

9. For *Tea Service*; Henry G. Reed, Assignor to self and Charles E. Burton, Taunton, Massachusetts.
10. For *Stoves*; N. S. Vedder and Ezra Ripley, Assignors to L. Potter & Co., Troy, New York.
11. For *Stoves*; N. S. Vedder and Wm. L. Sanderson, Assignors to L. Potter & Co., Troy, New York.
12. For *Stove*; N. S. Vedder and Wm. L. Sanderson, Troy, Assignors to George Warren, Mechanicsville, New York.
13. For *Types*; George Bruce, City of New York.
14. For *Stoves*; A. C. Barstow, Providence, Rhode Island.

The claims on the above, are for the several shapes, forms, ornaments, and configurations.

MECHANICS, PHYSICS, AND CHEMISTRY.

*On a New Method of obtaining Carbonate of Potash from Felspar and similar Minerals.** By Dr. E. MEYER.

The author's process consists essentially in decomposing the mineral by calcination with lime, and then treating it with water under a pressure of 7 to 8 atmospheres. With felspar 14 to 19 equivs. of lime are used to 1 equiv. of felspar, or to 100 parts of felspar 139 to 188 parts of lime.

The lime is employed either as hydrate or in the form of chalk; it is intimately mixed with the felspar to a plastic mass, which is made into round balls of 3 to 4 inches in diameter, slowly dried, and then exposed to a temperature between a bright red and a white heat. The temperature must be so high, that the mass, after burning, may contain neither carbonate of lime nor uncombined caustic lime. It should therefore exhibit a very inconsiderable elevation of temperature with water. It is usually caked together. Of course, for such a decomposition, a very intimate mixture of the felspar and lime is requisite. The more lime employed, the shorter the time necessary. After burning, the mass is powdered and heated with water in a vessel capable of bearing a pressure of 8 atmospheres, in which the decomposition is completed in 2 to 4 hours. The solution above the powder (which is never firmly solidified, as the formation of steam probably prevents cohesion) is caustic to the touch, is free from hydrate of lime, and always contains all the soda, and potash to the amount of about 9 to 11 per cent. of the weight of the felspar employed.

A second extraction of the powder freed from the solution of potash is of no great use; little potash, but plenty of lime is dissolved; the latter cannot be taken up by the solution in the first instance. It is of no great advantage to continue the extraction longer than 4 hours.

If the alkaline solution, after saturation with carbonic acid, be evaporated to dryness, a little alumina and silica separate first of all; the carbonate of soda then crystallizes, and at last carbonate of potash remains, which, when pure minerals are employed, is perfectly free from other acids.

* From the London Chemical Gazette, No. 366.

As regards the mass remaining insoluble in water, the very intimate mixture of its constituents renders it peculiarly suitable for the preparation of a Portland cement, the composition of which varies within the same limits. These cements, however, sometimes contain more alumina. This want of alumina, if it be a defect at all, is easily supplied by the addition of a little clay, with which the residue need only be mixed. The author has found, however, that the powder taken out of the kettle, and again strongly calcined, sets very rapidly and firmly under water, so that the addition of clay is unnecessary.

As a matter of course, this mode of preparation will not be applied exclusively to pure felspar, as other felspars or minerals containing potash, must also be adapted for this purpose. Thus, for example, there are many granites which contain about 7 per cent. of potash, and from which the manufacture of potash would appear to be remunerative. Of course, in this case, the chemical composition is to be taken into consideration, and the amount of lime added to be modified accordingly. All that has to be done is to establish the proportion of 3 or 4 equivs. of base to 1 equiv. of acid, in which potash, soda, lithia, lime, and magnesia are to be regarded as bases, and silica, alumina, and oxide of iron as acids. Any chlorine or fluorine that may exist has no influence, and magnesia, instead of being injurious, has been found to be preferable to lime for the separation of potash. Moreover, it is well known that mica, which would play an important part when granite is employed, is far more easily decomposed than felspar, for, as Mitscherlich has lately discovered, it is even completely decomposed by muriatic acid in a glass tube at 212° F.

The points to be observed in carrying out this process on a large scale are now to be referred to; these, however, may easily require modification by local and other circumstances.

As the abundant result in potash depends especially upon the complete decomposition of the felspar, and the latter can only be effected by a very intimate mixture with lime, the greatest attention is to be paid to the fine division of the substances to be employed, in order that in the intermixture the portions of felspar may be in contact with the lime in many places. The felspar, or the mineral containing felspar (of course, only granites with a small proportion of quartz will be operated on), is burnt in a furnace which works uninterruptedly, or in any reverberatory furnace, taken out of the fire whilst still red-hot and thrown into water. By this treatment it will be split in every direction, and rendered sufficiently soft for further division. It is then powdered under stampers, or between cast-iron crushing rollers, and afterwards ground with water upon mill-stones. The bottom stone and the runner must be of quartz or granite, and possess considerable weight. The finely ground powder is then passed through sieves into the lixiviating apparatus, very finely lixiviated, and conducted into pits to settle. It is of the greatest importance only to employ fine lixiviated powder in the manufacture, as this greatly facilitates and hastens the decomposition by ignition, and causes a saving in fuel. The time occupied in lixiviation is not so considerable as it might appear at the first glance, as the rule adopted in the

porcelain factories is not to be applied here. The greater specific gravity of the felspar causes it to settle far more rapidly than clay; it is unnecessary, as in porcelain factories, to bestow great care on purity, on the exclusion of dust, iron, &c., so that the simplest arrangement is sufficient for the purpose. The coarser powder is, of course, ground again.

A similar fine division is required for the lime, and when this is employed in the burnt state, it is most completely effected by slaking. Nevertheless, when circumstances admit of the employment of carbonate of lime, the latter is to be preferred, because the balls or cakes prepared with it shrink less in drying, and retain more cohesion and solidity in the fire. In this case, of course, lixiviation is necessary.

In any case the lime and felspar must be in a state of the finest division before they are mixed together. The author does not think it necessary to say anything about the proportionate weights beyond what has been already stated; it is impossible to give any definite numbers, as they would be different for each raw material, for which reason a preliminary analysis is necessary. So much lime must always be added, that 3 or 4 equivs. of base may be presented to 1 equiv. of acid. It is to be observed, however, that as the materials are obtained in the form of a fine mud, the amount of moisture in them must be determined, when the proper quantities may be arranged by measure upon this basis. Measuring in this way is more exact and convenient than weighing.

The intimate mixture of the materials is most conveniently effected by means of a clay-mill, the usefulness of which is now well known. The paste is allowed to pass through until it is perfectly homogeneous. As soon as this is the case, the mixture issuing from the clay-mill is cut by the machine itself into cylindrical pieces of 5 to 6 inches in length, and 2 to 2½ inches in diameter. These are slowly dried, and then put in the furnace to be burnt.

The best furnace for burning the mass is the porcelain furnace, because a more uniform heat can be attained in all parts of it than in the ordinary tile-furnaces. The latter may, however, be employed. A blast-furnace with a permanent blast would also be suitable, although inequalities of temperature are very liable to occur in it in different parts. The porcelain furnaces may be 2 or 3 stages high, and be furnished with 4 or 6 charges. Any fuel may be used, as the ashes carried on by the draft cannot produce the same injury here as in the burning of porcelain. The necessary temperature is a bright red heat, but it should be ascertained for each material by some preliminary trial burnings, as the greater or less degree of fusibility plays an important part, and fusion is not necessary. The cylinders contract considerably by burning, and are partly broken up. They are ground, and then mixed with water in the steam-kettle, in which the decomposition is to take place.

For the sake of simplicity and easy management, several kettles are heated by the steam of one generator. It is then unnecessary to moderate the fire during the emptying of the kettles, but the refrigeration necessary for emptying and filling them may be produced by simply shutting off the steam. A double bottom is also unnecessary, as a solidification of the mass and consequent overheating of the wall of the kettle

cannot take place. The powder is put into the kettle by a suitable arrangement; the necessary quantity of water is let in, and then the connexion with the steam-generator is established. Fluid may be drawn off by a cock, to ascertain the quantity of alkali dissolved. When the decomposition is completed, the solution is allowed to flow out into clearing vessels by the pressure of the steam. When the suspended pulverulent mass has settled, the supernatant lye is conducted into the evaporating pans. The powder remaining in the kettle is cleaned out, and new masses immediately introduced, so that the working of the kettle is continued uninterruptedly. The lye, which contains caustic potash and soda, is either sold as such, or saturated with carbonic acid by passing the air of the fire over it, by which the evaporation is hastened at the same time. If the decomposition has been complete, no lime separates in this process, but only alumina and silica, which were dissolved in the caustic lime; this sediment is raked together and removed. During the subsequent cooling the carbonate of soda crystallizes, whilst the more soluble carbonate of potash is obtained by calcination. The carbonate of potash thus obtained is almost chemically pure, and far preferable to any prepared from the ashes of plants.

The powder taken out of the kettle and the clearing vessels, which may be again lixiviated to furnish a lye which may be employed afterwards instead of water, contains the constituents of a hydraulic cement. It is made into balls, or by means of a clay-mill into cylinders, either by itself, or with the addition of a little clay, and then burnt in a furnace. After burning, the pieces are pounded in the dry state, finely ground between granite rollers, and sifted; they then furnish a cement which resembles Portland cement in its composition, but far exceeds it in homogeneity.—*Dingler's Polytechn. Journ.* cxliii. p. 274.

*The Aggregate Weight of Blows in the Production of a Marble Statue.**

It has been often observed of a block of marble under a sculptor's hands, "The figure is there, all that has to be done is to cut it out." Without considering the head-work necessary to make a statue, it will be acknowledged that it is likely to require some handwork to cleave it out of its native bed. It may not so readily occur, however, to think of the whole weight of blows, each after each, from first to last, necessary to deliver it from its primeval imprisonment. That this is something considerable may be easily conceived, and a little calculation will enable us to arrive at it, at least, in a degree. We will leave out of the question how many tons of force by gunpowder first reft the fragment from its mother bed in the mountains of Carrara, or how many tens of thousands of pounds of bumps it got in rolling, and slipping, and bounding down its rough slide from the summit to the base of the cliffs, where the teams of buffaloes took it in tow, and conveyed it to Leghorn. We will only consider the weight of blows it receives after it arrives in the sculptor's studio in the course of being made into a statue. The reader

* From the London Art-Journal, No. 38.