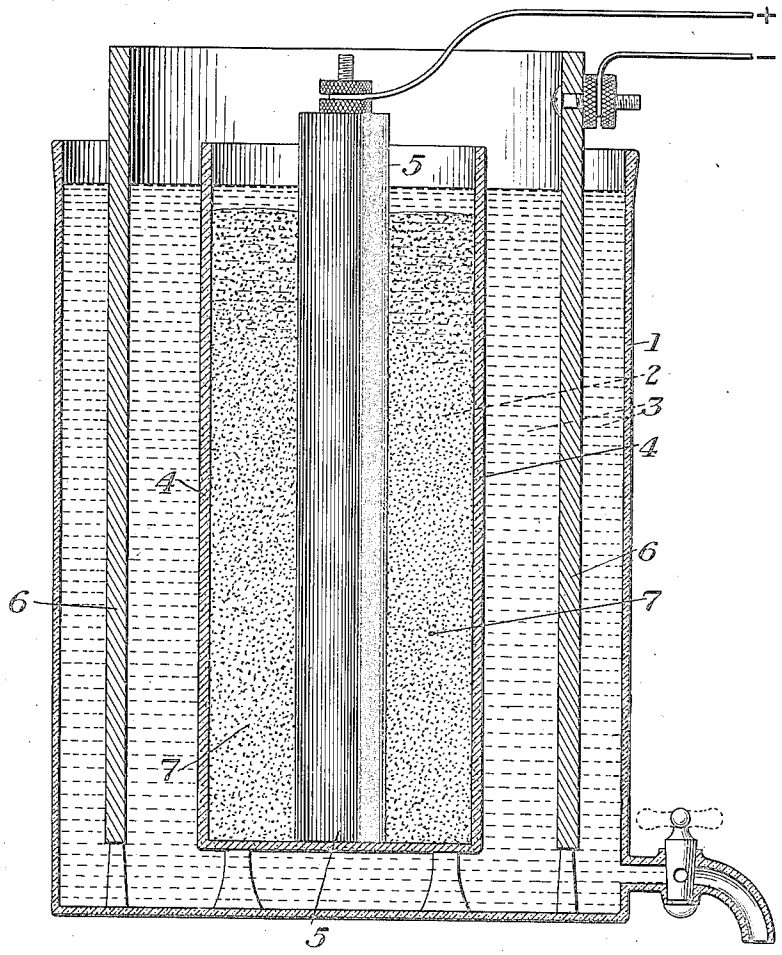
E. L. ANDERSON.

POTASH EXTRACTION.

APPLICATION FILED APR. 8, 1916.

1,253,560. Patented Jan. 15, 1918.



WITNESSES

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POTASH EXTRACTION.

1,253,560. Specification of Letters Patent. Patented Jan. 15, 1918.

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To all whom it may concern:

Be it known that I, EDWARD L. ANDERSON, a citizen of the United States, and resident of Pittsburgh, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Potash Extraction, of which the following is a full, clear, and exact description, reference being had to the accompanying drawing, forming part of this specification, which shows a vertical section of one form of apparatus for carrying out my method.

The invention relates to potash extraction and more particularly to the process of extracting potash from feldspar or the like by electrolysis.

Various attempts have been made to decompose feldspar or the like material by electro-chemical methods, but all have proven too costly due in part to the fact that the feldspar being of such high electrical resistance the amount of electrical energy necessary to bring about the decomposition of the feldspar was so great as to prove unprofitable on a commercial basis.

I have discovered that feldspar or the like material may be decomposed by electro-chemical means with a relatively small amount of electrical energy by first mixing an insoluble conductive material, such as carbon or a carbon compound, so as to make the mixture a conductor of electricity. This is preferably accomplished by finely grinding the feldspar and mixing it with a certain amount of finely ground carbon. Similar results may be obtained by mixing finely ground feldspar with crude oil, then heating the mixture to a red heat out of contact with the air so as to deposit on each particle of feldspar a conducting film of carbon.

I have also discovered that the extraction of potash is greatly facilitated by subjecting the feldspar thus prepared to the action of an electric current in a solution containing a substance which combines with the potash in the feldspar to convert the potash into an easily electrolyzable form. The potash as combined in the feldspar is in an insoluble and difficultly electrolyzable form. I have produced the substance which combines with the potash to render it more readily electrolyzable by electrolyzing a material which upon electrolysis yields such substance or decomposing agent. The material preferably employed is hydrofluorsilicic acid which is decomposed by the electric current liberating silicon fluorid which breaks down the insoluble feldspar combining with the potash to form an easily electrolyzable potash compound.

The preferred method of procedure is described as follows, reference being had to the illustrated embodiment of my apparatus.

A vessel 1 is divided into two compartments 2 and 3 by means of a porous partition 4 of unglazed clay or carbon. In the drawing this porous partition is shown in the form of an inner cup placed within the outer vessel 1. The compartment 2 forms an anode compartment in which is placed a carbon electrode 5. The other compartment 3 forms a cathode compartment in which is placed a copper or carbon electrode 6.

The feldspar or similar material is finely ground, mixed with carbon, and packed in the anode compartment, the mixture of feldspar and carbon being indicated by reference numeral 7. The mixture is saturated with water containing five or ten per cent. of hydrofluorsilicic acid, or hydrofluoric acid which in a short time will be converted by the reactions into hydrofluorsilicic acid.

The cathode compartment 3 is filled with water. A direct current is passed through the cell from the anode 5 to the cathode 6. The carbon mixed with the feldspar renders such mixture conducting and allows the current to flow through the body of pulverized feldspar which would otherwise have a high electrical resistance.

The action of the electric current is to decompose the feldspar producing potassium hydroxid in the cathode compartment and a mixture of aluminum oxid and silica in the anode compartment.

The following reactions are believed to take place in the cell: The hydrofluorsilicic acid is decomposed by the current, liberating silicon fluorid in the anode compartment and in contact with the feldspar. The liberated silicon fluorid immediately decomposes the feldspar, combining with the potash and aluminum to form fluorsilicates of potash and aluminum. The fluorsilicate of potash thus formed is more easily electrolyzable than the feldspar and is in turn decomposed by the electric current yielding potassium hydroxid in the cathode compartment and silicon fluorid in the anode compartment. The silicon fluorid combines with a fresh supply of feldspar or combines with the water to form hydrofluorsilicic acid, which in turn

is electrically decomposed to yield silicon fluorid which decomposes a fresh supply of feldspar. The aluminum fluorsilicate thus formed is readily decomposed producing silicon fluorid, aluminum oxid and silica. The silicon fluorid like that produced by the decomposition of the potassium fluorsilicate goes through the cyclic reaction to combine with the fresh supply of feldspar. The aluminum oxid and silica remain in the anode compartment. The following equations are believed to express the reactions taken place in the cell:

$$2H_2SiF_6+K_2Al_2O_36SiO_2=K_2SiF_6+Al_2SiF_6+6SiO_2.$$

K_2SiF_6 (upon electrolysis)$=2KOH$ (at cathode)$+SiF_4+2HF$ (at anode).

$$3SiF_4+2H_2O=2H_2SiF_6+SiO_2.$$

Al_2SiF_6 (upon electrolysis)$=Al_2O_3+SiF_4+2HF.$

$$3SiF_4+2H_2O=2H_2SiF_6+SiO_2.$$

The potash which is recovered in the cathode compartment in the form of potassium hydroxid may be drawn off from time to time, boiled to dryness, when it is ready for the market. At the end of the operation the contents of the anode compartment are removed and the hydrofluorsilicic acid is washed out and reused. The mixture of aluminum oxid, silica and carbon removed from the anode compartment are separated by any suitable separation method. The aluminum oxid and silica form valuable by-products. The aluminum oxid may be used in the manufacture of abrasives or reduced by any of the well known methods of making the metal aluminum. The silica produced is of a fine white texture and is valuable for use in paint, paper and other industries. The carbon, after being separated from the mixture, may be again used for a fresh charge of feldspar.

By the term "feldspar or the like" I intend to include feldspar or like potash containing materials including orthoclase, microclin, cerecite, granites and various other potash containing rocks. It is obvious that the method may be practised with forms of apparatus other than that illustrated in the drawing and that certain modifications in the method may be employed within the scope of the following claims.

I claim:

1. Those steps in the process of extracting potash from feldspar or the like, which consist in grinding it and mixing it with an insoluble electrically conductive material, and in subjecting the mixture to the action of an electric current.

2. Those steps in the process of extracting potash from feldspar or the like, which consist in grinding it and mixing it with an insoluble electrically conductive material, and in subjecting the mixture to the action of an electric current in a solution containing a substance which combines with the potash to convert it into an easily electrolyzable form.

3. Those steps in the process of extracting potash from feldspar or the like, which consist in grinding it and mixing it with carbon, and subjecting the mixture to the action of an electric current.

4. Those steps in the process of extracting potash from feldspar or the like, which consist in grinding it and mixing it with carbon, and subjecting the mixture to the action of an electric current in a solution containing a substance which combines with the potash to convert it into an easily electrolyzable form.

In testimony whereof I have hereunto set my hand.

EDWARD L. ANDERSON.

Witnesses:
GEO. E. STEBBINS,
H. M. CORWIN.