

# UNITED STATES PATENT OFFICE.

JAMES HARGREAVES AND THOMAS ROBINSON, OF WIDNES, ENGLAND.

## IMPROVEMENT IN THE MANUFACTURE OF SULPHATE OF SODA AND POTASSA.

Specification forming part of Letters Patent No. 151,389, dated May 26, 1874; application filed April 20, 1874.

*To all whom it may concern:*

Be it known that we, JAMES HARGREAVES, of Widnes, in the county of Lancaster, England, analytical chemist, and THOMAS ROBINSON, of the same place, iron-founder, have invented Improvements in the Manufacture of Sulphates of Soda and Potassa, of which the following is a specification:

Our invention relates to improvements in or upon that method or process of manufacturing sulphate of soda and sulphate of potassa by passing currents of mixed sulphurous acid, air, and water vapor (preferably heated) through or among heated chloride of sodium and chloride of potassium, for which Letters Patent No. 149,859, dated April 21, 1874, have been granted to us.

First. As means for obtaining increased effect in the production of sulphate from a given quantity of sulphurous-acid gas, mixed with air and water vapor, we employ the said sulphurous-acid gas, air, and water vapor in about the following proportions: To every two volumes of sulphurous-acid gas we add two volumes of water vapor, and air in sufficient quantity to furnish one volume of free oxygen.

In practice we find that the air which passes through ordinary pyrites or sulphur-burners with the sulphurous-acid gas contains sufficient free oxygen to combine with the sulphurous acid and form sulphuric acid.

Second. As means for providing an increased surface of chloride of sodium or chloride of potassium, for the action of the mixed sulphurous-acid gas, air, and water vapor thereon when in the chambers or vessels, and at the same time leaving free passages for the currents of mixed sulphurous-acid gas, air, and water vapor, we use the said chloride of sodium or chloride of potassium in pieces, containing each about three-quarters of a cubic inch. We form the pieces by breaking rock-salt, or by moistening, pressing, drying, and breaking salt which is in powder or small crystals; or we use bay-salt with crystals of the size mentioned.

When chloride of potassium has to be prepared the treatment just mentioned for chloride of sodium is followed.

We would have it understood that we do not claim the forming and breaking of the

pieces, as this part of our invention consists only in the use of the chlorides in pieces of about the size named.

Third. As means for causing the currents of sulphurous-acid gas, air, and water vapor to act uniformly on the mass of chloride of sodium or chloride of potassium in the chambers, and for preventing the said currents from passing rapidly up the sides of the chambers, we place the pieces of smaller size at or near to the sides of the chambers.

A convenient method of obtaining chlorides in pieces of small size in admixture with a mass of pieces of about the size mentioned under the above second part consists in breaking large blocks of rock, stove-dried, or other salt by stampers or other appliances, and a convenient method of causing the small pieces to pack or remain at the sides or inner surfaces of the chambers consists in pouring or filling the chlorides into the chambers from the top, at or near the sides or inner surfaces. In this way the smaller pieces remain at the sides, while the larger pieces roll toward or pack in the middle.

Fourth. As means for fully utilizing the sulphurous-acid gas in the mixture of the same with air and water vapor, and at the same time converting the whole of the chlorides into sulphates, we pass the mixture of sulphurous-acid gas, air, and water vapor, together with any hydrochloric acid given off, in succession, through two or more chambers containing the chloride of sodium or chloride of potassium—that is to say, through the mass of chloride contained in one chamber, thence through the chloride contained in a second chamber; or a larger number than two may be used.

Fifth. As means for rendering the production of sulphate of soda or sulphate of potassa continuous, we use a series (preferring not less than four) of chambers. When four chambers are used the gas is admitted into No. 1, and passes through Nos. 2, 3, and 4, escaping at the latter. When the formation of sulphate is completed in No. 1 the mixture of sulphurous-acid gas, air, and water vapor is then admitted first to No. 2, and then to Nos. 3 and 4 afterward, when No. 1 is recharged also to and through it. The chambers, therefore, alternately become the first, intermediate,



and last of the series. The mixed sulphurous-acid gas, air, and water vapor, it will thus be obvious, pass, in ordinary working, first into the chamber in which the material is most nearly converted into sulphate, and the hydrochloric acid formed, together with any other gases, passes away from the chamber last charged with chloride to the condensing-tower.

Sixth. As an alternative method of rendering the production of sulphates continuous, we employ a tower or chamber of considerable height to contain chloride of sodium or chloride of potassium, and we pass the current of mixed sulphurous-acid gas, air, and water upward through the mass. When the lower portion of the chloride is converted into sulphate it is withdrawn and fresh chloride added at the top.

The tower or chamber is in height at least three times its diameter or width. This part of our invention can only be beneficially employed when the mass of chloride of sodium or chloride of potassium is packed in the tower in the manner described under the above third head, and we only claim the sixth part when the mass of chloride is so packed.

Having now described the nature of our said invention, and particularized the same in such manner that others will be enabled to beneficially carry the several improvements into effect, we claim—

1. Under the first head, the employment of mixed sulphurous-acid gas, air, and water vapor in the proportions mentioned, or thereabout, for the purposes set forth.

2. Under the second head, the employment of chloride of sodium and chloride of potassium in pieces of the size named, or thereabout, for the purposes set forth.

3. Under the third head, placing the pieces of chloride of sodium or chloride of potassium of smaller size near the sides or inner surfaces of the chambers, for the purposes set forth.

4. Under the fourth head, passing the mixed sulphurous-acid gas, air, and water vapor in succession through the mass of chloride of sodium or chloride of potassium contained in two or more chambers, for the purposes set forth.

5. Under the fifth head, rendering the production of sulphate of soda and sulphate of potassa continuous by passing the mixed sulphurous-acid gas, air, and water vapor through the mass of chloride of sodium or chloride of potassium contained in a series of two or more chambers, each of which becomes in its turn the first, intermediate, and last of the series, substantially as set forth.

6. Under the sixth head, rendering the production of sulphate of soda and sulphate of potassa continuous by passing the mixed sulphurous-acid gas, air, and water vapor through chloride of sodium or chloride of potassium contained in a high tower or chamber, when the said chlorides, or either of them, are or is packed in the manner described under the above third head, substantially as set forth.

JAMES HARGREAVES.  
THOMAS ROBINSON.

Witnesses:

JOSEPH NIELD,  
JAMES JOHNSON.