

UNITED STATES PATENT OFFICE.

JAMES R. COOPER, OF HANCOCK, MICHIGAN.

IMPROVEMENT IN REFINING COPPER.

Specification forming part of Letters Patent No. **153,743**, dated August 4, 1874; application filed April 22, 1874.

To all whom it may concern:

Be it known that I, JAMES R. COOPER, of Hancock, in the county of Houghton and State of Michigan, have invented a new and valuable Improvement in Deoxidizing Copper; and I do hereby declare that the following is a full, clear, and exact description of the construction and operation of the same.

This invention has relation to processes for refining copper or any alloy containing copper.

The nature of my invention consists in subjecting copper or any of its alloys, wherein it is desired to purify the copper, to the action of a single heat at or below the melting-point of the metal, in a sealed vessel containing charcoal or other carbonaceous substance, which will deoxidize the copper and leave it in a "native" or malleable state and of a beautiful color, therefore adding to its value for commercial and other purposes. Copper and its alloys become more or less malleable in proportion to the amount of oxygen which is combined with the metal or metals.

In the process of refining copper it becomes necessary to oxidize the metal to a high degree in order to remove all foreign metals and other substances, after which it becomes necessary to deoxidize the metal as thoroughly as the nature of the case will admit. In this operation great care and judgment are requisite, as the metal is more or less exposed to the action of the atmosphere on the one hand, and on the other, if the operation is carried too far, the carbon is absorbed, which is expelled again on the cooling of the metal.

It has hitherto been supposed that in the process of refining copper it only becomes malleable when the oxygen has entirely disappeared, and that upon the entire disappearance of the oxygen the metal was subject to absorb carbon from the coal, and by the presence of this carbon the character of the metal became entirely changed. It was also supposed that owing to the presence of this carbon the metal became more porous and of a lighter color, and that the metal was unfit for any practical use until the excess of carbon was united with its equivalent of oxygen. I have discovered that we never in the ordinary way of refining entirely remove the oxygen

from the metal; that if it were possible to remove the oxygen entirely and keep the metal from any further action of the atmosphere any amount of carbon which the metal had absorbed would be expelled from it on its cooling without detriment, and leave the copper so pure that it would stand the test of malleability of from two to three times greater than the ordinary copper of commerce.

In the usual manner of refining copper this metal will absorb carbon, and at the same time hold a certain amount of oxygen, although the affinity between carbon and oxygen is very strong, yet the practical result is, that the oxygen cannot traverse the melted copper and unite with the carbon therein, and when the metal becomes so charged with free carbon on its being removed from the furnace and poured into molds as soon as the cooling commences the carbon is rejected. On the passage of the carbon through the metal the former comes in contact with the oxygen held in the metal and forms gases, which, in their efforts to escape, cause the porous condition and change of fiber which is found to have taken place in the metal.

Instead of exposing the copper to atmospheric influences while refining it, I conduct the process as follows: I take crucibles, retorts, or other suitable vessels and line them with powdered charcoal, charcoal and clay, or with any other carbonaceous material. The metal is then put into these vessels and they are hermetically sealed, after which they are slowly subjected to a heat which is below that necessary to melt the metal. I thus remove all the oxygen which the metal contained. The crucibles may be provided with false bottoms of powdered charcoal or other carbonaceous material, and lined as described, and the metal may be melted in them, by which means I produce a fine close-grained metal, which may be desirable for many purposes.

The linings of the crucibles may conform to the shape and size of the ingot or bar. By this means hollow ingots may be made sound and perfect by first casting them from ordinary copper with cores, and then placing a mixture of damp clay and pulverized charcoal in the bottom of the crucible and properly adjusting

a suitable core in the ingot and then packing the latter with charcoal and clay to form the mold.

It will be seen that I may conduct the process either below the melting-point of the metal, or in some cases the metal may be melted.

Brass and alloys of copper are converted in the same manner as copper. The lower the temperature at which they melt the more readily do they part with their oxygen. The fracture is entirely changed by the process, and the copper will entirely lose the crystalline formation.

I am well aware of the process of treating copper set forth in the Letters Patent granted to John Feix, dated November 25, 1873; and I do not claim anything therein set forth.

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

The process herein described of thoroughly deoxidizing copper and its alloys at a single heat in vessels which are sealed to permit the escape of steam and prevent ingress of air during the entire process, as described.

In testimony that I claim the above have hereunto subscribed my name in the presence of two witnesses.

JAMES RENRICK COOPER.

Witnesses:

ALFRED MARSH,
D. B. COOPER.