MISCELLANEOUS.

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Lectures on Chemistry.—No. 4.

[An abstract of a Lecture on "Potassium and its Compounds," delivered before the Mechanics' Institute, at Cincinnati, Ohio, by Prof. Chas. W. Wright.]

Potassium is obtained by heating a mixture of carbonate of potash and charcoal to whiteness in an iron retort. The potassium is condensed in a copper receiver, kept cool by being surrounded by a freezing mixture, and which contains naphtha or rock-oil,into which the melted potassium drops, and is preserved from the action of the oxygen of the air.

Potassium is a brilliant white metal, with the lustre of polished steel; and is so soft that it can be moulded by the fingers, and can be readily cut with a knife. It melts at 150°, and is so light that it floats upon the surface water. On exposure to the air it is instantly tarnished, being converted into oxide of potassium, or what is chemically termed "Potassa." When thrown upon water it bursts into a beautiful purple flame, forming a solution of potassa, which has an alkaline re-action. In this experiment the combustion is due, in part, to the potassium combining with the oxygen of the water, it having the power to decompose that liquid; hence it is kept under the surface of naphtha, a liquid which contains no oxygen.

The equivalent, or combining number, of potassium or "kalium" is 39 19, and its symbol, K.

Hydrate of Potassa—water combined with the oxyde of potassium, K.O H.O.—This substance is obtained by boiling 10 parts of carbonate of potash in 100 parts of water, and adding little by little, 8 parts of recently slacked lime. After boiling a short time it is allowed to cool, when the carbonate of lime or chalk subsides to the bottom of the vessel. When properly prepared, the clear liquid does not effervesce on the addition of an acid. The whole operation must be conducted in a covered ~~vessel, so as~~ to exclude the air. When evaporated to dryness, and melted, and run into moulds, it constitutes the "potassa fusa" of the drug stores; when in solution it is termed "liquor potassæ."

Potassa, or caustic potash, is deliquescent, and rapidly absorbs carbonic acid from the atmosphere, and must be preserved in well stoppered bottles. It readily attacks and dissolves the skin, and is highly poisonous. The antidote is vinegar or sweet oil.

With the fixed oils, potassa combines and forms a class of salts commonly called "soaps." Most of the fats and oils consist of oleic, margaric, and stearic acids, combined with an organic base, "glycerine;" potassa being the stronger base, combines with the fatty acids, forming salts or soaps, which, when potassa is the base, are soft, but if soda is the base they are hard.

Carbonate of Potassa, K.O.C.O.—This compound is always obtained by lixiviating or leaching wood ashes. Carbonate of potash, however, never exists as such in plants, the potassa being in combination with some vegetable acid, as oxalic, citric, tartaric, &c. When the plants are burned the vegetable acids are converted into carbonic acid, which, combining with the potassa, forms the carbonate of potassa, or what is commonly termed "potashes." The branches of trees yield more than their trunks, shrubs next, and herbs and leaves still more, on incineration. This distribution is probably due to the saline matter existing chiefly in the juices of the plant. Certain plants, as wormwood, for example, yield more carbonate of potassa, when burned, than others. Organic acids, when combined with potassa, undergo the same change when taken into the systems of animals, that they do when burned in the air, being converted into carbonic acid, which, uniting with the potassa, is thrown from the system as carbonate of potassa.

Nitrate of Potassa, Nitre, Saltpetre, K.O.N. O^5.—In the decomposition of animal matter containing nitrogen, in contact with alkaline bases, nitric acid is always formed, which, combining with the bases, generates that class of salts called "nitres," or the "nitrates." Nitric acid is probably formed in all cases by the oxydation of ammonia, which is the nitrogenous compound evolved in all cases of putrefactive decomposition. Thus, eight equivalents of oxygen and one of ammonia yield one equivalent of nitric acid and three equivalents of water. This change will be more intelligible when expressed in the form of a rationale, thus :—$N.H^3.+L.O.=N.O^5.+3H.O.$

In certain districts in India, nitrate of potassa appears to be formed in the soil in this way, and is obtained by leaching the earth taken from such localities. In some countries this natural process is imitated by keeping decomposing animal matter and lime together, whereby the nitrate of lime is generated, and decomposed by being lixiviated with carbonate of potassa, by which the nitrate of potassa and carbonate of lime are formed. Thus :—$Ca.O N.O^5.+K.O.C.O^2=K.O.N.O^5.+Ca.O.C.O^2$. Nitrate of lime exists naturally in certain caves, and is converted into nitrate of potassa when treated in the manner above mentioned. At the Mammoth Cave, in Kentucky, nitrate of potassa was once obtained in this way. This cave is the resort of innumerable bats, which, by their death and decay, will account, in part at least, for the presence of nitrate of lime.

Nitrate of potassa readily parts with its oxygen at an elevated temperature, and, from its containing a large quantity of that element, is extensively used in the manufacture of deflagrating mixtures, as gunpowder &c. The ingredients of gunpowder are sulphur, charcoal, and nitre. The sulphur accelerates the combustion and generates most of the heat, while the combustion of the charcoal furnishes carbonic acid gas, which, by occupying much greater space than its constituents, before combustion, produces much of the force of the explosion. The following rationale will give an idea of the re-action of the constituents of gunpowder produced by their explosion :—$3C.+K.O.N.O^5+S.=3C.O^2.+K.S.+N$; three equivalents of carbonic acid, one of sulphide of potassium, and one of nitrogen gas, being the result of the deflagration. Gunpowder, when ignited, does not explode instantaneously, but the combustion is communicated from one particle to the next until it is entirely consumed. Bodies which explode instantaneously are not adapted for the movement of projectiles, their action not being productive of a sustained effort, is local, and would tend as much to shatter the fire-arms as to project the ball. Gunpowder, when struck violently, sometimes explodes, and fatal accidents are occasionally the result of inattention to this fact. Fire-arms are sometimes burst by being discharged when the ball is not in contact with the charge of gunpowder—when it is not "rammed home," as the phrase is. This is cause by the great expansion of the air which is contained between the ball and the charge, and which undergoes so great dilatation, in connection with the deflagration of the powder, as to burst the piece.

Chlorate of Potassa, K.O.Cl.O^5.—This salt is obtained by transmitting a stream of chlorine gas into a solution of potassa. Six equivalents of chlorine, and six equivalents of potassa, yield one equivalent of chlorate of potassa, and five equivalents of chloride of potassium, one equivalent of the chlorine being converted into chloric acid, by abstracting five equivalents of oxygen from five-sixths of the potassa, used in the experiment, the chloric acid combining with the remaining equivalent of potassa, forms the chlorate of potassa, and the five remaining equivalents of chlorine and potassium, combining from five equivalents of chloride of potassium. These salts are separated by crystallization. The following is a rationale of the process :—$6K.O.+6Cl.=K.O.Cl.O^5.+5K.Cl.$

When mixed with combustibles, this salt deflagrates with much more violence than saltpetre. It was at one time used in the manufacture of percussion caps, as a mixture of it and sulphur detonates violently when struck by a hammer. Chlorate of potassa is used as an oxydizing agent in calico printing, and for the preparation of pure oxygen gas.

Iodide of Potassium, K.I.—This substance is obtained by decomposing the iodide of zinc with an equivalent quantity of carbonate of potassa; carbonate of zinc and iodide of potassium being the result of the decomposition, thus :—$Zn.I.+K.O.C.O^2.=K.I.+Zn.O.C.O^2$.

Iodide of potassium is extensively used in medicine, and has been recently employed in the preservation of butter; but as it is no way superior in this respect, to common salt, and and possesses a poisonous action, when slowly introduced into the system, for a considerable length of time, by producing glandular absorption, its employment for this purpose should be staictly avoided.

The Atmosphere, and its Effects upon Animal Life.

A very interesting lecture was delivered on the 11th inst., by Dr. Griscom, at the New York Mechanics' Institute, on the "Influence of Air in connection with Animal Life." The lecturer commenced by saying that he supposed some of them would be surprised to hear that they lived at the bottom of an immense ocean of air fifty miles deep; yet it was so, and the color of this ocean, which is called the atmosphere, is a deep cerulean blue. To perceive this color it was necessary to be able to see at once the whole volume, and also on a calm and clear day, for no color could be perceived if seen in small quantities, or when there was either wind or haziness. In like manner the color of water could not be seen in small quantities, and was only perceptible where there was a vast expanse of ocean. The air was also a substance capable of condensation and expansion. Its expansion was seen in the winds, by which ships were made to traverse the ocean, and also in windmills. The tornado was another phase of its expansion, by which trees were uprooted and houses overturned, and was almost equal to the power of steam. The greatest weight of the atmosphere was fifteen pounds to the square inch, and this weight presses on every way, both upward and downward. To explain the pressure upwards, the lecturer exhausted the air out of a large vase, which then remained fast to the plate on which it stood, but on the air being let in it was easily removed. I remember, said he, being asked the question, if there is a pressure of fifteen pounds to the square inch, the reason why we were not at once crushed by the weight; but this is, as I before explained, because the air presses in all directions with the same force, and hence there is an equilibrium.—This is a most important element, and one which requires to be known, and also that the air never presses more than fifteen pounds to the square inch. The next quality of the air is elasticity. Press it so as to make it occupy a smaller space than it otherwise would, and then take away the weight, and it comes back and occupies its original space. The lecturer then explained that in the air there were two gases; one oxygen, which is that part of the atmosphere by which chiefly we live, and which is the one-fifth part; and the other nitrogen, which is four-fifths of the atmosphere. Oxygen supports life and combustion, and nitrogen restrains its effects and dulls its operation. The quantity of air which a person consumes depends in a measure on oneself, and by training can be made more or less. The tailor and shoemaker take little in comparison with the laborer, and the public speaker and singer, or those who cry commodities for sale through the streets. A man in good health makes eighteen respirations in a minute, and in twenty-four hours consumes fifty-one hogsheads of the air. As the oxygen which supports life is so small we ought to be very particular how we permit other gases to mix with it and vitiate it. The blood when it enters the lungs, is black, but when the oxygen acts on it it becomes red, and sends it through the veins to impart life and animation. This black blood is produced by carbon and imparts the blackness which we see in the face of persons who lose their lives by suffocation, because the oxygen was not allowed to reach the lungs to purify it. When we send out the air from the lungs we do not send it in the same manner as we inhaled it, for when exhaled it is as deadly a poison as arsenic or corrosive sublimate. The lecturer showed this by experiments, and filled a vase with his own breath, in which a lighted candle would not live. It was such air as killed persons who went down into wells in the country, or who died when a pan of charcoal was placed in a room. The danger of taking impure matter into the stomach was not so great as into the lungs, for the stomach had power to eject impurities which the lungs had not. Beside the impure air which we exhale there are 2,800 pores on every square inch of the surface of the body, and to a body of large size there are 2,590 square inches; and these multiplied make 7,000,000 of pores. There is a sort of drainage pipe in the body, which sends out matter as well as gas, and this pipe is calculated at twenty-eight miles long. The particles of matter which are sent out, and which do not dissolve are so numerous, that in China, where the houses are low and a great many persons are in the habit of assembling in one room, it has been discovered that, after fifteen or twenty years, these particles adhere to the ceiling of the rooms that the farmers will contract to put up a new ceiling if they are allowed to take down the old one, so valuable has it been found for manure.

Parker's Water-Wheel Patents

Some of our readers having misunderstood some of our articles concerning the patents on Parker's Water-Wheel, which were published in our last volume, we would state that the original patent was issued Oct. 19th, 1829, and was extended seven years from its original date, it therefore expired in 1850, and is now public property. The claims of this patent are as follows :—

"1st. The compound vertical percussion and re-action wheel for saw mills and other purposes, with two, four, six, or more wheels on one horizontal shaft. The concentric cylinders enclosing the shaft, with the manner of supporting them. The spouts which conduct the water into the wheels, from the penstock, with their spiral terminations between the cylinders. 2nd. The improvement in the re-action wheel by making the buckets as thin at both ends as they can safely be made, and the rim no wider than sufficient to cover them. The inner concentric cylinder; the spout that directs the water into the wheel; and the spiral termination of the spout between the cylinders. 3rd. The rim and blocks, or planks, that form the apertures into the wheel, and the manner of forming the apertures. The conical covering on the blocks, with the cylinder or box, in which the shaft runs; and the hollow or box gate, in any form, either cylindrical, square, rectangular, or irregular."

Another patent was issued to Messrs. Parker for improvements in Water-wheels June, 27th, 1840, which will expire June 27th, 1854. The claim is—"the placing of the said wheel or wheels, or of wheels analogous thereto, in their construction and mode of operation within air and water-tight cases or box, denominated drafts, substantially in the manner and for the purpose set forth."

Our readers will now understand the exact scope of the two patents, without the necessity of relying upon the statements of others.

Fire Telegraph in Boston.

We have received a letter from Boston, stating that the article in the Scientific American, taken from a Lowell paper, about the failure of the "Fire Telegraph," is not correct The article, "probably originated," says the letter, "from a report to the City Government, that the *Alarm* was inefficient—that is, there was not enough of it. The City has, therefore, added three more bells, and also more alarm boxes. There is no failure about the Boston Fire Telegraph, and the City would be loth to go back to the old system, for, under the present, alarms of fire have decreased about 40 per cent. There have been but few irregularities, which may be well allowed for the newness of the system." Thus, as quoted, writes our correspondent.

A splendid mass of pure gold weighing 28 lbs. 4 oz. has been lately found at the Australian diggings. This superb mass has been purchased by the executive of the colony for $8,250, and has been transmitted per steamer to England as a present to Queen Victoria.

Philadelphia last year consumed 3,253,177,762 ale gallons of water, and 1,415,188,000 feet of gas. The daily average consumption of water in the city proper and the districts of Southwark and Moyamensing was 6,731,744 gallons.