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(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 941.

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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