

UNITED STATES PATENT OFFICE

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PROCESS OF DECARBURIZING IRON OR STEEL OR THEIR ALLOYS

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My invention relates to improvements in the decarburization of iron and steel and their alloys.

The decarburization of iron and steel and their alloys is generally carried out by bringing these materials in the melted or the red hot state in contact with oxygen or an oxygen containing gas mixture and thus oxidizing the carbon. It is also well known in the art that a number of other gases and gas mixtures, more particularly steam, carbon monoxide or hydrogen as well as a gas mixture designated as "blast furnace gas" and consisting mainly of nitrogen and carbon monoxide are suitable for the decarburization process, more particularly for edge decarburization.

On the other hand the fact is well known in the art that a carbon content above 0.008 p. c. is sufficient to exert a detrimental effect upon the magnetic properties of the iron, and in particular increases the hysteresis losses. None of the at present known decarburization processes renders it possible to go below this limit, however.

According to my invention this end in view is attained by heating to temperatures corresponding at least to red heat (and therefore including melting temperatures) the iron or steel or their alloys to be decarburized in an atmosphere of hydrogen under application of pressures, which are of the order of 100 atmospheres. Preferably my improved process is carried out at a temperature of at least 1000° centigrade (1800 Fahrenheit), in order to speed up the process. The decarburization process may, for instance, be carried out in a chamber in which a constant high pressure of hydrogen prevails and the walls of which are kept at a low temperature.

To generate the heat necessary for carrying out my improved process the iron to be decarburized is heated in a crucible of ceramic material either by high frequency or by electric resistance heating. In many cases it is advisable to blow the hydrogen gas continuously in a closed cycle of circulation through the molten or red hot mass

of iron until the carbon content has dropped sufficiently, and to remove the methane mainly forming during the treatment, by selective absorption media, by decomposition at high temperature and lower pressure, or by freezing it out. If my improved process is applied to red hot iron, the iron is preferably employed in the form of thin pieces, such as sheets, strips or wires, in order to obtain a thorough decarburization up to the desired limit. After the termination of the process the hydrogen is preferably first withdrawn by a suction pump and the chamber evacuated in which is contained the decarburized iron. The iron is then heated to a high temperature to expel any occluded hydrogen. The cooling down of the iron after the application of my improved process is preferably carried out in a vacuum. If molten iron has been treated the iron is preferably cast into moulds under exclusion of air. The charges should be as large as possible, since the loss of heat is then lower. The hydrogen may, if desired, be preheated before bringing it in contact with the iron to be decarburized.

According to my improved process it is possible in a comparatively short time to obtain chemically pure iron, if desired, without losses of iron or any constituents of the alloy, which frequently occur in the known processes. If pure hydrogen is employed in my process no scale is formed on the iron.

Various modifications and changes may be made without departing from the spirit and the scope of the invention, and I desire, therefore, that only such limitations shall be placed thereon as are imposed by the prior art.

I claim as my invention:

1. In a process of decarburizing iron or steel or their alloys by heating to temperatures corresponding at least to red heat in an atmosphere of hydrogen, the application of a pressure in the treatment chamber of the order of 100 atmospheres.
2. In a process of decarburizing iron or steel or their alloys in an atmosphere of

hydrogen, the application of a pressure of the order of 100 atmospheres and of a heating temperature of over 1000° centigrade.

3. In a process of decarburizing iron or steel or their alloys by heating to temperatures corresponding at least to red heat in an atmosphere of hydrogen, the application in the treatment chamber of a pressure of the order of 100 atmospheres, the walls of the treatment chamber being kept at a low temperature.

4. In a process of decarburizing iron or steel or their alloys by heating to temperatures corresponding at least to red heat in an atmosphere of hydrogen, the application of high frequency current for heating the material to be treated and of a pressure of the order of 100 atmospheres in the treatment chamber.

5. In a process of decarburizing iron or steel or their alloys by heating to temperatures corresponding at least to red heat in an atmosphere of hydrogen, the application of an airtight crucible of a material containing no carbon and a pressure of the order of 100 atmospheres in said crucible.

6. In a process of decarburizing iron or steel or their alloys by heating to temperatures corresponding at least to red heat in an atmosphere of hydrogen, the application in the treatment chamber during the decarburization process of a pressure of the order of 100 atmospheres, the hydrogen being withdrawn by a suction pump after the decarburization is finished and the decarburized iron being heated to a high temperature in a vacuum.

7. In a process of decarburizing iron or steel or their alloys by heating to temperatures corresponding at least to red heat in an atmosphere of hydrogen, the application in the treatment chamber during the decarburization process of a pressure of the order of 100 atmospheres, the hydrogen being withdrawn by a suction pump after the decarburization is finished and the decarburized iron being heated to a high temperature in a vacuum and also cooled in a vacuum.

8. The process of treating iron or steel or their alloys, which consists in decarburizing them by heating the metal to temperatures corresponding at least to red heat in an atmosphere of hydrogen under a pressure of the order of 100 atmospheres, then removing the hydrogen by suction, and thereupon heating the decarburized metal to a high temperature in a vacuum.

9. The process of treating iron or steel or their alloys, which consists in decarburizing them by heating the metal to temperatures corresponding at least to red heat in an atmosphere of hydrogen under a pressure of the order of 100 atmospheres, then removing the hydrogen by suction, and thereupon

heating the decarburized metal to a high temperature in a vacuum and subsequently cooling such metal in a vacuum.

In testimony whereof I affix my signature.
WALTER SCHOTTKY.

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