(No Model.)

B. RÖSING.

PROCESS OF EXTRACTING LEAD FROM ITS ORES.

No. 494,349. Patented Mar. 28, 1893.

Fig. 1

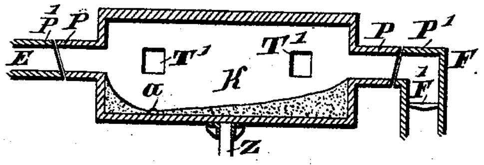


Fig. 2.

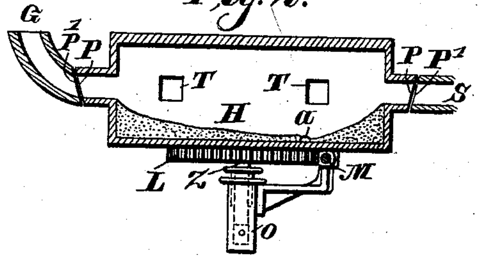


Fig. 3.

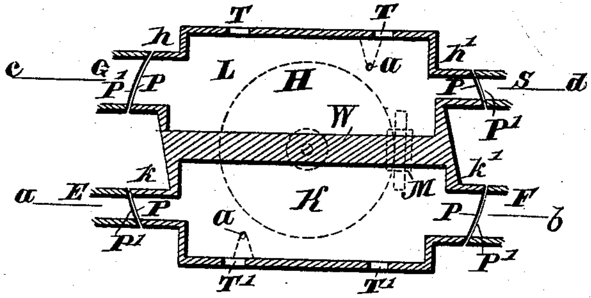
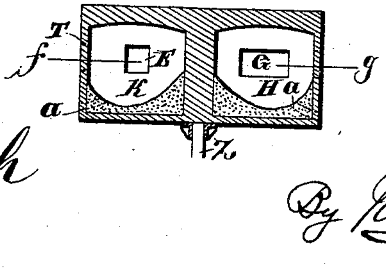


Fig. 4.



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PROCESS OF EXTRACTING LEAD FROM ITS ORES.

SPECIFICATION forming part of Letters Patent No. 494,349, dated March 28, 1893.

Application filed April 22, 1892. Serial No. 430,254. (No specimens.) Patented in Germany February 5, 1892, No. 64,615; in France February 5, 1892, No. 219,175; in Belgium February 5, 1892, No. 98,235; in Sweden February 5, 1892, No. 3,940; in Spain March 18, 1892, No. 12, 984, and in Italy March 31, 1892, XXVI, 31,236, and LXI, 222.

To all whom it may concern:

Be it known that I, BERNHARD RÖSING, doctor of philosophy, a subject of the King of Prussia, residing at No. 149 Berlinerstrasse, Charlottenburg, Germany, have invented certain new and useful Improvements in and Relating to the Extraction of Lead from its Ores or from other Plumbiferous Materials, (for which I have obtained Letters Patent in Germany February 5, 1892, No. 64,615; in France February 5, 1892, No. 219,175; in Belgium February 5, 1892, No. 98,235; in Sweden February 5, 1892, No. 3,940; in Spain March 18, 1892, No. 12,984, and in Italy, March 31, 1892, Vol. XXVI, No. 31,236, and Vol. LXI, No. 222;) and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters of reference marked thereon, which form a part of this specification.

This invention relates to the extraction of lead from its ores or from other plumbiferous materials, and more especially to the extraction of lead by what is known as the double decomposition process, whereby the lead is obtained in a metallic form by the reaction of an oxygen compound of lead upon a sulphide of lead or a sulphide compound of lead. The oxygen compounds of lead heretofore employed in this process were derived from various sources, as for instance, by roasting lead ores, or from flue dust, slags, or gangue or litharge and lead sulphides, these compounds generally containing lead oxide or sulphate. In the reaction that ensues, when an oxygen lead compound is brought in contact with a lead sulphide, the oxygen of the former combines with the sulphur of the latter to form sulphurous acid which escapes with the other gases and products of combustion to a condenser, and thence to the chimney of the furnace whether reverberatory or other, the lead in both materials being separated in a metallic form. This is also the case when the oxygen lead compound contains lead sulphate, the sulphur of the latter combining with the oxygen of the former to form sulphurous acid. These reactions take place according to the following equations:—

$$2\,PbO+Pbs=3\,Pb+SO_2$$
$$PbSO_4+PbS=2\,Pb+2\,SO_2$$

This process of extracting lead by double decomposition presents many inconveniences and gives rise to serious losses. In the first place, in carrying out this process the roasting of the materials and the double decomposition require a comparatively large expenditure of fuel, and during the process of roasting some of the lead is volatilized, while if silver is present and the temperature is not properly regulated the latter is also volatilized and passes over with the gases and products of combustion. On the other hand, the process requires time and is very laborious. Finally, during the reaction and formation of sulphurous acid gas the latter escapes with other gases and the products of combustion by which said sulphurous acid gas is not only largely contaminated but greatly attenuated, so that its separation from the foreign gaseous products of combustion becomes very difficult and costly.

The object of my present invention is to obviate the difficulties and inconveniences above referred to, and consists in a process and in the provision of means whereby the double decomposition may be effected without the use of fuel in a rapid and economical manner, so that the sulphurous acid gases formed are obtained in a substantially pure state for use as may be desired, or for conversion into sulphuric acid.

In carrying out my improved process I combine the oxygen and sulphide of lead compounds under such conditions that the double decomposition will be effected by the heat generated by the reaction without the application of artificial heat. To this end I smelt the oxygen compound of lead and then cause the same to flow onto the sulphide or sulphide compound of lead which I preferably preheat, or the heated sulphide or sulphide compound of lead may be brought into contact or mixed with the fluid oxygen compound of lead, the result of which is an instantaneous and very violent reaction under evolution of a great amount of heat sufficient to maintain the reaction to completion, so that the application of heat is avoided and consequently the sulphurous acid gases are not contaminated by any foreign gases or products of combustion and may be readily condensed for use or converted into sulphuric acid. This reaction taking place instantaneously proceeds very rapidly so that a very notable saving in time and labor is also effected.

The process of double decomposition described may also be carried out by combining the oxygen compound of lead with a carbon or carbonaceous material, in which case carbonic acid gas and carbonic oxide will be formed by the reaction, as is well known.

Any suitably constructed furnace may be employed in carrying out my invention.

Referring now to the accompanying drawings—Figures 1 and 2 are vertical longitudinal sections taken respectively on lines *a*—*b*, and *c*—*d*, of Fig. 3, of a furnace especially designed for carrying out my improved process of double decomposition. Fig. 3 is a horizontal section of the furnace taken on line *f*—*g*, of Fig. 4, which latter is a vertical transverse section of said furnace.

As shown in Fig. 3, the furnace is divided into two compartments or chambers, K, and H, by a partition wall, W, said chambers having at each end a short or stub flue, *h*, *h'*, and *k*, *k'*, respectively, and in the side walls of said chambers are provided charging or working holes, T, T, and T', T', respectively, normally closed by suitable doors, not shown. The hearth of these chambers is so constructed as to incline toward a tap hole, *a*, which is thus located at the point of greatest depth of the chambers, the hearth forming a pocket at that point for the collection of the metallic lead which is drawn off from time to time, or after each operation of double decomposition. The furnace is adapted to revolve about a vertical axis or journal, Z, and is also adapted to be raised above the flue connections and lowered again. Any suitable means may be provided for revolving the furnace about its axis, Z, and raising and lowering the same.

In Fig. 2 I have shown the journal, Z, provided with a gear wheel, L, meshing with a pinion, M, the shaft of which may be revolved from any suitable prime motor, and in said figure I have shown the journal, Z, as constructed in the form of a piston fitted and working in a hydraulic cylinder, O, for the purpose of raising and lowering the furnace by hydraulic pressure in a well known manner, and these devices are only given as an example, as various other forms of mechanisms well known in the arts may be employed for revolving and raising and lowering the furnace.

The stub flues, *h*, and *h'*, as well as the stub flues, *k*, and *k'*, are adapted to be brought into register with a feed hopper, G, and flue, S, or with the flues, E, F, by properly positioning the furnace, and said flues have their abutting faces so constructed as to form a tight joint between them; in the drawings I have shown these abutting faces, *p*, and *p'*, of the flues of substantially conoidal form, which construction is well known.

The feed hopper, G, which is normally closed by a cover or door, not shown, serves for the introduction into the chamber communicating therewith of the molten oxygen compound of lead, the flue, S, leads to a condenser or other apparatus for the reception of the sulphurous acid gases, the flue, E, is connected with the chimney of the furnace, not shown, while the flue, F, leads to the fire place, F', Fig. 1.

The operation of the furnace is as follows: Assuming that the chambers, H, and K, are both charged with sulphide of lead or a sulphide compound of lead, as for instance, galena, the charge in chamber, H, having been heated while the charge in chamber, K, Fig. 3, is being heated by the fuel in the fire place, F', the heat and products of combustion entering chamber, K, through the flues, F, *k'*, and passing out to the chimney through flues, *k*, E, the charges of material being introduced into the said chambers through the charging or working apertures, T, T, and T', T', respectively. The cover from the feed hopper or flue, G, is now removed and a suitable charge of an oxygen compound of lead, as for instance litharge, is caused to flow onto the galena in said chamber, H, a violent reaction will at once ensue under evolution of heat and formation of sulphurous acid gas which escapes through flue S, the lead in both materials separating in the form of a metal and collecting about the tap-hole, *a*. When the reaction commences to subside it may be activated by working up (stirring the materials) which can be done through the working holes, T, T, until the reaction is completed, the lead being drawn off from time to time, or at the completion of the reaction as may be found necessary. The heat evolved by the reaction is more than sufficient to maintain the materials at the proper temperature to the completion of the double decomposition, so that no fuel is used in this operation, whereby the sulphurous acid gases, or the carbonic acid gases in case a carbon is used instead of a sulphide, are obtained in a substantially pure form. During the process of decomposition, which as stated, proceeds not only very energetically but also very rapidly as compared with the time required in the practice heretofore, the galena in chamber, K, is being heated and preferably to a temperature approximating a roasting temperature, the feed flue or hopper, G, being of course closed during the reaction. The furnace is now elevated above its connections and turned one hundred and eighty degrees, and while in this elevated position the residues in chamber, H, are withdrawn through either or both of the sub flues, *h*, and *h'*, and the furnace is again lowered, so that the last-named flues will now be in communication with the flues, F, and E, respectively, while the stub flues, *k*, and *k'*, will be in communication with the flues, S, and the feed hopper or flue, G, molten litharge being introduced through the latter into chamber, K, to repeat the reaction above described. It will thus be seen that while double decomposition without fuel is going on in one of the furnace chambers the sulphide of lead material is being heated in the other, so that the process is a substantially continuous one, the litharge or other oxygen compound of lead being smelted in a suitable furnace or smelter.

The loss of heat during the short time required to discharge the contents of one chamber and recharge the same with sulphide material is insignificant, and of no importance, more especially in view of the fact that during the reaction more than sufficient heat is generated to compensate this loss and sustain the reaction to completion.

Although I prefer to preheat the sulphide material for the reason that the reaction is more energetic and more rapid and takes place under a greater initial evolution of heat, yet the said preheating is not absolutely necessary. It will be readily observed that a loss of lead by volatilization cannot take place in this process, nor is this the case with silver, should any be present in the lead compounds, so that the latter can be readily obtained by well known means.

In case the residues of the double decomposition should contain lead or silver or both in such quantities as to warrant their extraction, this may be effected in the blast furnace in a well-known manner, or by other means.

Having thus described my invention, what I claim as new therein, and desire to secure by Letters Patent, is—

1. In the extraction of lead, the hereindescribed improvement, which consists in bringing a molten oxygen compound of lead into contact with a decomposing agent that will liberate the lead from said oxygen compound, the decomposition being effected solely by the heat of the molten oxygen compound and the heat generated by the reaction.

2. In the extraction of lead the hereindescribed improvement, which consists in bringing a molten oxygen compound of lead, as litharge, in contact with a sulphide or sulphide compound of lead, as galena, the decomposition being effected solely by the heat of the materials and the heat generated by the reaction.

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