A solution of the blue vitriol and a caustic soda lye are then prepared, both at 15 deg. Baumé. The former is placed in a copper pan, and heated to about 78 deg. to 100 deg. F. Room must be left for sufficient alkaline lye to precipitate the solution. The lye is placed in a wooden or iron vessel, with a plug for running off the lye at pleasure. This vessel is placed over the copper pan, and as soon as the temperature is reached, the plug is opened, and the lye is allowed to flow out in a thin stream into the copper solution, stirring all the time, till the liquid is completely decolorized. No excess of lye must be added, and the temperature must not be allowed to rise higher, or blackening may ensue. We may ascertain when sufficient lye has been added, by filtering a small sample off from the precipitate. If enough lye has been added, the liquid will be as clear as water, and will give no further precipitate with an addition of more lye. The precipitate, which now appears green, is taken out and washed, and drained upon filters till it become a thick paste. It has now to undergo the process of "blueing." For this purpose a potash lye is prepared, not perfectly caustic. This is effected by dissolving in an ordinary caustic lye, at 17 deg. Baumé, so much crude potash that it may mark 22 deg. to 25 deg. Baumé. It is allowed to settle, and is then fit for use. The blueing is performed in copper pans, which should be movable. About 50 lbs. of the green precipitate may be placed in the pan, and about half a small pail of the lye is poured upon it, and immediately stirred well with a wooden spatula. The mixture takes a more blue color, which change goes on for some time. A small sample is placed upon paper, and the color examined. Another small portion is put in a glass, a little caustic lye is added, stirred up, and compared again, and a few drops are placed upon the same paper. If the color of the first sample is satisfactory, or if a further addition of lye produces no more decided blueness, sufficient lye has been added. If, however, a bluer shade appears in the sample, more lye—say $\frac{1}{4}$ pail—is added to the bulk, and stirred up, testing again till the full blue shade has been reached. The contents of the copper pan are then emptied into a cistern containing a very large excess of water, and washed repeatedly by decantation, so stirring until every trace of caustic lye and alkaline salt is removed. If this is not done the color will become blackened in spots on drying. When the washing is completed, the color is strained through cotton cloths, pressed in cakes about $1\frac{1}{2}$ inch in thickness, and then cut into pieces 2 inches square. These are then carefully dried at first at a temperature not exceeding that of the atmosphere, finishing off at about 100 deg. F.; 100 lbs. blue vitriol, with 100 lbs. potash, will yield in this manner 38 to 39 lbs. of color.

WILD YELLOW LAKE.

Take any quantity of the clear decoction, dissolve in it a little alum (free from iron), and then precipitate with soda, carbonate of soda, or, better still, with tin crystals. The lake is a pure yellow, without any orange cast. The color, however, is not permanent, and gradually fades on exposure to light.—*Chemical Review*.

A NEW OXYGEN RETORT.*

By WILLIAM J. CHADWICK.

THE oxygen mixture is in the form of perforated cakes, instead of plugs or cylinders. The shape of the retort is made so that the cake lies upon the bottom, and is only in contact on that side. The cakes, with the bottom bearing on the retort, consist simply of manganese, sand, or other substance containing no chlorate of potash, upon the top of which is placed the oxygen mixture, still forming one compact cake.

The retort consists of two small iron castings, the bottom one a flat, circular plate, with two projecting lugs. The

upper portion, which is bell-shaped, is made a little larger inside than the cakes to be used, and is attached to the bottom portion by means of a bayonet joint, although other fastenings may be adopted. The gas-tight joint between the two portions is easily made by grinding the two surfaces together, after having turned them to something like the shape. The stand simply supports the retort over an ordinary Bunsen burner, and may be attached to the top of the gas-holder, hung upon the side, or placed upon a convenient table, or even on the floor.

From the bent tube on the top portion of the retort an india-rubber or flexible pipe conveys the gas direct to the gas-holder. A small wash bottle may be used, or an ordinary back pressure valve, or an ordinary tap.

The object of using cakes of the above description is that they leave the retort perfectly clean; for, as it is the chlorate of potash that fuses and sticks to the retort, the manganese or sand which forms the bottom of the cake, and is the only portion in direct contact with the retort, is a sure means of preventing any sticking. This plan I also adopted in the case of plugs or cylinders. The perforation of the cakes is simply to facilitate the generation of the gas.

PREPARATION OF PURE BISMUTH.

ACCORDING to Thürrach, pure bismuth may be obtained by the following method: Commercial bismuth is melted under a surface of potassium chlorate to which from two to five per cent. of sodium carbonate had previously been added; the quantity depending upon the amount of impurities in the bismuth. The resulting regulus is dissolved in the least quantity of nitric acid. The solution is to be mixed with a concentrated solution of oxalic acid in slight excess, and then considerably diluted. After the precipitate has settled, it is separated from the clear liquid by decantation and filtration and washed with cold water. If the precipitate is allowed to remain too long in contact with the supernatant

liquid, it is likely to become contaminated with iron; but the subsequent ignition of the dry precipitate again removes this impurity. By ignition the oxalate splits into metal and carbonic acid. In presence of iron there is formed a bismutho-ferric oxide, which may be completely separated from the metal by hydrochloric acid. The chief aim of the author was to devise a process which would remove iron and silver as completely as possible, but traces of the latter metal may still remain.—*Schweiz. Woch.*

TREATING LUBRICATING OILS.

HERETOFORE it has been necessary to mix hydrocarbon, or mineral lubricating oil, with a considerable proportion of fatty oils, to give it the necessary body or viscosity; but these fatty oils (both animal and vegetable) are all more or less oxidizable in the air, producing gummy matters becoming very acid, and if left in warm places on cotton, wool, clothes, sawdust, or similar material, are exceedingly liable to spontaneous combustion. For lubricating the pistons of high-pressure compound surface-condensing engines, both marine and stationary, the fatty oils are particularly objectionable, for, in addition to the before-mentioned faults, the high-pressure steam decomposes them into fatty acids, and glycerin, which are, of course, carried into the boilers, where the fatty acids corrode most powerfully, and with the glycerin make a kind of soap, producing excessive priming. But Mr. Humphrey, of Chester, England, claims that he is able to produce mineral or hydrocarbon lubricating oil of such a body that no mixture of fatty oils whatever is required, the viscosity being equal to the best olive, and considerably superior to sperm; while being perfectly neutral, it cannot act on or corrode the condensers or boilers, nor form concretions in the cavities of the pistons and steam passages; nor does it act on the india rubber valves of the air pumps to any injurious extent when used for internal lubricating of steam engines. For ordinary lubricating it is perfect, as it forms no gum or acid, and it is absolutely safe from spontaneous combustion, with a lubricating power equal to sperm. The oil treated by his invention is also specially suited for lubricating fast-running machinery, and for all kinds of fast-running mechanism. He first submits the oil to careful fractional distillation, and collects the heavy portion of the product. In the refining or chemical treatment, instead of agitating the chemicals with the oil by means of paddles, screws, or other mechanical means, as have heretofore been used, he forces a large stream of compressed air through a pipe at or near the bottom of the vessel, by which very important advantages are obtained. As well as a most thorough and complete agitation, a considerable effect is produced, powerfully aiding the action of the chemicals used; at the same time, the great volume of air passing through carries off all traces of oils of low gravity and boiling points, the result being lubricating oil possessing more body and higher specific gravity and flash-point than any mineral lubricating oils heretofore produced, making it specially adapted for lubricating the pistons, slide valves, and other parts of steam engines, machinery, and other apparatus. The oil may be produced from coal, shale, peat, bitumen, asphaltum, petroleum, and other oil producers, as is found most economical and convenient.

ESTIMATION OF BORACIC ACID.

AN easy and practical method for the determination of boracic acid, which has long been a desideratum, appears to have been supplied by Mr. Paul Berg, an abstract of whose method we give in the following: It having been observed that the addition of strong alcohol to a solution of boracic acid or a borate, which has been partially precipitated by baryta, causes the complete separation of barium borate, there only remained the necessity to find an acid which would form both a sodium and a barium salt soluble in alcohol. Such an acid was found to be bromhydric acid, since NaBr, as well as BaBr₂, are easily soluble in 95 per cent. alcohol, and having the additional advantage that sodium borate is easily decomposed by it into sodium bromide and hydrated boracic acid.

Finely powdered borax is dissolved in hot water, introduced into a flask, colored with a little tincture of litmus, and enough bromhydric acid is added to produce an acid reaction. There is then in solution, sodium bromide, boracic acid, and the excess of bromhydric acid. The flask is now closed with a doubly perforated cork, carrying a tube filled with pieces of caustic potassa, to absorb any carbonic acid which might be carried in by the air,* and a small funnel, containing a moistened filter. Cold saturated baryta-water is passed through the latter into the flask, until, after gently shaking, the precipitate which forms at first is redissolved. Freshly boiled alcohol of 95 per cent. is now poured in through the same funnel, so as to produce an alcoholic solution of about 55-60 per cent. in the flask, the potash tube and funnel are removed, and replaced by short glass-rods, the flask is shaken and then set aside for 24 hours. The glass rods are then again removed, the potash tube inserted into one of the perforations, and a syphon tube into the other, by means of which most of the clear liquid may be removed. Alcohol of 75 per cent. having been rapidly poured in after removal of the syphon, the flask is again hermetically closed and set aside. When the sediment has been deposited, the liquid is removed in the same manner, the sediment, consisting of barium borate transferred to a tarred filter, and washed with alcohol of 75 per cent., taking care to prevent free access of air, except towards the end. The filter and precipitate are finally dried in the exsiccator and weighed as barium (mono-) borate; BaO, B₂O₃ + 4 aq.—*Zeitsch. f. anal. Chem.*

EXPLOSION OF NITRO-HYDROCHLORIC ACID.

AT Bow Street Police Court, London, recently, Messrs. Rouch & Co., who were represented by their manager, Mr. G. H. Turner, were summoned for having sent out a dangerous explosive liquid, and causing damage to a tablecloth and other property in chambers occupied by Captain Hawley Smart, at St. Martin's Chambers, Trafalgar Square.

Mr. Montagu Williams, in support of the summons, said that the matter had been taken up on public grounds by Captain Smart, a gentleman in the military service, but also well known as an author and novelist. If he had been pursuing his literary occupations at the time of the explosion he might have been deprived of his eyesight or otherwise injured for life. It appeared that on the morning of the 9th April, a boy delivered at the chambers a small packet, resembling a medicine bottle. There was no address written on the bottle, and the boy was unable to say for whom it was

intended. The landlady, Mrs. Billingham, thinking that it must be for Captain Smart, desired the servant to place it on that gentleman's table, and it was left there till the return of the captain between 10 and 11 at night.

Captain Smart deposited that he saw the packet lying on his table. He looked at it for a moment, and then sat down in front of the fire with his back towards the table. Suddenly he was startled by a loud explosion, like the bursting of a soda-water bottle, and he saw that the packet on the table had disappeared. The room was filled with smoke and a suffocating vapor, causing him to open the doors and windows, and as both the tablecloth and table appeared to be burning, he procured a wet cloth and took other means to prevent the spreading of fire. He found that the bottle had been splintered to atoms, and the neck of it, with a cork still in it, was found upon the floor. Stains caused by the contents of the bottle were to be seen on the carpet, the furniture, and a portion of his own wearing apparel, and he burnt one of his fingers through taking up a fragment of the bottle. The label of Messrs. Rouch was still adhering to the bottle. He sent to them for an explanation of the matter, but they treated the inquiry with such nonchalance, not to say rudeness, that he resolved to place the matter in the hands of his solicitors.

Mr. G. H. Ogston, analytical chemist, of Mincing Lane, described the mixture as a most dangerous one, stronger than nitric acid, and more destructive than vitriol. It was known as *aqua regia*, and was a combination of nitric and hydrochloric acids, and he was surprised that any chemist could have sent out such a preparation without a proper description of it, and a caution as to its dangerous character written outside.

The defence was that the mixture had been made up from the prescription of a medical man, and, when sent out by the boy, was accompanied by proper instructions, the prescription, and the address of the gentleman for whom it was prepared, viz., Major Furlong, who resided in another set of chambers under the same roof as Captain Smart. It happened that the boy neglected to deliver the prescription, etc., and address. With respect to the statement that the clerk of Messrs. Frere, complainant's solicitors, was treated with insolence by Mr. Rouch—who said that it was an attempt to extort money, and that he was "smart" as the complainant—it was alleged that the complainant and his solicitors behaved in a very "bumptious manner," and that Mr. Rouch consequently lost his temper. It was urged that the occurrence was merely accidental, and that there being no willful intention the complainant could not be sustained; but Mr. Flowers remarked that such an explosion would probably have happened in Major Furlong's chambers with similar or worse results. The defendant said if the instructions had been delivered with the bottle it would have been seen that the bottle was to be kept in an upright position, and the defendant's boy was called to prove that he lost the paper at the time, but finding it afterwards, delivered it the next morning.

Mr. Flowers said that there had been great carelessness, and fined the defendants 40s. and £3 12s. 6d., the amount of damage done by the explosion.—*London Times*.

SYNTHESIS OF UREA.

It has been noticed by E. Schmidt (*Ber. deut. chem. Gesell.*, 1877), that carbonic oxysulphide, as occurring in the thermal spring of Harkány, when passed into a concentrated aqueous solution of ammonia at 0° C., is absorbed in large quantities. Ammonium oxysulphocarbamate is formed,

which after exposure for some time to ordinary temperatures, or by the application of heat, breaks up, partly into urea and sulphuretted hydrogen:

while another part, combining with water, forms carbonate of ammonia and ammonium sulphide:

The second reaction is reduced to a minimum if the liquid be treated without delay with freshly prepared lead oxide; as a lecture experiment, the liquid may be at once evaporated without the employment of the metallic oxide. Crystals of urea more than an inch in length can readily be formed by this means.

ON FORMATION OF SALTPETRE BY ORGANIC FERMENTS.

It is commonly accepted that the nitrates distributed in the ground arise from combustion of ammonia and nitrogenous substances of organic origin; but no very definite ideas have been acquired regarding the mechanism of this combustion. Is the saltpetre formation the result of a direct and purely chemical reaction between the oxygen and the nitrogen compounds? Does it occur under the co-operation of organisms which act as ferments, or simultaneously by both these processes? "These questions arose," said MM. Schloering and Muntz (in a recent note to the French Academy), "after M. Pasteur had proved that certain organisms, such as the mycoderma of wine and vinegar, have the property of conveying the oxygen of the air to the most various organic substances, and are the most active agents for the destruction of organized material which has ceased to live. On the other hand, M. Pasteur shows that organic substances, which are at least as decomposable as those which form saltpetre in the ground, offer a remarkable resistance to oxygen, when they remain protected from all organic germs. These two facts led to the supposition that, at least in the cases of rapid combustion and formation of saltpetre, organic agencies are operative; while at the same time it may be allowed that oxygen is capable by its chemical and physical force, of consuming nitrogenous substances, and transforming them into saltpetre."

Starting from this standpoint, the authors made experiments which appear to support the supposition referred to, without absolutely demonstrating its correctness.

In the course of an investigation as to whether humus must be present in the ground in order that drainage water may be purified, i.e., that the substances dissolved in it may be fully consumed, a wide glass tube 1 meter in length was filled with 5 kilogrammes of quartz sand that had been strongly heated, and was mixed with 100 grammes of powdered lime. The sand was sprinkled daily with equal quantities of drainage water, which was so calculated that the liquid took eight days to percolate through the tube. During the first twenty days there was no trace of saltpetre formation, and the quantity of ammonia in the filtered water remained unaltered; then saltpetre appeared, and as its quantity quickly increased, it was soon evident that the drainage

*Read before the Manchester Photographic Society.

*The necessity of excluding carbonic acid arises from the subsequent presence of free baryta in the liquid, which might be converted into carbonate, and thereby contaminate the precipitated borate.