

# UNITED STATES PATENT OFFICE.

PHILIP J. INCH, OF THE UNITED STATES NAVY.

## PROCESS OF CARBURIZING IRON.

SPECIFICATION forming part of Letters Patent No. 413,513, dated October 22, 1889.

Application filed January 3, 1889. Serial No. 295,307. (No specimens.)

*To all whom it may concern:*

Be it known that I, PHILIP J. INCH, of the United States Navy, now stationed at Washington, in the District of Columbia, have invented a new and useful Improvement in Processes of Carburizing Iron; and I do hereby declare that the following is a full, clear, and exact description of the same.

My invention relates to the treatment of metals, and is designed to give to the surface of the metal treated the capacity of resisting the action of acids and the injurious effect of exposure to the elements. In many situations a metal having the capacity of resisting acids is of great value—as, for instance, in pulp-digesters, in which sulphuric acid is used, and which now require a lining of lead, which, while effective for a certain length of time, soon breaks away or creeps under the action of the acid, and of course such a lining also adds to the expense of the digester.

It is the object of my invention to treat metals to an improved process, by means of which the surface will be rendered capable of resisting the action of acids, so that it may be used directly in such situations as the boiler of a digester without requiring any interior lining. It is also obvious that such a metal would be very valuable for use in many other situations.

In my treatment I first take the metal and thoroughly clean it from all scale or oxide, and then subject it to a bath of a solution of potash, which has a neutralizing effect on the iron, and then I subject the metal to a mixture of carbon and water, the carbon being preferably the ordinary graphite or plumbago, which leaves the surface in a condition susceptible to the action of hydrogen, which makes a carbide of the surface. I then place the iron so treated in an ordinary muffle and subject it to the action of petroleum or hydrocarbon vapor for ten minutes or more at a very high temperature—namely, about 1,000° Fahrenheit. I then subject the articles, about the same temperature, to the action of superheated steam for about thirty minutes, which has the effect of setting the surface, and finally the articles are removed and sub-

jected to a bath of fish or other nitrogenous oils.

It will be understood that in the treatment of the metals the muffle is closed to atmospheric air, and is under an internal pressure of about fifteen pounds above the atmospheric pressure, though it will be understood that this may be varied, and may be either more or less, according to conditions required. This pressure I have found aids in producing a union of the surface and carbon.

I have found by the use of the first bath of alkali—such as potash—that a chemical action takes place on the surface of the iron, which in the treatment of graphite produces an affinity for the graphite, which causes it to adhere closely to the surface, and while this first bath is not absolutely necessary, I prefer to use it, as the best results follow, as without it there is a liability of the surface to scale, the affinity between the surface of the iron and the graphite and subsequent carbon treatment being much less than when the iron is first subjected to the alkali bath. By subjecting the iron to the action of the graphite the surface is carburized, and this requires but a very few minutes of treatment in the muffle under the action of the hydrocarbons.

Instead of the potash, I may subject the metal to a bath of any known alkali.

I do not desire to be limited to the final oil bath, though I prefer this, as it gives a tempering effect and improves the appearance of the iron.

What I claim is—

The hereinbefore-described process of carburizing iron, consisting in subjecting the iron to a mixture of graphite, then applying to the iron, in a muffle closed to the atmospheric air, a hydrocarbon vapor, and finally applying steam, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

PHILIP J. INCH.

Witnesses:

F. L. MIDDLETON,  
WALTER P. KEENE.