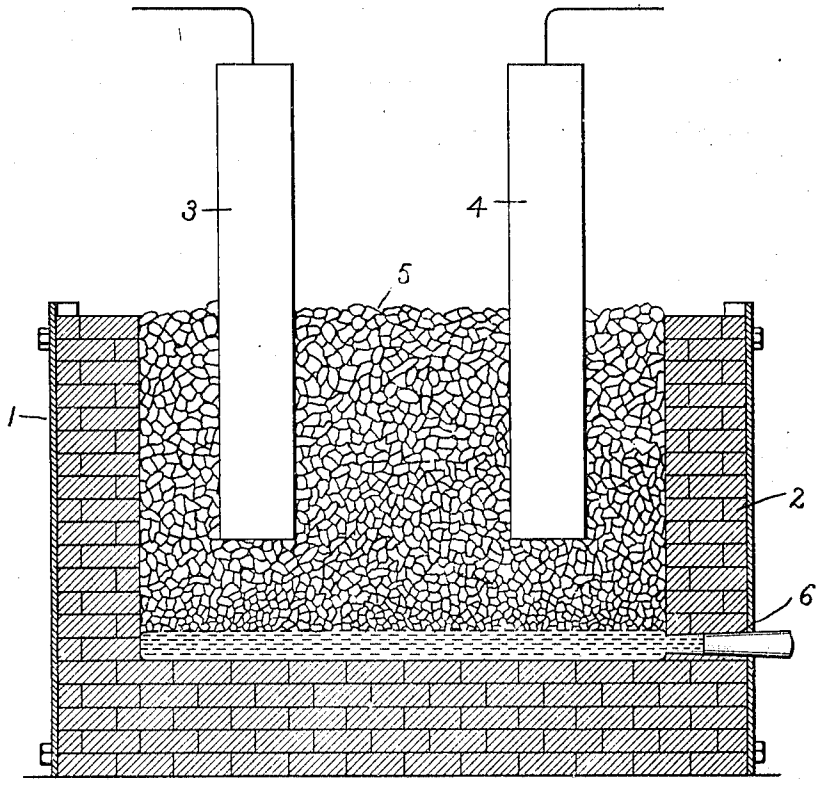
C. A. HANSEN.

PRODUCTION OF ALLOYS.

APPLICATION FILED AUG. 6, 1909. RENEWED APR. 12, 1911.

1,041,072. Patented Oct. 15, 1912.



Witnesses:

J. Ellis Glen

Marcus L. Byng.

Inventor:

Charles A. Hansen,

by Albert G. Davis

Att'y.

UNITED STATES PATENT OFFICE.

CHARLES A. HANSEN, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

PRODUCTION OF ALLOYS.

1,041,072. Specification of Letters Patent. Patented Oct. 15, 1912.

Application filed August 6, 1909, Serial No. 511,524. Renewed April 12, 1911. Serial No. 620,666.

To all whom it may concern:

Be it known that I, CHARLES A. HANSEN, a citizen of the United States, residing at Schenectady, in the county of Schenectady, State of New York, have invented certain new and useful Improvements in the Production of Alloys, of which the following is a specification.

My invention relates to the production from metals having a high affinity for carbon of alloys such as ferro alloys containing boron, vanadium, chromium, manganese, molybdenum or titanium. In the production of these alloys it is highly desirable to keep the alloy when molten out of contact with carbon, as it absorbs carbon readily in this condition. A furnace lining is, therefore, necessary which will not introduce carbon into the material, such, for example, as a magnesite lining. The use of such linings, however, is attended with great difficulty and rendered impracticable by the reaction mixture, which contains corrosive oxid, fusing to a fluid mass below the reduction temperature. This fluid mass attacks all linings but a carbonaceous lining, which is objectionable, as stated above. Furthermore, the fusing of the mixture not only renders its confinement difficult, but it is much more difficult to reduce when in a fluid condition.

According to my invention, the reaction mixture is trapped in a sponge, so to speak, of carbon, thus preventing contact of the corrosive oxid with the lining. The furnace, in which the reaction is carried on, is lined with a non-carbonaceous lining, such as a magnesite lining.

The accompanying drawing is a diagrammatic sectional view of a furnace suitable for reducing the mixture.

The reaction mixture is incorporated with a viscid, carbonaceous material, such as pitch, in such a manner that the particles of the reaction mixture are coated with the carbonaceous material. Upon carbonization the particles of the mixture will, therefore, be more or less completely surrounded with carbon, which forms a cellular or spongy mass, trapping the particles of mixture. If desired, the carbonaceous material may be added in such proportion that after carbonization the remaining carbon may by itself be sufficent to reduce the oxid or oxids; but, preferably, a certain amount of powdered reducing material, such as powdered coke, is added to the mixture. In either case after the carbon forming the spongy mass which traps the particles of reaction mixture is consumed by interaction with the oxids, the reduced metal falls to the bottom of the furnace chamber, where it is confined by the non-carbonaceous lining. The reduced alloy under these conditions absorbs or combines with but a surprisingly low percentage of carbon.

As a specific example of reduction involving my invention, I will describe the production of ferro-boron. A charge of powdered boric acid, which has been previously fused, powdered iron oxid, powdered coke and pitch is thoroughly mixed in a ball mill. The exact proportions of these materials, of course, will depend upon the amount of fixed carbon and of pitch and the particular oxids used; but, as an example, I will state that I have used a mixture consisting by weight of 15.5 parts of boric acid, 14 parts of magnetite, 8.5 parts of graphitized coke, and 5 parts of pitch containing 40 per cent. fixed carbon; but I do not wish to be limited to these particular proportions. After being thoroughly mixed, the mixture is preferably kneaded by a suitable steam-heated mixing machine, and is then pressed into pellets, which are carbonized at a temperature of, say, 800° C. After carbonizing the pellets are broken up into pieces of convenient size and charged into an electric arc furnace of the general type illustrated in the drawing. The furnace consists of a casing 1, lined with a refractory brick 2, as magnesite brick. The two electrodes 3, 4 are inserted into the broken material and connected electrically in series. The heat is generated in the well-known way by the high resistance of the charge 5, which consists of broken, irregular material. The carbon combines with the oxygen, and the reduced iron alloys with the reduced boron and sinks to the bottom of the furnace, from where it is removed through tap hole 6. By following out this procedure the amount of carbon in the product may be confined within the limits of one-half of one per cent., or even less.

While I have described my process particularly with reference to the production of ferro-boron, I aim by the appended claims to cover other alloys made in a simi-

lar way, such, for example, as already specified in the introductory paragraph.

What I claim as new and desire to secure by Letters Patent of the United States, is—

1. The process, which consists in incorporating a reducible boron compound and ferric material with a viscid carbonizable binder, heating to carbonize said binder and form a spongy mass, and subsequently heating to a higher temperature.

2. The process, which consists in intimately mixing oxid of boron, oxid of iron, and a reducing agent with a viscid carbonizable binder, heating to carbonize said binder, and subsequently heating to a temperature at which carbon will interact with the oxids present.

3. The process, which consists in intimately mixing oxid of boron, ferric material and carbon with a viscid carbonizable binder, heating to carbonize said binder, and subsequently subjecting said material to the heat of an electric arc while supported on a carbon-free furnace lining.

4. The process, which consists in coating with carbonaceous material the particles of a comminuted charge containing chemically active compound or compounds of metals having a high affinity for carbon, the proportions of said compound or compounds and carbon being substantially in proportion called for by a reaction between the same carbonizing to form a spongy mass of carbon supporting the compounds to be reduced, heating the mixture to the reaction temperature and supporting the reduced product upon a carbon-free surface.

In witness whereof, I have hereunto set my hand this 5th day of August, 1909.

CHARLES A. HANSEN.

Witnesses:
BENJAMIN B. HULL,
MARGARET E. WOOLLEY.