

UNITED STATES PATENT OFFICE.

MARTIN F. COOMES AND ARUNAH W. HYDE, OF LOUISVILLE, KENTUCKY.

PROCESS OF CARBURIZING MALLEABLE CAST-IRON OR LOW-CARBON STEEL.

SPECIFICATION forming part of Letters Patent No. 422,120, dated February 25, 1890.

Application filed May 29, 1889. Serial No. 312,567. (Specimens.)

To all whom it may concern:

Be it known that we, MARTIN F. COOMES and ARUNAH W. HYDE, citizens of the United States, residing at Louisville, in the county of Jefferson and State of Kentucky, have invented certain new and useful Improvements in the Process of Carburizing Malleable Cast-Iron or Low-Carbon Steel; and we do 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.

Our invention relates to the manufacture of steel; and its object is to effect a cheap and rapid carburization of malleable cast-iron or of low-carbon steel by the use of certain carbon compounds which are readily decomposed by contact with the heated metal to be carburized, whereby the carbon is set free and unites with the metal, thus converting the malleable cast-iron into steel or the low-carbon steel into high-carbon steel.

To carry our invention into effect we employ any of those organic acids which result from the oxidation of what are termed in the science of chemistry the "glycols." They are divided into two groups, which are known as the "lactic-acid" series and the "oxalic-acid" series. They contain carbon in combination with hydrogen and oxygen, and are readily decomposed by the application of heat. Of any one of these acids we form a bath, into which is placed the metal raised to a white heat, where it is allowed to remain while cooling. The metal parts with its heat, which decomposes the acid, and the carbon thus set free is absorbed by and chemically unites with the metal. In our process these acids may be employed either singly or mixed together, and in any desired quantity, to supply the requisite carbon, a deficiency or sur-

plus of carbon affecting the extent and economy but not the completeness of the carburization. A quantity insufficient to carburize the whole mass will case-harden it, if case-hardening is desired; or the metal may be reheated and the process repeated. When desired, before placing the heated metal in it the bath may be heated to any extent short of decomposing it.

In our process the alkaline salts of the acids named, which are soluble in water, are the equivalents of the acids.

The most useful and available substances for our process are oxalic acid, tartaric acid, and the alkaline salts of these acids.

We have found by experiment that the following bath gives excellent results, namely: cream of tartar, four ounces; oxalate of potash, four ounces; water, one gallon.

Having fully described our invention, what we claim, and desire to secure by Letters Patent, is—

1. In the manufacture of steel, the process of carburizing malleable cast-iron or low-carbon steel, which consists in placing the metal raised to a white heat in a bath containing an organic acid which results from the oxidation of a glycol, substantially as described.

2. In the manufacture of steel, the process of carburizing malleable cast-iron or low-carbon steel, which consists in placing the metal raised to a white heat in a bath containing oxalic acid, substantially as described.

In testimony whereof we affix our signatures in presence of two witnesses.

MARTIN F. COOMES.
ARUNAH W. HYDE.

Witnesses:

W. E. BUCKEL,
W. C. PETTY.