Eng. Pat. 21,364, Oct. 24, 1901.

THE cleaned wheat or other grain is first subjected to a steam spray in a closed pipe, fitted with a worm conveyor. By the latter the grain is conveyed into a hopper provided with a stirrer, and then passes into an obliquely-mounted drum made of acid-proof material. The wheat is here brought into contact with a current of sulphur dioxide gas, by which it is bleached, and falls by its own weight out of an opening at the lower end of the drum.—W. P. S.

Milk; Manufacture of Condensed or Desiccated —. J. H. Campbell, New York, and C. H. Campbell, Philadelphia, U.S.A. Eng. Pat. 3561, Feb. 19, 1901.

THE milk is placed in a tank heated by a water-jacket. Heated air is then blown through the milk until the evaporation has produced a fluid of the consistency of ordinary condensed milk. The air blast is so directed as to produce a rolling motion in the milk, and the temperature is kept below 48° C. The milk thus reduced in volume is then run into a rotating drum, and further dried by hot air until a semi-solid material is obtained. This is broken up into small lumps, which, by being forced through a sieve, are converted into small granules. The granulated mass now passes into a canvas drum, where it is completely dried by hot-air currents, and is then ground. The above semi-solid material may be mixed with flour, cocoa, &c., before drying. The plant for carrying out the above process is claimed, together with the method and products.—W. P. S.

Eggs; Process for Preserving —. E. Teisler, Strehla, Germany. Eng. Pat. 8524, April 25, 1901.

THE process claimed consists in immersing the eggs in a solution of fluosilicic acid or its salts.—W. P. S.

Meats; Process for Curing —. L. M. Schlarb, Allegheny, Pennsylvania, U.S.A. Eng. Pat. 23,141, June 3, 1901. Under International Convention.

THE process consists in injecting brine and carbon dioxide under pressure into the meat by means of suitable needle-nozzles connected to a tank containing the brine and carbon dioxide, the pressure in the tank being about 2 atmospheres. The meat is now placed in a vessel from which the air is exhausted, and brine is then allowed to flow in. The meat is allowed to remain in the brine for about 10 hours, and may then be subjected to the action of carbon dioxide under pressure.—W. P. S.

Meat Extracts, and Process for Manufacturing same. U. Ciantar and F. W. F. Ross, London. Eng. Pat. 199, Jan. 3, 1901.

MEAT extracts as usually prepared contain only non-nutritive stimulating compounds, termed by the inventors "waste product" compounds, without any of the natural coagulable muscle proteids, which are capable of sustaining life. The present invention relates to the recovery of these latter, by reducing raw meat to the state of a very fine pulp, with or without a freezing process to burst the cells, then subjecting the pulp to the action of a saline solution which renders the coagulable proteids loose and partially soluble, in which condition they are readily floated out. The proteids are then extracted by washing and agitation in copious solution, and separated from the muscle fibres by passing through a filter, the meshes of which will hold back the coarse fibrous matter, whilst allowing the coagulable proteids to pass through, the latter being subsequently coagulated, preferably by heat. The fibrous residue may then be boiled with the extraction liquors for the preparation of ordinary meat extracts.—J. F. B.

Food Products [Mixtures of Casein and Fat]. J. H. Hooker, Buckingham. Eng. Pat. 5406, March 14, 1901.

PRECIPITATED casein is dissolved in water made slightly alkaline, and to the warm solution cream, melted butter, margarine, or the like is added. The mixture is well stirred and cooled, when it may be moulded.—W. P. S.

Vegetable Fat, Edible; Method of Manufacturing —. G. C. Warr and W. T. Wright. Eng. Pat. 22,602, Dec. 11, 1900.

See under XII., page 262.

UNITED STATES PATENTS.

Preserving Organic Substances [Foods &c.]; Methods of —. A. Mészáros, Székesfejérvár, Austria-Hungary. U.S. Pat. 691,402, Jan. 21, 1902.

SEE Eng. Pat. 6371, 1901; this Journal, 1901, 601.—L.A.

Yeast [Bread-making]. G. Heilenman, Louisville, Kentucky, U.S.A. U.S. Pat. 690,279, Dec. 31, 1901.

THE inventor claims a "yeast flour," consisting of corn meal, 24 parts; potato flour, 4 parts; sodium bicarbonate, salt, and anise flour, 1 part each. When required for use, the flour is stirred up with boiling water in a jar, which is then covered and allowed to stand for 12—14 hours at a temperature of 90°—100° F. The contents are then stirred, and, after two hours' further standing, are added to the ingredients of the bread.—J. F. B.

Centrifugal Cream Separator. W. C. Hartmann, Cleveland, Ohio. U.S. Pat. 689,878, Dec. 31, 1901.

THE machine consists of a cylindrical vessel with a conical cover, which extends over the edge of the vessel, and is clamped down to a rubber ring carried by a broad flange thrown off from the outside of the vessel below its upper edge. The milk, which is fed into the lower part of the revolving vessel through a central tube, is separated, the cream being drawn towards the centre and rising up around the central tube to the outlet at the top, and the skim milk being thrown to the outside of the vessel, and being compelled to rise, overflow, and then pass downwards to the



lower edge of the conical cover, where the outlet is situated. Wings carrying sloping plates radiate from the central tube and facilitate the rising of the cream.—L. A.

Centrifugal Liquid-Separator [Milk]. P. M. Sharples, Westchester, Pennsylvania, U.S.A. U.S. Pat. 690,833, Jan. 7, 1902.

THE invention relates to cream separators in which rotation is caused by a steam jet. The separation is carried out in two concentric chambers, readily removable for cleaning. The exhaust steam is prevented from heating the milk, unless desired, by a special construction of the outer casing.—J. W. H.

[*Lard*] *Rendering Tank.* W. C. Marshall. U.S. Pat. 690,525, Jan. 7, 1902.

See under XII., page 263.

(B.)—SANITATION; WATER PURIFICATION.

Lead; Action of Water on —. S. Růžicka. Arch. Hyg., 41, 23—45. Chem. Centr., 1901, 1, [2], 131.

Simple Solutions of Inorganic Salts in Distilled Water.—The influence of the salt dissolved in the water is not dependent upon the nature of the basic component, the corresponding salts of all the bases examined (K_2O , Na_2O , CaO , MgO , $(NH_4)_2O$) having practically the same effect. The action of the salt is dependent upon the acid component, nitrates having an accelerating, or at the least—at certain concentrations—not a retarding effect; chlorides, sulphates, and carbonates having a retarding influence on the action, that of chlorides being the least, and that of carbonates the greatest.

Solutions of Mixed Salts.—Carbonate added to the solution of sulphate, chloride, or nitrate causes a diminution in the action on lead. Sulphate added to the solution of chloride or nitrate causes a diminution, but added to the solution of carbonate has no influence. Chloride added to the solution of sulphate and nitrate causes a diminution in the action, but added to a solution of carbonate accelerates the action (in one experiment, in which the carbonate was in large excess, the chloride had no influence). Nitrate added to the solution of carbonate, sulphate, or chloride caused, in every case, an increase in the action of the solution on lead. If the lead comes continuously in contact with fresh portions of a carbonate solution, the quantity of metal given up to the liquid decreases.

With lead exposed continuously to fresh portions of a nitrate solution and with free access of air, the amount of metal dissolved decreases to a very small value, if a sufficient quantity of carbonate is added, but without such addition, the weight of metal dissolved increases very rapidly.

Free carbon dioxide contained in the water causes, contrary to the view generally held, a decided diminution in the action on lead.

The presence of organic substances does not, as a rule, accelerate the action on lead (maceration of grass, radish leaves, and fish diminish the action, maceration of peat increases it). Of the bodies examined, those which have the greatest effect in diminishing the action of the water on lead are carbonates, carbon dioxide, and the infusion of grass.

The action of water on lead is explained in the following manner:—With all aqueous solutions and also with distilled water containing air or oxygen, lead hydrate (lead carbonate?) is dissolved from the surface of the lead in the form of a fine powder. If the water contains a salt, the acid set free by dissociation combines with superficial particles of lead to form the corresponding salt. If this salt is soluble in water, a fresh surface of the lead is continually exposed to the water, and a considerable quantity may be dissolved, but if the salt formed is insoluble, it forms—provided the acid is present in sufficient quantity—a protective covering on the surface of the lead, and so hinders the action of the water.—A. S.

ENGLISH PATENT.

Noxious Vapours and Sulphurous Fumes; Apparatus for Exhausting and Condensing —. T. G. Webb and Webb's Patents, Ltd. Eng. Pat. 1515, Jan. 23, 1901.

See under VII., page 253.

UNITED STATES PATENTS.

Water Purifier and Filter; Portable —. C. E. Holland. New York. U.S. Pat. 691,545, Jan. 21, 1902.

THE purifier consists of two concentric vertical tubes of aluminium, insulated from one another, and fixed to the side of an ordinary table filter. These tubes are connected to the opposite poles of an electric light circuit, and the water enters the filter by passing up between them.—L. A.

Fecal Matter; Apparatus for Clarifying —. F. W. Dittler, Berlin. U.S. Pat. 691,365, Jan. 21, 1902.

THE fecal matter is passed through a series of three closed tanks, provided with outlet pipes for gases, leading into a chimney. The first is a sort of septic tank, the second an aerating tank, and the third a filtering tank containing coke and saprol or other disinfectant.—L. A.

Disinfecting Sewer-Vaults; Apparatus for —. W. Martin, Chicago, Illinois. U.S. Pat. 690,866, Jan. 7, 1902.

THE apparatus consists of two shallow pans, upper and lower, separated from one another by a wire-gauze ring, and slung by a chain. Sulphur and manganese dioxide are placed in the lower pan and ignited. Chloride of lime is placed in the upper pan. The wire gauze ring encloses the flaming sulphur and prevents the ignition of inflammable sewer gases.—L. A.

Grease from Garbage; Process of Extracting —. S. H. Brown. U.S. Pat. 689,535, Dec. 24, 1901.

See under XII., page 263.

(C.)—DISINFECTANTS.

Alcohol Vapour; Disinfecting Action of —. Seige. Arb. Kais. Ges.-A., 18, 362—369. Chem. Centr., 1902, 1, [2], 130.

THE author finds that even in the most favourable cases, the destructive action towards spores of alcohol vapours is not so rapid as that of steam in motion at 100° C. He states that the disinfectant action of the vapours of alcohol-water mixtures decreases with increasing proportions of alcohol, until finally it is practically nil. The author accepts the explanation of Frank and Brun, viz., that the vapour from strong alcohol causes a shrinking of the outer covering of the spores, and so retards the destructive action, whilst with weak alcohol, the water-vapour softens the outer covering and facilitates the penetration of the vapours. It was observed that spores which had previously been treated with water, were killed more quickly than those which had been kept absolutely dry, whilst, on the other hand, no perceptible difference was observed, when the spores were first soaked for a considerable time in alcohol, and then dried.

The results of the experiments show that it is not advisable to use alcohol vapour in place of steam for disinfecting purposes, in industries in which animals suspected of infection with anthrax are employed.—A. S.

Formaldehyde; Detection and Determination of Methyl Alcohol in —. Duyk.

See under XXIII., page 283.

ENGLISH PATENT.

Vermin; Process and Apparatus for Producing an Explosive Gas for Use in Exterminating —. W. Leybold, Hamburg. Eng. Pat. 20,761, Oct. 16, 1901.

A GAS which is free from oxygen and does not form an explosive mixture with air, is prepared for use in



exterminating rats and mice on board ship, &c., by blowing air through anthracite or coke contained in a generator, at such a pressure—in relation to the depth of the fuel, and to the temperature of combustion—as is calculated to avoid the production of more than 5 to 6 per cent. of carbon monoxide in the gas finally obtained. The apparatus described consists of a water-jacketed generator having a slanting grate, beneath which the compressed-air-pipe is fixed, and having a firebrick-lined, or water-cooled, outlet through which the gases are led into a chamber, where a continuous spray of water from the upper part of the chamber cools the gases.—H. B.

UNITED STATES PATENTS.

Disinfecting Purposes; Compound for —. W. Martin, Chicago, Illinois. U.S. Pat. 690,867, Jan. 7, 1902.

A MIXTURE of manganese dioxide, 1 part, and sulphur, 2 parts.—L. A.

Aseptic Preparation from Pancreas, and Process of Producing the same. W. Weber, Stolberg II, Germany. U.S. Pat. 691,681, Jan. 21, 1902.

PREPARATIONS of pancreas are made by the aid of organic acids, such as salicylic, benzoic, and succinic, which do not exert a destructive action upon the enzymes, and are at the same time antiseptic. Thus, a solution of pancreatin or fresh pancreas juice is made feebly alkaline and mixed with the acid in question, the precipitate is filtered off, washed, and purified with alcohol and ether. By adding alkali or an alkaline salt to the moist precipitate, a soluble preparation is obtained.—L. A.

XIX.—PAPER, PASTEBOARD, Etc.

ENGLISH PATENTS.

Sizing Preparation. J. Pate, Barnley. Eng. Pat. 2645, Feb. 7, 1901.

CLAIM is made for the addition of boiled linseed or the juice of linseed to sizing tallow or a sizing mixture, together with one or more of the following substances:—Sodium silicate, formalin, caustic potash, and with or without farina. —C. A. M.

Viscose; Treatment of —, for the Preparation of Useful Products therefrom. C. F. Cross and E. J. Bevan, London, and C. Beadle, Erith. Eng. Pat. 3592, Feb. 19, 1901.

SEE Fr. Pat. 309,548; this Journal, 1902, 65.—J. F. B.

Casein; Process for Obtaining Pure Solutions of —. J. R. Hatmaker, London, from J. A. Just, New York. Eng. Pat. 4207, Feb. 27, 1901.

THE inventor claims the combined use of sulphuric and acetic acids in the treatment of casein from milk, the former for precipitating the casein from the milk, and the latter for reprecipitating the casein after solution in an alkaline solvent. The separated milk is treated with sulphuric acid, the curd is drained and washed, then dissolved in sodium bicarbonate solution and reprecipitated by acetic acid. The purified casein is drained and washed, and dissolved in a minimum quantity of alkaline bicarbonate. The treatment with acetic acid is stated to have a beneficial effect in removing lime salts thrown down by sulphuric acid. If a very pure solution of casein be desired, it may be clarified by treatment in a centrifugal separator.—J. F. B.

India Rubber; Manufacture of Compounded —. C. O. Weber and A. Cairns. Eng. Pat. 50, Jan. 1, 1901.

See under XIII. C., page 264.

UNITED STATES PATENTS.

Paper-Pulp Strainer. N. L. Vrooman and R. R. Kirkland, New York, U.S.A. U.S. Pat. 689,934, Dec. 31, 1901.

THE patentees claim a screening device comprising a polygonal cylinder, having on each of its sides a series of

longitudinal bars with serrated surfaces forming substantially V-shaped teeth with correspondingly shaped intervening recesses and removable screen bars extending transversely of each of the cylinder sides, and adapted to the recesses. The longitudinal bars are carried in radial slots on the end plates of the cylinder. Several sets of variously formed screen bars may be kept to suit the different classes of work required.—J. F. B.

Paper-making Machine. H. Parker, Bellows Falls, Verm.; U.S.A. U.S. Pat. 690,030, Dec. 31, 1901.

THIS invention relates more particularly to means for collecting the "stuff" from the pulp on a revolving cylinder from which it is continuously removed and delivered in a concentrated state suitable for the addition of the bleaching agents and the mineral loading materials. The interior of the paper-making cylinder is divided into compartments with means for producing a suction inside from the ends, and for cutting off the compartments, as they come into a certain position, from the action of the suction, so that the web may be removed from the roll. The removal is effected by a doctor of special construction, inside which a suction is produced in order to draw the soft web through the doctor, whence it is discharged into a stack in the desired condition for subsequent operations.—J. F. B.

Paper, Paper Pulp, and Paper Stock; Machine for Tearing up —. C. Wurster, London. U.S. Pat. 690,505, Jan. 7, 1902.

THIS machine is designed for tearing, rather than cutting up, paper supplied in the sheet form for re-pulping. The paper is first fed into a hopper where two rotary feeding fluted rollers or rollers with very heavy teeth compress the loose paper stock. At the same time thick layers of broken papers as they come from the *salle* are disarranged by the teeth of the rollers, and opened up so that only a few sheets are presented to the action of the saws. Another fluted roller placed below forces the paper on to the teeth of circular saws where it is torn into strips and bands, and iron fingers in the shape of hooks fixed between the blades of the saws tear the strips of paper into smaller pieces, which are conveyed to the pulping engine. The paper may be prevented from clogging between the saws by forcing compressed air or steam between them.—J. F. B.

Pulping Machine. C. Wurster, London. U.S. Pat. 690,506, Jan. 7, 1902.

THIS pulping machine consists of a trough divided into two portions, a feeding portion and a working portion, and a shaft arranged in the trough carrying kneading and transporting propellers in the working portion, feeding the material in one direction and kneading and transporting propellers in the feeding portion, feeding the material in the opposite direction. The propellers in the working section feed the material towards a discharge outlet, and those in the feeding portion feed it away from the outlet. The feeding portion is open to the hopper and the working portion is closed. The effect of the propellers is to heap the material up at the feeding end so that only that which is turned over from above reaches the working propellers, and the impurities collect at the bottom of the feeding section, which is made shorter than the working section. —J. F. B.

Wood Pulp or Similar Materials for the Manufacture of Paper; Centrifugal Sizing Apparatus for Sizing —. H. Schiller, Weissenfels, Germany. U.S. Pat. 690,777, Jan. 7, 1902.

IN a centrifugal sizing apparatus for wood pulp and similar materials, the inventor claims the combination of a rotary system of horizontal discs provided within an upright sieve-casing, with upright plates arranged radially between the horizontal discs at a point in juxtaposition to the outer edges of the discs, and forming "compartments" solely adjacent to the outer edges, *i.e.*, on the outer portions of the discs; inclined plates are also arranged radially to the lower side of the bottom horizontal disc in order to throw the material, dropping into the annular channel below the discs, again against the sieve.—J. F. B.



Paper Pulp; Apparatus for Purifying — A. Aberg, Hermagor, Austria. U.S. Pat. 691,091, Jan. 14, 1902.

In apparatus for purifying paper pulp and the like, the inclined baffle plates of the "sand-traps" are caused to travel in a direction contrary to that of the pulp. The baffle plates travel on an endless chain in a shallow trough, in contact with the bottom, and sweep the impurities into a recess or collector, whence they are removed by a worm conveyer. Between the baffle plates are situated intermediate brushes or laths, which dip only a short distance into the pulp and remove the scum from the surface, and are cleaned by a sprayer situated over a gutter.—J. F. B.

Paper-making Machine. C. E. Barrett and J. E. Horne, Lawrence, Mass., U.S.A. U.S. Pat. 691,333, Jan. 14, 1902.

THE 14 claims of this specification relate to the means adopted for removing the adjusting devices of the shake frame from underneath the front end thereof to a place above it, out of the way of any moisture which is liable to fall on them when in the former position.

The front end of the shake frame is suspended from overhead supports, provided with means for adjusting the shake frame vertically. The shake rails are stiffened by making the shake frame in the form of a truss.—J. F. B.

Peat; Apparatus for the Production of Half Stuff from — C. Esser, Wiener Neustadt, Austria-Hungary. U.S. Pat. 690,863, Dec. 31, 1901.

SEE Eng. Pat. 9589, 1901; this Journal, 1901, 830.—J.F.B.

Films [Cellulose]; Art of Making — C. N. Waite, Cranford, N.J., U.S.A. U.S. Pat. 690,211, Dec. 31, 1901.

THE invention relates to the impregnation of cellulose or cellulose compounds with lactic acid, for the purpose of rendering the films permanently tough and flexible. The use of lactic acid with amorphous cellulose, cellulose esters, nitrates and acetates is specified.—J. F. B.

Cellulose; Manufacture of Threads, &c. from — M. Fremery and J. Urban, Oberbruch, Germany. U.S. Pat. 691,257, Jan. 14, 1902.

SEE Eng. Pat. 6735, 1899; this Journal, 1900, 344. See also this Journal, 1900, 821.—J. F. B.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

Hydrochlorated Sulphates. C. Baskerville. J. Amer. Chem. Soc., 1901, **23**, [12], 894—897.

By heating mercuric sulphate with hydrochloric acid, drying and subliming at 240° C., the compound $\text{HgSO}_4 \cdot \text{HCl}$ was obtained in small yield. When mercuric sulphate was heated in hydrochloric acid, a small quantity of $\text{HgSO}_4 \cdot 2\text{HCl}$ was formed; it is a white, crystalline, very deliquescent substance. Mercuric chloride dissolves without decomposition in strong sulphuric acid; on heating, a crystalline sublimate was obtained. Molecular amounts of mercuric chloride and $\text{H}_2\text{SO}_4 \cdot \text{H}_2\text{O}$ gave a sublimate of $\text{HgSO}_4 \cdot 2\text{HCl} \cdot \text{H}_2\text{O}$.

At 150° C., $3\text{CdSO}_4 \cdot 8\text{H}_2\text{O}$ loses $4\text{H}_2\text{O}$; if the sulphate be heated in hydrochloric acid gas at that temperature, the compound $3\text{CdSO}_4 \cdot 4\text{H}_2\text{O} \cdot 4\text{HCl}$ is formed. At 200° C., at which the sulphate becomes anhydrous, $3\text{CdSO}_4 \cdot 8\text{HCl}$ is formed; this compound is fusible and volatile.—A. C. W.

Carbon Tetrachloride; Method of Manufacturing — C. Combes. Rev. Prod. Chim., **4**, [23], 356.

THE method consists in introducing any of the chlorides of sulphur into a vertical retort, made of some material not attacked by chlorine and charged with carbon (coke, charcoal, &c.). Heat is applied to the outside of the retort, and the products of the reaction—carbon tetrachloride, carbon bisulphide, and undecomposed sulphur chloride—are collected after passing through a condenser. They are then separated by distillation, the carbon bisulphide being

converted into tetrachloride by ordinary methods, whilst the resulting sulphur chloride is added to that already recovered, and the two are returned to the retort.

The conversion of the sulphur chloride into carbon tetrachloride without the formation of any carbon bisulphide, may be effected by introducing free chlorine into the lower part of the retort. Moreover, the employment of a dephlegmator, maintained at a suitable temperature, between the retort and the condenser, enables the distilled sulphur chloride to be collected and returned to the retort through a siphon, in which event the process becomes continuous, and the carbon tetrachloride collected in the receiver will contain only a very small proportion of carbon bisulphide.

—C. S.

Glyceroarsenic Acid. V. Auger. Comptes Rend., **134**, [4], 238—240.

WHEN arsenic acid is heated with glycerin, esterification occurs, as is shown by the escape of water, the amount of water so escaping corresponding, according to the proportions taken, with one or two of the hydroxyl groups of the glycerin. When the operation is carried on at 150° C., under a pressure of 20 mm. of mercury, the reaction is very rapid; no glycerin distils over, and a white, amorphous solid remains. On dissolving this, however, it is at once completely hydrolysed, so that no solution of glyceroarsenic acid can be obtained.—J. T. D.

Pyrazolonephenyldimethylsalicylate. B. Tei. Boll. Chim. farm.; through Pharm. Centralh., **43**, [2], 22.

ONE part of salicylic acid, dissolved in 2 parts of ether, is mixed with a solution of 1 part of phenyldimethylpyrazolone in 2 parts of water or chloroform. By recrystallising from alcohol the compound formed, large crystals of pyrazolonephenyldimethylsalicylate may be obtained.—J. O. B.

Pilocarpine. A. Pinner and R. Schwarz. Ber., 1902, **35**, [1], 192—210 (see also Jowett, this Journal, 1900, 373, and J. Chem. Soc., 1901, 1331); and Pinner and Kohlhammer, this Journal, 1900, 846, and Ber., **34**, 727.

THE authors have repeated the work of Jowett (*loc. cit.*) and have confirmed his results; the compounds described by Pinner and Kohlhammer (*loc. cit.*) have also been prepared and analysed again. They find also that if pilocarpine or isopilocarpine is oxidised at the ordinary temperature by about three molecular proportions of potassium permanganate, the main product is a homologue of malic acid having the formula $\text{C}_8\text{H}_{14}\text{O}_5$; whilst if pilocarpine is oxidised with chromic acid at 80°—90°, it yields an acid of the composition $\text{C}_{11}\text{H}_{16}\text{O}_5\text{N}_2$, which, with potassium permanganate at ordinary temperatures, undergoes further oxidation, giving another acid, $\text{C}_7\text{H}_{12}\text{O}_5$. These two acids, $\text{C}_8\text{H}_{14}\text{O}_5$ and $\text{C}_7\text{H}_{12}\text{O}_5$, were not obtained by Jowett, who, however, isolated the corresponding lactonic acids of the composition $\text{C}_8\text{H}_{12}\text{O}_4$ and $\text{C}_7\text{H}_{10}\text{O}_4$. The indifferent substance previously obtained by the authors during the oxidation of pilocarpine with permanganate, is now shown to be most probably methylurea. Pilocarpine has been obtained in long needles melting at 34° by removing the last traces of chloroform and water as far as possible from the syrup which, when seeded with crystalline material, gradually solidifies.—T. II, P.

Pyrazole Derivatives. Buchner and v. d. Heide. *Pyrazole Carboxylic Acid from 4-Phenylpyrazole.* Behaghel and Buchner. *Phenylacetylene and Diazoacetic ethyl ester.* Buchner and Lehmann. *5(3)-Pyrazole Carboxylic Acid from 5(3)-Phenylpyrazole.* Buchner and Hachumian. Ber., 1902, **35**, [1], 31—34; 34—35; 35—37; and 37—42.

See under IV., page 248.

Laudanine. O. Hesse. J. prakt. Chem., 1902, **65**, [1], 42—45. (See also Pictet and Athanasescu, this Journal, 1900, 1036.)

LAUDANINE is soluble in sodium hydroxide solution, and if a large excess of the alkali is employed, the sodium compound, $\text{C}_{20}\text{H}_{24}\text{O}_4\text{NNa} + 4\text{H}_2\text{O}$, separates out in the form of a white crystalline powder. The interaction of this sodium



compound, or even of laudanine itself, with molecular proportions of either sodium or potassium hydroxide and methyl iodide, in methyl alcohol solution, results in the formation of laudanine methyl chloride, and of the methyl ether of laudanine, and the latter compound is found to be identical with the *i*-laudanone obtained from papaverine by Pietet and Athanasescu (*loc. cit.*).

When ethyl iodide is used in place of methyl iodide, the ethyl ether of laudanine is obtained, but the yield in this case amounts to 80 per cent. of the theoretical quantity. The hydrochloride of the ethyl ether, $C_{30}H_{54}(C_2H_5)NO_4 \cdot HCl + 5H_2O$, separates from water in beautiful colourless prisms which are soluble in alcohol; the aqueous solution is optically inactive, and gives no colour reaction with ferric chloride; the platinumchloride, $[C_{30}H_{54}(C_2H_5)NO_4]_2 \cdot H_2PtCl_6 + 2H_2O$, separates as a yellow flocculent precipitate quickly becoming crystalline. Ethyllaudanine itself, prepared from the hydrochloride, separates from its ethereal solution in a varnish-like transparent mass which liquefies at $40^\circ-50^\circ$; it behaves like laudanine towards both pure sulphuric acid and acid containing ferric oxide, and is readily soluble in ether, alcohol, chloroform, acetone, or benzene; in alcoholic solution it has a basic reaction, and gives no colour reaction with a little ferric chloride. Attempts to decompose the salts of *i*-ethylaudanine into the *d*- and *i*-constituents have up to the present been unsuccessful.—T. H. P.

Digitoxin in Digitalis Leaves; Determination of —
W. Stoeder.

See under XXIII., page 283.

α - and β -Eucaine; Identification and Properties of —
C. L. Parsons. J. Amer. Chem. Soc., 1901, 23, [12], 885—893.

α -EUCAINE is *n*-methylbenzoyltetramethyl- γ -oxypiperidine-carboxylic methyl ester; β -eucaine is benzoylvinyl-diacetone-alkamine; both are sold in the form of hydrochloride. β -Eucaine is used almost exclusively, and is furnished when "eucaine" alone is demanded. In analysis it would generally be a question of distinguishing β -eucaine hydrochloride from cocaine.

The eucaines are very similar in properties to cocaine, and in general their identification is essentially a separation from each other and from cocaine. The bases are most readily extracted by light petroleum spirit or ether, after making slightly alkaline with ammonia. α -Eucaine melts at $103^\circ C$., its hydrochloride at about $200^\circ C$. with decomposition; β -eucaine melts at $91^\circ C$., its hydrochloride at $268^\circ C$. with decomposition. α -Eucaine hydrochloride is soluble at the ordinary temperature in about 10 parts of water and in 1 part of alcohol, the β -eucaine salt in about 33 parts of water and in 9 parts of alcohol; cocaine hydrochloride dissolves in less than its own weight of water or alcohol.

With the following reagents the hydrochlorides of α -eucaine, β -eucaine, and cocaine react alike:—Mayer's reagent gives a light-yellow amorphous precipitate. Wagner's reagent gives a voluminous reddish-brown precipitate even in dilute solutions. Tannic acid (1:10) gives no precipitate, or only a very slight transparent flocculency. Picric acid (1:100) gives a fine lemon-yellow precipitate, soluble in acids; in solution stronger than 1 per cent., the α -eucaine pierate is more insoluble than either of the others. An alcoholic solution of iodine yields a brown precipitate soluble in excess. Sulphomolybdic acid gives no precipitate. Mercuric chloride (1:20) gives a fine, white precipitate in moderately strong solutions, easily soluble in excess. A mixture of ferric chloride and potassium ferricyanide gives no precipitate, except a white one in strong solutions. The author has not been able to obtain the precipitate of Prussian blue, stated by Allen to be given with cocaine. Cadmium iodide gives a white precipitate. Potassium ferrocyanide yields a slight, colourless, gelatinous precipitate in solutions of 10 per cent. strength; this reaction is not given by a saturated solution of β -eucaine, probably because the solution is too weak. Potassium ferricyanide gives a white precipitate in moderately strong solutions, which should be acidified with hydrochloric acid. Potassium bromide,

chloride, and bromate give no reaction. On acidifying with strong nitric acid, evaporating to dryness on a watch-glass, and treating with 1—2 drops of alcoholic potash, the characteristic odour of ethyl benzoate is obtained.

The following reactions are characteristic of α -eucaine salts. Potassium iodide (1:10) gives a white, silky precipitate even in moderately dilute solutions. In 1 per cent. solutions all these bases are precipitated by ammonia; β -eucaine and cocaine dissolve immediately in an equal volume of strong ammonia, but α -eucaine is not dissolved by 10 vols. of ammonia. A similar difference exists in stronger solutions, but is not so easily recognised. A strong solution of potassium bichromate, added drop by drop to a 0.5—1 per cent. solution of α -eucaine, gives a fine lemon-yellow precipitate after the addition of 1 or 2 drops; the precipitate is much increased by 1—2 drops of strong hydrochloric acid; it is notably insoluble in water or hydrochloric acid. Cocaine in 1 per cent. solution is not precipitated by potassium bichromate, but the addition of 1—2 drops of strong hydrochloric acid throws down a lemon-yellow precipitate, easily soluble in very slight excess of hydrochloric acid or on dilution. β -eucaine acts like cocaine. The α -eucaine precipitate is quite crystalline; all three bases may give a slight yellow colloidal precipitate, which sticks to the sides of the tube and dissolves slowly, but this does not interfere with the test, and does not appear if the reagents are added slowly.

The following are distinctive reactions of cocaine:—If the hydrochloride be ground with dry calomel and then moistened with alcohol, it rapidly turns greyish-black; α -eucaine hydrochloride slowly turns dark grey whilst the β -eucaine salt is unaltered. In 1 per cent. solutions, cocaine gives with platinum chloride a yellow crystalline precipitate insoluble in hydrochloric acid; α - and β -eucaine are only precipitated in stronger solutions, and the precipitates readily dissolve in hydrochloric acid. If a very small drop of potassium permanganate be added to a drop of the hydrochloride solution, with cocaine the original colour generally remains for 30 minutes, whilst with the eucaines it almost immediately changes to brown. Cocaine hydrochloride is lævo-rotatory; in aqueous solution $S_d = -52.2$, and, in an alcoholic solution of specific gravity 0.9355, $S_d = -68.06$. The hydrochlorides of α - and β -eucaine are inactive.

β -Eucaine hydrochloride is characterised by its comparative insolubility in water and alcohol. No distinctive reaction has been found. The hydrochlorides of the three bases, when pure, are easily recognisable under the polarising microscope.—A. C. W.

Stylophorum diphyllum; Chemistry [Alkaloids, &c.] of — J. O. Schlotterbeck and H. C. Watkins. Ber., 1902, 35, [1], 7—23.

Stylophorum diphyllum, a species of the papaveraceæ, known locally as "yellow poppy" or "celandine poppy," grows in certain districts in the United States. According to Lloyd, the roots, under the name of "large golden seal," are occasionally mixed with *Hydrastis*. According to Eykman and Schmidt (Arch. Pharm., 226, 622), the principal alkaloid in the plant is identical with chelidonine from *Chelidonium majus*. Schmidt and Selle also announced the presence of two other alkaloids (Arch. Pharm., 228, 98).

The authors examined the dried roots, which had been collected and examined with the greatest care. The powdered material was moistened with dilute ammonia, dried in the air, and extracted by chloroform in a large Soxhlet apparatus. The chloroform solution was evaporated, and the residue exhausted with hot dilute acetic acid. The chloroform was driven off by steam from the extracted material, which was then percolated with water, in order to obtain the soluble salts and the ammonium salts of the acids previously combined with the alkaloids. The red solution, containing the acetates of the bases, was precipitated by ammonia, the precipitate thoroughly washed with water, dissolved in a little glacial acetic acid, the solution diluted, precipitated by ammonia, and this process repeated until the precipitate was almost white. The mixture of alkaloids was then dissolved in acid, the solution mixed with ether, made alkaline with



ammonia, the mixture vigorously shaken for a short time, and the ethereal solution at once filtered through a plug of cotton wool and set to crystallise. Crystals of two forms were deposited: prisms and needles; by carefully watching the crystallisation, these could be separated. The greater part of the indifferent substances separated as an amorphous powder at the boundary of the two liquids in shaking with ether. In addition to the alkaloids which crystallised out, three others were obtained from the ethereal mother-liquors.

Chelidonine.—The alkaloid present in predominating quantity crystallised in monoclinic prisms, which have the peculiar property of emitting flashes of light when scratched with a glass rod or shaken in a bottle, either alone or with water, ether, or benzene (see this Journal, 1901, 845). The base was purified by dissolving in dilute sulphuric acid, adding strong hydrochloric acid, dissolving in hot water, cooling in ice, and repeating the recrystallisation ten times. The base separated from this salt melted at 136°C .; it is without doubt identical with chelidonine (this Journal, 1897, 696). The alkaloid has the formula $\text{C}_{20}\text{H}_{19}\text{O}_5\text{N}\cdot\text{H}_2\text{O}$, and melts at 136°C .; it can be dried to constant weight at 100°C . Henscke dried at 125°C . (Arch. Pharm., 226, 624), at which temperature the base darkens, which it also does *in vacuo* over sulphuric acid and phosphoric anhydride. The best analytical results were obtained from the nitrate, obtained by decomposing the hydrochloride with silver nitrate. Chelidonine is apparently a tertiary base; it contains no methoxyl group. Wagner's reagent gives a chocolate-coloured precipitate, which, when dissolved in methyl alcohol, and allowed to crystallise, gives bright red needles and almost black prisms—the tri-iodide and penta-iodide respectively. The optical rotation of free chelidonine in solution in absolute alcohol is $[\alpha]_D = +115^{\circ}24'$.

Stylopine, $\text{C}_{19}\text{H}_{19}\text{O}_5\text{N}$.—This alkaloid is next to Chelidonine, contained in largest proportion in *Stylophorum diphyllum*. The needle-shaped crystals from the mixture of prisms and needles mentioned above, after purification by the same process as chelidonine, yielded this new alkaloid. It melts at 202°C ., is almost insoluble in hydrochloric acid, and insoluble in sulphuric acid, by which property it may readily be separated from chelidonine. The free alkaloid is readily soluble in glacial acetic acid, but with more difficulty in dilute acids. The base contains no methoxyl groups. Its specific rotation when dissolved in absolute alcohol is $[\alpha]_D = -315^{\circ}12'$.

Protopine occurs in the next largest quantity. It is somewhat soluble in ammonia, and hence was obtained approximately pure in only one or two fractions resulting from the recrystallisation of the mixture of alkaloids. The alkaline liquid, from which the alkaloids had been extracted by ether, was acidified by acetic acid, evaporated to a small volume, precipitated by caustic potash, and the precipitate taken up in ether. From the filtered ethereal solutions, protopine separated in prisms and warty aggregates. When pure, it formed large prisms melting at 204° — 205°C . A periodide was obtained, which crystallised in fine wine-red rosettes. (See also this Journal, 1898, 791; 1900, 767.)

Diphylline.—This new alkaloid was found in very small quantity in *Stylophorum*, together with chelidonine, from which it was separated by fractional crystallisation from ethereal solution. The pure substance melts at 216°C . In acetic acid solution it behaves towards reagents similarly to stylopine, except that the hydriodide precipitated by potassium iodide is amorphous.

Sanguinarine.—The free alkaloid is very soluble in ether, and was thus obtained after the crystallisation of the bases previously mentioned. The ethereal solution was treated with dry hydrochloric acid gas, the ether poured off, the red salt dissolved in hot water, ammonia added, and the solution extracted by ether. The filtered ethereal solution deposited, when left *in vacuo*, aggregates of white plates, which turned red when air was admitted.

Chelidonic Acid, $\text{C}_7\text{H}_4\text{O}_6\cdot\text{H}_2\text{O}$.—From the aqueous percolate the free acid was obtained in silky needles. (See Monatsh. für Chem., 29, 131.)—A. C. W.

Alkaloids; Resistance of Vegetable — to Decay. T. Panzer. Zeits. Unters. Nahr. und Genussm., 1902, 5, [1], 8—10.

PORTIONS of two corpses, in which morphine had been found in appreciable quantity, were covered with water and allowed to stand in a loosely covered beaker at the room temperature. At the end of six months, the decomposed mass was examined, and was found still to contain morphine.—A. C. W.

Vanillin; Preparation of — from Protocatechuic Aldehyde Carbonic Acid Methyl Ester. Pharm. Centralh., 43, [3], 38—39.

14.2 KILOS. of protocatechuic aldehyde are dissolved in concentrated sodium carbonate solution, and mixed, with constant agitation, with 12.6 kilos. of dimethyl sulphate. After standing for some time, combination commences, action being aided by heating on a water-bath. The mixture is then acidified, extracted with ether, the solvent evaporated, and the residue treated with chloroform, which removes the vanillin; the latter is easily purified by recrystallisation. The unattacked protocatechuic aldehyde which remains may be recovered and used again.—J. O. B.

Jasmine Flowers; Essential Oil of —. E. Erdmann. Ber., 1902, 35, [1], 27—30.

A REPLY to A. Hesse (this Journal, 1901, 1137). The two methods for obtaining the jasmine perfumes—*enfleurage* and extraction—lead to different products, which may be regarded as different fractions of one and the same mixture of oils. Readily volatile perfumes, not yet isolated, play a part here.

In regard to the production of perfume during *enfleurage*, the following criticisms are made:—From Hesse's defence of Passy's hypothesis (this Journal, 1901, 1138), and his references to the physiological work of Charabot, a synthetic method of production would be assumed, which the author regards as impossible, since plants cannot produce considerable quantities of oil in 24 hours under natural conditions. Hesse now, however, assumes the perfume to be ready formed in the blossoms, possibly as glucosides. This may be the case, but the perfume would then be produced by a fermentation outside the organism of the plant. Exact parallel experiments on the same material, with all details described, are necessary to substantiate such a hypothesis. In only one case were Hesse's researches conducted on the same material, the distillation with steam (this Journal, 1901, 1137), and the *enfleurage* conducted at Grasse (this Journal, 1901, 275). Hesse does not state how the 620 kilos. of water were quantitatively extracted by ether, and does not describe exactly how the essential oil in the jasmine pomade was determined (this Journal, 1899, 396), so that his results cannot be checked.

Finally, there is a difference between Hesse and the author as to whether extracts of jasmine flowers, obtained by means of volatile solvents, contain methyl anthranilate. The jasmine extract used by the author (this Journal, 1901, 930) was obtained from Roure-Bertrand fils, of Grasse, with a guarantee of purity and freedom of the flowers from orange blossoms. The methyl anthranilate was obtained by distilling with steam and extracting the fluorescent distillate with ether, from which an oil was obtained, which soon solidified and was identified by many properties and compounds with methyl anthranilate. The remainder of the same jasmine extract was that used in the determination of methyl anthranilate by the author's process. (See page 283.)

—A. C. W.

Volatile Oils; Specific Gravities and Coefficients of Expansion for —. O. Schreiner and W. R. Downer. Pharm. Archives, 4, [9], 165—173.

HAVING reinvestigated the change in gravity, at the various degrees of temperature, between 15° and 25°C ., for a series of essential oils, the authors have obtained the following figures.



Essential Oil.	Average Change for each Degree between 15° and 25° C.	Coefficient for Expansion between 15° and 25° C.
Bay oil	0.00067	0.000916
Bergamot	0.00067	0.000944
Bitter almonds	0.00063	?
Cade	0.00049	0.000740
Cajuput	0.00063	0.000969
Caraway	0.00058	?
Cassia	0.00063	0.000794
Cinnamon	0.00067	0.000828
Cinnamon leaf	0.00070	..
Clove	0.00063	0.000834
Copaiba	0.00050	..
Coriander	0.00073	0.000984
Cubeb	0.00067	0.000821
Ergyron	0.00060	0.000903
Eucalyptus globulus	0.00074	0.000977
Fennel	0.00072	..
Lemon	0.00062	0.000957
Nutmeg	0.00066	0.000959
Orange, sweet	0.00063	0.000935
Pennyroyal	0.00065	0.000859
Peppermint	0.00060	?
Pimento	0.00068	?
Rosemary, French	0.00060	..
Rosemary flowers	0.00067	..
Sandalwood	0.00063	..
Sassafras	0.00063	0.000807
Savin	0.00067	..
Spearmint	0.00068	0.000867
Star anise	0.00062	0.000845
Thyme	0.00063	?
Wintergreen	0.00062	0.000872
Wormseed	0.00064	0.000883

The formula used in calculating the coefficient of expansion was $a = 3\beta \frac{p}{p^1} + \frac{p-p^1}{p^1(t^1-t)}$, where p and p^1 = weights of oil at temperature t and the higher temperature t^1 ; $\beta\beta$ is the coefficient of cubical expansion of glass, and was taken as 0.000026.—J. O. B.

Methyl Anthranilate; Detection and Determination of—
E. Erdmann.

See under XXIII., page 283.

ENGLISH PATENTS.

Cyanamide and its Compounds; Manufacture of—G. W. Johnson, London. From the Deutsche Gold- und Silber Scheide-Anstalt vormals Rössler, Frankfurt-on-Main, Germany. Eng. Pat. 3328, Feb. 15, 1901. (See also this Journal, 1901, 1139.)

The manufacture of cyanamide is claimed by a process which consists in causing carbon or carbonaceous matter to act on the amide of an alkali metal. Carbon is added to melted sodamide at about 380° C.; during the formation of the cyanamide, the temperature is gradually raised to 550°—600° C. Or sodium is melted, the requisite amount of carbon added, and ammonia passed in. The disodium cyanamide, $\text{Na}_2\text{N}_2\text{C}$, is converted into other cyanamides by double decomposition in concentrated aqueous solution. Free cyanamide is obtained by decomposing the disodium cyanamide with oxalic acid.—A. C. W.

Cinchona Alkaloids; Acidyl Derivatives of—, and their Manufacture. J. Y. Johnson, London. From Vereinigte Chininfabriken Zimmer and Co., Frankfurt-on-Main, Germany. Eng. Pat. 11,783, June 8, 1901.

The process is claimed for the production of acidyl derivatives of the cinchona alkaloids, which consists in heating the alkaloids or their salts with phenol esters at temperatures from 110°—150° C., and removing the phenol *in vacuo* or by dilute acids. Anisylquinine, cinnamylquinine, succinylquinine, the quinine ester of aminocarbonic acid, and other new compounds obtained by the process are claimed as new articles of manufacture, and also their use for therapeutic purposes.—A. C. W.

UNITED STATES PATENTS.

Bismuth Oxyiodide Methylenebigallate. S. L. Summers, Philadelphia, Pennsylvania, U.S.A. U.S. Pat. 690, 672, Jan. 7, 1902.

BISMUTH oxyiodide methylenedigallate, $\text{Bi}_2\text{I}_2\text{C}_{15}\text{H}_{12}\text{O}_{12}$, is a reddish-brown impalpable powder, insoluble in water and alcohol, obtained by acting on bismuth oxyiodide or a compound of crystallised bismuth nitrate iodine and potassium iodide, with methylenedigallic acid, washing the precipitate, and drying at a temperature below 60° C. The process and product are both claimed.—A. C. W.

Bismuth Oxyiodide Methylenebigallate. S. L. Summers, Philadelphia, Pennsylvania, U.S.A. U.S. Pat. 690,673, Jan. 7, 1902.

BISMUTH oxyiodide methylenedigallate is produced by adding to a solution of bismuth nitrate in glacial acetic acid, an aqueous solution of potassium iodide and sodium acetate containing methylenedigallic acid in suspension, so that the bismuth oxyiodide, at the moment of its formation, is converted into the new salt.—A. C. W.

Hexamethylenetetramine Quinate. G. Wichmann and M. Gabler, Berlin. U.S. Pat. 690,804, Jan. 7, 1902.

MOLECULAR quantities of hexamethylenetetramine and quinic acid are dissolved in a suitable solvent (alcohol) and the solution evaporated *in vacuo*. On stirring, the residue crystallises. The salt melts at 118°—125° C., and is readily soluble in water; it is stated to be of great therapeutic value. The process and product are claimed. (See Eng. Pat. 14,834, 1899; this Journal, 1900, 687.)—A. C. W.

Urea Quinate. O. Schütz and G. Dallmann, Gummersbach, Germany. U.S. Pat. 690,080, Dec. 31, 1901.

THE process claimed consists in dissolving separately 1 mol. of quinic acid and 2 mols. of urea, mixing at a temperature below 70° C., and evaporating *in vacuo* below 55° C. to a thick liquid. On cooling, prismatic crystals of the salt separate, which melt at 106°—107° C.—A. C. W.

Quinine Salicylic Ether. F. Hofmann, Elberfeld, Germany. U.S. Pat. Re-issue 11,960, Jan. 7, 1902.

SEE Eng. Pat. 8165, 1901; this Journal, 1901, 1139.

—A. C. W.

XXI.—PHOTOGRAPHY.

Colour Photography; Lumière Process of— Brit. Jour. Phot., 1902, 49, [2176], 52—53.

FOR the light filters optically worked glass is evenly coated with a 10 per cent. solution of gelatin, 5 c.c. to each 10 cm. of glass surface, and thoroughly dried; the plates obtained are immersed for five minutes in the following solutions at 70° F.:—For the green screen: $\frac{1}{2}$ per cent. solution of Methylene Blue N, 5 c.c.; $\frac{1}{2}$ per cent. solution of Auramine G, 30 c.c. For the blue-violet screen: $\frac{1}{2}$ per cent. solution of Methylene Blue N, 20 c.c.; water, 20 c.c. For the red screen: $\frac{1}{2}$ per cent. solution of erythrosin, 18 c.c.; saturated solution at 60° F. of Metanil Yellow, 20 c.c.. Two plates of each are cemented together, film to film, with Canada balsam to form the screens. The plates to be used with the screens are: with the green, Lumière orthochromatic, series A; with the blue, Lumière extra rapid, blue label; with the red, Lumière orthochromatic, series B. The printing of the colour records from the negatives obtained is carried out as follows:—A sheet of non-stretching baryta paper is mounted on a glass plate, which has been previously edged with a band of benzol, 1,000 parts; masticated rubber, 15 parts; and when dry coated with a collodion, prepared as follows:—Alcohol, 500 parts; ether, 625 parts; pyroxylin, 12.5 parts; castor oil, 3 parts. The prepared support is sensitised with the following solution (5 c.c. to 13 by 18 cm. plate):—Water, 1,000 parts; gelatin emulsion, 120 parts; Coignet's hard glue, 120 parts; ammonium bichromate, 60 parts; 25 per cent. solution of potassium citrate, 40 parts; cochineal red, 1 part; alcohol.



200 parts. After drying, the sensitive papers are stripped from their supports, printed again, mounted on glass, and soaked first in cold water for two hours, and finally in water at 100° F. for half an hour, when the paper support will leave the print, the development being continued until all the soluble gelatin is dissolved; the plate is then washed, placed for five minutes in alcohol, and allowed to dry. The colourless positives obtained are dyed in the following baths:—For the green record positive: water, 1,000 parts; 3 per cent. solution of Erythrosine J., 25 parts. For the red record positive: water, 1,000 parts; 3 per cent. solution of Diamine F, 50 parts; 15 per cent. solution of hard glue, 70 parts. For the violet record positive: water, 1,000 parts; Chrysophene G, 4 parts; dissolve at 160° F. and add alcohol, 50 parts; immersion for 12 hours is sufficient at ordinary temperatures. The positives are placed together and viewed to determine where correction is necessary; a further immersion in the dye-baths being adopted for intensification, and in water for reduction, with the exception of the blue positive, which may be reduced by a 20 per cent. solution of glue. To finally place the films in superposition, a temporary support coated with hard glue, 50 parts; water, 1,000 parts, is applied to the yellow positive; when dry, the paper is stripped and the yellow film applied to the blue positive by using the following mountant: Water, 1,000 parts; hard gelatin, 120 parts; glycerin, 50 parts. When quite dry, the paper is stripped from the glass, bringing off both the blue and yellow films; the operation is repeated for the red film, and the picture finally transferred to glass in a similar manner.

—J. W. H.

Toning Baths. Brit. Jour. Phot., 1902, 49, [2177], 63.

F. NOVAK, of the Vienna Technical School, has tested photographic prints quantitatively for the amount of gold and silver they contain after being toned in either the borax, sulphocyanide, or combined baths. A celloidin film requires more gold for a given tone than albumin; the less the quantity of silver in the print, the greater the quantity of gold; the sulphocyanide bath uses more gold than the combined bath, so that if stability has any relation to the amount of gold present, the manufacturers' preference for the sulphocyanide bath is justified.—J. W. H.

ENGLISH PATENT.

Cinematographic and other Photographic Films; Method and Apparatus for Developing, Fixing, and Toning—

H. J. Haddon, London. From H. T. W. Elsner and P. Latta, Dresden, Germany. Eng. Pat. 21,873, Oct. 30, 1901.

THE strip of film is conducted through serially arranged baths of small holding capacity, in which guide rollers have bearings for guiding the strip through the baths, liquid being continuously supplied to and conducted from each bath, the liquid escaping from each series of baths being collected in a vessel common to the series for the purpose of being used again.—J. F. B.

UNITED STATES PATENT.

Films; Art of Making— C. N. Waite. U.S. Pat. 690,211, Dec. 31, 1901.

See under XIX., page 272.

XXII.—EXPLOSIVES, MATCHES, Etc.

Fulminates; Preparation of— F. Angelico. Atti. R. Accad. dei Lincei Roma, 10, [5], 476—478. Chem. Centr. 1901, 2, [6], 40a.

THE author gives a new method for the preparation of fulminates, which may, perhaps, be capable of technical application. For the preparation of mercury fulminate, a solution of mercury in an excess of dilute nitric acid is treated with a concentrated aqueous solution of malonic acid and a few drops of sodium nitrite solution. A considerable rise of temperature takes place and a copious evolution of carbon dioxide, and the mercury fulminate separates out;

it can be purified by crystallisation from boiling water. The author regards fulminic acid as the oxime of carbon monoxide, C:NOH, and states that the course of the reaction in the process described, probably consists in the conversion of the malonic acid successively into isonitrosomalonic acid, C:NOH(COOH)₂; isonitromalonic acid, C(NOOH)(COOH)₂; isonitroacetic acid, CH(NOOH)(COOH), isonitromethane, CH₂:NOOH; and fulminic acid, C:NOH.—A. S.

ENGLISH PATENT.

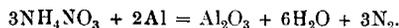
Sparkling Fireworks. F. J. Bishop, Warmley, Gloucestershire. Eng. Pat. 1508, Jan. 23, 1901.

THE composition consists of gunpowder (12 to 20 parts), black sulphide of antimony (3 to 9 parts), sulphur 2 to 6 parts, and aluminium ($\frac{1}{2}$ to 3 parts).—G. W. McD.

UNITED STATES PATENTS.

Blasting Agents. H. von Dahmen, Vienna. U.S. Pat. 689,577, Dec. 24, 1901.

FINELY divided magnesium or aluminium, preferably the latter, is intimately mixed with ammonium nitrate to form the explosive. It is considered that the exothermic change resulting from the conversion of aluminium into its oxide gives an increased mechanical effect. The decomposition proceeds according to the equation—



Aluminium is said to be unattacked by the ammonium nitrate, and hence the explosive mixture is safe for storage. No actual proportions are given in the specification.

—G. W. McD.

Guncotton; Press for— A. Hollings, Chorlton-cum-Hardy, England. U.S. Pat. 690,728, Jan. 7, 1902.

THE claim is for "a ram head for guncotton presses having an annular interior water chamber, a helical groove in the periphery of the head, a packing ring in rear of grooved portion thereof, and a plurality of passages connecting said chamber with said groove and with the face of the head." The object of the invention is to prevent guncotton under compression becoming dry and heated, as is sometimes the case in presses with solid rams.—G. W. McD.

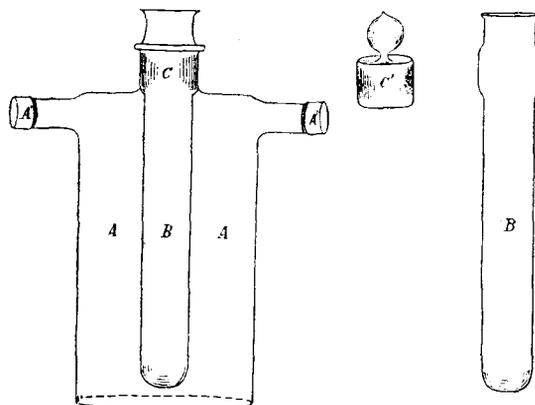
XXIII.—ANALYTICAL CHEMISTRY.

APPARATUS, ETC.

Sulphur Trioxide; Apparatus for Experiments with— H. Wichelhaus. Ber., 34, [17], 4135.

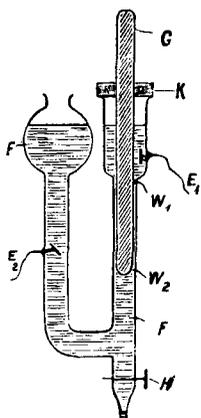
AN apparatus for the collection and easy removal, for experimental purposes, of sulphur trioxide prepared in the lecture room or laboratory.

The figure almost explains itself; the test-tube, B, widened near the mouth, has the widened part, C, ground to fit the



neck of the bottle. A, which, when these are not being used, can be closed by the stopper C'. The test-tube is filled with ice, and the sulphuric anhydride contained in the gases passing into the bottle from the contact apparatus by one of the side necks, A', A'', is condensed upon the cold tube. When enough has been so collected, the tube is removed and replaced, if need be, by another.—J. T. D.

Electrical Liquid Resistance for Laboratories; A Simple
— R. Abegg. Zeits. für Elektrochem., 1902, 8, [3], 43—44.



The accompanying figure shows an instrument which has been conveniently employed for obtaining weak currents from a source at high potential. The electrolyte is chosen to suit the particular circumstances, and may vary from sulphuric acid of maximum conductivity to ordinary water. The resistance is obtained by submerging more or less of the glass rod G and by varying its diameter. An especially convenient apparatus contains two resistance pieces W_1 , W_2 , one of them being provided with a thick rod for coarse adjustment, and the other with a thin rod for fine adjustment, the two electrodes corresponding to E_1 , shown in the figure, being connected in parallel.—J. S.

Floats in Burettes; Use of — Kreitling. Zeits. angew. Chem., 1902, 15, [1], 4—6.

The previous trials of Erdmann's cylindrical burette floats and the present determinations made with the spherical ones lead to the conclusion that it is advisable not to use floats at all. The old method of observing the lowest point of the meniscus with the aid of suitable screens is, in the author's opinion, the best way of reading burettes.

—J. N. G.

UNITED STATES PATENT.

Testing Paper, and Method of Making Same. K. Dieterich, Helfenberg, Germany. U.S. Pat. 691,249, Jan. 14, 1902.

The invention relates to the manufacture of test paper which is sensitive to two or more different chemicals at the same time, by first providing the paper with narrow insulating strips of a substance impervious and as far as possible indifferent to the chemicals to be tested, and then applying the various testing substances in parallel separated strips on the paper. Adjacent strips of red and blue litmus colouring matter can thus be applied. Insulating materials, such as paraffin, ceresin wax, or varnish, may be used.

—J. F. B.

INORGANIC—QUANTITATIVE.

Hydrofluoric Acid, Aqueous; Determination of the Strength of — F. Winteler. Zeits. angew. Chem., 1902, 15, [2], 33.

SOLUTIONS of hydrofluoric acid cannot be titrated with standard alkali using litmus or methyl orange as indicator, but it is possible to ascertain the strength of the liquid by the aid of phenolphthalein, provided the alkali is free from carbon dioxide. For manufacturing purposes, the sp. gr. of the liquid is a sufficient indication of its strength, but sulphuric and hydrofluosilicic acids must be absent. The author appends a table of the strength of hydrofluoric acid, the figures in which differ materially from those given by Eckelt (this Journal, 1898, 578). They were obtained with the balance, using a platinum bob; all the beakers, pipettes, &c., were carefully paraffined and calibrated, and the alkali was quite free from CO_2 .

Strength and Sp. Gr. of Aqueous Hydrofluoric Acid.

HF.	Sp. Gr.	° B.	HF.	Sp. Gr.	° B.
Per Cent.			Per Cent.		
1	1'003	0'5	26	1'092	12'0
2	1'007	1'0	27	1'095	12'4
3	1'011	1'5	28	1'098	12'7
4	1'014	2'0	29	1'101	13'1
5	1'018	2'5	30	1'104	13'4
6	1'023	3'0	31	1'106	13'7
7	1'027	3'5	32	1'109	14'1
8	1'030	4'0	33	1'112	14'4
9	1'035	4'5	34	1'114	14'7
10	1'038	5'0	35	1'117	15'0
11	1'041	5'5	36	1'120	15'4
12	1'045	6'0	37	1'122	15'7
13	1'049	6'5	38	1'125	16'0
14	1'052	7'0	39	1'127	16'3
15	1'055	7'5	40	1'130	16'5
16	1'059	8'0	41	1'133	16'8
17	1'062	8'4	42	1'136	17'2
18	1'066	8'8	43	1'138	17'5
19	1'069	9'3	44	1'141	17'8
20	1'072	9'7	45	1'143	18'1
21	1'076	10'1	46	1'146	18'4
22	1'079	10'5	47	1'149	18'7
23	1'082	10'9	48	1'152	19'0
24	1'086	11'3	49	1'154	19'3
25	1'089	11'7	50	1'157	19'5

—F. H. L.

Phosphoric Acid in Organic Substances [Milk]; Determination of — F. Rieger. Zeits. physiol. Chem., 34, 109—113. Chem. Centr., 1902, 1, [1], 67.

For the determination of phosphoric acid in milk, the author recommends concentrating a known weight to a syrup in a platinum crucible, and then either igniting, in the usual way, with sodium carbonate and potassium nitrate, or treating the syrup according to Keller's modification of Carius' method. The two methods give concordant results. An alternative method is to precipitate the milk with copper sulphate and caustic soda (Ritthausen), and then ignite the precipitate with sodium carbonate and potassium nitrate. The author states that the precipitate contains the whole of the phosphorus originally present in the milk, thus confirming Schlossmann's assertion that Ritthausen's reagent precipitates not only the albuminoids, but also various other constituents of milk.—A. S.

Boric Acid; Titration of — K. Farnsteiner. Zeits. Unters. Nahr. und Genussm., 1902, 5, [1], 1—8.

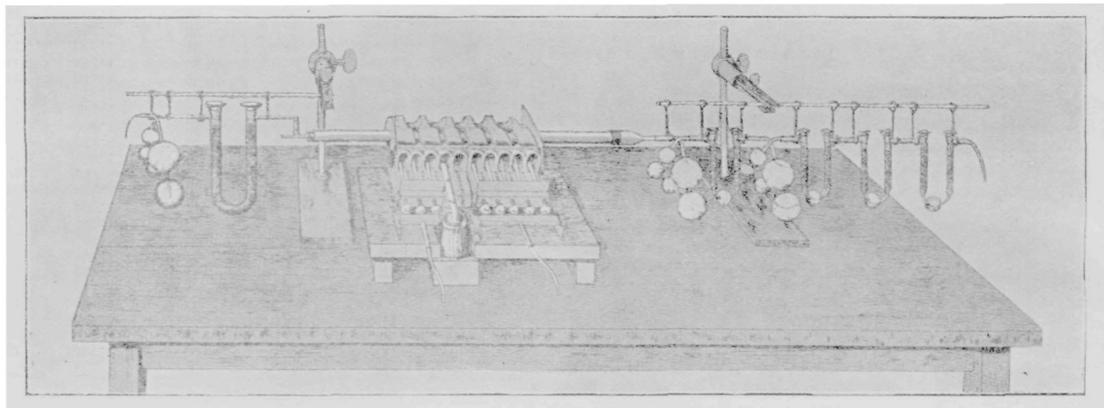
THE author has investigated the behaviour of boric acid towards alkalis in the presence of phenolphthalein in solutions in methyl and ethyl alcohol. The (semi-normal) alkaline solutions in alcohol were prepared without the addition of water; in the case of baryta, the water of crystallisation was first removed by heating over an open flame. When methyl alcoholic soda or potash is added to a solution of boric acid in methyl alcohol, using phenolphthalein as indicator, as with aqueous solutions containing glycerin, there is no sharp change; a slight red coloration first appears, which becomes deeper on the further addition of alkali. In dilute solutions the limits of this zone of change are near together; when the strength of the solution does not exceed 1 per cent., the end reaction appears when the formation of KBO_2 is almost complete. When methyl alcoholic baryta is used, the end-reaction is sharper, but not absolutely definite; the precipitate produced settles rapidly towards the end of the titration, and does not hinder the observation of the end-point. The formation of an ester, if it really occurs, does not affect the titration: solutions of boric acid in methyl alcohol have exactly the same titre after 24 hours as when fresh. A distillate obtained from methyl alcohol containing boric acid required 8'85 c.c. of alkali to neutralise the free acid and 0'15 c.c. to decompose the ester. A slight addition of water to the methyl alcohol solution of boric acid at once lowers the titre; the end-point obtained in pure methyl alcohol solutions before neutralisation is complete, is to be ascribed to the water present in the alcohol and produced by the reaction.



One gram. of crystallised borax dissolved in methyl alcohol required 10.0 c.c. of semi-normal methyl alcoholic baryta, whilst 1 gram. dissolved in water required 10.5 c.c. of semi-normal hydrochloric acid with methyl orange as indicator. If methyl alcoholic sulphuric acid be added to a methyl alcoholic borax solution until the mixture is acid

Five grms. of steel turnings or drillings, mixed with 15 to 20 grms. of re-fused lead chromate, are placed in a porcelain boat within a deep tray of sheet platinum, and pushed into a porcelain tube. The platinum is used to prevent the sticking of the boat to the tube by chromate which may creep over the edge. The front part of the

Fig. 1.



APPARATUS FOR DIRECT COMBUSTION OF CARBON IN STEEL.

to methyl orange, the whole of the boric acid may be carried over into the distillate. The determination of boric acid by the distillation method in the presence of much chloride may thus be made possible.

Quite different results were obtained with ethyl alcohol as solvent. In absolute alcohol the end-reaction appears when one-sixth to one-seventh of the boric acid is converted into the normal salt. If water be then added, the coloration disappears, a turbidity is produced, and finally there is a distinct end-reaction. In 95 per cent. alcohol the precipitate appears at once, but the end-reaction indicates about 1 mol. of alkali to 2.36 mols. of boric acid. The precipitate contains approximately K_2O and B_2O_3 in the ratio 1 : 2.18. When boric acid is added to potash, both in ethyl alcoholic solution, the end reaction appears almost at the ratio $K_2O : B_2O_3 = 1 : 2$.—A. C. W.

Boric Acid ; Determination of —. A. Hebebrand. Zeits. Untersuch. Nahr. und Genussm., 1902, 5, [2], 55—58.

THE author describes a method of determining boric acid in which the liquid containing this preservative is evaporated to dryness in a platinum basin, after rendering feebly alkaline with soda. The residue is ignited until all carbon has disappeared, and is then treated with 5 c.c. of water containing about 0.5 c.c. of hydrochloric acid. The solution is transferred to a test tube, and the platinum basin washed out with 15 c.c. of alcohol. 15 c.c. of hydrochloric acid (sp. gr. 1.19) and 0.2 c.c. of a 0.1 per cent. turmeric solution are then added, and the test-tube allowed to stand for half an hour. The colour produced, varying from faint brown to rose-red according to the amount of boric acid present, may be compared with that obtained from tubes containing known quantities of boric acid.—W. P. S.

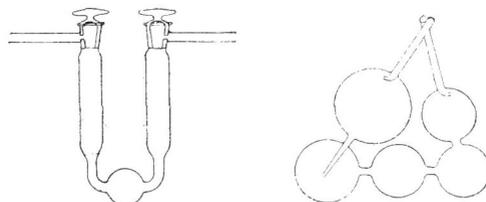
Steel ; Determination of Carbon in —, by Direct Combustion. B. Blount. Analyst, 1902, 27, 1—5.

In his previous endeavours to burn steel turnings in oxygen without admixture of any oxidising or fluxing agent, the author found that there was a considerable tendency to leave a core of unoxidised metal, which was liable to contain unburnt carbon; and if heating was continued long enough to completely oxidise this core, the operation became unduly prolonged. By mixing the turnings, however, with lead chromate, and by raising the temperature as high as the porcelain tube will stand, a practicable working process has now been devised.

tube contains copper oxide, which is heated, as well as the tube behind the boat, in a Fletcher combustion furnace. The exact spot where the boat lies is more intensely heated by means of a benzoline blast lamp. The complete arrangement is shown in Fig. 1.

The oxygen, purified by passing through the potash-bulb and soda-lime U-tube seen on the left, enters the porcelain tube through the glass T-piece with flattened end, which allows the boat to be seen within the tube during the combustion. The front end of the porcelain tube projects several inches beyond the furnace, in order to cool the gases, and is connected to the absorption train by means of a glass cap fixed over a rubber ring, instead of by a tube passing through a bung. The absorption train finally adopted comprises (1) an empty bulb-tube to cool the gases; (2) a drying-tube of sulphuric acid pumice; (3) the potash-bulb and similar drying-tube in which the CO_2 is weighed; (4) a second drying-tube, which is weighed occasionally to ascertain that no moisture escapes the first; and (5) a guard tube of sulphuric acid pumice, to which an aspirator may be attached. The U-tubes are of special design, having a bulb in the bend containing sulphuric acid, through which the gases bubble. The potash-bulb is also of novel design, shown in Fig. 2, the entrance bulb being extra

Fig. 2.



POTASH-BULB.

large and heavy so that the tube hangs naturally in the best position for absorption. With adequate temperature, no difficulty was experienced in burning the whole of the steel in about one hour; even thick turnings left no core. In the earlier experiments, discrepancies occurred between this method and the standard method of solution in double copper salt and separate combustion of the carbon, but these tended to disappear as the necessary conditions became better



understood, as shown in the table of results. The remaining defects are due chiefly to the imperfectly refractory nature of the glaze on the porcelain, which becomes slightly sticky at the temperature employed.

Description of Steel.	Carbon (Percentage) found.	
	By Solution Method.	By Direct Combustion.
Tyre.....	0·675	0·619
Rail.....	0·404	0·393
".....	0·399	0·407
".....	0·373	0·330
Tyre.....	0·643	0·645
".....	0·618	0·557
Rail.....	0·401	0·419
".....	0·432	0·435
".....	0·430	0·408
".....	0·457	(1) 0·422 (2) 0·393 (3) 0·438
".....	0·470	0·429
Nickel steel.....	0·323	(1) 0·324 (2) 0·324
Tyre.....	0·459	0·445
Plate.....	0·288	0·277
Rail.....	0·455	0·467
".....	0·568	0·575

* Improved apparatus for cooling and absorption.

—L. A.

Sulphur in Pig Iron; Colorimetric Method for the Determination of —. W. G. Lindsay. School of Mines Quarterly, 1901, 23, [1], 24—27.

THE method is based upon the formation of Methylene Blue by sulphuretted hydrogen, and the best conditions for the test were found to be the addition to the sulphide solution, in a narrow Nessler tube, of 0·1 c.c. of a 2 per cent. solution of paraphenylene dimethyl diamine hydrochloride (unsymmetrical), which is then oxidised by the addition of 0·05 c.c. of a 10 per cent. solution of ferric chloride in the presence of 1·5 c.c. of dilute sulphuric acid. The tints produced are compared with standards obtained with known quantities of sodium sulphide.

The method was tested with three kinds of iron, a grey forge Durham pig iron, a brittle white cast iron, and a grey pig iron high in sulphur. Five grms. of each were treated with hydrochloric acid, and the hydrogen sulphide absorbed by soda which was then diluted to 250 c.c. Five c.c. of this solution, equal to 0·1 grm. of iron, were measured into a 50 c.c. Nessler tube, diluted to the mark after the addition of the sulphuric acid, and then mixed with the diamine solution and ferric chloride in the above proportions. The results agreed closely with those obtained by Elliot's method, equally with low and high sulphur contents, but of course with both methods only the sulphur evolved as gas is estimated. The result with the grey forge was low for this reason, viz., 0·25 per cent. compared with 0·65 per cent. obtained by other methods. As an evolution method it is simple and rapid. It may be varied by using other diamines, such as paraphenylene-diamine, which produces a violet coloration.—A. W.

Manganese in Spiegel; Determination of —. T. F. Hildreth. School of Mines Quarterly, 1901, 23, [1], 27—33.

THE author reviews the various methods of estimating manganese in spiegel, and gives the results of experimental tests with each. The following summary of average figures obtained with the same spiegel shows the variations by different methods:—

Gravimetric method (basic acetate, bromine, and phosphate), 22·69 per cent.

Volumetric method (Ford-Williams), 22·73 per cent.

Volhard method (see table in next column).

For each of the three acid solutions 5 grms. were dissolved, diluted to one litre, and divided into five equal parts for the different methods of neutralisation. The

Volhard Method and its Modifications.

	HCl Solution.	HNO ₃ Solution.	H ₂ SO ₄ Solution.
Neutralised by—	Per Cent.	Per Cent.	Per Cent.
1. NaHCO ₃	22·93	22·94	22·94
2. BaCO ₃	22·40	22·39	..
3. Na ₂ CO ₃ and ZnO in excess after dilution.	22·47	22·58*	22·73
4. Na ₂ CO ₃ and ZnO, avoiding excess.	22·63	22·78	22·53†
5. Na ₂ CO ₃ and ZnO in great excess at once.	22·39	22·63	22·63

* Stone's method as given by Auchy.

† Original Volhard method.

results show that there are four reliable methods, viz.:—Standard Gravimetric, Ford-Williams, Volhard, and Stone. Of these the first is the most accurate and the last the most rapid. The following points are brought out by the investigation:—The precipitation by (NH₄)₂ HPO₄ without ammonium chloride, as given by Dakin, gives accurate results. Sodium or potassium chlorate can be used equally well in the Ford-Williams method. Särnstrom's method is inferior to any of the zinc oxide methods of neutralisation before titration. Barium carbonate gives low results and an uncertain end point, showing the necessity of zinc salts. The presence of chlorides is undesirable, whilst there is no choice between nitrates and sulphates. The best results were obtained in a sulphate solution to which an excess of zinc oxide was added after neutralisation with the same oxide and dilution. The original Volhard method and Auchy's modification of Stone's method give identical results as shown above, but they are about 0·1 per cent. too low. The results in the table are irregular, although the duplicates agree, and they show that, whilst nothing definite can be deduced in respect to the excess of zinc oxide and the manner of adding it, the neutralisation and standardisation should be exactly the same each time.—A. W.

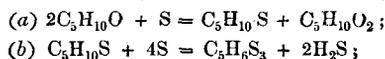
Gold and Iridium; Separation of —. Mietzschke. J. Pharm. Chim., 1902, 15, [2], 68.

WHEN gold containing iridium is fused in a clay crucible in a muffle for 1—2 hours at a high temperature, the iridium is entirely converted into silicate, which forms a brownish-black molten mass on the sides and bottom of the crucible. The gold is poured off, and the adherent mass again fused in the same crucible with a mixture of litharge, reducing agents, and fluxes. The button of lead-iridium is then refined with an addition of silver. The separation of silver and iridium offers no difficulty.—A. C. W.

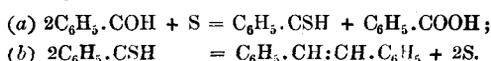
ORGANIC—QUALITATIVE.

Cotton-seed Oil; Chemistry of Halphen's Reaction for —. P. N. Raikow. Chem.-Zeit., 1902, 26, [1], 10—11.

IN the author's opinion the active substance producing the red coloration in Halphen's reaction must be an unknown unsaturated acid. Taking into consideration facts recorded in a former communication (this Journal, 1901, 856), there appears to be an analogy between the reaction and changes that aldehydic and ketonic compounds undergo under the influence of free sulphur. These changes may take place in two directions. Thus the sulpho-aldehydes or sulphoketones first produced may be transformed into other sulphur compounds with the liberation of hydrogen sulphide, as in the case of valeriac aldehyde:—



or there may be a condensation to sulphur-free compounds with the liberation of free sulphur after the manner of benzaldehyde:—



Presumably the first part of these reactions corresponds with the formation of the red coloration in Halphen's reaction, and the second part with the disappearance of the colour under the long-continued action of sunlight.

The liberation of hydrogen sulphide, which the author has observed in Halphen's reaction, evidently points to a reaction of the first type; and if a reaction like that of benzaldehyde also occurs, where there is complete regeneration of the sulphur, a small amount of sulphur should be able, after a sufficient lapse of time, to render a large quantity of cotton-seed oil inactive to Halphen's test.

In order to decide this point, 2 mgrms. of flowers of sulphur were added to one of two flasks containing 100 c.c. of cotton-seed oil, and the flasks closed and exposed to direct sunlight for 17 months. In each case the oil then only gave a coloration with Halphen's reagent of a fifth of the intensity of that produced by the original oil. From this it appears that sunlight alone, if its action be continued sufficiently long, is capable of modifying the active substance giving Halphen's reaction.

It was shown before that cotton-seed oil became completely inactive when exposed to direct sunlight with a sufficient quantity of sulphur. From the above experiments the author concludes that this change does not take place under the influence of a slight amount of sulphur, and that therefore reactions of the benzaldehyde type probably do not occur. The presence of hydrogen sulphide was not observed in the flask containing the 20 mgrms. of sulphur, but the decomposing action of light upon that compound would afford a satisfactory explanation of this.—C. A. M.

Oxidising Ferments; Phenolphthalin as a Reagent for — J. H. Kastle and O. M. Shedd. Amer. Chem. J., 1901, 26, [6], 526—539.

PHENOLPHTHALIN or dihydroxytriphenylmethane carbonic acid is obtained by reducing phenolphthalin with zinc dust in alkaline solution. It is rapidly oxidised by oxidising agents and slowly by the air to phenolphthalin, the formation of which is made evident on the subsequent addition of alkali. Phenolphthalin is a very convenient substitute for guaiacum in the study of oxidising ferments. The tests are made in tubes by mixing 5 c.c. of the extract under investigation with 1 c.c. of a neutral solution of the sodium salt of phenolphthalin, leaving for some time at the ordinary temperature, and then adding sufficient 1/20th normal alkali to determine an alkaline reaction. Blank tests should always be made, to correct for the slight oxidising action of the air. The authors have devoted most of their attention to the study of the oxydase of the potato tuber; they find, however, that this oxydase is widely distributed in other vegetable tissues, but amongst animal secretions they have so far only found it in human saliva. The oxidation of guaiacum by potato oxydase is very rapid, but not instantaneous; that of phenolphthalin proceeds much more slowly. The rate of oxidation can easily be followed by colorimetric observations, and appears to be proportional to the time of contact up to a certain limit; in the case of extracts of potato cuticle, the maximum coloration is obtained after one hour. The passage of air through the tubes during the tests in no way increases the oxidising action; hence it is concluded that the potato oxydase is not a catalytic carrier of atmospheric oxygen. All the tests were made in extracts with a faint acid reaction. There appears to be a complete parallelism between the oxidation of guaiacum and that of phenolphthalin by extracts of living tissues, both qualitatively and as regards relative intensity; tissues which possess this property also turn brown when exposed to the air. This oxydase is evidently not identical with Loew's "catalase," which decomposes hydrogen peroxide.—J. F. B.

Milk; Test for Boiled and Unboiled — Utz. Pharm. Centralbl., 42, 149; through Zeits. angew. Chem., 1902, 15, [1], 12.

HYDROGEN peroxide and paraphenylenediamine solution are simultaneously added to the sample (Schaffer's test).

Unboiled milk becomes blue at once; boiled milk does not give the reaction. The colour does not appear so quickly if the milk contain a small quantity of formaldehyde.

—J. N. G.

ORGANIC—QUANTITATIVE.

Glycerins; Analysis of Commercial —, by the modified Manganese Method. J. Gailhat. Monit. Scient., 1902, 16, [722], 89—106.

AFTER describing and criticising the various methods employed or proposed for the determination of glycerin, the author discusses the application of his method (Bull. Soc. Chim., 1901, 25, 395) to the examination of pure and crude glycerin.

Preparation of Solutions of Pure Glycerin. — The glycerin redistilled *in vacuo* and containing only traces of fatty acids was washed with ether, diluted with four times its volume of water, treated with purified animal charcoal, and filtered. After concentrating the liquid on the water-bath, again diluting it, and again concentrating it, the product contained 80—82 per cent. of pure glycerin, and could be weighed without fear of hydration during the weighing.

Action of the Manganese Solution on Solutions of Pure Glycerin. — On treating 25 c.c. of a solution of pure glycerin (about 6 grms. per litre) with 50 c.c. of potassium permanganate solution (15 grms. per litre), 25 c.c. of a 15 per cent. solution of manganese sulphate, and 25 c.c. of concentrated sulphuric acid, the reaction commences before the boiling point is reached, and reducing substances, including formaldehyde and formic acid, are liberated, and can be detected in the condensed vapours. If, however, the reaction be carried out by boiling the liquid for at least 15 minutes under a reflux condenser, and the liquid subsequently distilled, the distillate is free from reducing substances.

The same facts were noted when the glycerin solution was treated with potassium bichromate and sulphuric acid, as in the methods of Hehner (this Journal, 1889, 4), and of Richardson and Jaffé (this Journal, 1898, 330), showing that the oxidation is incomplete unless the vapours first evolved are condensed and brought into action again.

Determination of Glycerin in Pharmaceutical Glycerins. — A glycerin of known strength is diluted so that a litre contains about 5.9 grms. of anhydrous glycerin. Let this quantity be represented by Q, whilst P represents the weight of a similar quantity of the glycerin under examination, and X the quantity of anhydrous glycerin present.

Three oxidising mixtures are prepared, each containing potassium permanganate solution (50 c.c.), manganese sulphate solution (25 c.c.), and sulphuric acid (20 c.c.) of the strengths given above. The first of these is titrated at 45° C. by adding 50 c.c. of seminormal oxalic solution, and determining the excess of the latter with decinormal permanganate solution. To the other two are added respectively 25 c.c. of the solution of the standard glycerin and 25 c.c. of the solution under examination, and the liquids boiled for 25 minutes under reflux condensers. They are then cooled to 45° C., treated with 10 c.c. of seminormal oxalic acid, and titrated with decinormal permanganate solution. If A represent the amount of oxygen, expressed in c.c. of permanganate, consumed by the standard glycerin solution, and B the quantity consumed by the unknown glycerin, the percentage of glycerin in the latter is calculated by means of the equation—

$$X = \frac{100 \times Q \times \frac{B}{A}}{P}$$

To obtain accurate results it is essential to have the glycerin, oxalic acid, and permanganate solutions at exactly the same temperature during the titration.

Analysis of Crude Glycerins. — The author describes the origin of the impurities found in commercial glycerin, and discusses their influence on the determination of glycerin by the method described above.

Volatile Fatty Acids in Soap Works Glycerins. — The volatile acids usually amount to about 1 per cent. in terms



of sulphuric acid, but in certain cases exceed 2 per cent. The author subjected 500 grms. of these acids to distillation under a pressure of 20 mm. in Henninger's apparatus, and obtained the following fractions:—(1) A mixture distilling below 40° C., and consisting of acetic and butyric acids with traces of formic acid; (2) essentially butyric acid, distilling between 70° and 80° C.; (3) essentially caproic acid, distilling between 125° and 127° C.; and (4) essentially caprylic acid, distilling between 147° and 149° C. The first fraction was too small to be further rectified, and the residue of volatile acids higher than caprylic acid was insignificant in comparison with the quantity of glycerin (225 kilos.) treated.

The influence of each of the above-mentioned acids on the author's manganese method is shown by experiments given in detail, from which the conclusion is arrived at, that their action is negligible, provided that the active oxygen in the solution after the oxidation of the glycerin does not exceed one-tenth of that introduced in the 50 c.c. of seminormal permanganate solution.

Action of Impurities partially eliminated by Treatment with Lead or Silver Salts.—An allowance for this can be made in the following manner:—250 c.c. of a solution of the crude glycerin (about 5.9×2 grms. of glycerin per litre) are treated with a slight excess of silver nitrate and lead subacetate, diluted to 500 c.c., and filtered.

A second portion of 200 c.c. of the same solution is treated in the same manner, and also diluted to 500 c.c. and filtered. The first solution will then contain a quantity, X (approximating 5.9 grms. per litre), whilst the second will only contain four-fifths of that quantity; but both will contain in solution the same quantity of the precipitates formed by the impurities. If Z represent the amount of oxygen required for the oxidation of the glycerin in 25 c.c. of the first solution, and z that consumed by the impurities in the same volume of liquid, the proportion of oxygen consumed by the second solution will be represented by $\frac{4}{5}Z + z$.

Further, if $Z + z = A$; and $\frac{4}{5}Z + z = B$;

$$Z - \frac{4}{5}Z = A - B; \text{ and}$$

$$Z = 5(A - B).$$

Again, if C represent the amount of oxygen absorbed by 25 c.c. of the standard glycerin solution containing a grms. (approximately 5.9 grms.) of glycerin, and x represent the amount of oxidisable impurities per litre in terms of glycerin in each of these liquids—

$$\frac{X + x}{a} = \frac{A}{C},$$

and

$$\frac{\frac{4}{5}X + x}{a} = \frac{B}{C};$$

whence

$$X - \frac{4}{5}x = \frac{A - B}{C},$$

$$\text{and } X = 5a \left(\frac{A - B}{C} \right).$$

The author states that he has applied this method to the examination of a large number of soap-works glycerins, and has found that, provided the excess of active oxygen in the liquid after oxidation does not exceed one-tenth of that originally added, the action of the impurities not precipitated, may be neglected. It is also essential that the solution should contain a quantity of pure glycerin approximating 5.9 grms. per litre.

The method is illustrated by test experiments, and, according to the author, the results obtained, with the precautions mentioned above, are more accurate than those given by any other method.—C. A. M.

Galic Acid in Tanning Materials; Detection and Determination of — M. Spica. Gazz. chim. ital., 1901, 31, 201. Chem.-Zeit., 1902, 26, [2], Rep. 4—5.

On shaking a solution of gallic acid with a solution of potassium plumbite, and then diluting the liquid with water,

a scarlet coloration is produced. This reaction is not given by tannin, and can therefore be employed for the detection and determination of gallic acid in tanning materials. The reagent is prepared by treating a solution of lead acetate with potassium hydroxide and dissolving the precipitated lead hydroxide in potassium hydroxide solution, care being taken to avoid an excess of the latter.—C. A. M.

Carbohydrates; Method of Drying, and Determination of the Water of Crystallisation of — E. Schulze. Chem.-Zeit., 1902, 26, [1], 7—8.

AFTER pointing out that many carbohydrates undergo partial decomposition, when heated at temperatures not much above 100° C., the author describes an apparatus with which he has obtained good results. This consists of a copper trough-shaped vessel containing a solution of salt or a mixture of glycerin and water, the boiling point of which is somewhat over 100° C. Through this trough passes a copper tube, about 30 cm. in length by 2.5 cm. in diameter, open at each end. A glass boat containing a weighed quantity of the substance is placed in this tube and a current of dry hydrogen passed through, whilst the liquid in the bath is heated to the boiling point.

In this way maltose is readily freed from its water of crystallisation, as is also the case with stachyose after about 30 minutes heating. Raffinose must first be heated for about an hour in hydrogen at about 75° C. in order to prevent fusion, and the temperature can subsequently be raised to 100° C. Otherwise it fuses, and cannot then be completely freed from water, even by heating at 105°—110° C.

Scalose ($C_{18}H_{32}O_{16}$), a carbohydrate isolated by the author from rye, rapidly became constant in weight in this apparatus. On the other hand, lactose only lost part of its water of crystallisation, which was to be expected, since it is ordinarily necessary to heat this carbohydrate to 130° C. to obtain an anhydrous product.

The author calls attention to the possibility of the temperature of drying influencing the analysis. Thus he found a sample of lupeose dried at 110°—115° C. to have a composition corresponding with the formula $C_6H_{10}O_5$, whereas the preparation dried at 100° C. in hydrogen gave figures corresponding with the formula $C_{12}H_{22}O_{11}$.—C. A. M.

Yeast; Determination of Potato Starch in — A. Hebebrand. Zeits. Untersuch. Nahr. und Genussm., 1902, 5, [2], 58—61.

A WEIGHED quantity (about 1 gm.) of the yeast containing potato starch is rubbed down with 20 c.c. of sodium carbonate solution (containing 7 per cent. Na_2CO_3), and a slow stream of chlorine gas is led through the mixture for one minute. 150 c.c. of water are then added and the starch allowed to settle. Several successive quantities of water are added, each being decanted off, and the sediment of starch is finally brought on to a weighed filter, washed with water, then with alcohol, ether, and light petroleum spirit in succession, dried at 100°—105° C., and weighed. It may be assumed that the potato meal originally added contained 80 per cent. of dry starch. The process gives accurate results.

—W. P. S.

Malt; Analysis and Valuation of — F. Cerny. Oesterr. Brauer- und Hopfenzeit., 1902, [2], 17; through Woch. für Brau., 1902, 19, [4], 43—44.

THE author took samples of malt from the same germinating couch after 5, 7, and 10 days respectively and kilned them. Part of each sample was then put into a corn-tester, and the corns accurately cut into halves; there were thus obtained germ-halves and awn-halves for each period of germination. A comparative study of all these samples gave a very good indication of the gradual progression of the modification of the endosperm towards the point of the corn. The mashing of the whole malt samples showed, as might be expected, very inferior results for the five days' germination as compared with the seven and ten days' samples; the yield from the two latter did not differ very considerably. The maltose content [diastatic power], and the colour of the worts increased with the time of germination. The sifted meal from the whole malts gave paler



worts than those obtained by mashing with the husks, and in this case the maltose content was lower in the 10 days' sample than in the seven days. The cut corns were also ground, and sifted meals were prepared; the awn-aloos were far more difficult to grind than the germ-halves owing to their deficient modification. The germ-halves even of the five days' malt were perfectly modified, in fact the yield of extract from the germ-halves decreased from the 5th to the 7th day, owing to the development of the embryo. The yield of extract from the awn-halves increased very considerably from the 5th to the 7th day, but only slightly from the 7th to the 10th day. The slight difference in the latter case may be attributed to the artificial modification produced by the fine grinding. The maltose content rose in both halves with the time of germination, but it was very deficient in the wort from the awn-halves of the five day malt. The colour of the worts in both cases increased with the time of germination, but was about twice as dark in the worts from the germ-halves compared with those of the awn-halves. The worts from the germ-halves were clear in all cases, but those from the awn-halves were opalescent except in the 10-day sample. The iodine reaction of the mash from the awn-halves of the five-day malt was still blue, in the other cases it was normal.

The colouring matter—apart from the husks—increased with the time of germination, and the author attributes this to the production of some readily caramelised substance, during the development of the acrospire. The colouring matter due to the husks also increased with the time of germination, showing that these undergo some change of a like nature.

The relative weights of the germ-halves and awn-halves showed a considerable difference, the awn-halves of the five-day malt being very heavy.—J. F. B.

Apples and some of their Products; Analysis of —
C. A. Brown, jun. J. Amer. Chem. Soc., 1901, 23,
[12], 869—884.

The composition of the edible or fleshy portion of the apple is given in the following table:—

—	Water.	Re- ducing Sugars.	Su- crose.	Starch.	Ash.	Acids, as Malic.
Unripe apples, 2 analyses.	80·87	6·43	2·84	3·92	0·27	1·14
Summer apples, 6 analyses.	85·00	7·10	3·38	1·04	0·28	0·68
Winter apples, 21 analyses.	83·16	8·16	4·16	..	0·26	0·59

These figures, taken together with other determinations made on the combined pulp and marc from different varieties of fruit, give the following approximate average percentage composition of the flesh of the ripe apple:—Water, 84·00; ash, 0·30; reducing sugars, 8·00; sucrose 4·00; starch, 0·00; marc, 1·80, containing cellulose, 0·90, pentosanes, 0·50, and lignin, 0·40; free acid, calculated as malic acid, 0·60; combined acid as malic, 0·20; pectins, 0·40; crude fat, 0·30; protein, 0·10; undetermined (tannin, &c.), 0·30. The composition of the ash of the apple is:—K₂O, 55·94; Na₂O, 0·31; CaO, 4·43; MgO, 3·78; Fe₂O₃, 0·95; Al₂O₃, 0·80; Cl, 0·39; SiO₂, 0·40; SO₃, 2·66; P₂O₅, 8·64; CO₂, 21·60.

The composition of apple juice is compared in the next table with that of other fruit juices. "Second pressings" are made by wetting apple pomace with water and re-pressing; they are used extensively for jelly-making and vinegar stock.

Kind of Juice.	Specific Gravity.	Solids.	Reducing Sugars.	Sucrose.	Free Acid, as Malic.	Ash.	Pectins.	Albu- minoids.	Optical Rotation.
Summer apples, 5 analyses.....	1·0502	12·29	6·76	3·23	0·72	0·29	0·12	0·03	- 26·67
Winter apples, 4 analyses.....	1·0569	13·96	8·57	3·40	0·45	0·27	0·12	0·02	- 45·15
"Second pressings".....	1·0376	9·14	6·87	1·49	Unde- termined.	0·20	Unde- termined.	Unde- termined.	- 31·94
Strawberry.....	1·0420	9·64	5·90	0·89	1·28	0·61	0·63	0·38	- 5·28
Red raspberry.....	1·0463	11·01	5·13	2·31	1·44	0·60	0·88	0·75	+ 7·32
Black raspberry.....	1·0567	13·65	9·52	..	1·85	0·60	0·72	0·38	- 25·20
Black cherry, very sweet.....	1·1034	24·90	16·35	..	1·47	0·79	0·30	0·63	- 29·80
Red cherry, sour.....	1·0461	11·22	7·33	..	1·32	0·57	0·25	0·56	- 12·96

The composition of samples of cider and cider vinegar of known purity is also given:—

—	Specific Gravity.	Solids.	Ash.	Reducing Sugars.	Acetic Acid.	Malic Acid.	Alcohol.	Pectins.	Albu- minoids.	Optical Rotation.
Cider, 6 analyses.....	1·0006	2·34	0·29	0·32	0·61	0·25	5·51	0·04	0·02	- 2·34
Vinegar, 4 analyses.....	1·0184	2·200	0·44	0·52	6·19	0·14	None	0·17	0·01	- 2·01

In regard to the analytical methods, the following points are noteworthy:—

Moisture and Solids.—In drying at 100° C. it is impossible to obtain a constant weight, owing to the decomposition of the sugars, levulose in particular. The method adopted was to pack a perforated brass tube, 9 × 2 cm., with asbestos, leaving a central cavity in the upper half, place the tube in a weighing bottle, run about 5 c.c. of the liquid into the cavity in the asbestos, re-weigh, place bottle and tube in a vacuum-drying apparatus, dry at 70° C., first with a slight current of air, and then at a vacuum of 25 ins. Dehydration is generally complete in 8–10 hours. In the case of fruits, the grated pulp was transferred to the perforated tube, which was only one-quarter filled with asbestos.

The percentage of solids in fruit juices may be calculated from the formula:— $245(s - 1)$, where s is the specific gravity. The results are generally somewhat nearer to the observed solids than determinations by means of the Brix hydrometer.

Reducing Sugars were calculated as invert sugar from the weight of copper reduced.

Levulose and Dextrose were in many cases separately determined. In the presence of both dextrose and sucrose, the percentage of levulose, l , is given by the formula—

$$l = \frac{v - v'}{G(t \times - 0.0323)}$$

where $v - v'$ is the algebraic difference between polariscope readings taken in a 200 mm. tube at 15° and 85° C., G is the specific gravity of the liquid, and t the difference in temperature between the readings. The factor $- 0.0323$ represents the deviation (Ventzke) for 1° C. difference of temperature produced by 1 gm. of levulose in 100 c.c. The percentage of levulose and the copper-reducing power being known, the percentage of dextrose can be calculated. Volumetric determinations by Soxhlet upon solutions of invert sugar have shown that, for the same volume of Fehling's solution reduced, 1 part of levulose corresponds to 0.924 part of dextrose. The author has found by Allihn's gravimetric method that 1 part of levulose is equal to 0.90 part of dextrose.



Starch.—The following process for removal of the reducing sugars, which is combined with the determination of the sugars, is the most expeditious:—100 grms. of the finely grated pulp are washed on a muslin filter with cold water, squeezing the muslin after each addition, until the filtrate amounts to 2 litres. Practically all the starch is then washed out of the pulp. After standing over-night in a tall cylinder, the starch is deposited in a compact mass; the liquid is then siphoned off, and used for the determinations of sugar and malic acid. The starch is transferred to a hardened filter paper and washed; it contains some cellular and albuminoid matter. The author then employed the method of hydrolysis by diastase. If the residue on the linen filter gives a reaction with iodine, the starch in it also should be determined by the diastase method.

The Marc is the portion of the fruit insoluble in water. The residue on the muslin filter is dried at 100° C. in a dish. The marc of apples consists of cellulose, lignin, and pentosans, with traces of ash and albuminoid matter. The cellulose is separated by the chlorination process of Cross and Bevan. The pentosans are best determined by distilling the dry marc with 12 per cent. hydrochloric acid, and precipitating the furfural in the distillate by phloroglucol. The lignin is then found by difference.

Pectins were determined by evaporating the fruit extract, juice, &c., to a small volume, precipitating with a large excess of 95 per cent. alcohol, allowing to stand over-night, collecting the precipitate in a Gooch crucible, and washing with alcohol. After drying at 100° C. to constant weight, the residue was burnt and the loss estimated as pectins.

—A. C. W.

Formaldehyde; Detection and Determination of Methyl Alcohol in —. Duyk. J. Pharm. Chim., 1902, 15, [2], 69—70.

AMMONIA is added, drop by drop, to 100 c.c. of the aldehyde diluted with 50 c.c. of water, the vessel being cooled. After standing several hours, the liquid should be alkaline to phenolphthalein; otherwise a few more drops of ammonia are added. Sodium carbonate is now added, to ensure the stability of the hexamethylenetetramine produced, and the liquid distilled. The 100 c.c. of distillate are neutralised with sulphuric acid and redistilled under a bulb tube. The fractions boiling between 65° and 100° C. are again distilled in such a manner that finally a fraction is produced containing about three-quarters of its volume of methyl alcohol. This fraction contains, as a rule, traces of the impurities of methyl alcohol—acetone, methyl formate and acetate—or of the substances used to denature it. The methyl alcohol is then converted into methyl iodide by allowing 5 c.c. to stand for some hours with 10 grms. of iodine and 2 grms. of red phosphorus, heating under an inverted condenser, and distilling, the methyl iodide being condensed in a receiver containing water, and its volume measured. It is unnecessary to apply corrections for the impurities which accompany the methyl alcohol; their quantity is small, and they compensate for the inevitable losses of methyl alcohol. By means of this process, commercial formaldehydes have been found to contain 3—10 per cent. of methyl alcohol.—A. C. W.

Methyl Anthranilate; Detection and Determination of —. E. Erdmann. Ber., 1902, 35, [1], 24—27.

WHEN methyl anthranilate is precipitated from essential oils by sulphuric acid (this Journal, 1901, 289, 1139), other bases are separated simultaneously. Since methyl anthranilate is the only primary base yet found in essential oils, the property of primary aromatic bases of forming azo dyestuffs may be utilised for its determination. For this purpose a soluble dyestuff, e.g., the compound with β -naphthol disulphonic acid R, may be used, and a colorimetric process adopted. If, however, more than fractions of a milligram of the ester are in question, it is preferable to bring the diazotised solution to a definite volume, and titrate with it an alkaline solution of β -naphthol. The end-point is then exactly obtained by using a diazo compound and naphthol solution as external indicators. The insoluble dyestuff is yellowish-red in colour.

An example is given: 0.3 gm. of methyl anthranilate was dissolved in benzyl acetate to 100 c.c.; 30 c.c. of this solution were diluted with 60 c.c. of ether, and shaken six times with quantities of 4 c.c. of hydrochloric acid (15 per cent.). The hydrochloric acid solution was diazotised, made up to 50 c.c., and titrated against 10 c.c. of 0.5 per cent. solution of β -naphthol, to which the necessary volume of strong soda solution had been added. Found: 0.08913 gm. of methyl anthranilate = 99 per cent. Even 0.3 c.c. of the same benzyl acetate solution (containing 0.0009 gm. of methyl anthranilate), when treated in a similar manner, gave a considerable precipitate.

The determination may be conducted in the presence of the ester of methylanthranilic acid (this Journal, 1900, 848). If nitrite solution be added slowly to the acid solution of the methyl esters of anthranilic and methylanthranilic acids, the primary base is first diazotised, then the solution suddenly becomes turbid, owing to the formation of nitroso-methylanthranilic acid methyl ester, which is, however, soluble in much water. Nitrite solution is added until nitrous acid is in excess, then the oily nitroso compound is extracted by ether, and the determination conducted as before.

An orange flower oil, described as "Essence de Neroli Pétales Bigarade," was found to contain 0.276 and 0.264 per cent. of methyl anthranilate in two experiments. In this case, the diazotised solution was extracted with ether to remove oily substances. A jasmine extract, of the consistency of soft wax, obtained by extraction with light petroleum spirit, was distilled with steam, the distillate (500 c.c. from 20 grms. of substance) four times extracted with quantities of 250 c.c. of ether, the ethereal solution evaporated to 25 c.c., and extracted by hydrochloric acid. 100 grms. of jasmine extract were found to contain 7.34 and 7.41 mgrms. of methyl anthranilate in two separate experiments.—A. C. W.

Digitoxin in Digitalis Leaves; Determination of —. W. Stoeder. Oesterr. Zeits. für Pharm., 39, [35], 386.

TWENTY grms. of the dried powdered leaves are treated with 200 c.c. of water, and heated on the water-bath in a tared flask for an hour, with frequent and thorough agitation. The mixture is cooled, made up to 220 grms., strained, pressed, and 150 grms. of the liquid (= 15 grms. of the leaves) filtered off. This filtrate is shaken out in a separator with 5 c.c. of ammonia, and 70 c.c. of chloroform, the mixture being well shaken together at intervals for two hours; 1 c.c. of the clear aqueous liquid is then withdrawn, shaken with 5 c.c. of ether, the ethereal layer withdrawn, evaporated, and the residue taken up with 2 c.c. of glacial acetic acid containing a trace of ferric chloride solution. A little of this solution floated over sulphuric acid should not show a reddish zone with a blue colour. 60 grms. of the chloroform extract (= 12 grms. of the leaves) are then taken and filtered, the filter and the containing flask being washed with a little chloroform. The chloroform is then distilled off, until about 2 c.c. of residue is left; when cool, this is treated with 10 c.c. of ether, filtered, the filter washed through with a little more ether, 50 c.c. of light petroleum spirit added to the filtrate and the mixture allowed to stand for 24 hours. The supernatant petroleum spirit is then decanted, the precipitated digitoxin washed with a further addition of 5 c.c. of petroleum spirit, the precipitate dried for half-an-hour at 100° C. and finally to constant weight in an exsiccator. This final weight should be between 0.0375 and 0.0525 gm. and the digitoxin should be of a bright yellow colour. 0.005 gm. of it should give the characteristic colour reaction when treated as above, with acetic acid, ferric chloride, and sulphuric acid.

—J. O. B.

Methozyl; Determination of —, in Substances containing Sulphur. F. Kaufer. Monatsh. für Chem., 1901, 22, [10], 1105—1108.

THE principle of this method consists in saponifying the compound by boiling potash and passing the alcohol vapour, after drying by means of ignited copper sulphate, into hydriodic acid, kept cool by a mixture of ice and salt; the methyl iodide can afterwards be distilled off and collected in



silver nitrate solution. In this way the formation of mercaptan in the hydriodic acid is avoided, since no hydrogen sulphide or sulphur dioxide can be evolved from the mixture of the compound and potash. The saponification vessel consists of a fractionating flask having a capacity of 15 c.c., and provided with an outlet tube which is bent at right angles and is connected with a U-tube charged with ignited copper-sulphate pumice; next comes a Winkler's absorption apparatus containing hydriodic acid and finally the Zeisel apparatus. In order to allow of a slow current of air being drawn through the apparatus, the methyl iodide is collected in a fractionating flask, the side tube of which passes into a smaller fractionating flask also filled with silver nitrate solution; the side tube of the latter flask is connected with the pump. The air passed through must be freed from acid by means of an alkali washing flask, and then dried by passing through concentrated sulphuric acid. The method is carried out as follows:—When a regular stream of air is passing through all parts of the apparatus, the substance, contained in a weighing tube, is introduced into the saponification flask together with 3 to 6 c.c. of caustic potash solution (sp. gr. 1.27). At the same time the Winkler apparatus containing hydriodic acid (sp. gr. 1.7) is cooled by means of a mixture of ice and salt, while the copper sulphate U-tube is placed in a beaker of water at 80°–90°. The saponification flask is slowly heated in an oil or glycerin bath so that gentle boiling takes place and this is continued until the contents of the flask becomes syrupy or solid. The heating bath is then removed and after the flask has cooled in the current of air, more alkali is added and distillation proceeded with as before. When this is complete, the cooling mixture is removed and the Winkler apparatus dried and left at the ordinary temperature for half an hour, after which the hydriodic acid is heated by immersing the lowest winding of the apparatus in an oil or glycerin bath and gradually raising the latter to 140°–150°; during the heating it is advisable to increase the flow of air. When all the methyl iodide has distilled over, the heating bath is allowed to cool and the silver iodide then separated and weighed. The hydriodic acid may be used several times in succession as it only undergoes slight dilution during each operation. Test experiments with potassium methyl sulphate, dimethyl sulphate, methyl benzenesulphonate, mono- and dimethyl sulphobenzoate gave good results. The method can be employed to differentiate between methyl groups of esters and of ethers.—T. H. P.

XXIV.—SCIENTIFIC & TECHNICAL NOTES.

Partially Miscible Liquids near the Critical Point.

J. Friedländer. *Zeits. Phys. Chem.*, 1901, **38**, 385–440.

Most of the experiments conducted by the author were with mixtures of isobutyric acid and water. With such mixtures, the temperatures at which the liquid becomes milky on cooling is usually 0.02° below that at which it becomes clear on warming, and the mean of these two temperatures is taken as the saturation point; this point can be determined within 0.01°–0.02°, provided that the composition of the mixture does not differ by more than 10 per cent. from the critical proportions. Solutions which have approximately the critical composition exhibit a bluish opalescence at temperatures up to 10° above the well-defined saturation-point, but, unlike a colophonium emulsion, this opalescence is not affected by time, and the volume, electrical conductivity, and internal friction of the liquid remain constant during a number of hours. The temperature coefficient of internal friction increases very greatly in the neighbourhood of the critical point, the maximum (34.3 per cent. per degree C.) being attained with a mixture of the critical composition within 0.15° of the critical temperature (25.8° C.). Similar observations were made with mixtures of phenol and water, and of benzene, water and acetic acid. Analogous results were also found for the opalescence, which increases greatly as the liquid approaches the critical mixture. The coefficient of expansion, conductivity, and refractive index of the solutions do not, however, show any marked variation when the critical state is approached, but change quite regularly and continuously.—A. S.

Catalytic Reactions; Mutual Influence of Two —, in the Same Medium. A. Coppadoro. *Gaz. chim. ital.*, **31**, [1], 425–450; *Chem. Centr.*, 1901, **2**, [6], 386.

THE author made a series of experiments in order to ascertain whether, if two catalytic reactions were proceeding in one and the same medium, these had any influence on one another. The experiments comprised the study, on the one hand, of the inversion of sugar by acid in a solution containing methyl acetate, and in one free from that substance, and, on the other hand, the hydrolysis of methyl acetate by acid in the presence and absence of sugar. The results show that with concentrated acid solutions, in both cases, the catalytic reactions are without influence on one another. In dilute solutions, the decomposition of methyl acetate is increased by the presence of sugar, but the author shows that this is due, not to a chemical action of the sugar on the acetate, but to the fact that the presence of sugar in solution diminishes the quantity of water, and so increases the concentration of the acid, and consequently the "reaction-constant." In dilute solutions, also, the inversion of sugar is diminished by the presence of methyl acetate, but this can be explained by the modification in the nature of the medium caused by the presence of the methyl acetate. The author concludes that *if two catalytic reactions proceed simultaneously in the same medium, they are without influence on one another.*—A. S.

Radio-Active Lead. F. Giesel. *Ber.*, **35**, [1], 102–105.

THE author describes his radio-active lead, and criticises the deductions of Hofmann and Strauss. From 2,000 kilos. of uranium mineral, he obtained active barium radium bromide, and from this, by separation with ammonia and sulphuretted hydrogen, he got three mgrms. of a radio-active substance which gave an effect equal to the best radium preparations, and which unexpectedly gives a strong emission of rays after a year. The spectrum of this substance, according to Demarçay, shows that it consists almost entirely of lead salt; there are two lines in the spectrum for which no explanation can be given (λ 3659.6 and λ 4116.8), and the radium spectrum is entirely absent. Demarçay suggests that the radio-activity is due to a hypothetical body having these two lines.

Debierne having shown that activity in barium can be induced artificially by actinium, the author supposes that the lead salts may have induced activity from the radium in the original preparations. He also distinguishes between radio-activity and phosphorescence, and states that radio-active substances emit Becquerel rays. Since his radio-lead has remained active for a year, he considers that he has some active substance present, while the radio-lead of Hofmann and Strauss loses its activity in some months. His preparation contains so little of any rare foreign matter as shown by spectrum analysis, that he thinks the preparation of Hofmann and Strauss could not be sufficiently pure for atomic weight estimation. For the varying results of the latter preparation, see this *Journal*, 1901, 290, 625. He also desires distinction to be made between radio-lead and radio-active lead (induced).—A. M.

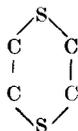
Chlorine; Preparation of [Laboratory] — by means of Permanganates. C. Graebe. *Ber.*, 1902, **35**, [1], 43–45.

THE author finds that the preparation of chlorine by means of a permanganate is most economical when solid potassium permanganate is made use of. The so-called commercial salt is, however, quite unsuitable for the purpose, as it only yields about 15–16 per cent. of the quantity of chlorine obtained from crystallised permanganate. The gas prepared in this way costs about double that obtained by using sodium chlorate, but it has the advantage of containing no admixed chlorine dioxide. The size of apparatus employed is the same for both methods, but when sodium chlorate is used, the salt is added gradually to the acid and is at once decomposed, so that the evolution of gas may be stopped immediately if required. With potassium permanganate, the apparatus previously described by the author is employed (see this

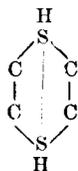
Journal, 1901, 473), the solid salt being placed in the flask and concentrated hydrochloric acid allowed to fall on it from a dropping funnel, the lower end of which is turned up in order to obtain a constant pressure of gas. Chlorine begins to come off in the cold, manganese dioxide separating and the liquid becoming warm; the flask must afterwards be heated to complete the evolution of gas. An excess of hydrochloric acid is necessary, suitable proportions being 10 mols. of acid to 1 mol. of the permanganate or 60—65 c.c. of acid of sp. gr. 1.17 to 10 grms. of the salt; using these quantities, 11.2 grms. of chlorine are obtained.—T. H. P.

Sulphur; Basic Properties of —. A. Edinger and J. B. Ekeley. Ber., 1902, 35, [1], 96—98.

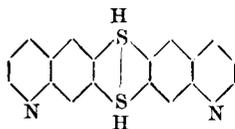
The authors have previously shown (Ber., 1900, 33, 3769) that the action of sulphur chloride on aromatic amines gives rise to certain chloro-products together with a series of bases which contain a sulphur-ring supposed to have the form—



It is, however, now found that the sulphur present exercises a basic function, as is shown by the following products of the action of moderately concentrated nitric acid on these compounds: Thioquinanthrene tetranitrate, $C_{18}H_{12}N_2S_2 \cdot 4HNO_3 \cdot 2H_2O$, and the tetranitrates of *p*-toluthioquinanthrene, and of the base yielded by *o*-toluquinone. The authors hence consider that the sulphur-ring is of the form—



the formula of thioquinanthrene then being—



This view is supported by the action of acetyl chloride on the bases, whereby the hydrochlorides of the corresponding acetylated bases are obtained; thus thioquinanthrene yields acetylthioquinanthrene hydrochloride, $C_{22}H_{16}O_2N_2S_2 \cdot 2HCl$. The acetyl group in such compounds is very loosely combined with the sulphur atom and is removed by gently heating with water. The bases form disulphates, that of thioquinanthrene having the composition, $C_{18}H_{12}N_2S_2 \cdot 2H_2SO_4$.—T. H. P.

Higher Hydroperoxides; Existence of —. A. Bach. Ber., 1902, 35, [1], 158—160.

The author points out that Ramsay's criticisms (this Journal, 1901, 1254), of the author's work on this subject (this Journal, 1900, 863), are based on a misunderstanding. In answer to Armstrong's criticisms (Proc. Chem. Soc., 1900, 16, 134), the author brings forward fresh experimental evidence, showing that mixtures of hydrogen peroxide solution with ordinary sulphuric or acetic acid give, on titration with permanganate, the theoretical quantities of oxygen. Hence the action of ordinary sulphuric acid on hydrogen peroxide gives rise to no compound ("persulphuric acid") which does not react with permanganate. The author concludes that the excess of oxygen found by him in the analysis of a peroxide solution prepared from

potassium tetroxide and ordinary sulphuric acid could not be due to the catalytic decomposition of a substance not acted on by permanganate.—T. H. P.

Sodium Hydride; Preparation and Properties of —. H. Moissan. Comptes Rend., 134, [2], 71—75.

SODIUM hydride, NaH, is obtained by heating sodium in carefully purified hydrogen at 360°—400° C. Transparent colourless crystals, soluble in melted sodium, attacked rapidly, even with incandescence, by the moisture in ordinary air, taking fire in oxygen at 230° C., in fluorine or chlorine at the ordinary temperature, decomposed explosively when [heated with oxidisers such as potassium chlorate, or when projected into strong mineral acids. Heated *in vacuo*, it is resolved into its elements below the temperature at which metallic sodium attacks glass.—J. T. D.

Potassium Hydride. H. Moissan. Comptes Rend., 134, [1], 18—21.

WHEN hydrogen is passed over potassium at 160° C., there is formed a hydride, KH. The substance is white, crystalline, rapidly decomposed by water, takes fire at the ordinary temperature in fluorine, chlorine, or dry oxygen, possesses extremely strong reducing powers, and is very similar, both in appearance and in properties, to calcium hydride.

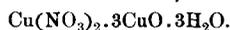
—J. T. D.

Strontium Hydride; Preparation and Properties of —. H. Gautier. Comptes Rend., 134, [2], 100—103.

By carefully heating the strontium-cadmium alloy (this Journal 1902, 121) in an atmosphere of pure dry hydrogen at a low red heat, maintaining a lower temperature in the part of the apparatus not containing the alloy, the whole of the cadmium is gradually expelled, and strontium hydride, SrH_2 formed. If the temperature be now raised till the hydride just fuses, it is rendered more compact and less easily alterable. The hydride is a white solid, which decomposes water with remarkable vigour, and is in all its properties similar to calcium hydride.—J. T. D.

Cupric Hydroxide; Action of —, on Aqueous Solutions of Metallic Salts. A. Mailhe. Comptes Rend., 134, [4], 233—236.

THE author has extended his work (this Journal, 1901, 943; 1902, 173) to solutions of metallic nitrates. Mixed basic salts of the formula $M(NO_3)_2 \cdot 3CuO \cdot 3H_2O$, were formed with zinc, cobalt, and nickel, all in green hexagonal plates isomorphous with the basic cupric nitrate—



A similar salt was obtained with manganese, but only in very small amount and with great difficulty. Cadmium gave a salt of the formula $Cd(NO_3)_2 \cdot CuO \cdot 5H_2O$; lead and mercury formed basic lead and mercuric nitrates respectively, while iron and aluminium were completely displaced from their nitrates.—J. T. D.

Alumina and Ferric Oxide at Incipient White Heat; Mutual Action of —. H. Warth. Chem. News, 1901, 84, [2196], 305.

IN the course of an examination of gibbsite ($Al_2O_3 \cdot 3H_2O$) from the Madras Presidency, possessing a pale reddish colour due to ferric oxide, the author observed that the mineral turned perfectly white when heated over the blowpipe flame. From further experiments with precipitated alumina and ferric oxide, it was found that even with as much as 7 per cent. of Fe_2O_3 in the mixed oxides, complete decoloration ensued on heating over the blowpipe flame, but beyond this proportion, there was a slowly increasing brown tint, which was well pronounced with 18 per cent. of Fe_2O_3 ; the brownish tint continued up to 34 per cent. of Fe_2O_3 , without any admixture of red. The absence of ferrous oxide and of magnetic oxide (Fe_3O_4) in the mixture, after heating over the blowpipe flame, was proved. It is worthy of note that whilst ferric oxide by itself has, at the temperature of the blowpipe flame, a decided tendency to change into magnetic oxide (Fe_3O_4), this tendency is checked by the presence of alumina. On the other hand, a mixture of alumina, with 6.8 per cent. of finely-pulverised magnetic



oxide, after careful ignition, also acquired a brown tint, and a test showed that the iron had been completely converted into ferric oxide.—A. S.

Potassium Cyanide and Cuprous Sulphocyanide; Interaction of—H. Itzig. Ber., 35, [1], 106—110.

The author is engaged on the preparation of complex anions with a view to examining their stability. Several double cyanides of potassium and copper have been described, which the author groups under three classes; i. $KCy, Cu_2Cy_2 + H_2O$; ii. $2KCy, Cu_2Cy_2$, and iii. $6KCy, Cu_2Cy_2$. A double sulphocyanide, $CuCNS, 12KCNS$, is known, which is only stable in concentrated solution.

By boiling cuprous sulphocyanide with potassium cyanide solution, and filtering, the compound $KCy, Cu_2Cy_2 + H_2O$ was unexpectedly obtained. It cannot be produced by direct action of potassium and cuprous cyanides. By concentrating the filtrate, substances represented by $2KCy, Cu_2Cy_2$, and $Cu_2Cy_2, 4KCN, 2KCNS + H_2O$ were obtained. The first two agree with the above compounds i. and ii. got by other means, and the last resembles iii. with $2KCNS$ replacing $2KCN$. It is very soluble in water, and gives peculiar reactions with $CuSO_4$ and $HgCl_2$ which point to the presence of a hitherto unknown anion.

Mercury Sulphocyanide-cyanide.—The compound, $Hg(CN)_2, KCNS$, has been described as produced by mixing solutions of mercuric cyanide and potassium sulphocyanide. This, like the above-mentioned double cyanides, gives reactions indicative of complex ions. By boiling mixtures of 1 mol. of mercuric sulphocyanide with 1 mol. and with 2 mols. of potassium cyanide, only the already mentioned $Hg(CN)_2, KCNS$ was obtained.—A. M.

Organo-Magnesium Compounds; Action of—, on Trioxymethylene. V. Grignard and L. Tissier. Comptes Rend., 134, [2], 107—108.

The ethereal solution of magnesium alkyl-bromide is boiled under a reflux condenser with trioxymethylene for one or two days; part of the ether is distilled off, and the boiling again continued for an hour or two. After cooling, the magma obtained is decomposed by ice, the precipitated magnesia dissolved in dilute sulphuric acid, and the alcohol formed is extracted and purified in the usual way. By this means, using, for example, magnesium ethyl bromide, normal propyl alcohol is obtained. The authors have thus prepared (with excellent yields in every case) normal propyl and butyl alcohols, isohexyl alcohol, benzyl alcohol, and α -naphthyl carbinol. The method promises to be very useful for the preparation of homologous alcohols and their derivatives.—J. T. D.

Melibiose. A. Bau. Chem. Zeit., 26, [7], 69—70.

(See also this Journal, 1899, 932.)

Rotatory Power of Crystalline Melibiose.—The rotatory power was determined in a solution after being previously boiled, and the amount of solvent ascertained after cooling. The mean of the results obtained gives the value $[\alpha]_D = +129.641$, equivalent to $+143.27$ for anhydrous melibiose.

Identification.—Melibiose furnishes a pure phenyl-osazone, in the form of yellow flakes when fresh, but deep brown when dry; (m. pt. 178° — 179° C.). The colour, though darker than that of lactosazone, is not, however, a reliable criterion. From water, the osazone recrystallises as fine needles 9 — 17μ in length, and 1 — $1\frac{1}{2} \mu$ in breadth, often slightly bent, and occurring in warty aggregations.

Behaviour towards yeast is a reliable means of identification. Before performing the experiment, it is necessary to ascertain the behaviour towards melibiose of the top- and bottom-fermentation yeasts employed; should the former, when added to a solution of melibiose or melitriose, give, after fermentation, a strong reduction of cuprous oxide on being tested with Fehling's solution, whereas the bottom-fermentation does not give any red precipitate under similar conditions, then both yeasts are suitable for the main test.

The substance suspected to contain melibiose must be free from constituents capable of restricting fermentation, in which event the presence of melibiose will be revealed by the results coinciding with those of the above preliminary test. Should, however, dextrins, galactose, pentoses, &c.

be present, a quantitative analysis will be necessary. Such sugars as *d*-glucose, *d*-fructose, *d*-mannose, *d*-galactose, saccharose and maltose, can readily be eliminated by fermentation with a pure culture of top-fermentation yeast.

—C. S.

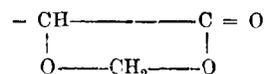
Hydroxy Acids; New Class of Aldehyde Derivatives of the—, especially Formal or Methylene Derivatives.

C. A. Lobry de Bruyn and W. A. van Ekenstein. Rec. trav. Chim. Pays Bas, 1901, 20, 331; through Zeits. Vereins deut. Zuckerind., 1901, [551], 1021—1030.

TOLLENS and his collaborators have recently described a new series of compounds containing a methylene group, obtained by the condensing action of strong mineral acids upon mixtures of formaldehyde and polyhydroxy organic acids.

The authors have now prepared a somewhat similar class of bodies from hydroxy organic acids generally, by effecting the condensation in simple aqueous solution or better under anhydrous conditions in chloroform solution, the presence of mineral acids being most di-advantageous.

The difference between the compounds prepared by Tollens and those now described lies in the fact that in the former the carboxyl group remains unaltered, whilst in the latter it enters into the reaction together with the neighbouring alcoholic hydroxyl. The new compounds are characterised by the grouping:



They are formed by evaporating a mixture of organic acid and formalin to dryness 10 or 12 times, or else by heating an excess of dry, powdered trioxymethylene with the acid and chloroform (with or without anhydrous sodium sulphate) in sealed tubes at 150° C., whereby the trioxymethylene is depolymerised. The reaction being reversible, the yields are small and the products are decomposed by prolonged heating with water and especially with alcohol; they are also resolved by heating to boiling with dilute caustic soda. The di-methylene derivative of α -tartaric acid, which is a neutral body, is fully described, the mono-derivative of citric acid is dibasic, and that of malic acid is mono-basic. The derivatives of many other hydroxy acids have been prepared in small quantities. Acetic and benzoic aldehydes react with hydroxy acids without a condensing agent to give similar compounds, which readily decompose.

—J. F. B.

Pseudophenols from Salicylaldehyde and Salicylic Acid.

K. Auwers and L. Huber. Ber., 1902, 35, [1], 124—131.

By treating salicylaldehyde or salicylic acid with formaldehyde or its derivatives and strong halogen hydrides, compounds having the formula $1.2.4. C_6H_3.OH.CHO.CH_2X$ and $1.2.4. C_6H_3.OH.CO_2H.CH_2X$ are obtained, where X = halogen (see also Eng. Pat. 17,118 of 1899; this Journal, 1900, 848). These compounds readily exchange their halogen, sometimes even in the cold, for the radicles of alcohol, water, organic acids and bases, giving products which, unlike the original compounds, are soluble in and are not attacked by aqueous lyes. The chloride, $C_6H_3.OH.CHO.CH_2Cl$ melts at 88° C., the corresponding bromide at 103° C., and the iodide, according to the authors, at 126° C. On boiling with water, or preferably on treatment with a mixture of acetone and water (3 : 1), these compounds are converted into hydroxymethylsalicylaldehyde, $C_6H_3(OH)CHO.CH_2OH$, melting at 108° C. The yellow alkaline or the colourless aqueous solution dyes the skin an intense yellow. The product gives an oxime, $C_6H_3O_3N$, melting at 121° C., whilst the monacetate, $C_6H_3.OH.CHO.CH_2OC_2H_5O$, obtained by boiling one of the above halogen derivatives with sodium acetate in acetic acid solution, forms shining needles melting at 61° — 62° C. The oxime of this product crystallises in needles melting at 134° C. Both oximes yield the diacetate of the nitrile of hydroxymethylsalicylic acid, $C_6H_3.OC_2H_5O.CN.CH_2OC_2H_5O$, melting at 58° C., but it was not possible by hydrolysis with hydrobromic acid to obtain the product $C_6H_3.OH.CN.CH_2Br$. By reacting with the equivalent quantity of bromine on the acetate mentioned above, melting at 62° C., dissolved in glacial acetic acid, and finally passing

hydrobromic acid into the hot solution, bromomethyl-bromosalicylaldehyde, $1.2.6.4. C_6H_2.OH.CHO.Br.CH_2Br$, separates on cooling. The product crystallises in shining needles from benzene and melts at $113^\circ C$. On boiling with aqueous acetone, hydroxymethylbromosalicylaldehyde is formed, which melts at $85^\circ C$. Its aqueous solution colours the skin yellow. When treated with sodium acetate it yields the monacetate melting at $102^\circ C$., which, like the acetate above (m. pt. $62^\circ C$.), behaves as a true phenol, being soluble in dilute caustic soda lye, from which solution it can be precipitated at once unchanged.

By evaporating a methyl alcoholic solution of chloromethylsalicylic acid, $C_6H_3.OH.CO_2H.CH_2Cl$, melting at $163^\circ C$., the latter is converted into methoxymethylsalicylic acid melting at $119^\circ C$. When hydrochloric acid gas is passed through the methyl alcoholic solution of this product, it reforms chloromethylsalicylic acid melting at $163^\circ C$. If this compound be digested for some hours with 10 times its weight of methyl alcohol containing 3—4 per cent. of hydrochloric acid, it yields methoxymethylsalicylic methyl ester, $C_6H_3.OH.CO_2CH_3.CH_2OCH_3$, which is a yellowish oil soluble in alkalis. When dissolved in methyl alcohol and treated in the cold with gaseous hydrochloric acid, it yields chloromethylsalicylic methyl ester, which crystallises from light petroleum spirit in white needles melting at $66^\circ C$. As a pseudophenol the compound is insoluble in alkalis and is readily decomposed by alcohols. By treatment with ammonia it is converted into the amide of methoxymethylsalicylic acid, $C_6H_3.OH.CONH_2.CH_2OCH_3$, melting at $108^\circ C$., but it has not been hitherto possible to convert this compound into chloromethyl-*o*-cyanophenol, $C_6H_3.OH.CN.CH_2Cl$.—T. A. L.

Amines, Aromatic; Thiosulphates of — A. Wahl.
Comptes Rend., 1901, 133, [26], 1215—1217.

WHEN a solution of sodium thiosulphate is added to solutions of the hydrochlorides of primary amines (aniline, *o*-, *m*-, and *p*-toluidine, α - and β -naphthylamine), normal thiosulphates, $(NH_2R)_2$, $H_2S_2O_3$, crystallise out. Secondary and tertiary amines do not form similar salts, but sulphur deposits, sulphur dioxide escapes, and after a while the free base separates out. Such a base as paraphenylenediamine also forms a thiosulphate. These thiosulphates are as a rule well crystallised and stable salts; their aqueous solutions are acid in reaction, and decompose when heated. The solid salts also decompose when heated, but at a higher temperature than the solutions, yielding sulphur, sulphur dioxide, and free base.

With nitrosodimethylaniline hydrochloride, no thiosulphate is formed, but the free base is precipitated, and at the same time dimethylparaphenylenediaminethiosulphonic acid is obtained, identical with that obtained by Berntsen by oxidising a mixture of dimethylparaphenylenediamine and sodium thiosulphate. The yield of this acid only accounts for 12—15 per cent. of the nitrosodimethylaniline which disappears; the other products of the reaction have not yet been investigated.—J. T. D.

Lactic Acid and Glycerin; Assimilation of —, by *Eurotyopsis Gayoni*. P. Mazé. Comptes Rend., 134, [4], 240—242.

EXPERIMENTS on the growth of *Eurotyopsis* when fed with lactic acid or with glycerin, both in a confined atmosphere and with free access of air, shew that a given weight of the plant consumes more lactic acid than it does glycerin or invert sugar; but the ultimate composition of the plant is the same, no matter which of these three substances be its food. From the presence of traces of acetaldehyde when lactic acid is used, as also from the ratio of carbon dioxide produced to oxygen absorbed, the author concludes that the portion of the lactic acid molecule actually assimilated is alcohol, which is perhaps previously oxidised to aldehyde. The assimilation of glycerin takes place in a manner akin to that of sugar, though there is more oxygen absorbed for a given weight of plant produced than with sugar. Probably the glycerin, like mannitol, loses in the first place two atoms of hydrogen by oxidation.—J. T. D.

OPENING OF THE SIR JOHN CASS TECHNICAL INSTITUTE, ALDGATE.

THE work of this Institute, which has been established and endowed by the governors of the Sir John Cass Foundation, was inaugurated on Wednesday, January 15th. The founding of this new technical Institute has been effected by means of property bequeathed by Sir John Cass, for the purpose of providing education for the children and young persons of the ward of Portsoken, of the City of London, over which he presided as alderman from 1710 to the day of his death, 8th July 1718. Owing to the increased revenues of the foundation, the Charity Commissioners prepared a new scheme for the administration of the funds, which included provision for the establishment and maintenance of a technical institute. The scheme was approved by Her late Majesty, Queen Victoria, in Council in 1895. The Institute, which has been built from the designs of Mr. Arthur W. Cooksey, is situated in Jewry-street, Aldgate, and is one of the polytechnics aided by the Technical Education Board of the London County Council and by the City Parochial Foundation. The building comprises laboratories, workshops and class-rooms for chemistry, metallurgy, physics, art metal work, drawing, design and modelling; also well-equipped rooms for cookery, laundry-work, and dressmaking. It contains, in addition, a valuable library of technical literature and a reading room, a large gymnasium and social rooms.

The inaugural address was delivered by Sir W. Roberts-Austen, K.C.B., F.R.S. The chair was taken by Sir Owen Roberts, M.A., D.C.L., vice-chairman of the governing body of the Institute. After referring to the scheme of the work set forth in the syllabus of the Institute, Sir W. Roberts-Austen proceeded to the more immediate subject of his address, "Metallurgy." It was, he said, an industrial art depending for its success on what were called the applications of science. He heartily wished that the term "applied science" had never been devised. All his life he had endeavoured to show that there was no essential difference between what was called pure and what was called applied science. In industrial life they simply applied the facts of science to a particular set of conditions or to the solution of a definite set of problems. The man who made a patient and accurate observation in the course of industrial work was just as much advancing science as the one who devoted himself to the solution of problems which seemed to have no immediate bearing on practical efforts or to be in any way practically useful. In concluding his address, Sir William referred to the valuable work that the governors of the foundation had effected by the establishment and equipment of the Institute. The chairman of the governing body, Mr. Alfred Lyon, and the chairman of the Institute Committee, Mr. George Baker, thanked Sir W. Roberts-Austen for his address.

Trade Report.

I.—GENERAL.

PATENT LAW AMENDMENT BILL.

Times, Feb. 11, 1902.

MR. GERALD BALFOUR (Leeds, Central), in moving for leave to introduce a Bill to amend the law with reference to applications for patents and compulsory licences, and other matters connected therewith, said the Bill was based on the recommendations of a committee appointed by the Board of Trade, in 1900, to inquire into the working of the Patent Act respecting certain specific questions. One of these was the question of examining the specifications of letters patent previously granted in the United Kingdom. The other was that of granting compulsory licences. He did not think that it was necessary for him at this stage of the proceedings to explain or justify the provisions of the measure further than to say that they followed very closely the recommendations of the committee, which were unusually detailed, and that those he was asking leave to introduce were a translation in the language of an Act of Parliament. He was aware that the public were of opinion that the committee



were not absolutely unanimous with respect to the recommendations, but he had followed closely the lines of them. It would be well to allow a considerable interval to elapse between the first and second reading of the Bill, in order to give those interested in the question an opportunity of studying the provisions. He would undertake on his part to consider most carefully and with an open mind any considerations that might be made to him.

Mr. Lewis (Flint Boroughs) said he was glad to hear that the right hon. gentleman proposed to follow the recommendations of the Select Committee, and to allow a considerable interval between the first and second reading stages. There could be no doubt that our patent law at the present time was in great need of amendment.

The Bill was brought up and read a first time.

The following is the text of the Bill :—

A Bill to amend the Law with reference to Applications for Patents and Compulsory Licences, and other matters connected therewith.

Be it enacted by the King's most Excellent Majesty, by and with the advice and consent of the Lords Spiritual and Temporal, and Commons, in this present Parliament assembled, and by the authority of the same, as follows :—

1.—(1.) Where an application for a patent has been made and a complete specification has been deposited by the applicant, the examiner shall, in addition to the inquiries which he is directed to make by the Patents, Designs, and Trade Marks Act, 1883 (in this Act referred to as the principal Act), make a further investigation, for the purpose of ascertaining whether the invention claimed has been wholly or in part claimed or described in any specification (other than a provisional specification not followed by a complete specification) published before the date of the application, and deposited in the Patent Office pursuant to any application for a patent made within *fifty years* next before the date of the application.

(2.) If on investigation it appears that the invention has been wholly or in part claimed or described by any such specification, the applicant shall be informed thereof, and the applicant may, within such time as may be prescribed, file an amended specification, and the amended specification shall be investigated in like manner as the original specification.

(3.) The examiner shall report to the comptroller the result of his investigations in such manner as the Board of Trade may direct.

(4.) The provisions of subsection five of section nine of the principal Act, as amended by any subsequent enactment, shall apply to reports under this section.

(5.) If the comptroller is satisfied that no objection exists to the specification on the ground that the invention claimed thereby has been wholly or in part claimed by a previous specification as before mentioned, he shall, in the absence of any other lawful ground of objection, accept the specification.

(6.) If the comptroller is not so satisfied, he shall, after hearing the applicant, and unless the objection be removed by amending the specification to the satisfaction of the comptroller, determine whether a reference to any, and, if so, what, prior specifications ought to be made in the specification by way of notice to the public.

(7.) An appeal shall lie from the decision of the comptroller under this section to the law officer.

(8.) Section eight of the principal Act and section three of the Patents, Designs, and Trade Marks (Amendment) Act, 1885 (which regulate the time for depositing a complete specification), shall have effect as if references therein to the period of nine months were references to the period of *six months*.

(9.) The investigations and reports required by this section shall not be held in any way to guarantee the validity of any patent, and no liability shall be incurred by the Board of Trade or any officer thereof by reason of, or in connexion with, any such investigation or report, or any proceeding consequent thereon.

(10.) An invention shall not be deemed to have been anticipated by reason only of its publication in a specification deposited in the Patent Office pursuant to an application made not less than *fifty years* before the date of the application for a patent therefor, or of its publication in a provisional specification of any date not followed by a complete specification.

(11.) The Board of Trade, with the sanction of the Treasury, may prescribe an additional fee not exceeding *one pound* in respect of the investigation mentioned in this section, which shall be payable on the sealing of the patent.

(12.) This section shall come into operation at such date as the Board of Trade may by order direct, and shall apply only to applications made after that date.

2. Section twenty-two of the principal Act (relating to the grant of compulsory licences by the Board of Trade) is hereby repealed, and the following provisions shall be substituted therefor :—

(1.) If, on the application of any person interested, it is proved to the satisfaction of the court that the reasonable requirements of the public with reference to the invention have not been satisfied by reason of the neglect or refusal of the patentee to work the patent or grant licences on reasonable terms, the court may order the patentee to grant licences on such terms as to the duration of the licence, the amount of royalties, security for payment, or otherwise, as the court, having regard to the nature of the invention and the circumstances of the case, may deem just.

(2.) On the hearing of any application under this section, the patentee, and any person claiming an interest in the patent as exclusive licensee or otherwise, shall be made parties to the proceeding, and the law officer, or such other counsel as he may appoint, shall be entitled to appear and be heard.

(3.) In any proceeding under this section the court may, if it thinks fit, and shall, on the request of any party to the proceeding, call in the aid of an assessor specially qualified, and try and hear the case wholly or partially with his assistance.

(4.) An order of the court under this section shall, without prejudice to any other method of enforcement, operate as if it were embodied in a deed made between the parties to the proceeding.

(5.) In awarding costs under this section, the court shall have regard to any previous request for, or offer of, a licence made either before or after the application to the court.

(6.) An appeal shall lie from the order of the court to the Court of Appeal; but, except by leave of the Court of Appeal, no appeal shall lie to the House of Lords from any order made by the Court of Appeal.

(7.) If an order granting a licence is subsequently reversed or varied on appeal, the appellate court may impose such terms as they may think just with respect to the validation of things done, and the disposal by sale or otherwise of articles manufactured, under the licence before the order granting it was reversed or varied.

(8.) Subject to the provisions of this section, all matters of practice and procedure in relation to the grant of compulsory licences shall be regulated by rules of court.

(9.) This section shall apply to patents granted before as well as after the commencement of this Act.

(10.) In the application of this section to Scotland, "law officer" means the Lord Advocate, and in the application of this section to Ireland, "law officer" means the Attorney-General or Solicitor-General for Ireland.

3. In subsection four of section eighty-two of the principal Act (which relates to the performance of the duties of the comptroller by other officers under the direction of the Board of Trade) the words "in his absence" shall be repealed.

4.—(1.) This Act may be cited as the Patents Act, 1902, and may be cited and shall be construed as one with the Patents, Designs, and Trade Marks Acts, 1883 to 1901.

(2.) It shall, except as otherwise provided therein, come into operation on the first day of January one thousand nine hundred and three.

(See also this Journal, 1902, 212.)



IMPORTS FROM FOREIGN COUNTRIES AND BRITISH POSSESSIONS.

Bd. of Trade J., Feb. 13, 1902.

	Month ended 31st January	
	1901.	1902.
	£	£
I.—Animals, living (for food).....	697,419	649,882
*II.—(a) Articles of food and drink, duty-free.	13,843,506	14,889,213
*(b) Articles of food and drink, dutiable.	4,084,853	5,383,665
Tobacco, dutiable.....	402,322	399,783
III.—Metals.....	2,355,315	2,600,354
IV.—Chemicals, dyestuffs, and tanning substances.	491,300	525,509
V.—Oils.....	972,291	1,111,860
VI.—Raw materials for textile manufactures.	9,218,659	10,892,272
VII.—Raw materials for sundry industries and manufactures.	4,073,790	3,872,232
VIII.—Manufactured articles.....	7,824,748	7,745,243
IX.—(a) Miscellaneous articles ...	1,435,851	1,958,030
(b) Parcel Post.....	87,462	94,306
Total value.....	45,987,516	50,131,348

* Sugar and cognate articles became liable to duties on the 19th April, 1901, and are included in Section II. (B.) throughout the present Return.

NOTE.—The values of the imports represent the cost, insurance, and freight. Those of the exports, the cost and shipping charges, and are known as the "free on board" values.

EXPORTS OF BRITISH AND IRISH PRODUCE AND MANUFACTURES.

Bd. of Trade J., Feb. 13, 1902.

	Month ended 31st January	
	1901.	1902.
	£	£
I.—Animals, living.....	40,940	47,119
II.—Articles of food and drink.....	1,018,525	1,232,048
III.—Raw materials.....	2,877,086	2,392,912
IV.—Articles manufactured and partly manufactured, viz. :—		
(a) Yarns and textile fabrics ..	9,943,086	9,779,079
(b) Metals and articles manufactured therefrom (except machinery and ships).	3,622,553	3,589,009
(c) Machinery and mill work ..	1,458,458	1,419,341
(d) Ships, new (not registered as British).	449,667	584,240
(e) Apparel and articles of personal use.	1,103,788	1,046,532
(f) Chemicals and chemical and medicinal preparations.	852,450	756,377
(g) All other articles, either manufactured or partly manufactured.	3,092,136	3,118,757
(h) Parcel Post.....	294,842	289,160
Total value.....	24,753,531	24,254,574

EXPORTS OF BOLIVIA THROUGH ANTOFAGASTA (CHILE), DURING 1900.

Foreign Office Annual Series, No. 2736.

Products.	Quantity (approximate).	Value (approximate).
		£
Antimony.....	Tons 302	22,569
Copper bars (small).....	" 60	3,659
Tin bars (small).....	" 8,721	195,371
" Bismuth of silver".....	" 31	6,165
Borate of lime.....	" 1,491	11,138
Cascarilla (Peruvian bark) ..	" 2½	315
Copper bars.....	" 4	476
Goat skins.....	" 50	1,887
Chinchilla skins.....	Dozen 41,849	84,744
Kid skins.....	Tons 3½	167

EXPORTS OF BOLIVIA, &c.—continued.

Products.	Quantity (approximate).	Value (approximate).
		£
Hides.....	Tons 239	12,507
Copper ingots.....	" 3,875	106,880
Tin bars.....	" 1,568	97,916
Gum.....	" 2½	520
Wolfram metal.....	" 2	120
Alloy minerals.....	" 13½	2,780
Antimony minerals.....	" 877	45,510
Copper minerals.....	" 882	13,182
" and silver minerals...	" 5	94
Tin minerals.....	" 78	370
Silver minerals.....	" 23,340	1,742,738
Wolfram minerals.....	" 125	7,153
Silver and lead minerals.....	" 102	1,558
Gold minerals.....	" 1	150
Zinc minerals.....	" 106	8,077
Gold bars.....	Troy oz. 93½	399
Silver bars.....	" 93,680	11,244
Gold bearing lead bars.....	Tons 4,731	72,110
Lead bars.....	" 179	2,733
Sulphide of silver.....	" 102	124,722
Cinchona.....	" 62	4,665

IMPORTS AND EXPORTS OF FRANCE (1899—1900).

Foreign Office Annual Series, No. 2737.

Return showing the Principal Articles of Import from the United Kingdom (including Malta and Gibraltar) during the Years 1899—1900.

Articles.	Value.	
	1899.	1900.
	£	£
Chemicals and chemical manures.	983,358	926,920
Copper and copper ore.....	657,801	291,720
Skins, dressed.....	506,351	647,200
India-rubber goods.....	350,762	403,300
Pottery, glass and crystal wares..	342,200	342,800
Rubber.....	307,416	345,500
Coal tar.....	258,219	319,480
Raw hides and peltries.....	241,121	357,520
Leather goods and dressed peltries	235,097	111,440

Statement showing Value of Exports from France to the United Kingdom (including Malta and Gibraltar) during the Years 1899—1900.

Articles.	Value.	
	1899.	1900.
	£	£
Brandy, spirits, and liqueurs.....	938,009	959,000
Raw hides and peltries.....	896,001	736,520
Sugar, refined.....	760,439	1,112,800
Pottery, glass, and crystal.....	718,774	782,320
Oils, essential.....	185,118	225,640
" others.....	183,804	128,520
Caoutchouc, gutta-percha.....	170,079	326,270
" manufactures of.....	139,198	103,840
Margarine.....	104,696	84,960
Perfumery.....	103,323	130,040
Sugar, raw.....	2,196,730	3,868,440
Dressed skins.....	2,138,712	1,847,120
Chemicals.....	538,946	515,000
Copper and copper ore.....	1,145,812	1,195,000
Leather goods and dressed peltries	1,548,028	1,847,120
Rags.....	373,726	368,200

IMPORTS AND EXPORTS OF CHILE.

Foreign Office Annual Series, No. 2736.

The greatest increases in imports, during 1900, occurred in brown sugar, tallow, empty bottles, glassware, drugs, stearin and matches.



The manufacture of stearin candles seems to be definitely established; an increase in the import of stearin amounted to 364 per cent., corresponding with a decrease of 63 per cent. in the import of candles.

The main increase occurred in the export of nitrate, which totalled 109,945,156 pesos (about 8,245,886*l.*), an increase, over 1899, of 13,294,874 pesos (about 997,115*l.*).

Copper bars showed an increased export of 2,970,927 pesos (about 222,819*l.*), the total shipments amounting to 17,899,200 pesos (about 1,342,440*l.*).

Other increases occurred in wax, auriferous copper bars, copper ingots, guano and trefoil seed.

Of the British exports, over 91,000,000 pesos represented nitrate, copper and copper ores, guano, borate of lime, and quillai bark being also important.

IV.—COLOURING MATTERS, Etc.

NATURAL INDIGO IN INDIA.

Manchester Guardian, Jan. 7, 1902.

Fuller particulars are now available of the controversy that has been raging in Calcutta, between indigo planters and buyers, as to what, under present conditions, is the market value of new-crop indigo. Until a few years ago, the extent of the crop, outstanding stocks, and the volume of the demand were the controlling elements. As a general rule, a small crop meant higher prices for the planters, and a large crop, the contrary. When the ordinary trade demand was satisfied, and the estimated requirements covered, enterprising houses were ready to take the residue, and hold for an advance, which always came, sooner or later. Upon occasion, efforts were made to corner the article, and large buyers acting in unison so far monopolised stocks, as to practically control prices for the time being. In those remote times, values of good medium qualities of indigo fluctuated violently between 3*s.* and 6*s.* to 7*s.* per lb., but recently the range has contracted to 2*s.* 6*d.* to 4*s.*, anything above the latter figure being now looked upon as extreme.

To-day artificial indigo practically dominates the Calcutta market. The planters have struggled hard, but vainly, to get higher prices than last season's average for their produce. Buyers have made out an unanswerable case for not meeting planters' desires, pointing out that, if the new Calcutta crop were wholly held over, existing stocks, supplies from other sources, and artificial products would in themselves more than suffice to meet the world's requirements, as shown by the following figures:—

	Chests.
Estimated stocks, England, Continent, and America, January 1, 1902	9,000
Madras crop	15,000
Central America	5,000
Java	5,300
Estimated total supply of natural indigo, excluding Calcutta crop	34,000
Estimated production of artificial indigo 1902 (say equal)	16,000
Total prospective supply, excluding Calcutta crop ..	50,000
Estimated world's annual consumption	40,000

If to this is added, say, 28,000 chests for the Calcutta crop, the strength of the buyers' position, as compared with the sellers', is obvious. The planters are now accepting readily last season's average rates, which are rather below London July values.

The gradual growth of the supplies of artificial indigo is shown by the following figures:—1898, equal to 2,760 chests; 1899, equal to 6,850; 1900, equal to 11,000; and 1901, equal to 14,000 chests. A somewhat remarkable fact accompanying this development has been that natural indigo in competition has fully held its own in price. This is accounted for, partly by a sequence of poor crops in 1896—1900, but, chiefly, by the preference still undoubtedly shown for the natural dye by most consumers.

VII.—ACIDS, ALKALIS, Etc.

NITRATE OF SODA STATISTICS FOR JANUARY, 1902.

W. Montgomery and Co., Feb. 3, 1902.

The deliveries in Europe, during January, amounted to 70,000 tons, against 55,000, in Jan. 1901. The shipments were cabled as only 69,000 tons, the loading still being interfered with by the strike at Iquique, which has now lasted for six weeks, without any prospect of termination.

The visible supply amounts to 617,000 tons, against 829,000 tons, on the same date last year. The shrinkage in the supply has produced a very firm market, the few available cargoes being eagerly competed for at 10*s.* 3*d.* to 10*s.* 4½*d.* per cwt.

POSITION OF THE GERMAN SODA INDUSTRY IN 1901.

R. Hasenclever. Chem. Ind., 25, [3], 73—75.

The proposed reduction of the import duty on soda is viewed with surprise and alarm by the German soda-makers. In the new tariff scheme, out of 144 chemical products, a reduction of duty is proposed only on five: graphite, crystallised, calcined, and caustic soda, and bleaching powder.

The following table shows the import duties in marks per 100 kilos. on the varieties of soda at different dates:—

	Crystals. Soda Content, 21.	Soda Ash. Soda Content, 57.	Caustic. Soda Content, 70.
1857	6'00	6'00	20'00
1865	1'50	4'00	6'00
1873	1'50	1'50	6'00
1880	1'50	2'50	4'00
Present proposals	0'90	1'50	3'50

The result of the reduction in 1873 (which is said to have been made to appease the papermakers, whose proposal that the export of rags should be prohibited was not approved by the Government) was that the production of soda went down from 58,000 to 42,500 tons. On the other hand, the increase of duty in 1880 greatly benefited the soda-makers, and cannot have been detrimental to the soda users, as the enormous development of German chemical industries since that date shows. The new proposals, if carried, will greatly injure the German alkali trade; for, while even in 1880, it was admitted on all hands (and this was the chief argument for the increased duty) that the German makers were heavily handicapped, as compared with the English makers, in the matters of original cost of raw materials, carriage, &c., there has since that time been no improvement in this respect, but rather the reverse. Coal, which for many years cost the Rhenania works on the average 7 marks per ton, now costs 13'60; and as the profits on State Railways form an important item in the Imperial revenue, and the Government refuse to establish a canal system, reductions in the cost of carriage are not to be looked for. The only well-situated ammonia-soda work is that of the German Solvay Co., in Bernburg, where, besides the brine, there are worked on the spot limestone and lignite; all the other works pay heavy freights on their materials, and this is still more the case with the Leblanc soda works, the raw materials of which weigh eight times as much as their products. Of 21 Leblanc soda works in existence 20 years ago, only five remain; the reduced tariff would inevitably cripple these. It would make Germany the most favourable foreign market for the English and American soda makers; the present tariff just prevents this, as the following table of tariffs (marks per 100 kilos.) shows:—

	Crystals.	Soda Ash.	Caustic.
France	1'54	3'30	5'25
Austria	1'60	2'40	6'00
Russia	11'00	11'00	18'00
Germany	1'50	2'50	4'00
United States	1'85	3'46	6'92

In the only European countries where there is no import duty, Holland and Belgium, the soda industry has died out, with the single exception of Solvay's original work at Couillet.

In 1879, the increased tariff proposals were opposed by the users of soda, who preached a free-trade doctrine; but the makers of dyestuffs did not oppose the higher tariff. Now, however, it would appear that the dyestuff makers have joined with the soap boilers in advocating the reduction. They have no foreign competition to speak of, and hence can afford to advocate a free-trade policy. It would seem that the present proposals are a compromise between the maintenance of the present duty and its total abolition; but the author hopes that the proposals may yet be negatived, and that the soda makers will not suffer for their faith in the permanence of the present duty, which has induced them to sink large capital in additions to works and improved plant.

The following table shows the progress of the industry for 30 years; it will be remembered that, as stated above, changes in the duty came into force in 1873 and 1880:—

Year.	Total Production.	Total.		Excess.	
		Import.	Export.	Import.	Export.
1872	58,000	13,335	2,003	11,330	..
1873	..	16,695	1,651	15,044	..
1874	..	23,276	1,648	20,628	..
1875	..	25,482	1,784	23,698	..
1876	..	27,664	4,067	23,597	..
1877	..	26,084	2,806	23,278	..
1878	42,500	25,101	3,353	21,748	..
1879	..	26,626	2,938	23,688	..
1880	..	22,150	3,615	18,535	..
1881	81,000	26,560	4,256	16,104	..
1882	..	19,823	4,597	15,226	..
1883	..	14,826	6,934	7,892	..
1884	..	10,726	14,630	..	3,904
1885	..	8,591	15,470	..	7,079
1886	135,000	4,469	15,408	..	10,939
1887	..	4,105	19,741	..	15,636
1888	..	3,293	21,096	..	17,803
1889	..	2,275	21,757	..	19,482
1890	..	1,531	30,233	..	28,702
1891	210,000	380	41,489	..	40,609
1892	..	932	42,425	..	41,473
1893	..	1,166	36,772	..	35,606
1894	..	1,404	41,533	..	40,129
1895	..	1,785	36,458	..	34,673
1896	257,000	2,306	47,363	..	45,057
1897	..	2,224	51,571	..	49,347
1898	..	1,428	43,773	..	42,345
1899	..	2,178	45,585	..	43,407
1900	..	6,157	47,055	..	40,898
1901	325,000	..	..	..	..

—J. T. D.

EMERY IN GREECE AND TURKEY.

U.S. Cons. Repts., Jan. 22, 1902.

Two years ago, an American Company made an offer to the Greek Government to buy 7,000 tons of emery per year, for ten years, at 106½ francs per ton, but the arrangement fell through. The total annual consumption of Naxos emery is 5,000 to 6,500 tons. Of this, the United States takes 1,500 to 2,000 tons, and Europe, 4,000 to 5,000 tons. The Naxos mines have never been leased.

Turkey has emery mines in the neighbourhood of Smyrna. Some mines are the property of the Government, but many are owned locally. The total annual exports of Smyrna emery stone range from 17,000 to 20,000 tons, of which 10,000 tons go to America, and the balance to Europe. The amount of corundum found in Turkish emery varies from 40 to 57 per cent., with the exception of Kuluk stone, which is said to contain about 37 per cent. Corundum in the Naxos stone is reputed to run as high as 60 per cent. The prices of Smyrna stone vary with the quality from 2l. 16s. to 4l. per ton, f.o.b. Smyrna. No emery can be produced f.o.b. Smyrna for less than 2l. 10s. The Kuluk stone is shipped from the port of Kuluk, where it is quoted f.o.b. Kuluk, at 2l. to 2l. 8s. per ton. Turkish stone is not "treated" after leaving the mine, except by hand picking; it is never washed or crushed.

SULPHATE OF COPPER FOR GREECE.

U.S. Cons. Repts., Jan. 21, 1902.

A United States firm has been awarded the contract to supply copper sulphate (500 tons) to the Currant Bank of Greece, to be used in combating the pernospera.

The conditions governing the bids were:—

(1) The quality of the copper sulphate must be 98 to 99 per cent. pure, as determined by a chemical analysis certified by the Greek consular officer of the place of shipment, the right being reserved by the bank to subject it to a second analysis upon its receipt.

(2) It is to be packed in barrels made of dried wood with iron hoops, each barrel to have a net weight of 5 cwt. (English), or 560 pounds.

(3) Prices are to be quoted c. i. f. Patras.

(4) The delivery must be made by the 28th of February, 1902, in one or several shipments at the convenience of the seller, but the entire amount to be in hand at the expiration of the above date.

(5) The Currant Bank will deposit the value of the sulphate with one of the banks of this city, to be selected by the seller, to which he will send the bills of lading, &c. Upon the arrival of the sulphate, the seller will draw upon the bank for the amount.

(6) Every bonâ fide bidder must deposit 10,000 drachmas (250l.) in securities satisfactory to the Currant Bank as a guarantee of the fulfilment of the contract.

(See also this Journal, 1901, 1041.)

HYPOSULPHITE OF SODA IN CHILE.

Bd. of Trade J., Feb. 13, 1902.

A law has recently been passed by the Chilean Congress, exempting hyposulphite of soda from Customs duty on importation into Chile.

VIII.—GLASS, POTTERY, AND ENAMELS.

CHINA AND EARTHENWARE TRADE OF SMYRNA (TURKEY).

Bd. of Trade J., Feb. 6, 1902.

The following particulars relating to the porcelain trade of Smyrna were published in the *Moniteur Officiel du Commerce*, of the 23rd ult. :—

France, Germany, and Austria share the trade of Smyrna in porcelain, the annual value of which amounts to 5,200l. to 7,000l. The principal porcelain articles which are sold at Smyrna are as follows:—

Table services, tea services, coffee cups, toilet services, night lamps, match-boxes, tankard stands, ash-pans.

"Articles de luxe" do not sell well, cheapness being the chief desideratum. The Smyrna trade requires only articles of low qualities, both white and ornamented.

France exports to Smyrna articles of second quality only, i.e., the best quality sold there, the chief being table services at 2l. 16s. to 8l. per set of 120 pieces, tea services from 8s. to 16s., coffee cups from 4s. to 9s. 7d., and toilet services from 5s. 7d. to 24s., according to quality.

Austria, which formerly had almost a monopoly in the ordinary porcelain article, has been ousted by Germany, and now the value of her trade barely reaches 800l. per annum. Austria supplies table and toilet services.

Germany is at the present time the chief supplier of porcelain articles to Smyrna. Her yearly sales reach the sum of about 4,000l., of which 3,200l. are of good and second quality, and 800l. ordinary articles. Tea and table services, toilet services, and ash-pans are sold c.i.f. Smyrna, as well as coffee cups of good and medium quality, but more especially those of common make, which sell at 4d. per dozen, c.i.f. Smyrna.

Russia has no direct trade with Smyrna in porcelain articles, but a small quantity of teapots and saucers of Russian manufacture are sent *viâ* Constantinople, and sold at moderate prices. The value of the trade is estimated at about 80l. per annum.



The Smyrna buyer attaches great importance to the rate quoted for goods covering cost in full of freight, insurance, &c., to Smyrna, instead of free to the station of the town of departure.

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

CEMENT IN THE UNITED STATES.

Eng. and Mining J., Jan. 25, 1902.

In the January number of *Stone* is given a warning against the apparent danger of an over-production of cement in the United States. The production, especially of Portland cement, has been increasing at a very rapid rate, and even at the present time, it is probably in excess of the demand, notwithstanding the great activity in building which has resulted from the prosperity of the past two or three years. The older established companies have undoubtedly built up a very large and prosperous trade, and the present danger is that the newer concerns will be driven to force their product upon the market at all sorts of prices in consequence of the necessity of obtaining cash returns, which many of them must have. This tendency to too rapid expansion is especially apparent in Michigan, where the number of new concerns started during the past year has been very considerable, and where there is a probability that, if all the new companies go into operation, they will not only produce more than can be sold; but it is also possible that the plants operated will be much too large for the supply of cement material in the State. At present there is a tendency to seize upon every deposit of so-called marl; but not all the marl is suited for the manufacture of cement, and it is very probable that too little discrimination has been exercised in this respect.

SCOURING-BRICKS: CUSTOMS DECISION (UNITED STATES).

Bd. of Trade J., Jan. 6, 1902.

Scouring bricks, prepared from ground pumice stone and sand, mixed and pressed into different sizes, are dutiable as "pumice stone wholly or partially manufactured," under par. 92 of the Tariff, at the rate of 6 dols. per ton.

X.—METALLURGY.

MINERAL PRODUCTION OF CANADA FOR 1901.

Imp. Inst. J., Feb. 1902.

The metallic products of Canada chiefly comprise gold, silver, lead, nickel, copper, zinc, and pig iron; whilst, in the United States, besides these, there are produced mercury, antimony, platinum, and aluminium, which do not appear in the Canadian returns. Antimony is found in one province of Canada, Nova Scotia, and was at one time produced to a small extent, but a lawsuit stopped operations. Aluminium, although not yet produced in Canada, exists in deposits to the extent of millions of tons. Canada also has corundum, but it is too valuable for its abrasive powers to be used to provide aluminium. The production of corundum is this year being undertaken in Canada on a somewhat extensive scale.* Copper mining companies are now in existence in Canada, having an authorised capital exceeding 140 million dollars, only a small proportion of which has so far been actually employed. Eight of these companies—namely, four in Ontario, two in Quebec, and one each in Nova Scotia and New Brunswick—are working mines of copper and pyrites; six companies, all in Ontario, copper and nickel; 32, in British Columbia, gold and copper. In nickel, Canada outstrips the United States and all other countries.

The non-metallic division of the mineral wealth of the United States and Canada comprises fuels, building materials, abrasive materials, chemical materials, pigments, and what one may term "miscellaneous." The fuels include coal, natural gas, and petroleum. In these, as in the metallic division, Canada is gaining rapidly on the United States. The products of the latter country were 31 times greater than that of Canada, in 1890, but fell to 27 times

greater, in 1900. The increase, in that period, in the United States was 75.9 per cent., and in Canada, 120.7 per cent. In building materials, such as stone, tiles, clay for brick, and cement, Canada's increase in the same period was 67 per cent., against 19 per cent., in the United States. Canada (Ontario) is unique in that it is the only maker of arsenic on the continent of America. Last year the Canadian Goldfields Company, Ltd., produced 606,000 lb. of arsenic, of an estimated value of 22,725 dols., as a by-product of their gold-milling operations.

NICKEL MINING IN SILESIA (GERMANY).

Eng. and Mining J., Jan. 25, 1902.

It is stated in *Stahl und Eisen* that the Martha and Benns nickel mines, in the district of Frankenstein, Silesia, are making steady progress. Whilst, in 1899, only 80 tons of nickel ore were mined, the production rose to nearly 4,000 tons, in 1900, valued at about 4,000*l.* The smelter is installed at the Martha Mine, and has a daily capacity of 20 tons.

XII.—FATS, OILS, Etc.

COPRA, COCOANUT-OIL, AND VEGETABLE TALLOW IN THE STRAITS SETTLEMENTS.

Imp. Inst. J., Feb. 1902.

During 1900, there was imported into the Straits Settlements 93,074,933½ lb. of copra, the import value of which was 4,455,489 dols. Mexican. During the same year there was exported 91,160,026¾ lb. of copra, valued at 4,416,937 dols. Mexican. Of coconut oil, there was imported during 1900, 10,105,733½ lb., the import value of which was 1,011,679 dols. Mexican. The exports amounted to 14,740,553½ lb., the value of which was 1,500,910 dols. Mexican. Imports of coconuts amounted, in 1900, to 21,409 dols. in Mexican currency, and the export to 311,773 dols. Mexican, showing a large local production. Of vegetable tallow, imports, during the year 1900, amounted to 52,533½ lb., valued at 7,034 dols. Mexican, whilst exports amounted to 91,900 lb., valued at 37,948 dols. Mexican. About 60 per cent. of these imports came from Japan, and the remainder from Burma; all the exports went to Great Britain.

SOAP, OIL, AND CANDLE INDUSTRY AT SALONICA (TURKEY).

Eng. and Mining J., Jan. 25, 1902.

Soap.—In *Les Corps gras Industriels* the annual importation of Marseilles soaps at Salonica is estimated at 200,000 frs. The sales may be considerably extended in spite of local manufacture.

The local soaps, produced principally at Mitylene and in Crete, owe their extremely low prices to the introduction of a large quantity of talc. If the French manufacturers were to produce a similar quality, so as to compete with the prices of the local soaps, they would secure a large market at Salonica and in Macedonia.

The products employed for the manufacture of the local soaps are talc (296 tons), coming principally from Marseilles, and, in less quantities from Trieste and from Italy; and soda (total importation, 523 tons), 326 tons being imported from England, and 182 tons from Antwerp.

Seed Oils (total importation, 558 tons, valued at 418,000 frs.) come entirely from Marseilles. Italy furnishes almost all the sulphurated oils—1,042 tons, valued at 782,000 frs., out of a total of 1,104 tons, valued at 828,000 frs. The remainder is divided between France and Germany.

Candles.—The sale of French candles at Salonica is insignificant. Holland (140 tons) and Italy (60 tons) are the principal providers. To judge by the figures of importation of French candles at other places in the Levant, it must be possible to increase this figure greatly.

Olive Oils.—French oils of good brands find a sure market at Salonica, where, however, they are sought for by a limited class of consumers. The necessity of shipping to Turkey only absolutely pure olive oils is essential. Those containing cottonseed, arachis, or sesame oil, are barred at

* See also this Journal, 1901, 855.

the Salonica custom house. The slightest trace of cottonseed oil is sufficient to warrant confiscation, or a return to the consignor. This has often occurred, according to importers, when the olive oils have only been transported in barrels which formerly contained cottonseed oil.

XIII. A.—PIGMENTS, PAINTS, Etc.

"LITHOPONE": CUSTOMS DECISION (RUSSIA).

Bd. of Trade J., Feb. 6, 1902.

The following decision has regard to the classification under the Russian Tariff:—

Tariff classification of "lithopone."—The white paint known as "lithopone," consisting of sulphate of baryta and zinc sulphide, is dutiable, under section 137 of the Tariff, at the rate of 4 roubles 50 copecks per pound (11. 9s. 7d. per cwt.), with the addition of the surtax of 10 per cent., laid down by the Imperial Ukase of the 5th August, 1900.

XIII. C.—INDIA-RUBBER, Etc.

BALATA IN DUTCH GUIANA.

India-Rubber and Gutta-Percha Trades' Journal (through Imp. Inst. J., Feb. 1902).

The balata industry in Dutch Guiana is flourishing, the revenues from concession fees for these having amounted to 800l., in 1900. Not less than 14,820,000 acres were set apart for the purpose of testing the presence of balata, and concessions have been granted for 395,200 acres. There is a growing request for this article, owing to the higher prices obtained in the market. The chief export of balata goes to the United States and to Great Britain. Through the severe by-laws, prohibiting the felling of balata trees in Surinam, a decrease of the trees will very probably be prevented, although control is very difficult. This is mostly done through journeys of policemen, especially in the district of Nickerie. On Jan. 17th, 1901, the Governor published the conditions, according to which, in future, four months concessions for ascertaining the presence of balata will be granted free of charge. Its wording is as follows:— (a) No exploitation must take place. (b) The expeditions must consist of a foreman and six workers for every 123,500 acres, or part of it. (c) Within three weeks from the day of granting concession, a certificate must be sent to the police at the Government-Secretariat, that the persons named are engaged by contract, and one month after the granting of concession, another certificate that the expedition is on its way. (d) The concession will at once be cancelled (i) if the respective papers be not sent in properly in the time mentioned above; (ii) if it be furthermore evident that the company does not carefully follow the conditions under (b) and (c), or tries to avoid them, if laws regarding public order, safety, or health be not respected, or if exploitation take place on ground that is only granted for testing.

XIV.—TANNING; LEATHER; GLUE, Etc.

TANNIC ACID FROM SORREL.

Handels Museum (through Imp. Inst. J., Feb. 1902).

The constantly increasing difficulty of obtaining the necessary tannic acid for the preparation of leather is mostly caused by the fact that the tanning stuffs formerly used have been extracted from the bark or fruit of trees. These grow slowly, and, in consequence, large tracts of land are necessary for obtaining the needed supplies. The endeavours to rectify these conditions, by using a quick-growing plant containing tannic acid, have been successful, through the discovery, in the plains of Mexico and California, of a sorrel (*Rumex hymenosepalus*), in the bulbs of which tannic acid exists. In a dried condition, 35 per cent. of tannic acid is produced. As the wild plants were soon exhausted, plantations were commenced, in 1896, and the large bulbs were used for tanning, and the smaller ones for cultivating new plantations. The tannic acid is much increased by the plentiful use of water. The plants grow to the length of about a metre, and the leaves make an edible vegetable.

(It is interesting to note that the experimental cultivation of *Rumex hymenosepalus* was undertaken some years ago in New South Wales, but no further development appears to have resulted.)

XVI.—SUGAR, STARCH, Etc.

NEW SUGAR PLANT IN PARAGUAY.

Ch. of Comm. J., Feb. 1902.

Some time ago, a plant (growing in the north of the country), which is distinguished on account of its sweetness, was examined and described by the Director of the Agronomical Institution, at Asuncion. This plant, which has been christened botanically *Eupatorium Rebaudianum*, is called by the Paraguayan Guarani population caá-héé, or azucá-caá, or cira-caá, which signifies sweet yerba, sugar-herba, or honey-herba. It is a plain-looking herb, a few decimetres high, with small leaves and tiny blossoms. It grows in the highly-situated camping grounds which environ the chains of mountains Anambay from the extreme north to the sources of the Rio Monday. Its powerful properties of sweetness are remarkable. A few leaves suffice to sweeten a large cup of tea or coffee. On putting only quite insignificant portions of the leaves into the mouth, the taste of sweetness is retained for an hour after. It does not contain any injurious substance whatever. The director considers that the sweetness is not to be ascribed to the sugary contents, as the sweetening power by far exceeds that of sugar. Moreover, it is stated that the sweet matter contained in the plant cannot, like sugar, be brought to a state of fermentation by adding yeast. He rather assumes that it is a new chemical substance, which must first be examined by a chemical analysis. At the moment a German is trying to cultivate the plant in Nueva Germania. It is also contemplated to bring the leaves, mixed with the Paraguay tea (Yerba), into commerce.

SUGAR-CANE CULTIVATION IN MEXICO.

Bd. of Trade J., Feb. 6, 1902.

The sugar industry of Mexico is beginning to be largely developed. In all parts, capitalists are forming companies for the cultivation of the sugar-cane. There is a marked tendency to abandon the cultivation of maize for the more remunerative one of sugar-cane. It is estimated that the area of sugar-cane plantations has increased by about 22 per cent. during the past season.

SUGAR PRODUCTION IN NICARAGUA.

U.S. Cons. Reps., Jan. 27, 1902.

During the last twelve months, Nicaragua has exported over 4,000,000 lb. of cane-sugar (not refined). Of this amount, over 3,000,000 lb. were sent to the United States, and about 1,040,000 lb. to Vancouver, British Columbia. Nearly all was produced in the Departments of Chinandega and Leon, and exported from the port of Corinto. Sugar is also produced in the Departments of Managua, Granada, Rivas, Carazo, and Chontales, but not in sufficient quantities for local consumption. Four years ago the production of sugar in Nicaragua was less than half the home consumption. Two years ago the production exceeded the consumption by about 1,000,000 lb., and since then the production has increased over 300 per cent.

ESTIMATED SUGAR PRODUCTION IN EUROPE FOR SEASON 1901-2.

U.S. Cons. Reps., Jan. 28, 1902.

The International Union for Sugar Statistics has just published the results of its investigations, made in December 1901, as to this year's beet-sugar crop in European countries (see table on next page). Whilst these figures are approximate estimates, they are considered to be as nearly correct as can be made before the final estimates are prepared at the end of the season.

There will be apparently an over-production of sugar in Europe, amounting to 1,000,000 tons in excess of the normal consumption, and the stock to be carried over to next season may be 1,500,000 tons, the effect being un-



Country.	Acreage allotted to Sugar-Beet Culture.		Production of Sugar Beets.		Production of Sugar.	
	1901-2.	1900-1901.	1901-2.*	1900-1901.	1901-2.*	1900-1901.
	Acres.	Acres.	Tons.	Tons.	Tons.	Tons.
Germany.....	1,168,420	1,095,889	15,630,410	13,252,291	2,220,850	1,974,785
Austria.....	896,132	839,152	8,944,700	7,408,000	1,306,900	1,083,300
France.....	741,300	718,220	9,278,400	8,717,439	1,080,300	1,100,171
Russia.....	1,467,527	1,346,942	8,304,545	6,406,024	1,079,550	893,520
Belgium.....	170,252	167,071	2,509,000	2,463,000	325,000	320,000
Holland.....	120,091	115,384	1,483,000	1,225,000	200,100	178,100
Sweden.....	70,424	71,412	876,000	865,500	121,392	115,547
Denmark.....	37,065	34,594	44,300	398,255	57,500	50,760
Other.....	..	162,970	..	..	221,000	..

* December estimate.

precedently low prices. In December, raw sugar was quoted at the Magdeburg exchange at 1.62 cents per lb.

It would seem that the unprofitable business would check over-production, but the entire beet-sugar industry of Europe is on an artificial basis.

Considerable anxiety is felt here as to the tariff the United States Congress will put on Cuban sugar.

As early as 1893, Cuba produced not less than 1,160,172 tons of sugar, which is about one-half the amount consumed by the people of the United States to-day. The war reduced its sugar crop to 281,420 tons, in 1899, but it has risen, in the face of financial difficulties, to almost treble that quantity within two years, and at the end of another year, it is possible it may again reach 1,000,000 tons. With plenty of capital and labour, and with improved machinery, there is every reason to suppose that Cuba will become the largest producer of sugar in the world.

SUGAR BOUNTIES FOR THE 1902-3 SUGAR CAMPAIGN IN BELGIUM.

Bd. of Trade J., Feb. 13, 1902.

In the official *Moniteur Belge* of 20th—21st ult. is published the text of a law passed by the Belgian Government, modifying the existing legislation respecting sugar, and providing for the grant of a direct bounty on sugar produced during the season 1902—3.

Article 1 of the law states that native raw sugars declared for export, or for deposit in a bonded warehouse, are classed into three categories, and enjoy a rebate from excise duties fixed as follows:—

	Francs.
1st category, Nos. 11 and over, Dutch standard ...	45.00
2nd category, Nos. 8—11 " " ...	40.95
3rd category, below No. 8 " " ...	38.43

In order to be admitted to exportation or to deposit in a bonded warehouse, with the drawback fixed by Article 1, the sugar must be capable of giving the following yield of refined sugar per 100 kilos. of raw sugar:—

	Kilos.
Sugar of the 1st category, not less than	88
" 2nd " "	80
" 3rd " "	76

Article 2 states that sugar exported or deposited in a bonded warehouse, which would be known to give on refining a yield of more than 2 kilos. less than the quantity fixed by the category in which it is declared, will be officially classed in conformity with Article 1, without prejudice to the penalties incurred by the person for making a false declaration.

Article 3 states that the Minister of Finance is determining the method of analysis of sugar as regards the yield on refining.

Article 4 states that the words "*non humides*" which terminate section *d* of Article 176, section 1 of the Law of 16th April, 1887, are suppressed.

Article 5 states that Articles 7—9, par. 1, section *b*, and Section 5 of Article 10 and Article 12 of the Law of the 9th August, 1897, are made applicable to sugar used in biscuit manufacture.

Temporary Dispositions.

Article 6.—1. In modification of par. 2 of Article 8 of the Law of 11th September 1895, only that part of the excess of receipts in 1902 above 3,600,000 frs. will be taken into account.

2. A bounty of 2 frs. per 100 kilos. of sugar "*pris en charge*" during the sugar campaign of 1902—3 is granted to manufacturers of raw sugar from beet, but the total amount of bounty paid must not exceed 5,000,000 frs. If the quantity "*pris en charge*" exceeds 250,000,000 kilos., the bounty per 100 kilos. will be reduced proportionately to the excess.

XX.—FINE CHEMICALS, Etc.

MEDICAL AND PHARMACEUTICAL PREPARATIONS: CUSTOMS REGULATION (RUSSIA).

Bd. of Trade J., Feb. 6, 1902.

Medical and Pharmaceutical Preparations not mentioned in the List of Preparations authorised to be Imported into Russia.—Applications for leave to import these articles must be accompanied by two samples for examination. If imported in special packages, with labels and descriptions, the samples must also be accompanied by these labels and descriptions.

XXII.—EXPLOSIVES, MATCHES, Etc.

"CORDITE M.D.": A NEW EXPLOSIVE.

Chem. and Druggist, Feb. 1, 1902.

The Explosives Committee, British War Office, which consists of Lord Rayleigh, Sir Andrew Noble, Sir William Crookes, Sir W. Roberts-Austen, and Mr. R. B. Haldane, besides members representing the War Office and the Admiralty, have now made effective trials with the new smokeless powder to be known as "Cordite M.D." The original cordite, patented, in 1889, by Sir Frederick Abel and Professor Dewar, consists of 58 per cent. of nitroglycerin, 37 per cent. of trinitrocellulose (with a small proportion of soluble gun-cotton), and 5 per cent. of vaseline. Cordite M.D. is not patented, but nitrocellulose is the base, and it contains a percentage of nitroglycerin not nearly so high as that in cordite. The advantage of the new powder is that it is not so erosive as cordite, and in other respects it is far superior.

MATCHES AT FOOCHOW (CHINA).

Foreign Office Annual Series, No. 2738.

The match factory, established here, in 1899, by a British firm, is now actively working. Nearly 2,000 persons, men, women, and children, are employed in it, and the average output is about 20 cases a day, each containing 7,200 boxes of matches. The production could easily be increased to 40 cases a day. These Foochow matches are sold retail at the same price as the imported Japanese article, which they are rapidly superseding, both at Foochow and in the interior, through their superior quality.



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.

2697. P. N. Hooper. Improvements in gas or vapour separators. Feb. 3.
2865. H. E. Auman. Improvements in and relating to smelting furnaces. Complete Specification. Feb. 4.
3096. R. S. Brownlow. Improvements in filters. Feb. 7.
3128. A. G. Brookes.—From H. J. Merck and Co., Germany. Improvements in and relating to apparatus for comminuting or disintegrating superphosphates. Complete Specification. Feb. 7.
3295. J. J. E. Bekker and R. Harvey. See Class XVI.
3373. F. W. Monteith. Improvements in and connected with furnaces. Complete Specification. Feb. 10.
3492. Siemens Bros. and Co., Ltd.—From Siemens and Ha'ske Aktien Gesellschaft, Germany. An apparatus for filtering liquids and treating them with gases. Complete Specification. Feb. 11.
3752. F. Furstenheim. Improvements in and connected with sterilising apparatus. Complete Specification. Feb. 13.
3831. F. C. Roberts. Improvements in hot blast stoves. Complete Specification. Feb. 14.
3851. T. Kirkland. Improvements relating to heating and cooling apparatus. Feb. 14.

COMPLETE SPECIFICATIONS ACCEPTED.*

1901.

2467. H. S. Hatfield. Gas thermometers and pyrometers. Feb. 12.
5553. B. G. Smith. Apparatus for operating platforms of hoists, gas purifier lids and the like. Feb. 12.
6428. J. Kirkaldy. Portable distilling apparatus. Feb. 12.
7237. Per. W. Lindberg. Centrifugal apparatus. Feb. 12.
7336. C. Groll. Rotary furnaces. Feb. 19.
- 23,277. H. Koppers. Wall constructions for coke ovens by means of a particularly shaped stone. Feb. 19.
- 26,165. T. R. Murray. Pumps for pumping or compressing gases or vapours. Feb. 12.

II.—FUEL, GAS, AND LIGHT.

APPLICATIONS.

2706. M. Graham. Improvements in gas producers and furnaces. Feb. 3.
2751. L. G. Harris. Improvements relating to the manufacture of gas. Complete Specification. Feb. 3.
2752. G. L. Badger. Improvements relating to the treatment of hydrocarbons for the production of fuel. Complete Specification. Feb. 3.
2851. G. V. Foster and E. F. Mackusick. Improvements in acetylene gas generators. Complete Specification. Feb. 4.
2870. T. A. Johnson. Improvements in gas producers. Feb. 4.
2929. W. Udal. Improvements in acetylene gas generator. Feb. 5.
2964. A. G. Bloxam.—From F. Gehre and K. Hocke, Germany. Improvements in the manufacture of briquettes of fuel ore or the like. Feb. 5.
3206. W. E. Heys.—From L. M. Thompson, United States. Improvements in gas lighters. Complete Specification. Feb. 8.

3217. H. Marshall. Method of lighting trains and other vehicles by means of carburetted air. Feb. 8.
3306. C. Kleyer. Improved heating element. Feb. 10.
3343. A. J. Boulton.—From G. Viarme, France. Improvements in or relating to gas generators. Feb. 10.
3363. W. H. A. Sieverts. Improvements relating to gas burners. Feb. 10.
3641. W. P. Warren. Improvements relating to acetylene generators. Feb. 12.
3643. W. P. Warren. Improvements relating to the production of acetylene gas, and end products suitable for use as metal polish and the like. Feb. 12.
3783. F. E. Bowman. Improvements in gas producing plant. Feb. 14.

COMPLETE SPECIFICATIONS ACCEPTED.

1901.

2713. R. P. Pictet. Apparatus for the industrial production of liquid air. Feb. 19.
2750. J. C. H. Kramers and J. G. Aarts. Manufacture of water-gas and semi-water-gas, and apparatus therefor. Feb. 12.
6904. H. D. Shiersant and W. A. Coulson. Apparatus for generating acetylene gas. Feb. 19.
- 20,282. C. D. Lépine. Acetylene gas generator. Feb. 19.
- 21,692. H. D. Fitzpatrick.—From F. H. Macpherson, Canada. Vapour generators for incandescent lighting. Feb. 19.
- 21,756. E. F. Colborn. Production of combustible gas from hydrocarbon oil. Feb. 19.
- 23,277. H. Koppers. See Class I.
- 24,577. M. Toltz and A. Sipschutz. Acetylene gas lighting system. Feb. 19.
- 24,837. S. T. Wellman and C. H. Wellman. Coke-ovens. Feb. 19.
- 25,495. E. D. Holmes.—From O. N. Guldin, of The Western Gas Construction Company, United States. Improvements in mouthpieces and lids of gas retorts, applicable to the lids of other receptacles. Feb. 19.

III.—DESTRUCTIVE DISTILLATION, TAR PRODUCTS, PETROLEUM.

APPLICATION.

3401. H. Danzer. Improvements in and connected with bitumen and asphalt cauldrons. Feb. 11.

IV.—COLOURING MATTERS AND DYESTUFFS.

APPLICATIONS.

2722. O. Imray.—From The Basle Chemical Works, Switzerland. Manufacture of green sulphurised dyestuffs. Complete Specification. Feb. 3.
3152. F. Gaess. A process of preparation of mono-formyl- α_1 - α_2 -naphthyl-diamine β_3 - or β_4 -monosulpho acid. Feb. 7.
3362. H. E. Newton.—From The Farbenfabriken vormals F. Bayer and Co., Germany. Improvements in the manufacture or production of new derivatives of the anthracene series. Feb. 10.
3775. J. Y. Johnson.—From The Badische Anilin und Soda Fabrik, Germany. Improvements in the manufacture and production of disazo colouring matters. Feb. 10.

COMPLETE SPECIFICATIONS ACCEPTED.

1901.

6878. T. R. Shillito.—From J. R. Geigy and Co., Switzerland. Manufacture of artificial indigo from α -isatine-anilide. Feb. 12.
7250. O. Imray.—From The Farbwerke vormals Meister, Lucius und Brüning, Germany. Process for the manufacture of new azo components and azo dyestuffs. Feb. 12.



7632. J. Y. Johnson.—From The Badische Anilin und Soda Fabrik, Germany. Manufacture and production of azo colouring matters and their after treatment on the fibre. Feb. 12.

16,409. O. Imray.—From Farbwerke vormals Meister, Lucius und Brüning, Germany. Manufacture of orange-yellow to red mono-azo-dyestuffs suitable for the preparation of lakes. Feb. 19.

V.—PREPARING, BLEACHING, DYEING, PRINTING, AND FINISHING TEXTILES, YARNS, AND FIBRES.

APPLICATIONS.

2690. J. Auchinvole, of the firm of Johnston and Farie. Improved method of and means for washing, bleaching, dyeing, sizing, and similarly treating yarns or like fibrous materials and fabrics. Feb. 3.

2891. M. Geïssler. Improvements in apparatus for dyeing cloth or other porous materials. Complete Specification. Feb. 5.

3155. F. B. Aspinall, G. H. Wise, and E. S. Wilson. Improvements relating to the treatment of cotton seed. Feb. 7.

3178. F. H. Long. Improvements in processes for bleaching paper pulp and the like. Complete Specification. Feb. 7.

3422. S. W. Wardwell. Improvements in or relating to a method of preparing yarn and like materials for dyeing and finishing processes, and the cop or package produced thereby. Complete Specification. Feb. 11.

3425. R. W. Goddard. Improvements in the method of and apparatus for dyeing warps for weaving. Feb. 11.

VII.—ACIDS, ALKALIS, AND SALTS.

APPLICATIONS.

2743. A. Krause. Improvements in or relating to the preparation of substances containing peroxide of magnesium. Complete Specification. Feb. 3.

2856 H. H. Lake.—From K. Oehler, Germany. Improvements relating to the manufacture of sodium sulphate and hydrochloric acid. Feb. 4.

2867. G. E. Davis and A. Roland. Improvements in the removal of arsenic from sulphuric acid. Feb. 4.

2916. T. B. Saunders. Improvements in the means or method of manufacturing strong hydrochloric acid. Feb. 5.

2987. R. Threlfall and G. E. Wilson. Improved means for producing chlorates or perchlorates of the alkali or alkaline earth metals. Feb. 5.

3045. E. W. Wheelwright. Improved compounds of phosphorus and sulphur and methods of manufacturing same. Feb. 6.

3161. O. Imray.—From Farbwerke vormals Meister, Lucius und Brüning, Germany. Improved manufacture of sulphuric acid and sulphuric anhydride, and apparatus therefor. Feb. 7.

3381. T. Ewan. Improvements in the manufacture of cyanogen compounds. Feb. 11.

3611. O. Imray.—From Die Farbwerke vormals Meister, Lucius und Brüning, Germany. Improved manufacture of sulphuric anhydride by the contact process. Feb. 12.

3891. J. H. Hudson. Improvements in obtaining alkaline compounds. Feb. 15.

3923. H. von Hochstetter. Improvements in and connected with the manufacture of acetic acid and other acids of the fatty acid series. Feb. 15.

COMPLETE SPECIFICATIONS ACCEPTED.

1901.

3327. H. Rabe. Process for the production of anhydrous sulphuric acid. Feb. 19.

6829. J. Y. Johnson.—From The Badische Anilin und Soda Fabrik, Germany. Manufacture of sulphuric acid. Feb. 12.

VIII.—GLASS, POTTERY, AND ENAMELS.

APPLICATIONS.

3355. W. P. Thompson.—From Fontaine and Cie., Germany. Improvements in or relating to the manufacture of glass ware. Complete Specification. Feb. 10.

3514. F. von Poschinger. Improvements in the manufacture of cathedral glass. Feb. 11.

COMPLETE SPECIFICATION ACCEPTED.

1901.

3100. R. D. Lucas. Decoration of china, earthenware, glass, enamelled iron ware, and the like. Feb. 19.

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

APPLICATIONS.

2742. G. A. Taylor and W. Macleod. An improved fibrous plaster. Complete Specification. Feb. 3.

3051. F. H. Bruce. Improvement in the treatment of wood for the purpose of rendering the same fire-proof. Feb. 6.

3105. J. L. Gordon. An improved cement for general building purposes. Feb. 7.

3294. J. Bilsbury. Improvements in and appertaining to kilns for drying and burning bricks. Feb. 10.

3300. J. Jackson. Improvements in the manufacture of fire-resisting bricks and blocks. Feb. 10.

3364. G. C. Marks.—From C. Frerichs, Germany. Improvements in connection with glazing for calcareous sandstone and the like. Feb. 10.

3402. G. A. Newton. Granitene. Feb. 11.

3493. F. Jurschina. An improved process for the manufacture of artificial stone. Complete Specification. Feb. 11.

3518. F. Jurschina. Improved process for the manufacture of artificial acid-proof stone. Complete Specification. Feb. 11.

3555. B. Budd. Improvements in the production of concrete artificial or manufactured stone, plaster, and similar substances used for building, for paving, and for other purposes. Feb. 12.

COMPLETE SPECIFICATIONS ACCEPTED.

1901.

4657. J. Steiger. Manufacture of cement. Feb. 19.

1902.

385. A. Wolskel. Preparing asphalt. Feb. 12.

X.—METALLURGY.

APPLICATIONS.

2805. G. Westinghouse.—From W. J. Knox, United States. Improvements in methods of treating copper ores. Feb. 4.

2846. W. McKie. Improvements in or relating to the manufacture of iron, steel, and copper. Feb. 4.

2865. H. E. Auman. See Class I.

2971. H. Buderus. Improvements in means for producing iron castings direct from furnaces. Feb. 5.

3331. W. P. Ingham. Improvements in or connected with the manufacture of slag wool. Feb. 10.

3344. O. Thiel. Improvements in or relating to the manufacture of iron. Complete Specification. Feb. 10.

3357. C. Renstrom. Process for hardening copper or the alloys of copper. Complete Specification. Feb. 10.

3483. S. Phelps and W. G. Clark. An improved process for welding or uniting copper and its alloys to iron, steel, and other metals. Feb. 11.

3644. W. S. Simpson. Improved method of hardening, toughening, or improving the quality of metal. Feb. 12.

3650. W. P. Thompson.—From Konrad von Meyenburg and E. R. Butler, Switzerland. Improved method and apparatus for increasing the coherence and resistance to pressure of blocks of ore and the like. Feb. 12.

3724. G. A. Herdman. Improvements in moulding slag wool. Feb. 13.

3834. F. C. Roberts. Blast furnace charging apparatus. Complete Specification. Feb. 14.

COMPLETE SPECIFICATIONS ACCEPTED.

1901.

493. H. M. Taquet. Treatment of zinc ores. Feb. 19.
2781. E. Kikut. Blast devices for furnace and for other purposes. Feb. 19.

6322. Sir A. Hickman and W. Hutchinson. Manufacture of steel and ingot iron. Feb. 19.

7568. V. Fattelay. Manufacture of steel. Feb. 19.

14,266. J. S. Wolfe, L. J. Englert, and T. J. Geiger. Composite metal. Feb. 12.

14,306. P. Garuti and R. Pompili. New process of soldering with oxy-hydrogen gas. Jan. 22.

22,233. P. M. Justice.—From C. Davis, United States. Method of treating iron and steel. Feb. 12.

22,730. H. Johnson and G. W. Frier. Process of manufacturing steel. Feb. 19.

24,235. C. A. Keller. Manufacture and treatment of alloys. Feb. 19.

25,671. P. M. Justice.—From C. Davis, United States. Method or process of hardening steel. Feb. 12.

26,595. W. F. Bedell. Amalgamators. Feb. 12.

XI.—ELECTRO-CHEMISTRY AND ELECTRO-METALLURGY.

APPLICATION.

3819. J. T. Niblett. Improvements in and relating to storage batteries. Feb. 14.

COMPLETE SPECIFICATIONS ACCEPTED.

1901.

5764. L. Mond. Obtaining zinc by electrolysis, and apparatus for that purpose. Feb. 12.

26,729. T. J. Bain and J. O. Hunt. Electric battery. Feb. 12.

XII.—FATS, OILS, AND SOAP.

APPLICATION.

3164. J. Klimont. An improved process for the purification of fats or fatty substances. Complete Specification. Feb. 7.

COMPLETE SPECIFICATIONS ACCEPTED.

1901.

11,074. G. Dangoise and La Société Générale Belge de Déglycerination. Separating glycerine from oils and fatty matters. Feb. 12.

16,483. J. Rank. Method of separating vegetable oils from ground seeds. Feb. 19.

25,425. F. V. Speltie. Process and apparatus for extracting oil from fish and obtaining dried residues serving as "guano." Feb. 19.

XIII.—PAINTS, PIGMENTS, VARNISHES, RESINS, INDIA-RUBBER, ETC.

APPLICATIONS.

2782. J. C. Chandler and S. B. Chandler. Compound in substitution of red and white lead when used for joint making. Feb. 4.

3268. W. P. Thompson.—From A. L. Tedesco, France. Improved process for the manufacture of varnishes. Feb. 8.

3468. R. B. Price. Improvements relating to the recovery of rubber from vulcanised rubber waste. Complete Specification. Feb. 11.

3855. E. Zühl. A new or improved process for the regeneration of caoutchouc. Complete Specification. Feb. 14.

COMPLETE SPECIFICATION ACCEPTED.

1901.

11,337. F. J. Corbett. Apparatus for manufacturing white lead. Feb. 12.

XV.—MANURES, ETC.

COMPLETE SPECIFICATIONS ACCEPTED.

1901.

2335. J. Ostersetzer. Manufacture of artificial manures. Feb. 12.

5215. R. Burnard. Manufacture of alkaline superphosphate. Feb. 19.

25,425. F. V. Speltie. See Class XII.

XVI.—SUGAR, STARCH, AND GUM, ETC.

APPLICATIONS.

2952. W. P. Thompson.—From G. Reynaud and A. Bonna, France. An improved process for converting vegetable cellulose into glucose and its derivatives. Feb. 5.

3295. J. J. E. Bekker and R. Harvey. Improvements in and relating to mills for grinding sugar cane and like grinding purposes. Feb. 10.

3642. M. Kowalski. A new or improved process for purifying by extraction the syrups, drainings, and molasses obtained in the manufacture of sugar. Complete Specification. Feb. 12.

3930. J. Y. Johnson.—From The Société des Produits Amylacés, France. Improvements in the manufacture of starch from rice, maize, and other amylaceous products. Feb. 15.

COMPLETE SPECIFICATION ACCEPTED.

1901.

10,884. C. Steffen. Process of obtaining very pure concentrated saccharine juices, and nutritious pulp poor in water from beetroots without the use of water. Jan. 22.

XVII.—BREWING, WINES, SPIRITS, ETC.

APPLICATIONS.

2708. J. Kirby. An improved apparatus for separating yeast from fermenting liquors in vats, casks, "pieces," or other nearly closed vessels, also for aerating the fermenting liquor. Feb. 3.

2863. J. H. Jewell. Improvements in distilling apparatus. Complete Specification. Feb. 4.

COMPLETE SPECIFICATION ACCEPTED.

1901.

6428. J. Kirkaldy. See Class I.

XVIII.—FOODS, SANITATION, ETC., AND DISINFECTANTS.

APPLICATIONS.

A.—Foods.

3505. F. C. Staender. Improvements in the production of milk powder. Feb. 11.

3646. A. E. Bertie-Smith. A new or improved process or treatment for preserving cream. Feb. 12.

3914. C. Steffen. Improved process for the production of saccharine foodstuffs. Complete Specification. Feb. 15.



3924. L. Hochecker. Improvements relating to the manufacture, preservation, and utilisation of fruit paste. Feb. 15.

3949. H. H. Lake.—From Aktieselskabet "Progress," Norway. An improved process for preserving eggs. Complete Specification. Feb. 15.

B.—Sanitation; Water Purification.

2892. W. P. Lincoln and M. S. Greenbaum. Improved process of reducing and deodorizing residues. Feb. 5.

3516. F. J. Farrell. Improvements in apparatus for softening water. Feb. 11.

C.—Disinfectants.

2813. J. B. de Alzugaray. Improvements in and connected with the manufacture of disinfecting and antiseptic fluids and compounds. Feb. 4.

3333. P. Ruben. Process of preparing a disinfecting material. Feb. 10.

XIX.—PAPER, PASTEBOARD, Etc.

APPLICATIONS.

2713. F. Nemecek. Improvements in or relating to the manufacture of paper. Feb. 3.

3178. F. H. Long. See Class V.

XX.—FINE CHEMICALS, ALKALOIDS, ESSENCES, AND EXTRACTS.

APPLICATIONS.

2748. W. M. Binnie. Improvements in the production of artificial campher. Feb. 3.

2787. C. M. Aikman. Preparation of extract of maté. Feb. 4.

3871. H. H. Lake.—From W. J. Schieffelin, United States. Improvements relating to the preparation of compressed drugs. Feb. 14.

COMPLETE SPECIFICATION ACCEPTED.

1901.

6937. J. Heron. Manufacture of a vegetable extract. Feb. 12.

XXI.—PHOTOGRAPHY.

APPLICATIONS

3371. A. J. Boulton.—From C. L. F. Freelandt, Russia. Improved manufacture of gelatine films for photographic purposes. Complete Specification. Feb. 10.

3476. T. K. Barnard. Improvements in apparatus relating to colour photography. Feb. 11.

XXII.—EXPLOSIVES, MATCHES, Etc.

APPLICATIONS.

2724. C. G. Redfern.—From La Société Générale pour la Fabrication de la Dynamite, France. A new explosive compound. Feb. 3.

3144. W. P. Thompson.—From R. H. F. Rennick, India. Improved detonator applicable for use with sensitive explosives. Feb. 7.

3202. W. R. Hodgkinson and J. B. Finlaison. An improved shortened method of manufacture of nitra'ed celluloses, gun-cotton, and the like. Feb. 8.

3238. F. Hess. Method for the treatment and use of detonating compositions. Complete Specification. Feb. 8.

3334. J. Wetter.—From The Westfälisch-Anhaltische Sprengstoff-Aktiengesellschaft, Germany. Improvements in safety explosives or blasting compositions. Feb. 10.

3951. H. H. Lake.—From Aktieselskabet "Progress," Norway. Improvements relating to the manufacture of wood matches. Complete Specification. Feb. 15.

COMPLETE SPECIFICATION ACCEPTED.

1901.

17,628. H. H. Lake.—From J. Blake, United States. Machines for making matches. Feb. 12.

