

## UNITED STATES PATENT OFFICE.

EDWARD HOLL MILLER, OF LONDON, ENGLAND.

## METHOD OF TREATING REFRACTORY ORES.

SPECIFICATION forming part of Letters Patent No. 751,401, dated February 2, 1904.

Application filed November 27, 1903. Serial No. 182,852. (No specimens.)

*To all whom it may concern:*

Be it known that I, EDWARD HOLL MILLER, a subject of the King of Great Britain and Ireland, residing at 81 Chardmore road, Clapton Common, London, England, have invented a certain new and useful Improved Method for the Treatment of Refractory Ores; 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.

This invention has for its object the treatment of refractory lead zinc ores such as are found in the Broken Hill mines of New South Wales and elsewhere. Many methods have been put forward, some of which are still in vogue, but are inefficient in their ultimate results.

The adaptability of this invention is great, inasmuch as it is effective and cheap.

The crushed ore is mixed with from two-thirds to an equal bulk of silicious matter, such as fine sand, the silica in the original ore contributing to this amount. Finely-ground hard pitch (either artificial or natural) is then added to this mixture in quantity equal to about one-twentieth to one-fifth of the original weight of ore taken. If the ore is fairly rich in silver, it is advantageous to add some lime. This admixture is then made into a stiff paste, with as hard a water as obtainable, by passing through edge-runners or other suitable means. This stiff paste is cast into suitable shapes for packing into a retort, and these are either dried spontaneously or artificially at a low temperature, (30° to 60° centigrade.) These blocks are then packed in retorts lined with suitable refractory material or in furnaces capable of being used for distillation. During the packing of the blocks in the retorts small spaces or interstices are left here and there to allow of the passage of gas given off now and again at the commencement of operation. As the packing is going on each layer is sprinkled, if the retort be cold, with slaked lime, and when the retort is full some coarse lumps of quicklime are put on the top. Heat is applied to the retort, which is gradually raised from incipient redness to a dull red heat. The pitch which, it should be

observed, is not used as a binding agent in making the briquets undergoes destructive distillation, some of the products of which first distil over, others playing a part in the reaction. During this distillation any antimony, bismuth, selenium, or tellurium is got rid of. On raising the temperature still further metallic zinc will distil over. The heating is continued until no more zinc will distil over. The briquets then contain but a small percentage of zinc and the lead in the form of metallic lead disintegrated throughout their mass. The lead can be melted out into ingots by methods found most suitable. Its silver contents can be extracted by well-known methods. It will be observed that no roasting of the ore, whether preliminary or otherwise, is resorted to.

A trial on a parcel of Broken Hill ore having the composition, lead, 17.27; zinc, 15.54; manganese, 7.2; iron, 7.86; alumina, 1.00; sulfur, 12.30; silica, 33.45; oxygen, traces of copper, &c., 5.38; fine gold, one pennyweight, and fine silver fourteen ounces and fifteen pennyweight per ton of two thousand two hundred and forty pounds, was carried out in the following manner: A hundred-pound packet of ore was mixed with about twenty pounds of fine sand, five pounds of pitch, and one pound of calcium oxid, the whole made into briquets and dusted over with lime, these briquets charged into a hot retort, the top layer being dusted with slaked lime. The packing of these briquets was done so as to allow interstices for the escape of gaseous matter. The retort was gradually brought to whiteness. After half an hour's heating zinc began to come away and did so continuously for two hours, when its evolution ceased. The briquets were in excellent condition and assayed 1.12 per cent. of zinc, as they had lost one-third of their weight. This shows an extraction of ninety per cent. of zinc. The briquets are fairly hard and tough after treatment, and so are suitable for smelting.

What I claim, and desire to secure by Letters Patent, is—

1. The herein-described process for the treatment of refractory lead-zinc ores consisting in mixing the ore with silicious matter and

pitch, with the addition of lime according to the silver value of the ore, forming the mixture into dry blocks, packing the blocks in a furnace with suitable air-spaces, and sprinkling the layers with lime and gradually raising the temperature, whereby substantially the whole zinc content of the ore is converted into metallic zinc which distils over, and the lead and silver contents of the ore are also converted into the metallic state in which state they are retained in the residue in the retort and recovered therefrom by melting out.

2. The herein-described process for the treatment of refractory lead-zinc ores, consisting in mixing the ore with silicious matter and pitch, forming the mixture into dry blocks,

packing the blocks in a furnace, with suitable air-spaces, sprinkling the layers with lime and gradually raising the temperature, whereby substantially the whole zinc content of the ore is converted into metallic zinc which distils over, and the lead and silver contents of the ore are also converted into the metallic state, in which state they are retained in the residue in the retort and recovered therefrom by melting out.

In testimony whereof I have affixed my signature in presence of two witnesses.

EDWARD HOLL MILLER.

Witnesses:

A. D. JAMESON,  
A. NUTTING.