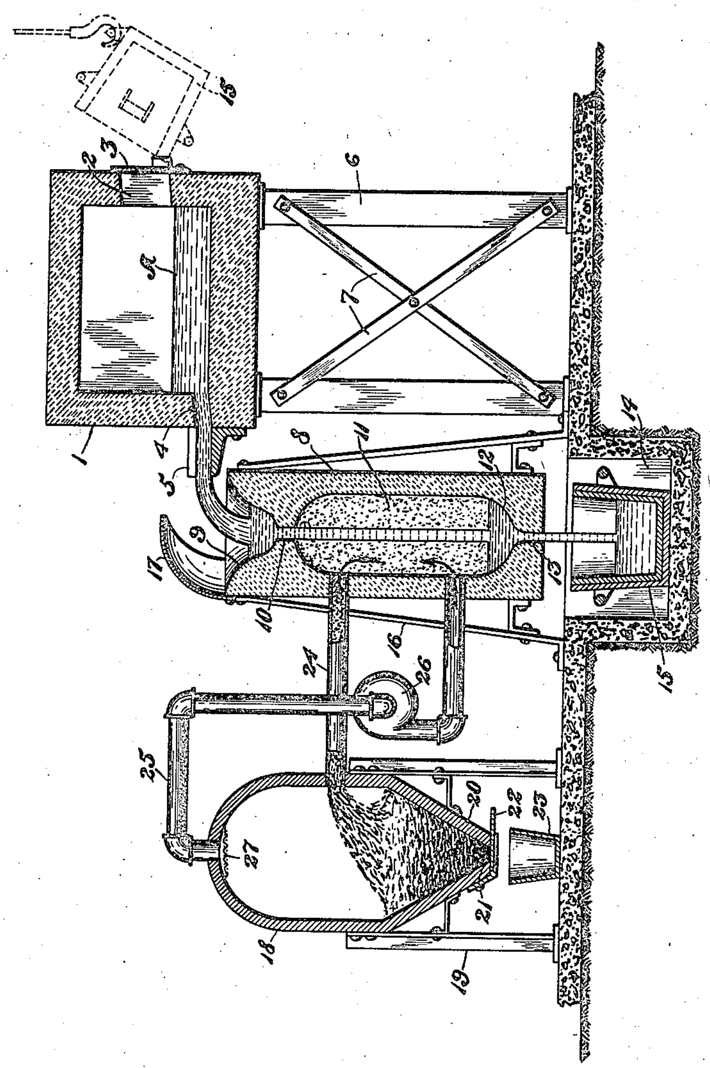
T. F. BAILY.
PROCESS OF PRODUCING GRAPHITE.
APPLICATION FILED JAN. 31, 1922.

1,420,512. Patented June 20, 1922.



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# UNITED STATES PATENT OFFICE.

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PROCESS OF PRODUCING GRAPHITE.

1,420,512. Specification of Letters Patent. Patented June 20, 1922.

Application filed January 31, 1922. Serial No. 533,083.

*To all whom it may concern:*

Be it known that I, THADDEUS F. BAILY, a citizen of the United States, residing at Alliance, in the county of Stark and State of Ohio, have invented new and useful Improvements in Processes of Producing Graphite, of which the following is a specification; this application in part being a continuation of the common subject matter of my former application filed March 19, 1921, Serial No. 453,736.

The invention relates to a method of producing graphite and more particularly to a process by means of which artificial graphite is extracted from super-heated iron which is substantially fully saturated with carbon.

The usual method of producing artificial graphite has been by passing an electric current through anthracite coal or similar carbon, bringing the same to an extremely high temperature, at which temperature the amorphous carbon is converted into graphite and is then allowed to cool.

The objects of the present invention are to produce graphite containing less impurities than the graphite produced by the electro-thermal method above mentioned and at a considerably less cost than is possible in the production of graphite by the electro-thermal method.

It is well known that iron at the freezing temperature will retain only about 4.3% of carbon, and that as the iron is heated to a molten state, it is capable of absorbing amorphous carbon, the capacity of the molten iron for absorbing carbon increasing as the temperature of the iron is increased.

This being the case, when molten iron at a high temperature is fully saturated with carbon and then allowed to cool, all of the surplus carbon which has been dissolved in the molten iron is thrown out of the cooling bath in the form of graphite flakes or powder, only the residual 4.3% of carbon remaining in the iron.

In carrying out the process, iron is heated in a furnace to a temperature at which the iron will absorb additional carbon. Coke or carbon in other form in proper quantity to be absorbed is then dissolved in the bath.

The bath is then poured in its super-heated and saturated condition from the furnace in which it has been heated, and cooled slightly above its freezing temperature, which process will throw out of the bath, in the form of graphite, the excess dissolved carbon above the residual 4.3% which is retained in the iron at its freezing temperature.

This cooling is preferably accomplished by pouring the molten iron into a closed chamber, allowing the iron to cool to near its freezing temperature, the carbon being thrown off from the cooling chamber in the form of graphite which collects in the chamber, the iron being poured from the chamber while still in the molten state.

If desired, a suction may be created in the cooling chamber to cause the iron to cool more rapidly, or to remove the graphite from the cooling chamber. The iron which has eliminated the surplus carbon is received in a suitable receptacle as it passes from the cooling chamber and may be reheated and recharged with carbon indefinitely, the same process being carried through successively.

The process may be carried out with the use of the apparatus illustrated in the accompanying drawing, in which the figure is a vertical, sectional view through an apparatus suitable for the purpose.

A melting furnace of any suitable design is illustrated at 1, provided with a filling opening 2, normally closed by a door 3, and with an outlet opening 4 which is normally closed by a plug in the usual manner and which communicates with a pouring spout 5. For the purpose of the invention, this furnace is necessarily elevated and may be mounted upon any suitable structure such as the standards 6 which are braced by the cross bars 7.

A cooling receptacle 8, preferably in the form of an elongated, upright cylinder, is located in position to receive the molten iron from the pouring spout 5 of the furnace, and is provided at its upper end with the cupped receptacle 9, having a central reduced outlet opening 10 communicating with the inner cooling chamber 11, the lower end of which is cut as at 12 and provided with a reduced outlet opening 13.

A pit 14 is preferably provided beneath the cooling chamber and arranged to receive a bucket or other receptacle 15, the cooling chamber being supported above said pit in any suitable manner as by the uprights 16, a baffle plate or guard 17 being preferably provided at the upper end of the cooling chamber to prevent the molten metal from spattering or splashing out of the receptacle 9 as it is poured from the spout of the furnace.

A graphite collecting receptacle 18 may be located adjacent to the cooling chamber, being preferably supported above the floor as by the frame 19 and provided with the tapered or conical lower end portion 20 having an outlet opening 21 therein which is normally closed by the sliding door 22. A removable receptacle 23 may be placed beneath the collector as shown to receive the graphite therefrom.

The upper portion of the cooling chamber communicates with the intermediate portion of the collector by means of the pipe 24, a pipe 25 extending from the upper end of the collector to the lower portion of the cooling chamber, a blowing fan of any usual construction being located in the fan casing 26 which is provided in said pipe between the collector and cooling chamber.

In carrying out the invention with the apparatus shown in the drawing, iron as indicated at A, is placed in the furnace through the opening 2, the bucket 15 being arranged to be carried up to said opening in any usual manner as by a crane or the like. The outlet opening 4 of the furnace is, of course, plugged to retain the iron therein.

The iron is then heated in the furnace to a temperature at which it will absorb additional carbon. Coke or carbon in other form, in proper quantity to be absorbed by the molten iron, is then dissolved in the bath.

The plug is then removed from the outlet opening 4, the bath being poured in its superheated and saturated condition through the pouring spout 5 of the furnace and into the receptacle 9, passing in a thin stream through the opening 10 and through the closed cooling chamber 11, passing out of the cooling chamber through the opening 13 into the bucket 15 which is placed in the pit 14 to receive the same.

As shown in the drawing, the opening 10 is slightly smaller than the opening 4 of the furnace, the opening 13 being slightly smaller than the opening 10. A small pool of the molten iron will thus collect in the receptacle 9 and a similar pool in the cupped bottom 12 of the cooling chamber, these pools sealing the cooling chamber from the outer air.

As the molten iron in its saturated condition is passed in a thin stream, as shown, through the cooling chamber 11, it will be cooled to slightly above its freezing temperature by means of the circulation of an inert non-oxidizing gas forced through the cooling chamber by the fan, which process will throw out of the bath in the form of graphite flakes or powder, the excess carbon above the residual 4.3% which is retained in the iron at its freezing temperature.

The circulation of the inert or non-oxidizing gas caused by the fan, will draw graphite flakes or powder from the upper end of the cooling chamber and deposit them in the collector as shown in the drawing, a fine mesh screen 27 may, if desired, be placed at the inlet to the pipe 25 to prevent the graphite flakes from being carried back into the cooling chamber.

The graphite may be removed from the collector from time to time, by opening the door 22, allowing the graphite to drop into the receptacle 23. The iron which has eliminated the surplus carbon is received in the bucket 15 as it passes from the cooling chamber and may be poured back into the furnace 1 and reheated and recharged with carbon indefinitely, the same process being carried through successively.

If silica or similar impurities are present in the iron, it may be desirable to first heat the iron up to the desired temperature and pour the same, allowing it to cool when the silica and similar impurities will be thrown out of the bath, after which the iron may be reheated and recharged with carbon indefinitely, the graphite flakes or powder which are then thrown out of the cooling bath, being in the form of pure graphite.

The advantages of this method of producing graphite, over the existing method, are quite obvious. There is no ungraphitized carbon present in the finished product, as is the case in a charge of material in the electro-thermal process.

As the molten iron exercises a clarifying effect upon the carbon, eliminating certain impurities which would otherwise be present in the finished graphite produced by the electro-thermal method, a better and more pure product is obtained by the present method.

I claim:—

1. The method of producing artificial graphite which consists in saturating a bath of super-heated molten iron with carbon, pouring the saturated molten iron into a closed cooling chamber, cooling the iron sufficiently to throw the surplus carbon out of the bath into said chamber in the form of graphite and withdrawing the molten iron from the cooling chamber.

2. The method of producing artificial graphite which consists in saturating a bath of molten iron with carbon, pouring the molten iron through a closed chamber in a thin stream, cooling the iron sufficiently to throw the surplus carbon out of said stream into the chamber in the form of graphite and withdrawing the molten iron from the cooling chamber.

3. The method of producing artificial graphite which consists in saturating a bath of super-heated molten iron with carbon,

pouring the molten iron into a closed cooling chamber, cooling the iron sufficiently to throw the surplus carbon out of the bath into the chamber in the form of graphite and producing a suction in the cooling chamber to assist in the removal of the graphite from the iron.

4. The method of producing artificial graphite which consists in saturating a bath of super-heated molten iron with carbon, pouring the molten iron into a closed cooling chamber, cooling the iron sufficiently to throw the surplus carbon out of the bath into the chamber in the form of graphite, and passing an inert gas through the cooling chamber to assist in the removal of the graphite from the iron.

5. The method of producing artificial graphite which consists in saturating a bath of super-heated molten iron with carbon, pouring the molten iron in a thin stream through a closed cooling chamber, allowing the iron to cool sufficiently to throw the surplus carbon out of the bath into the cooling chamber in the form of graphite and conveying the graphite by suction to a collector chamber.

6. The method of producing artificial graphite which consists in saturating a bath of super-heated molten iron with carbon, pouring the molten iron into a closed cooling chamber, cooling the iron sufficiently to throw the surplus carbon out of the bath into the cooling chamber in the form of graphite, withdrawing the molten iron from the cooling chamber and reheating the molten iron and again saturating the super-heated iron with carbon.

7. The method of producing artificial graphite which consists in saturating a bath of super-heated molten iron with carbon, pouring the molten iron in a thin stream through a closed cooling chamber, cooling the iron sufficiently to throw the surplus carbon out of the bath into the cooling chamber in the form of graphite, conveying the graphite by suction to a collector chamber and continuously withdrawing the molten iron from the cooling chamber.

THADDEUS F. BAILY.