

UNITED STATES PATENT OFFICE.

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ART OF SEPARATING METALS.

SPECIFICATION forming part of Letters Patent No. 491,084, dated February 7, 1893.

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To all whom it may concern:

Be it known that I, JOHN J. CROOKE, a citizen of the United States, residing at New York, county of New York, and State of New York, have invented certain new and useful Improvements in the Art of Separating Metals, fully described and represented in the following specification.

One of the by-products of the lead-silver blast furnace is a cupriferous matte. This matte when sufficiently concentrated for conversion into metallic copper will be found largely contaminated with sulphides of other metals extracted from the various ores treated in such furnaces, and when such matte is converted into copper, the copper will contain from one to one and one-half per cent. of arsenic and antimony, together with other metals injurious to copper. Metallic lead produced by the lead-silver blast furnace will also contain arsenic, antimony, bismuth, and other foreign metals. It is well-known, also, that metallic copper and lead produced by other processes contain such foreign metals in greater or less amounts, and constant attempts have been made to provide a simple and practical process of removing them.

The object of the present invention is to provide an improved process for removing such foreign metals from impure copper and lead, and a full description of the process I have invented for this purpose will now be given and the invention specifically pointed out in the claims.

The process is based upon the following reactions. Ammonium chloride will not remove the foreign metals from metallic copper or lead, but will remove them from the oxides of these metals as volatile chlorides. When oxide is formed upon the surface of copper or lead, it will be found to contain a larger percentage of the foreign metals as oxides than is contained in the bath of melted copper or lead as alloyed metals. When ammonium chloride is brought into contact with this impure oxide, an immediate reduction of the oxide takes place with a dissociation of the ammonium chloride and the formation of volatile chlorides of the injurious metals, especially the arsenic and antimony, which chlorides will pass from the furnace as vapor.

I attain the desired object in accordance with these reactions, by supplying oxygen to the copper or lead in a fused condition so as to form oxides of these metals, and applying to the oxide ammonium chloride. The oxygen may be supplied in any suitable manner, as by passing into or through the metal, air or other suitable fluid, or by applying to the metal salts or nitrates carrying sufficient oxygen, but in practice the oxygen is preferably supplied by an air blast and this blast is preferably directed upon the surface of the molten metal.

The ammonium chloride may be used alone, but I prefer to use with it, to increase the reducing action, a small quantity of finely divided carbon, preferably charcoal carbon, although any other easily oxidized carbonaceous material may be used. This is especially desirable in the case of lead, as it secures a slag carrying less lead and consequently a higher percentage of antimony.

The preferred manner of carrying out my invention is as follows:—When copper is the metal under treatment, it is first fused, preferably in the usual manner in the ladling furnace. After fusion, a blast of air from one or more tuyeres placed in the roof of the furnace is directed upon the surface of molten metal. Cuprous oxide, Cu_2O is immediately formed and promptly dissolved by the copper. The air blast is kept running until a sample of copper drawn exhibits a semi-crystalline structure caused by the absorption of the cuprous oxide. When this absorption has so far ceased as to allow a film of the oxide to remain on the surface of the copper, there are entered upon the bath at intervals of about two or three minutes, small quantities, preferably about two pounds, of a mixture of ammonium chloride $\text{N}_2\text{H}_4\text{Cl}$, and finely divided, easily oxidized carbon, preferably charcoal carbon, preferably in the proportion of about ten parts of carbon to one hundred parts of the chloride, the blast being continued meanwhile. The applications of the ammonium chloride and carbon are continued with the air blast until the copper has been brought to the required fineness, preferably 99.85 or thereabout. About two per cent. of the ammonium chloride and car-

bon by weight will remove about one and one-half per cent. of the foreign metals usually found in blister copper made from blast furnace matte, and with this treatment no flapping
5 will be required, and much less poling to bring the metal to a tough pitch. As above stated, the carbon may be omitted, but the best results are attained by its use.

To remove arsenic, antimony, bismuth, and
10 traces of other metals foreign to lead in a state of purity, the same method of procedure is followed as in the treatment of copper. In the case of lead, however, the oxide is not absorbed by the body of lead, but remains upon
15 the surface as formed.

What I claim is:—

1. The improvement in the art of separating foreign metals from impure copper and lead, which consists in supplying oxygen to
20 the copper or lead in a fused condition to form oxide, and applying to the oxide ammonium chloride, substantially as described.

2. The improvement in the art of separating foreign metals from impure copper and
25 lead, which consists in supplying oxygen to the copper or lead in a fused condition to form oxide, and applying to the oxide ammonium chloride and finely divided carbon, substantially as described.

30 3. The improvement in the art of separating foreign metals from impure copper and lead, which consists in subjecting the copper or lead in a fused condition to an air blast to form oxide and applying to the fused metal

at suitable intervals ammonium chloride, substantially as described. 35

4. The improvement in the art of separating foreign metals from impure copper and lead, which consists in subjecting the copper or lead in a fused condition to an air blast to
40 form oxide and applying to the fused metal at suitable intervals ammonium chloride and finely divided carbon, substantially as described.

5. The improvement in the art of separating foreign metals from impure copper and lead, which consists in supplying oxygen to the surface of the copper or lead in a fused
45 condition to form oxide, and applying to the surface of the fused metal at suitable intervals ammonium chloride, substantially as described. 50

6. The improvement in the art of separating foreign metals from impure copper and lead, which consists in supplying oxygen to
55 the surface of the copper or lead in a fused condition to form oxide, and applying to the surface of the fused metal at suitable intervals ammonium chloride and finely divided carbon, substantially as described. 60

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

JOHN J. CROOKE.

Witnesses:

CHAS. C. EMOTT,
ROBERT CROOKE.