

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. 422,121, dated February 25, 1890.

Application filed May 29, 1889. Serial No. 312,568. (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 substances which in the science of chemistry are known as "carbohydrates," (including the sucroses, glucoses, and amyloses,) mixed with alkalies, alkaline carbonates, or certain mineral acids. Of any one of these mixtures we usually form a bath by dissolving it in any quantity in water or in milk. In this bath 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 bath, and the carbon thus set free is absorbed by and chemically unites with the metal.

In another application, Serial No. 312,565, filed simultaneously with this application, we have claimed a process which employs the carbohydrates alone. This process differs from the former as follows, namely—that the mixtures are by the application of heat converted into other carbonic or carbonaceous compounds, which by additional heat are readily decomposed into lower carbon compounds, yielding the excess of carbon to the metal to be carburized. Thus certain carbohydrates, when heated with either nitric acid or the caustic alkalies, are oxidized and converted into saccharic, oxalic, tartaric, and other acids, which in turn are decomposed by the

heated metal and yield up carbon to it. For the purpose of our process, therefore, these mixtures are equivalents, their action under the application of heat being chemically identical.

The most useful and available mixtures for our process are those composed of sugars of any kind (and their equivalents, sirups, molasses, and other liquid residues of sugar-making) and the caustic alkalies.

An excellent bath, as we have found by experiment, is composed of sugar or molasses, one pound; caustic potash or soda, one ounce; milk, one pint; water, one gallon.

In our process the carbohydrates may be employed singly or mixed together and in any desired quantity to supply the requisite carbon, a deficiency or surplus 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, the bath may be heated to any extent short of decomposing it before placing the heated metal in it.

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 and low-carbon steel, which consists in placing the metal raised to a white heat in a bath formed by adding to water or milk a mixture composed of a carbohydrate and an oxidizing agent, substantially as described.

2. In the manufacture of steel, the process of carburizing malleable cast-iron and low-carbon steel, which consists in placing the metal raised to a white heat in a bath formed by adding to water or milk a mixture composed of a sugar and a caustic alkali, 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.