No. 891,248. PATENTED JUNE 23, 1908.

E. A. A. GRÖNWALL.

SMELTING FURNACE.

APPLICATION FILED MAY 1, 1906.

Fig. 1.

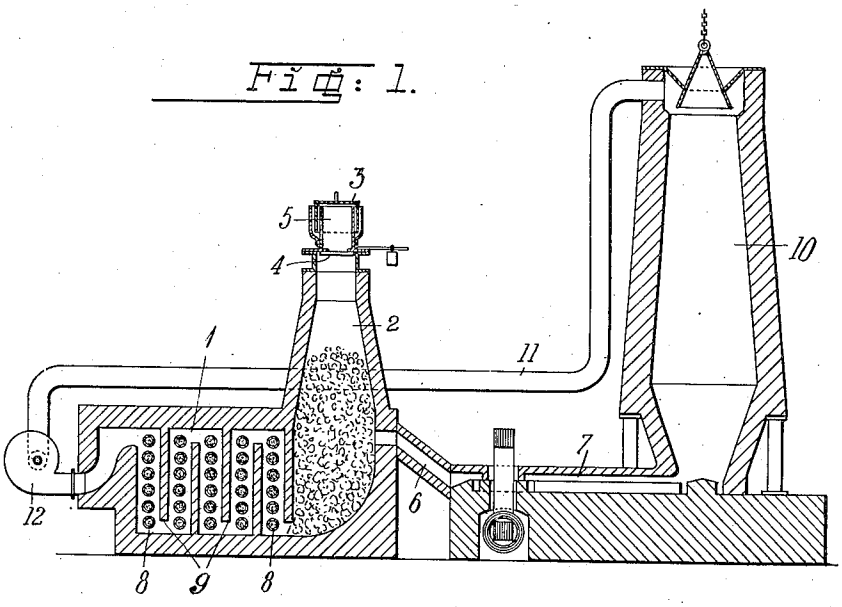
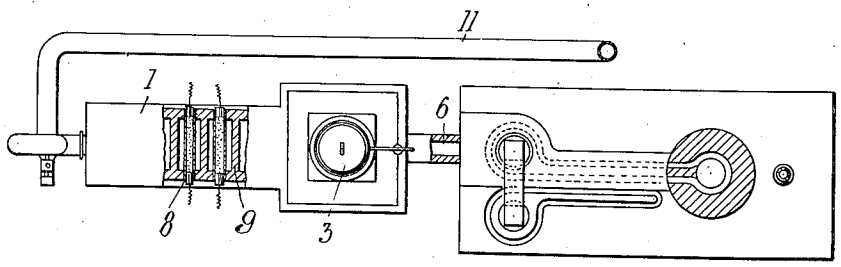


Fig. 2.



Witnesses:

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UNITED STATES PATENT OFFICE.

EUGEN ASSAR ALEXIS GRÖNWALL, OF LUDVIKA, SWEDEN.

SMELTING-FURNACE.

No. 891,248. Specification of Letters Patent. Patented June 23, 1908.

Application filed May 1, 1906. Serial No. 314,613.

To all whom it may concern:

Be it known that I, EUGEN ASSAR ALEXIS GRÖNWALL, engineer, a subject of the King of Sweden, residing at Ludvika, in the Kingdom of Sweden, have invented a certain new and useful Smelting-Furnace.

This invention relates to apparatus for carrying out a process for heating, smelting, or reducing materials, such as ore in various forms in which is effected the combustion or oxidation of carbon monoxid; and the invention especially relates to means for carrying out the process in which the carbon dioxid contained in the gases issuing from the smelting furnace, is converted into carbon monoxid, after which the gas containing the carbon monoxid, thus regenerated, is again introduced into said furnace for continuing the smelting process. In the smelting processes of this kind heretofore known, the gases from the furnace and containing the carbon dioxid have been heated by passing them through a regenerator that was heated by means of hot gases, said gases from the regenerator would in their heated condition pass through a layer of carbon to reduce the carbon dioxid to the monoxid. A process has also been used in which the gases from the blast furnace were led directly without previous heating to a chamber containing carbon heated by the influence of an electric current passing through it, whereby the carbonic oxid contained in the gases becoming heated was reduced to carbon monoxid through the action of the heated carbon.

The former mentioned method has disadvantages arising from the difficulty to uniformly heat the gases to a sufficiently high temperature to effect the reduction. While the other method mentioned is objectionable because of the unequal resistance of the carbon layer used for heating whereby the temperature will considerably vary, and the carbon dioxid will be unequally reduced. These difficulties are overcome in the apparatus of the present invention, in which the gases from the furnace containing the carbon dioxid, are first led through or over heating elements of fire proof material, which elements are heated by an electric current; and thereupon the heated gases are brought into intimate relation with a mass of carbon particles, whereby the carbon dioxid is reduced to the monoxid, and thereupon returned to the furnace.

In the accompanying drawings, is illustrated a furnace embodying the present invention, in which

Figure 1 is a vertical section and Fig. 2 a plan view partly in section.

The heating chamber 1 is constructed of fire proof material and is provided with heating elements 8 separated by baffles or walls 9, whereby the carbon dioxid drawn from the furnace 10 through pipe 11 by means of a blower 12, will have a zig-zag course through the heating chamber. This chamber communicates with a chamber 2, that is filled with carbon preferably in the form of charcoal. The chamber 2 is provided with two covers 3 and 4, only one of which is open at one time. The upper cover is first opened and the charcoal placed below it on the second cover, thereupon the top cover 3 is replaced and the lower cover 4 is swung permitting the charcoal to fall into the chamber. The chamber 2 is connected with the blast furnace 10 at its lower part by means of passages 6 and 7.

In the heating chamber 1, are arranged a number of conductors in the form of tubes or hollow bodies 8 of fire proof material that are filled with fire proof material having bad conductivity of electricity, such for instance as carbon, and emery powder, carborundum or other material offering considerable resistance to the current. Current being passed through these tubes they will be heated to a temperature of from 1000 to 1500 degrees centigrade without melting or fusing. These tubes may be connected in series or in multiple or otherwise as may be desired.

The operation of this apparatus is as follows: The gases emanating from the blast furnace or smelting furnace are conducted or forced into the heating chamber 1 through the pipe 11, and are caused to take a zig-zag direction coming into intimate contact with the heating elements 8 that are brought to a temperature of 1000 to 1500 degrees centigrade by the action of the electric current. This temperature will be sufficient to cause the reduction of the carbon dioxid to monoxide when the gases are brought into contact with the carbon in chamber 2; the carbon therein being also heated by the action of the gases, which will facilitate the reduction of the dioxid. The carbon in the chamber 2 being acted upon to form the monoxid by the oxygen from the carbon dioxid gases.

The carbon monoxid in the gases then passes through the passages 6 and 7 into the smelting portion of the furnace. The ashes formed during the combustion, (oxidizing,) of the carbon in the vessel or chamber 2 are drawn off from time to time as required. A portion of the gases from the chamber 2 are passed into the smelting furnace and part of the regenerated gases can be led off and used for other purposes.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:

1. In an apparatus of the character described, the combination of a smelting furnace, a closed chamber containing particles of carbon, a second chamber containing electric heating elements and capable of being heated to a temperature of 1000 degrees C. by an electric current, a passage connecting the heating chamber with the lower end of the said chamber containing charcoal, a passage leading from the charcoal chamber above the bottom into the smelting furnace, a passage leading from the upper portion of the smelting furnace into the other end of the heating chamber, and a pressure device in the latter passage for forcing some of the gases from the smelting furnace into the heating chamber.

2. In an apparatus of the character described, the combination of a smelting furnace, a closed chamber containing particles of carbon, a second chamber containing electric heating elements and capable of being heated to a temperature of 1000 degrees C. by an electric current, a passage connecting the heating chamber with the lower end of the said chamber containing charcoal, a passage leading from the charcoal chamber above the bottom into the smelting furnace, a passage leading from the upper portion of the smelting furnace into the other end of the heating chamber, a pressure device in the latter passage for forcing some of the gases from the smelting furnace into the heating chamber, the said heating elements being formed of a series of tubular bodies of fire proof material filled with refractory material of low conductivity.

In testimony that I claim the foregoing as my own, I have hereto affixed my signature in the presence of two witnesses.

EUGEN ASSAR ALEXIS GRÖNWALL.

Witnesses:

JOHN ANDERSON,

BERNHARD RYAN.