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THE ALKALI METALS POTASSIUM AND SODIUM.—III.

MODES OF MANUFACTURE AND USES.

Some additional points will first be stated regarding potassium. In May, 1888, potassium was quoted in New York at $32 per lb.; in May, 1889, at $28. It remained at the latter figure till August, 1893, when the quotation in Europe fell to $27.50 per kilogramme, or $12.50 per lb. To this add costs of package, transportation, commissions, and duty (if any).

Comparison with sodium will serve to show how greatly the price of a commodity is influenced by demand. For sodium there is a market, though a small one. But potassium is as yet little more than a chemical curiosity.*

Potassium is a bluish-white metal, softer than sodium. It melts at 144° F. and boils at a red heat.

The liquid alloy of potassium and sodium, as is known from early experiments, already referred to, can be made *directly* by operating on a mixture of their carbonates. Here is another point for inventors. But the most important field now is the manufacture of these two metals and their alloys *by electrolysis*. Probably the only chemist since Davy who has achieved anything in this direction was Matthiessen (deceased). About 1855 he struck out quite a suggestive path, in operating to obtain potassium by electrolysis. It was based on the general principle that mixtures of solid bodies, especially of those chemically allied, melt much more readily than their components.

He electrolyzed, between carbon electrodes, in a porcelain crucible, with a current of ten to twelve volts, a fused mixture of two parts of potassium chloride with three of anhydrous calcium bichloride. This mixture fuses readily over a gas burner. The flame is so arranged that complete fusion, up to the surface of the mass, occurs only around the anode, where the chlorine can therefore escape freely. The potassium floats under a crust of a solid or pasty consistence, which protects it from the air and the chlorine. After twenty minutes the crucible is cooled and broken up under hydrocarbon oil, when a mass of pure potassium is found. Calcium does not appear to be isolated at this temperature and by this current.†

Repetitions of this experiment, with careful study, would doubtless suggest to any inventive mind plans of operating it on a large scale. If sodium chloride were also added, the melting point would doubtless be lowered further. In this case more calcium should be present, the proportions being now, in 100, 46· of calcium bichloride, 30· of potassium chloride and 24· of sodium chloride. The product here should be the alloy, in equivalent proportions, of potassium and sodium, liquid above 45° F. With 48· calcium bichloride, 31· potassium, and 21· sodium chloride, it will remain liquid at 32° F. Probably with stronger current and higher heat a little calcium might be reduced, but the liquid alloy might then be *distilled over*, the calcium remaining behind. The temperature for this would be a low cherry-red, about 1,500 F°. In this case, the cast iron or black lead melting pot should have a lid with a vertical diaphragm across it, dipping into the melted chlorides below. On the anode side of this lid a pipe is attached extending upward, to carry off the chlorine. On the cathode side there should be a tube extending downward through the bottom of the melting pot, terminating above between the molten chlorides and the lid, while dipping below into a bath of melted paraffine wax, the latter kept cooled below its vaporizing point. This wax should be of low gravity when melted, below 0·8, so that the warm alloy, of gravity about 0·85, should readily *sink* in this condensing bath. This manufacture would also produce *chlorine*, a valuable by-product, going far to pay the cost.

Of a number of *uses* that have been proposed for these metals and alloys, but one can now be explained, for lack of space. This use, which is for *blasting* purposes, is due also to Dr. Henry Wurtz, the chemist mentioned before in this connection. His most improved method is to fill a thin sheet metal cartridge casing closed at bottom, one-third or one-half full of melted sodium or of the liquid alloy. A flat spiral coil of fine iron wire is then suspended slightly above the surface of the liquid metal, there being attached to the inner and outer termini of said spiral two thicker copper wires. Then a thin layer of melted paraffine wax is poured on the spiral and allowed to solidify. When solid and cold, another thin layer of paraffine wax is poured in, not hot enough to melt the previous layer. The object is to fill up any defects in the first layer. Even a third layer may well be applied, for precaution. When the blast is to be made, the cartridge may be put into its place, the copper wires attached to others leading near a voltaic battery or other source of electric current, so that a circuit may be formed through the iron wire spiral. Then from a distance the bore hole is filled with water from a hose, and the circuit completed. The wax melts, rises, and is displaced by the water. The explosion follows. This mode of blasting is available only in the open air, not in mines or other inclosed spaces, by reason of the alkaline smoke. The energy may be greatly intensified by an additional device. Before the cartridge is introduced, a thin sealed elongated glass bulb filled with *nitric acid*, just large enough to pass easily into the casing between the vertical wires, is introduced. In this case, some other precautions are desirable, but no room remains now for further details.

* Since the figures for cost of sodium were given, in the issue of December 30, 1893, p. 418, a reduction has been announced by European manufacturers to about $1 per pound. Doubtless to this figure also, as in the case of potassium above, some additiona costs must be added—certainly cost of transportation to this side of the Atlantic, and commissions

† *Journal* of the London Chemical Society, viii., 30.

PROGRESS IN TYPESETTING.

The facility with which events are now recorded in the printed page, to be multiplied in countless thousands of copies in time so brief as to be but barely appreciable, illustrates the march of modern invention. The art of printing from movable types is something over four hundred years old; but it is only within the last thirty years that the improvements have been such as to make possible the marvelous work now done by modern newspapers. There were fast printing presses before 1860, presses which would turn off twenty thousand copies of a paper an hour; but these presses printed direct from the type forms, for which the types were set by hand. The perfecting of rapid stereotyping processes, by means of which one type form would furnish duplicate plates for several presses, was effected between 1860 and 1865. This gave rise to the system now in vogue of printing from an endless roll, instead of the sheets being fed singly by an army of hand feeders. A far higher speed and a great saving in the cost of presswork were the immediate results. This lowering of the cost and making possible the largest desired issues in the shortest time, while the news was fresh, has stimulated newspaper production to a remarkable degree.

Notwithstanding the improvements made in other departments of the printing business, the typesetting—the work of picking up singly by hand each individual letter and character forming the printed page—has until recently remained unchanged. Work could be hastened by employing many hands, each one putting in type a few lines, but the process was slow and expensive. Thus, in all descriptions of printing, the largest item in the initial cost is that of putting the work in type. That inventors have long realized the importance of improvement in this direction has been plain enough, some two hundred patents having been issued from the United States Patent Office relating to typesetting and type-distributing machines. But the difficulties in the way of success have been enormous. Only two styles of machines have been put on the market in this country, and one in Europe, which have met with some degree of success commercially for a period of about fifteen years, and another and later candidate for favor forms the subject of our first page illustration. In the Mergenthaler or linotype machine, only one operator is required, and the rate of speed attained probably about four times the rate of typesetting by hand.

ANOTHER EXPLOSION OF A HIGH PRESSURE GAS CYLINDER.

A short time ago we had to chronicle the explosion of a high pressure gas cylinder upon a dock in Albany. On January 4 another explosion of the same kind of cylinder occurred at the factory of the Brin Oxygen Company, First Avenue and Twenty-first Street, in this city, where the gas is made and compressed. The company compresses oxygen gas and street gas in steel cylinders at 1,800 pounds pressure per square inch. The system adopted has been to first pump up to a pressure of 2,000 pounds and then to reduce to 1,800 pounds. Thus each filling operates as a sort of test of the cylinder. The gases used are pumped by Rand compressors into the cylinders lying horizontally on a filling table. A safety valve is provided to prevent the pressure being exceeded, and a pressure gauge is connected, so that the proper pressure can always be given.

On the day referred to, some of the operatives were engaged in filling three hydrogen cylinders. It is supposed that one of them neglected his work, which involved watching the gauge to see when the proper pressure was attained. Two cylinders, which were 100 foot ones, exploded. It is probable that the one struck the other and caused it to give way. A third one was merely dented. The fragments flew in all directions. One broken cylinder lodged in a small gas meter. The filling table was reduced to splinters, holes were blown in the roof, and altogether about $500 of damage to property was done.

One man was killed outright. He was the one whose special duty consisted in watching the pressure gauge and turning off the gas at the proper time. Whether he was guilty of carelessness or not, it would seem that the safety valve should have operated. It possibly was seated. Two other employes were badly injured.

Unfortunately it cannot be known whether the proper pressure was exceeded or not, as none of the workmen were watching the pressure gauge. This accident, following the Albany explosion, is, to say the

least, very unfortunate for the company. If it operates against the use of high pressure cylinders, it will be a matter of regret that so convenient a mode of dealing with gases must be abandoned.

The entire stock of cylinders has been recently called in and they have been subjected to the most rigid tests before being sent out, so that the company felt every security against so dreadful an occurrence.

Music and Longevity—Testimonial of an Octogenarian.

BY DR. P. H. VAN DER WEYDE.

My personal experience induces me openly to indorse what so ably and forcibly was expressed by Dr. Ephraim Cutter in an after dinner speech, published in the SCIENTIFIC AMERICAN SUPPLEMENT for September 16, and to offer myself as an example of the benign influence of the study and practice of music, and the great advantages I have derived therefrom.

Notwithstanding I will soon pass my eighty-first birthday, my mind and body are still in good condition; which I attribute to the fact that I have a variety of occupations, which induces me to give exercise to different parts of my brain as well as of my body, without overworking and exhausting one part.

I have collected some statistics about men occupied exclusively in one kind of mechanical labor, and found that they die before the average of the life of such as have to perform labor which does not require the continuous exercise of the same parts of the body, but who are occupied in labor which allows the exercise of almost all parts; so for instance men whose main occupation is the use of the sledge hammer are very short-lived and several crippled old men have testified to me that they were overworked in one certain pursuit without variation.

It is the same with the mind as it is with the body, and even more so; men occupied year after year with bookkeeping, or being cashiers, or teaching one exclusive branch of knowledge, or giving music lessons to beginners, or clergymen preaching orthodox sermons or praying according to the same system, break down early. Hence broken-down clergymen abound. When the mind is free to rove wherever reason calls it a better mental health results than is the case of a mind trammeled by theological dogmas.

But, as in the usual course of life men have frequently monotonous daily duties to perform, which wear out their mind and body, it may be a blessing to them when they can indulge in another occupation which is utterly different from any daily routine; and such an occupation is music, which has the double advantage that it can be enjoyed also by those who have not been musically educated, but whose tastes run in such a direction as to be able to enjoy good music.

This art has the great advantage to be eminently progressive, and causes the listener as well as the performer to satisfy the yearning of human nature for a higher and higher level of enjoyment, which, thanks to the successive labors of the men of inventive genius, has been provided for, by what may be called a musical literature, which is as rich in eminent names as is the literature of any nation either in prose or in poetry, while it has the enormous advantage not to be confined to any special language, but is written in the universal language of emotions, which the refined individuals of all nations understand and appreciate.

I will only recall a few of the names of the most eminent men in this roll of honor from Palestrina to Wagner; they are Corelli, Lully, Paradisi, Cherubini, Mehul, Martini, the five great Bachs—John Sebastian, Emanuel, Christian, John Ernest, Wilhelm Friedeman—Joseph Haydn, Mozart, Weber, Hummel, Beethoven, who is still at the head of them all both for originality and inexhaustible richness of new conceptions, so that he never repeats himself, as is the case with Mendelssohn.

Nathaniel Wheeler.

Nathaniel Wheeler, inventor of the patent rotary hook and stationary bobbin of the Wheeler & Wilson sewing machine, died at Bridgeport, Conn., Dec. 31, after an illness of two months. Mr. Wheeler had been president and general manager of the sewing machine company since 1875. He was born at Watertown, Conn., on September 20, 1820, and learned the blacksmith's trade. Subsequently he became interested in the manufacture of buttons and in machinery. In 1848 he began the manufacture of suspenders at Watertown with Messrs. Warner & Woodruff. Mr. Wheeler met Mr. Wilson in the New York *Sun* office, one day, and a partnership resulted for the manufacture of the sewing machine which is now so favorably known as the Wheeler & Wilson sewing machine. The works, which are located at Bridgeport, occupy ten acres and employ 10,000 hands. Mr. Wheeler invented many of the improvements which are now in use on the Wheeler & Wilson machine. He was a man of great vigor and exactitude in business, sagacity, and probity, generous, patriotic, useful in the community, and always ready to extend a helping hand where aid was necessary or desirable.

Orlando B. Potter.

The wealthy New Yorker and ex-member of Congress, Orlando B. Potter, was stricken with apoplexy and died on the evening of January 2. Mr. Potter was born at Charlemont, Franklin County, Mass., on March 10, 1823. He began life as a farm boy, and in this position managed to prepare for and in 1841 to enter Williams College. He was a remarkably bright student, but was forced to leave college on account of his health during his sophomore year. He then taught school on Cape Cod, and was finally able to enter Dane Law School, Harvard College, in 1845; was admitted to the bar in 1848. He was successful as a lawyer. In 1852 he took an interest in the Grover & Baker sewing machine invention, and under his direction the business rapidly increased. In 1853, Mr. Potter settled in New York. The company retired from business in 1876, their machine being superseded by improved inventions. Mr. Potter invested his fortune chiefly in real estate, and at the time of his decease it had risen in value to several millions of dollars.

Charcoal—its Uses and Utility.

W. K. Grayson, M.D., Florence, Texas, in the *Texas Sanitarian*, says that, as a general thing, there is less known among the laity and public generally about charcoal and its uses than any other article that is so common and so useful and so valuable. Charcoal laid flat on a burn causes the pain to abate immediately; by leaving it on for an hour, the burn seems nearly healed, if it is superficial. Tainted meat, surrounded with it, is sweetened; strewn over decomposed pelts, or dead matter, it prevents any bad odor or stench. Foul water is purified by its use. It is a fine and cheap disinfectant, and will sweeten offensive air if put in shallow dishes around the apartments of the sick. It is so extremely porous in its minute interior that it absorbs and condenses gases rapidly. One cubic inch of fresh charcoal will absorb about one hundred inches of gaseous ammonia. Charcoal forms an unrivaled poultice for malignant wounds and sores; in cases of what is called proud flesh, it is invaluable. It give no disagreeable odor, corrodes no metal, hurts no texture, injures no color, is a simple and safe sweetener and disinfectant. A teaspoonful of charcoal in half a glass of water will often relieve a sick headache; it absorbs the gases and relieves the distended stomach, pressing against the nerves which extend from the stomach to the head. It relieves constipation and heartburn.

Among the numerous and varied properties of charcoal there is one—one, too, of the most wonderful—which seems to be inadequately recognized, probably from its being imperfectly known. It is that of being able to condense and store away in its pores many times its own bulk of certain gaseous bodies, which it retains thus compressed in an otherwise unchanged state, and from which they can be withdrawn. A systematic task of examination of this subject developed these surprising results.

Operating with blocks of fine boxwood charcoal, freshly burnt, it was found that by simply placing such blocks in contact with certain gases they absorbed them in the following proportions:

Ammonia	30	volumes.
Hydrochloric acid	85	"
Sulphurous acid	65	"
Sulphureted hydrogen	55	"
Nitrous oxide	40	"
Carbonic acid	35	"
Carbonic oxide	9·42	"
Oxygen	9·25	"
Nitrogen	6·50	"
Carbureted hydrogen	5	"
Hydrogen	1·75	"

It is this amazing absorptive process that renders of so much value a comparative slight sprinkling of charcoal over dead animal matter as a preventive of the escape of the odors arising from decomposition. A dead dog was placed in a box in a warm place and covered with charcoal to the depth of between two and three inches; no odor or smell was emitted during several months, after which time an examination showed that nothing of the animal remained but the bones and a portion of the skin. To the large excess of oxygen over the nitrogen in the atmosphere, which was absorbed by the charcoal, and which thus rendered harmless the various vapors given off by the carcass as they were being absorbed, is doubtless owing the facts as before stated and the further fact of the charcoal never becoming saturated. For the sake of experiment on the value of charcoal for storing oxygen, place in a box one cubic foot of charcoal, without mechanical compression. A little over nine cubic feet of oxygen, representing a mechanical pressure of one hundred and twenty-six pounds on the square inch, can be drawn by a small hand pump, indicating a most feasible means by which atmospheric air can be decomposed in such a way as to provide a cheap supply of oxygen. The condensing power of charcoal applied to ammonia is equal to what would be obtained by subjecting this gas to a pressure of nearly one thousand two hundred and sixty pounds on the square inch. One could hardly readily, and at first thought, recognize this wonderful property of charcoal, yet it is nevertheless one, and can be readily demonstrated by actual experiment by those who wish for actual demonstration.

Combined Water Heating and Hot Air Furnaces.

There are many furnaces not entirely satisfactory, by reason of failure to warm one or more distant rooms. Their owners do not care to sacrifice them for steam, but would be very glad to add a little to their cost if they knew how to do so with success assured.

There is not a furnace in use to which hot water heating cannot be successfully attached. I have known good results to be secured by merely coiling the water pipe once or twice around the outside of the fire pot, not even entering the furnace. In every wrought iron furnace there is room and opportunity, if desired, to double the work of the furnace by suspending a simple coil of pipe, one to two inches in diameter, above the fire. By drilling through the wrought iron, and afterward making a gas-tight joint by means of asbestos packing and lock nuts, a coil may be introduced through the feed door without even taking the furnace apart.

One point furnace men feel a lack of confidence about is the size of the coil required to heat a given radiator or room. As I am talking to furnace men and not to steam fitters, I may be pardoned if I give a few data of a simple sort. Without going into the question of exposure, kind of building, etc., I merely state that the *average* amount of surface in the radiator or coil required to warm rooms in dwellings is about one square foot to sixty cubic feet of space. If I am going to plan to keep the radiator hot from an attachment to a furnace, I must know how much surface to apply to the fire. This requires some judgment, and must be made right, or trouble may occur. The work a square foot of surface in contact with the fire or hot gases of a furnace is capable of doing greatly varies, according to its location in the furnace. If I make my heater so large that the radiators cannot give out their heat as rapidly as they receive it, the water will boil and "blow off." If I make the surface too little, insufficient heating will result. Unfortunately, I can give no positive rules, but merely suggestions. If the coil is around the inside of the fire-pot, where it is in contact with the fire, then, under usual conditions, one foot of heater will warm twenty feet of radiator. If the coil be suspended immediately over the fire, where it receives the direct rays of heat from the bright coal as well as the hottest gases, one to twenty is about the figure. That means that three lineal feet of one inch pipe in the hottest part of a furnace will take up heat as rapidly as sixty lineal feet in a room will give it out.

A coil in a furnace, when it receives only the heat from the gases, will run down in power as it leaves the fire to from one to twenty to one to ten, or even one to five.

A caution concerning safety is necessary to those unfamiliar with the use of hot water. Always leave some way open for the escape of steam or expanding water. This may be done by running to a tank above the highest point in the system, or by direct connection to the water supply, if the connection be so made that the supply pipe cannot be closed, and the street pressure be not over 40 pounds per square inch.—*Heating and Ventilation.*

Why Mankind Has to Learn How to Swim.

A writer named Robinson, in *Nineteenth Century*, brings forward a quite plausible explanation of the fact that, while most of the animal creation appear to swim by intuition, man is almost alone in requiring previous training to enable him to keep his head above water. He says it is merely a matter of heredity, and due to our descent from races who were cave and rock dwellers and rock and tree climbers. This theory does not necessarily imply Darwinism, or go so far as to demand the belief that man is but a highly revised edition of some anthropoid ape. He suggests that almost all mammiferous animals, when conscious of danger, use instinctively the means given them for flight and escape, which involve precisely the motions best calculated to keep them afloat in water. The hereditary instinct of the man, however, is unfortunately, he says, to *climb* out of the danger. Hence, unless he has a natatory education, he throws his arms at once above his head, thus increasing the weight upon the latter, which, of course, goes then under water.

Thus the struggles of the untaught human being tend to his own destruction, as is well known to be the case.

It may be added that, admitting this view, we bar ourselves from any imputation of a *batrachian* element in our ancestry. Had there fortunately been such, we ought to have found ourselves swimming instinctively, when plunged into deep waters. Nevertheless, in any case, the frog has clearly been our preceptor or rather our examplar in this useful art, for man swims greatly like a frog, and by no means "like a duck" or "like a fish," as so often tritely phrased.