UNITED STATES PATENT OFFICE.

NELSON H. BRAY, OF SAN FRANCISCO, CALIFORNIA.

PROCESS OF CARBONIZING AND HARDENING METAL.

1,207,848. Specification of Letters Patent. Patented Dec. 12, 1916.

No Drawing. Application filed April 29, 1914. Serial No. 835,298.

To all whom it may concern:

Be it known that I, NELSON H. BRAY, a citizen of the United States, residing at 1216 Fifth avenue, in the city and county of San Francisco, State of California, have invented a new and useful Process of Carbonizing and Hardening Metal, of which the following is a specification.

This invention relates more particularly to the process of hardening steel by the direct application of an oxy-acetylene flame, in combination with other carbonizing elements, and chilling.

In the following description a simple manner of putting this invention into practice will be disclosed, but I do not wish to be understood as confining this invention to the specific mode of operation, or the ingredients set forth, as many variations may be introduced, well within the spirit of this invention as defined in the claims succeeding the description.

The commercial type of oxy-acetylene apparatus delivers through a blow-pipe a flame, composed of acetylene gas and oxygen under pressure. The proportions of acetylene gas and oxygen can be varied by regulation, for the particular results desired. In the present invention the acetylene predominates, its high carbon content being taken advantage of as a carbonizing agent.

The present process must not be confused with the well known process of case hardening, that consists in forming a superficial thin skin of hard metal overlying the mass of metal upon which it is formed. Case hardening serves very well under certain conditions, but practice has demonstrated that it will not for instance withstand heavy pounding and rolling action without spalling or splintering, the more ductile metal beneath causing the hard skin to separate from the main body; a perfect demonstration of the superficial character of case hardening.

The process forming the subject of this invention, alters the physical nature of the metal so treated, penetrating to a considerable depth, preserving or increasing the toughness, while raising the temper or hardness to the maximum. Spalling and such effects are impossible in steel hardened by this process.

The mode of operation in the practice of this invention includes the direct application to the surface of the metal of the oxy-acetylene flame, preferably with the acetylene element predominating. When the flame has heated the metal to the degree at which it is the most porous, that is broadly speaking, just short of the welding point, the highly divided carbon contained within the acetylene and its by-products of combustion are driven into the porous metal, or absorbed by it, to the depth to which the temporarily increased porosity extends, during the heating period. The absorption of carbon and other hardening elements, during this period of superporosity can be accomplished, by the surface application of commercial cyanid of potassium, followed by the application of a solution of salt and copper sulfate in water. This solution should be applied as nearly as may be to the surface of the heated metal, within the zone of the flame projected against it. When the limit of absorption has been reached, the process of hardening is completed by the direct application of a chilling bath, such as brine or other mixtures flowed over, or applied to the heated surface.

This hardening process may be localized that is to say a given area of the metal to be treated may be hardened, without altering the characteristics of the surrounding area; on the other hand the results are so uniform following the use of this process, that a piece of metal progressively treated will show no appreciable variation in hardness throughout the entire area treated at different times. The development of the oxy-acetylene art has not yet progressed to the point where a considerable volume of flame is available from a single blow pipe. At present large areas are being treated by this process by arranging the blow-pipes in gangs to increase the volume of flame to cover the desired area.

Having thus described this invention what I claim as new and desire to secure by Letters Patent is:

1. The process of carbonizing metals which includes heating the metal to a highly absorbent degree by the direct application of an acetylene flame containing an excess of acetylene.

2. The process of carbonizing metals which includes heating the metal to a highly absorbent degree by the direct application of an acetylene flame.

3. In the process of hardening metal by carbonizing, the step which consists in heat-

ing the metal to a highly absorbent degree by the direct application of an oxy-acetylene flame.

4. The process of treating metal, which includes the direct application of the oxy-acetylene flame, and applying carbonaceous elements to the metal during its most absorbent temperature.

5. The process of treating metal, which includes heating the metal to a high degree, by the direct application of an oxy-acetylene flame, and applying cyanid of potassium, and a solution of salt and copper sulfate, during the period of high temperature.

6. The process of treating metal which includes heating the metal to a high degree by the direct application of a high temperature flame, and applying cyanid of potassium, and a solution of salt and copper sulfate during the period of high temperature.

7. The process of carbonizing metal comprising heating the metal to a highly absorbent degree by the direct application of an open acetylene flame.

8. The process of carbonizing metal, which includes heating the metal to a temperature just short of the welding temperature by the direct application of an acetylene flame containing an excess of acetylene.

In testimony whereof, I have hereunto set my hand this 22nd day of April, 1914.

NELSON H. BRAY.

Witnesses:
BALDWIN VALE,
A. J. HENRY.