

UNITED STATES PATENT OFFICE.

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PROCESS AND APPARATUS FOR EXTRACTING COPPER FROM SLAG IN REVERBERATORY FURNACES.

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To all whom it may concern:

Be it known that we, PERCIVAL PAGE BUTLER and HARRY HOWARD STOUT, citizens of the United States, residing at Douglas, in the county of Cochise and State of Arizona, have invented certain new and useful Improvements in Processes and Apparatus for Extracting Copper from Slag in Reverberatory Furnaces, of which the following is a specification.

It is a well known fact that in the smelting of copper ores in a reverberatory furnace, an appreciable and sometimes considerable amount of copper is carried away in the slag and usually is a total loss, as heretofore attempts to treat the slag for the purpose of extracting the copper content have, generally speaking, proven to be failures. As a general rule, if in the smelting of the ore a matte containing 40% copper is produced, the resulting slag will contain .04% copper; if the matte produced contains 30% copper, the slag will contain .03% copper, etc. Theoretically it would be advisable to produce a matte, for example, 10% copper, in which event the slag would contain only .01% copper, but commercially this is impractical as the production of the great amount of matte would be very costly and the better practice has therefore been considered to be to produce a higher grade matte, attempts being made to subsequently treat the slag to extract the copper carried away therein. As stated, however, such attempts have usually been utter failures.

In the ordinary operation of reverberatory furnaces, in the extraction of copper, the skimming end of the furnace, which is the end remote from the firing or blast end and which is the end from which the slag is skimmed or discharged, is so low in temperature that complete fusion of the washing ore is not obtained, and we have discovered that the washing ore, and in fact the larger particles of the charge are carried down to the skimming end, without being fused, and pass out with the slag, causing of course an increase loss of copper.

The primary object of the present invention, in consideration of the waste of copper through being carried away with the slag in the ordinary reverberatory furnace practice,

is therefore to devise a process in the carrying out of which the slag within the reverberatory furnace will be washed of substantially all of its copper content and complete fusion of all particles whether of the original charge or of the washing ore will be effected.

We have discovered that if fluent washing ore is distributed or disposed over the surface of the slag in the reverberatory furnace, while the furnace is in operation, and the entire charge is superheated, the resulting slags will be very much reduced in their copper content, provided that the fluent washing ore is such that the matte from this ore per se, which is formed during its fusion, is of low copper content and high in iron sulphide, and that the fluent washing ore is not so high in specific gravity that it will fall through the molten slag in the furnace and enter the matte collected in the bottom of the furnace without fusion being effected, and provided further that the slag formed from the fluent washing ore per se is such that it will combine with the remainder of the slag to be washed and form a fusible compound. This constitutes the broad idea of our invention and the process may be carried out in various types of furnaces as will be hereinafter explained. A specific example of the process may, however, be stated as follows:

Assuming that in the smelting end of the reverberatory furnace or, in other words, the firing or blast end, a matte containing 35% copper is produced and that the resulting slag under normal conditions contains .035% of copper and under such conditions would carry with it to the skimming end of the furnace some unfused large sized particles of the washing ore, we would spread uniformly over the surface of this slag fluent washing ore of such character that the matte therefrom would contain approximately 10% copper, and we would then superheat the entire charge during the operation of the furnace in a manner which will be presently made apparent. The amount of fluent washing ore required to be spread over the slag within the reverberatory furnace would depend upon the amount of this ore, producing a 10% copper matte, which it would