it will be found that they are within 5% of the real value in all the figures, and within 3% in the first five columns, oak, hemlock, etc. From this it may be seen that the error in the execution of this method in ascertaining the percentage of tannic acid in an oak, hemlock, sumach, etc., would not exceed one ¼ of one per cent., while in the estimation of catechu, kino, etc., the error is quite large. The cause of this is that the tannate of copper precipitated from these last materials is contaminated with considerable other matter, and besides this the peculiar principles present in these materials exert a solvent action upon the tannate of copper. This method may be used for these last determinations, but the kino may be more accurately determined by Lœwenthal's method.

This method has been in use in my laboratory ever since I first investigated it, and the numerous analyses I am called upon to make of tanning materials and executed by it give the utmost satisfaction. I will continue to use it in all my leather researches now about to be commenced, also in commercial work. In conclusion I wish to tender my thanks to Mr. Jackson S. Schultz for valuable advice, and to all others who favored me with materials for this research, and facilitated it.

REVIEW OF INDUSTRIAL CHEMISTRY.

By. A. A. Breneman.

Sulphuric Acid.*—*Lunge* has undertaken to study againt he phenomena of the lead chamber in order to test the conclusions put forward by R. Weber (†) in 1867 as to the action of SO_2 on NO and N_2O_5. He finds that SO_2 and NO do not react upon one another, even at 100° C. when both are dry, but in presence of water they act slowly, the reaction requiring 48 hours for its completion at 15°. N_2O is formed, but the reduction does not extend further, no N being detected. Sulphuric acid of 1.45 sp-gr. does not hasten the reaction unless free O is also present. N_2O is produced in the latter case even when O is in excess of the amount required by the reaction $2\,SO_2+2\,NO+3\,O+3\,H_2O=2\,H_2\,SO_4+2\,HNO_2$.

In the normal condition of the chamber both steam and O are in excess and a loss of nitrogen corresponding to the nitrate used in

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(*) Ding. Jour. 243.1; Ber. D. Ch. Ges 14—2196. Chem. C. Bl. Dec. 7, '81.

(†) Ding. Jour. 184-246.

the pyrites burned must result, as N_2O is not absorbed by strong sulphuric acid in the Gay-Lussac tower.

The author also describes a new form of gas burette used in the investigation. *Laske* and *Benker* (*) propose to reduce the waste of nitric acid in the chamber process by two-thirds through the introduction of SO_2 at the outlet of the last chamber. NO_2 being reduced by this means to N_2O_3 which is more sóluble in H_2SO_4, complete absorption occurs in the Gay-Lussac tower.

Richter (†) effects thorough mixture of the gases of the lead chamber by aspirating them through one opening in the wall of the chamber and injecting them again at another. A steam jet is used for the purpose.

SODA.—*Scheurer-Kestner*(‡) discusses the method of *Pauli* (§) for the oxidation of soda lyes. The oxidation of sulphites to hyposulphites and sulphates through the action of MnO_2 is considerable but still incomplete at a temperature of 75°.

Rammelsberg (‖) finds in the soda liquors from the manufactory of Schoenebecker, peculiar red and yellow crystals containing vanadium and yielding, on re-crystallization, colorless octahedra of the general formula, $NaF\ 2\,Na_3\ RO_4\ 18\,H_2O$, in which R may be P or V. He ascribes the origin of the phosphorus to the limestone, the ash of coal and to the clay of the furnace, the latter being also the source of the vanadium.

The same author(¶) finds crystals of Gay-Lussite ($Na_2CO_3\ CaCO_3\ 5\,H_2O$) in soda liquors from the above works and ascribes to the formation of this substance one of the principal losses of soda in the Leblanc process.

Reidemeister(††) finds the same substance to separate from crude soda lyes during carbonation, but never from the fully carbonated liquor. It also occurs in the lime mud of the causticising vats in the manufacture of caustic soda. It is insoluble in water, but is decomposed by prolonged action of cold water, more readily with the aid of heat. It forms most abundantly in concentrated caustic liquors. An anhydrous soda-lime carbonate occurring in over-

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(*) Comptes Rendus, 92—181. Ding. Jour. 243.1.

(†) Ding. Jour. 243.1.

(‡) Ding Jour. 235-399.

(§) Comptes Rendus, 92.878. Ding. Jour. 242.4.

(‖) Ding. Jour. 242.4.

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(††) Ding. Jour., 242.-4.

heated or "burnt" balls in the black ash process gives crystalline structure to the mass and hinders subsequent lixiviation. The temperature of the black ash furnace should therefore be maintained at a point below the melting point of this double carbonate.

W. Smith and *T. Liddle* (*) have shown that the loss of soda in the residue left from the lixiviation of black ash may be lessened, and the soda recovered by prolonged digestion with cold water, which decomposes the insoluble Gay-Lussite. "Soda waste" heated one hour at 60° yielded .22 per cent., Na_2O out of 2.4 per cent. of soda present, and a sample of causticising mud yielded by the same treatment 2.62 per cent. of soda, while 2.5—3 per cent. remained insoluble. By using this mud to replace lime in the balling process the insoluble soda is recovered, but when the mud is rejected a loss as high as 7 per cent. of soda may occur. Wright has already shown that the total loss of Na_2O in the Leblanc process may amount to 20 per cent. The writers confirm the statement of Scheurer-Kestner that an excess of lime in the balling furnace favors the production of insoluble compounds of soda during lixiviation.

The manufacture of soda by the ammonia process of Solvay has been improved by *Honigman* (†), who employs a moderately elevated temperature in the absorbing vessel, securing by this means a granlar precipitate of bicarbonate instead of the slimy mud commonly produced in the cold. The precipitate is easily washed. After washing, it is pressed in the cakes which are decarbonated in an upright furnace, on the grate of which the cakes are exposed to a current of hot CO_2 from the generator. The dry powder falls through the grate, and the additional volume of CO_2 obtained is carried to the absorber.

Improvements in the apparatus of the ammonia process have also been made by *Montblanc and Gaulard* (‡), *Pechiney* (§) and by the *Societe Anonyme de Produits Chimique de Paris* (‖). *Ortlieb* and *Muller* (¶) apply the method of Solvay to the production of potassium carbonate, also through the substitution of trimethylamine for ammonia.

Trimethylamine, through the recent discovery of Camille Vincent, has become an abundant commercial product, being made

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(*) Chem. News, No. 43. Ding. Jour., 242.4.

(†) Ding. Jour., 243.-1.

(‡) Ding. Jour. 243.1. (§) Ib. (‖) Ib.

(¶) Bul. Soc. Chimique, Jan. 5th, '82.

from the residues of beet root molasses. A single firm, Tilloy & Dulanne, of Coumeres, turn out 1800 kilos of crude salts of trimethylamine per day.

A current of CO_2 is passed into a solution of equal equivalents of potassium chloride and neutral trimethylamine hydrochloride at 23° C. and potassium carbonate ($KHCO_3$) is precipitated. The reaction is limited by the inverse reaction, but this difficulty is overcome by operating under pressure. An excess of trimethylamine (2.22 molecules to 2 KCl) has been found to increase the yield.

Lunge (*) has directed the examination of several reactions which have been suggested as indicating new methods of making soda, or of improving existing methods. The results are given as follows:

1. The action of Al_2O_3 on $NaNO_3$ at high temperatures with recovery of the nitric acid causes rapid attack of the vessels (platinum, iron and glass used) and HNO_3 is only partly recovered. The reaction is less available for manufacturing purposes than the earlier one of Schiappi, in which $CaCO_3$ and $NaNO_3$ are used.

2. The decomposition of sodium sulphate by a solution of calcium bicarbonate (*Pongowski's method*) (†) was found impossible using a three-fold quantity of pulverized marble, acting for ten hours upon sodium sulphate in a solution saturated with CO_2.

3. Aarland's process for substituting $CaCl_2$ for $MgCl_2$ in treatment of soda waste by the well known method of Schaffner and Helbig failed entirely when tried in the laboratory. $CaCl_2$ decomposes Ca S only after prolonged boiling, a result which may be obtained with water alone.

POTASH.—*Gruneberg* (‡) reviews the progress of the Stassfurt industry in its relation to the production of potassium sulphate from the complex salts and mixtures of the natural deposit. He discusses a list of 20 patents which have appeared since 1877, and classifies them as follows:—

1. Preparation of Schoenite ($MgSO_4$, $K_2SO_46H_2O$) from Kieserite ($MgSO_4$) and KCl or Carnallite ($K\ Mg\ Cl_3\ 6H_2\ O$)
2. Preparation of Schoenite from Kainite.
3. Working of mother liquors for by-products.
4. Production of K_2SO_4 from Schoenite by methods other than those depending on decomposition of KCl.

The author concludes that a combination of different processes

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(*) Ding. Jour. 243 Heft. 2.

(†) French Patent, Mar. 27, 1872.

(‡) Ding. Jour. 243 Heft. 1.

will be found best in practice. In all processes it is advisable to use a minimum of water, and to have all waste liquors as rich in $MgCl_2$, and as poor in potassium salts as possible before they are rejected.

All methods of preparing potassium sulphate from these salts must compete with the direct method of the Leblanc process, by which the alkaline chloride is converted into sulphate, and are at an additional disadvantage in comparison with it, because of the loss of HCl in the waste liquors.

ABSTRACTS.

Abstracts from the *Comptes Rendus*, by A. Bourgougnon.

Complex Function of Morphine, and its Transformation into Picric Acid; also its Solubility. By M. Chastaing. No. 1. (Jan. 2nd, 1882).—Action of alkalies. Potassa, soda,baryta and lime dissolve morphia in the proportion of one equivalent of morphia for one equivalent of base. The solutions evaporated in a vacuum give crystallized products containing one equivalent of base, one equivalent of morphia and two equivalents of water.

Action of Nitric acid. Tetrahydrated nitric acid at a temperature of 100° C. transforms morphia into an acid with the formula $C_{20}H_{18}N_2O_{18}$, a tetrabasic acid crystallizing with difficulty. Baryta and lead salts of this acid contained $8\,H_2O$.

Monohydrated nitric acid, in sealed tubes at 100° C. transform the acid $C_{20}H_{18}N_2O_{18}$ into picric acid.

Solubility of morphia. 1 litre of water at 0° C. dissolve traces of morphia, at 10°, 0 gr. 10; at 20° 0 gr. 20; at 40° 0 gr. 40, of crystallized morphia. The solubility of morphia at 40° is then represented by a straight line, but above 45° the solubility is represented by a larger number than the elevation of temperature. From 45° to 100° the curve of solubility affects a parabolic form.

Carbonic Ether of Borneol. By M. A. Haller. No. 2. Jan. 9th, 1882.—This ether was found in the residues of preparation of the compound described by the author under the name of *Borneol Cyane.* When pure it affects the form of very light white needles or hexagonal tables, insoluble in water and the alkalies, not very soluble in cold alcohol, soluble in boiling alcohol, ether, chloroform, benzine, glacial acetic acid. Melting point 215° C. and sublimes without decomposition. Melted with caustic potash it gives potassium carbonate and borneol.