OXYGEN AT HIGH PRESSURE.

M. P. BERT.

THE author has shown that oxygen at high pressure rapidly destroys all living beings and of all anatomical elements. All those phenomena known as fermentation, where the action depends on the presence of living beings, such as acetification, putrefaction, etc., are completely arrested even by the transitory action of compressed oxygen, whilst fermentations due to a dissolved matter (diastase, emulsine, etc.) perfectly resist the influence. He has applied this action of compressed oxygen as a means of physiological investigation. He finds that the ripening of fruits is arrested by exposure to compressed oxygen, and is hence due to a cellular evolution. The poison of the scorpion, whether liquid or dried and re-dissolved in water, entirely resists the action of compressed oxygen. Such poisons owe their action to chemical compounds comparable to the vegetable alkaloids. Fresh vaccine matter submitted for more than a week to oxygen at a pressure equal to about 50 atmospheres retained its virtue. The matter of glanders, after similar treatment, rapidly killed horses inoculated therewith. Hence these kinds of virus do not owe their properties to living beings or living cells. Carbuncular blood, also, after exposure to compressed oxygen, though freed from bacteria, nevertheless retained all its dangerous properties.

DECOMPOSITION OF HYDROCHLORATE OF TRIMETHYLAMIN BY HEAT.

M. CAMILLE VINCENT.

THIS compound may serve for the easy and abundant preparation, not merely of mono-methylamin, but also of chloride of methyl, yielding hydrochlorate of ammonia as a by-product. This decomposition may be utilized for causing the chloride of methyl to react at a high temperature, and in the nascent state, upon various bodies, and especially upon aniline. If we heat a mixture of hydrochlorate of trimethylamin and hydrochlorate of aniline we obtain methyl-aniline, which distills over, and which only requires to be washed with water and rectified. If thus prepared it is free from all traces of aniline. The hydrochlorate of trimethylamin, which is now obtained on the large scale, may thus be judiciously utilized for the preparation of ammoniacal products and of pure chloride of methyl, which latter may serve either in the manufacture of methylated aniline colors, or in the preparation of pure methyl alcohol.

MANUFACTURE OF SULPHURIC ACID.

THE apparatus for the manufacture of concentrated sulphuric acid and other mineral acids, invented by Mr. L. Brumleu, of Berlin, consists mainly of a burner wherein brimstone or other sulphur-containing mineral is burned, of several vessels or chambers of any size or shape connected with the burner by means of pipes, and of an air pump or blower. The burner may be the same as used in the manufacture of sulphuric acid for the burning of brimstone or other minerals containing sulphur. At a suitable distance above the burning brimstone is a vessel of iron or other material, placed so that it is reached by the flame or heat of the burning material, and its contents become heated by the same. This vessel is filled with nitric acid or any other salts of nitre, with a due proportion of sulphuric acid, so that nitric acid is produced. At the side a small pipe of iron or other material is entered through the wall of the burner above the burning material, through which pipe a small stream of steam can be blown into the inside of the burner, just above the burning materials. From this burner, some distance above the burning brimstone, a pipe of a pretty large dimension is let through the back wall of the burner till within a short distance from the bottom of the first vessel or chamber, being passed through the top of this chamber. A damper is placed so that this tube can be closed inside the burner as occasion requires. The first vessel, or chamber, may be of any shape, the size being regulated in proportion to the quantity of sulphur to be burned and the size of the burner. By preference this chamber is constructed of brickwork, narrow, low, and long, for reason which will appear afterwards. It may be 12 to 20 ft. long, 4 to 5 ft. wide, and 2 ft. high, inside clear of the wall. The sole of the chamber must be of cast-iron plates, with a fire-place under it to heat the contents of the chamber. According to the nature of the acid to be made, the inside of this chamber must be lined with lead as far as up to the doors, or it may remain free from any lining, so that the sides and top are coated with cement and the sole of iron. This chamber is divided in different compartments by either glass plates or iron plates, according to requirement, cased in sheet lead, these divisions reaching only from the top of the chamber to about its middle, leaving the lower half of the chamber undivided. Each of these divided compartments is on one side provided with an opening so arranged that it can easily be closed by a sliding door of glass or otherwise. These slides or shutters must have a small hole just barely large enough to pass the handle of a rake through for the purpose of stirring up or raking the contents of the chamber without opening the doors. Besides the pipe or tube connecting the chamber with the burner there is another pipe carried through the top of the chamber to within a few inches of the sole of the chamber; this pipe is connected with an apparatus where air is heated in any way it may suit best, and also provided with a damper. This first chamber is connected with a second chamber of about the same dimension and size by a pipe coming out from the top of the first chamber, going through the top of the second chamber to within a short distance from the sole or bottom of the same. This chamber is also divided into several compartments, with this difference, that the partitions of the second chamber go from top to bottom, forming thereby several separated compartments, all connected through pipes going from the upper part of the first partition to within a short distance of the sole or bottom of the next, and so forth from the second to the third, and so on to the last compartment. This second chamber must be placed so much higher than the first one as to permit its liquid contents to run through the intermediate compartments into the first chamber. For this purpose all the chambers or compartments are connected by pipes of lead, glass, or any other suitable material, and these pipes are provided with cocks, so that they can be opened or shut as the case may require; these pipes going from the bottom of one partition to the bottom of the next one, the contents of all the partitions can be run into the first chamber. These small compartments require no lining, but only a coating of cement: openings or doors are not absolutely required, but may be useful for the purpose of inspecting the chamber and for repairs, and have to be so arranged that they can be luted air-tight. From the top of the last compart-

ment a pipe connects the whole chamber system with an air pump, blower, or other instrument suitable for sucking the air from the chamber.

When the apparatus is thus arranged it is ready for use. If it is to be employed for making sulphuric acid the chambers are kept dry and empty—that is no water is put in. The brimstone in the burner is then ignited, and when it is fairly burning and nitric acid provided in the vessel for that purpose, the blower is put in motion and the steam pipe is opened to let in a stream of steam. By the suction of the blower the sulphurous acid, the steam, and the nitric acid vapor will be drawn through the tube into the first chamber, and there, the chamber being kept cold, condensing drop down in a liquid form as sulphuric acid. To assist this dropping down and regulate the speed of passage through the whole chamber system half partitions are constructed as described. In the first chamber the strongest acid is produced, whereas the mostly exhausted vapors in passing the smaller chambers have only a very weak acid in small quantities, and finally pass out through the blower completely exhausted. During this stage of the process the cocks of the connecting pipes are kept open, so that all the weak acid which is precipitated in the compartments may run back into the first chamber.

The velocity and size of the blower or air pump must be regulated so that all the sulphurous acid, steam, etc., is drawn from the burner into the chamber. If the pump is too small or is worked too slowly sulphurous acid will escape through the door or air-holes of the burner, if too large or worked too quickly the draught will be too quick, and the vapors hurried too quickly through the chambers and not able to discharge all the sulphuric acid which is contained in them. The quantity of steam can be regulated in such a way that the acid in the chamber is about 40° Baumé strong, to avoid useless condensing afterwards. When in this way the first chamber is filled about half or up to the door, or as high as the lining of lead will admit, the act of concentrating begins and is continued till the acid has acquired strength of 66° Baumé or more. To obtain this object fire is made under the first chamber, the tube connected with the burner closed, and instead of that the tube connected with the hot-air furnace opened, and the cocks of the pipe closed which connects the different chambers. The blower or air-pump now put in motion draws the hot air quite through the weak and hot acid, and in so doing dissolves water and some acid in its passage, which is carried off with the air through all the small chambers, where, these being kept cold, the weak acid will be condensed and collect at the bottom of the chamber. The passing of hot air through the hot acid will not alone be the means of concentrating the acid by the passage of the air through the acid; it will be kept in a state of motion just as is produced by the boiling of a liquid, and a strong evaporation of water and acid takes place, which by the draught of the blower is drawn into the small cold chambers and there condensed. As soon as the required strength is obtained the acid may be drawn off by a syphon or a pipe left for this purpose in the chamber into a cooling vessel, or left in the apparatus to cool there, just as it may be convenient. To keep up a perpetual process each burner ought to connect with two sets of chambers, so that one makes weak acid during the same time that the other concentrates.

In applying the invention to the manufacture of chloride of lime or bleaching powder, the required ingredients are brought into the first chamber, and the process carried on the same way as for making sulphuric acid; the sulphuric acid formed then will, being condensed, drop down on the ingredients, decompose them, and make the chlor gas free, which in passing through the chambers will there deposit the moisture which it contained, and may then by the air pump or blower be conveyed through pipes to the rooms where lime is spread out to take the gas up and form bleaching powders. In the beginning of the process no fire is required until the contents of the chambers are nearly decomposed, when heat has to be applied to forward the process, and drive off all the gas by fire under the chambers as well as by the influx of hot air. When all the salts are decomposed the influx of sulphuric acid from the burner has to be stopped, and the fire as well as the influx of hot air continued till all or nearly all the chlor gas is driven off. During all the time the contents of the chamber have to be stirred up and raked up by means of iron rakes, the handles of which are passed through the small holes left for this purpose in the doors. Of course the doors have to be made tight as much as possible, and luted to prevent the escape of gas and the entering of cold air.

To decompose salt for the purpose of getting the sulphate of soda and hydrochloric acid, the first chamber is filled with salt, and the small chamber with water up to the door of the chamber, and then the process is carried on as for making sulphuric acid. The water in the small chambers will take up the gas which is created by the decomposition of the salt, and form thereby hydrochloric acid, whereas the salt is turned into sulphate soda. When all, or nearly all, the salt is decomposed fire is made under the chamber, and even with the assistance of hot air the whole mass is raked and stirred up by the rakes till all the gas is driven off just as is always done now in making this article. For works where much carbonic acid is used for the purpose of making bicarbonate of soda, the last chamber may be provided with a stirrer or agitator, and then filled with water and chalk or marble dust, the stirrer being kept in motion, and the gas being drawn through the chalk will be decomposed to muriate of lime, while carbonic acid getting free may be forced by the blower into the room where soda is arranged in the usual way to be transformed into bicarbonate of soda.

PRODUCTION OF ALUMINIUM.

LEAD or a sulphide of lead, or mixture of the two, are according to the invention of Mr. E. A. Wilde, of Notting Hill, melted, and in a melted condition are poured upon dried or burnt alum. The crucible in which they are contained is then placed in a furnace, and heated together with suitable fluxes. The metal when poured out of the crucible will be found to be mixed with aluminium. The aluminium and lead can either be subsequently separated the one from the other by any known means, or the alloy or mixture of the metals can be employed for various useful purposes for which pure lead is more or less unsuited.

MM. A. GUILLEMARE and F. Lecourt have experimented successfully with chlorophyll as a substitute for the salts of copper in giving a green color to peas, beans, cucumbers, and other canned or pickled vegetables. The color thus obtained is said to be more natural than that which is given by copper, the vegetables are more wholesome, and the flavor is better on account of the absence of all astringent or metallic taste.—*Comptes Rendus*.

SPECTRUM OF THE ELECTRIC SPARK IN A COMPRESSED GAS.

M. A. CAZIN.

THE electric spark in a gas is analogous to the ordinary flame of a hydrocarbon. In each of these luminous sources there are gaseous particles which produce a spectrum of lines, and solid or liquid particles which produce a continuous spectrum. These are derived in case of the spark from the electrodes and the sides of the vessel when very near. When the pressure is increased these particles are more abundant, their continuous spectrum becomes more brilliant, and, finally, causes the disappearance of the linear spectrum of the gaseous particles. It is in the flash of fire that things take place thus: the paler luminous halo or aureola is formed of gaseous particles whose linear spectrum is more or less visible; it is to the entire spark what the blue base of the flame of a candle is to the entire flame. At ordinary pressures, in nitrogen, the spark is pale and furrowed with small flashes of fire. We see in the spectroscopic the grooves ascribed to nitrogen, and in their intervals the characteristic lines of this gas. On compressing we see the grooves disappear little by little, whilst the continuous ground of the spectrum becomes more brilliant. When the pressure exceeds two atmospheres there are only six lines of nitrogen from the orange to the blue, and five diffused bands beyond. At 10 atmospheres there only remain the two nitrogen lines $\lambda = 567$ and $\lambda = 500$, and then a very brilliant line in the violet $\lambda = 424$, which first appears at 5 atmospheres. The sodium line is very distinct, whilst it is not to be distinguished at ordinary pressures. About 15 atmospheres the spark becomes dazzling; upon the continuous spectrum are seen the four lines above mentioned, and certain brilliant points due to platinum. In air compressed above 30 atmospheres the spark produces intense reddish vapors, and the spectrum showed the absorption spectrum of hyponitric acid.

THE JABLOCHKOFF ELECTRIC CANDLE.

A SECOND series of experiments illustrating the lighting capabilities of this important invention took place on June 15th last, at the West India Docks, London, in the presence of a large body of scientific gentlemen and others interested in this last addition to our illuminating appliances. On this occasion everything worked smoothly, and taking the experiments as a whole they were eminently satisfactory. The electric power was produced by one of the Paris Alliance Company's magneto-electric machines, with thirty-two horse shoe magnets of seven plates each, and worked by a small agricultural engine of about eight horse-power.

The trials commenced about 9 o'clock with the lighting up of the yard. Four lamps, mounted on posts about 15 feet high, were used, each of which were said to be equal to one hundred gas lights, but the size of the gas light was not specified. The lights were toned down by opal glass globes, which seemed somewhat too thick for the purpose, the light given out by the candles being, if anything, a little too subdued. The very slight flickering, of which we have already spoken, was much less apparent than on the occasion of the first trial—an improvement which was no doubt due to the engine being in better working order. It seems that a great deal depends on the motive power working regularly; for after the lamps had been burning for about five minutes the light suddenly improved, becoming much more steady and brilliant. After burning for about twenty minutes the lights were extinguished, and four gas lamps, with four powerful burners to each, were turned on, evidently with the intention of showing the difference between the orange color of the gas flame and the pure white of the electric lamp. The company then adjourned to a large warehouse at the top of the adjacent building, measuring about 50 yards long by 25 yards wide, which was lighted from the outside by three electric candles without any intervening globes. Two of these candles were placed at the side and one at the end, but being only breast high the shadows of persons passing in front of them greatly interfered with the experiments tried. One of the objects of this portion of the trial was to ascertain whether this light could be used for sampling various descriptions of produce and merchandise. Several experts were present, but owing to the position of the light being horizontal instead of vertical there seemed to be some doubt as to its value in the case of samples of coffee, grain, pepper, and similar commodities, inasmuch as the strong shadow cast horizontally by the individual grains of the produce under examination interfered materially with their color—the particular tint of a coffee berry, for instance, being an important factor in the estimation of the value of a sample. It was far otherwise with a number of samples of colored alpaca goods. The most difficult colors to judge of by gas light, or during foggy weather, are dark olive greens, puce, and blues. Next to these come the lightest shades of straw yellow and cream color. In the first case the colors are not to be distinguished from black, and in the second from white; but under the electric light the darkest navy blues and the lightest greys came out in their tints, even to the eyes of the uninitiated. The company then adjourned to the quay below, alongside which a large barque had been moored. Here the practicability of lighting ships' decks and holds, and the adjoining wharfs, was most satisfactorily demonstrated, as well as the portability of the light itself.

The amount of heat given off by M. Jablochkoff's candle is comparatively small, the glass globe of one of the lanterns used for lighting up the ship having been found to be only just comfortably warm after having been lighted for twenty minutes.

The last experiment tried was, scientifically speaking, the most interesting of the whole, demonstrating as it did that M. Jablochkoff has succeeded in entirely doing away with the necessity for using carbons for the electric light. His newest form of candle consists of a thin plate of his kaolin composition, about 1½ inches long by 1 inch broad, and about ½ inch thick. The sides of the plate are inserted in grooves cut in the wires forming the electrodes of the battery, which project very slightly above the top of the plate. In order to light this new form of candle a bridge of ordinary graphite is carried along the top edge of the porcelain plate. The graphite gradually disappears, and the melted portion of the porcelain becomes incandescent, gradually vaporizing at the rate of a millimetre an hour. The light given out by the porcelain seems softer, mellow, and much more constant and steady, than that given off by the combination of carbon and porcelain; indeed, after five minutes' examination with black spectacles, we failed to discern anything more than a barely perceptible start at distant intervals.

Altogether, MM. Jablochkoff and Denayrouze may be congratulated on the success which attended their very interesting series of trials on Friday night.—*Chemical News*.