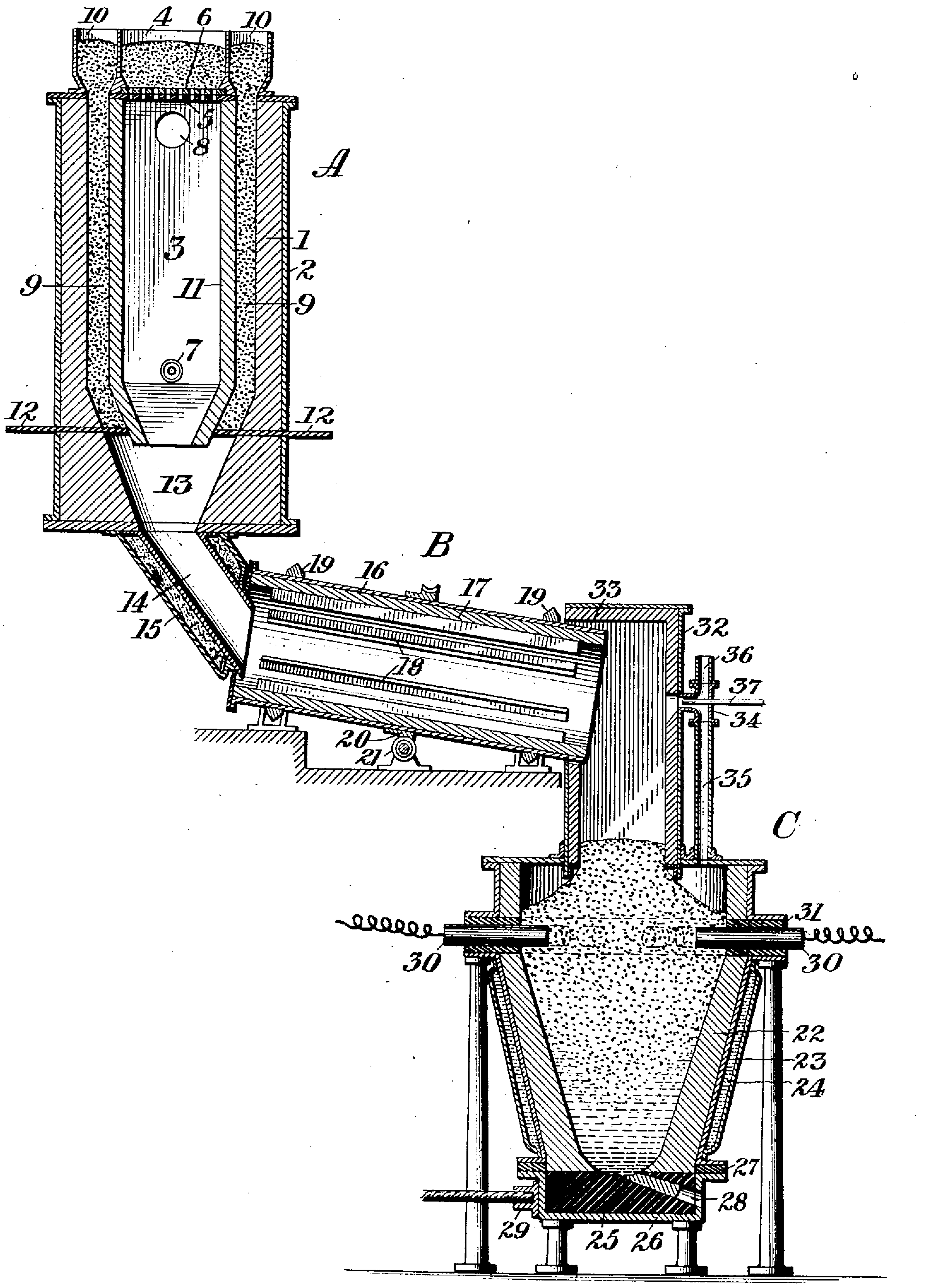
E. F. PRICE.

PROCESS OF SMELTING METALLIC COMPOUNDS AND PRODUCING CARBIDS.

APPLICATION FILED JULY 14, 1904.

904,991. Patented Nov. 24, 1908



Witnesses:

R A Balderson

J. B. Hill.

Inventor:

Edgar F. Price,

by Byrnes & Townsend,

Att'ys.

UNITED STATES PATENT OFFICE.

EDGAR F. PRICE, OF NIAGARA FALLS, NEW YORK, ASSIGNOR TO UNION CARBIDE COMPANY, OF NIAGARA FALLS, NEW YORK, A CORPORATION OF VIRGINIA.

PROCESS OF SMELTING METALLIC COMPOUNDS AND PRODUCING CARBIDS.

No. 904,991. Specification of Letters Patent. Patented Nov. 24, 1908.

Application filed July 14, 1904. Serial No. 216,535.

To all whom it may concern:

Be it known that I, EDGAR F. PRICE, a citizen of the United States, residing at Niagara Falls, in the county of Niagara and State of New York, have invented certain new and useful Improvements in Processes of Smelting Metallic Compounds and Producing Carbids, of which the following is a specification.

This invention especially relates to the production of calcium carbid by smelting a preheated charge of finely divided lime and carbon in an electric furnace.

According to the process, the lime and carbon are separately preheated and intimately mixed before they are charged into the furnace. The lime is preferably preheated by showering it downwards through a chamber and against hot products of combustion rising from burners below, while the carbon is gradually moved downwards through a passage or passages in the walls of the chamber and absorbs the heat conducted outwards from the central chamber.

The process may be carried out by apparatus of various forms. One which is effective for the purpose is shown in the accompanying drawing, in which the figure is a transverse vertical section through the preheating and mixing apparatus and the electric furnace.

The preheating apparatus A has a rectangular tower 1 of firebrick, with an iron casing 2, inclosing the lime-preheating chamber 3. Upon the upper end of the chamber 3 is a hopper 4, the lower end of which is closed by a perforated plate 5. Another perforated plate 6 is arranged to reciprocate upon the plate 5. One or more burners 7 for gaseous or liquid fuel enter the lower end of the chamber 3 and the products of combustion escape from the upper end of the chamber through an outlet 8. Around the chamber and extending downward through the walls of the tower are passages 9 into which divided carbon is fed from hoppers 10 at the upper end of the tower. The inner walls 11 of these passages are comparatively thin and the heat transmitted through them from the central chamber is absorbed by the carbon and raises it to the required temperature. The lower ends of the passages 9 are closed by slides 12 which may be withdrawn from time to time to intermittently deliver the heated carbon or be left partly withdrawn to continuously deliver it. The chamber 3 and passages 9 open below into a common receiver 13 from which a chute 14, surrounded by a heat-insulating jacket 15, extends into the mixing apparatus.

The mixer B is a revoluble cylinder with open ends, inclining downwards from its receiving to its delivery end. The cylinder comprises an iron casing 16 with a lining 17 of firebrick from which project longitudinal shelves 18. The cylinder is supported by rings 19 which rest on rollers, not shown, and is rotated by a circular rack 20 and a worm 21. The preheated lime and carbon delivered into the cylinder through the chute 14 are intimately mixed and thence pass into the electric furnace.

The incandescence furnace chosen for illustration is an annular stack 22 of refractory nonconducting material such as magnesia brick, with an iron casing 23. The major portion of the body is a downwardly converging bosh which is surrounded by a waterjacket 24. The hearth 25 of the furnace consists of a solid mass of carbon, set in an iron casing 26 which is insulated from the casing 23 by a refractory layer 27. A tap-hole 28 extends through the hearth. One terminal 29 of the source of electric current is secured to the hearth-casing 26, the hearth thus serving as one electrode. A number of radial electrodes 30 of the same polarity, here shown as cylindrical carbon rods, pass horizontally through the side walls of the furnace near its top, being insulated by refractory material 31. A chamber 32 extends from the upper end of the furnace and has in one side a circular opening 33 which receives the lower end of the mixing cylinder B. A burner 34 opens into the chamber 32 at a point opposite the end of the mixer and may be fed with the waste carbon monoxid from the furnace through the pipe 35 or with fuel from an external source by the pipe 36. Air is supplied to the burner by a pipe 37.

In employing the particular apparatus shown and described to carry out the process, the finely ground lime in the hopper 4 is delivered by the perforated plates in the form of a shower, which falls freely downwards through the hot products of combustion rising from the burners and thence through the receiver 13 and chute 14 into the mixer. The heat which escapes through the walls of the preheating chamber and would otherwise be wasted is utilized to heat the carbon in the passages 9. The preheated carbon, delivered in proper amounts by manipulating the slides 12, is thoroughly mixed with the preheated lime in the cylinder B and the mixture is introduced into the electric furnace until the charge reaches a height sufficient to surround the upper electrodes 30. An electric current is then passed between these electrodes and the carbon hearth 25 through the charge, acting as a resistance conductor. The preheated material is thereby readily raised to the temperature requisite for the production of calcium carbid and the carbon monoxid evolved by the reaction is delivered to the burner 34 and maintains a high temperature within the mixing cylinder. It will be seen that the density of the electric current increases downwards through the charge, by reason of its decreasing cross section, thereby increasing the amount of heat evolved from its upper toward its lower end. The temperature of the charge and of the calcium carbid product rises toward the lower part of the furnace and may be kept at a point sufficiently high to maintain a pool of the molten carbid in the furnace, this pool then serving as a resistance conductor as well as the charge. The molten carbid is removed through the tap-hole 28 as desired.

While the process has been specifically described in connection with the production of calcium carbid, it is obvious that it may be employed for various metallurgical and chemical operations in which a mixture of materials is electrically smelted. The finely divided ore or other material to be smelted or reduced is heated under the most favorable conditions by showering it through a hot atmosphere and the heat which would otherwise be lost by radiation is absorbed by the reducing agent. The carbon usually employed as a reducing agent is a better heat conductor than lime and many other materials to be smelted, and may be effectively heated in mass by the heat transmitted through the thin inner walls of the vertical passages. These walls serve as muffles and prevent the heating flame from coming in contact with the carbon, so that there is no loss of this reagent by oxidation, as is apt to be the case when it is heated by the direct action of products of combustion. The preheated materials, thoroughly mixed in the cylinder shown or by any other means, may be smelted in an incandescence or arc furnace with the minimum consumption of electric energy.

Both of the materials to be preheated may be showered downwards through a hot atmosphere and then mixed, or both of them may be heated in a mass when their heat conductivity is relatively high.

The words "smelting metallic compounds", as used in certain claims, generically include the production of calcium carbid.

I claim:—

1. The process of producing calcium carbid, which consists in separately preheating a calcium compound reducible by carbon, and carbon, mixing the preheated materials, and electrically heating the mixture to the required temperature, as set forth.

2. The process of heating a mixture of two materials, which consists in directly heating but one of the materials and thereby indirectly heating the other material, mixing the preheated materials, and electrically heating the mixture to the required temperature, as set forth.

3. The process of smelting metallic compounds, which consists in directly heating the compound and thereby indirectly heating a reducing agent, mixing the preheated materials, and electrically heating the mixture to the required temperature, as set forth.

4. The process of producing calcium carbid, which consists in directly heating a calcium compound reducible by carbon and thereby indirectly heating carbon, mixing the preheated materials, and electrically heating the mixture to the required temperature, as set forth.

5. The process of heating a mixture of two materials, which consists in directly heating one of the materials by showering it through a hot atmosphere, indirectly heating the second material by the heat unabsorbed by the first material, mixing the preheated materials, and electrically heating the mixture to the required temperature, as set forth.

6. The process of smelting metallic compounds, which consists in directly heating the compound by showering it through a hot atmosphere, indirectly heating a reducing agent by the heat unabsorbed by said compound, mixing the preheated materials, and electrically heating the mixture to the required temperature, as set forth.

7. The process of producing calcium carbid, which consists in directly heating a calcium compound reducible by carbon by showering it through a hot atmosphere, indirectly heating carbon by the heat unabsorbed by said compound, mixing the preheated materials, and electrically heating the mixture to the required temperature, as set forth.

8. The process of heating a mixture of two materials of different heat-conductivity, which consists in directly preheating the material of lower heat-conductivity, indirectly preheating the material of higher heat-conductivity, mixing the preheated ma-

terials, and electrically heating the mixture to the required temperature, as set forth.

9. The process of heating a mixture of two materials of different heat-conductivity, which consists in directly preheating the material of lower heat-conductivity by showering it through a hot atmosphere, indirectly preheating in mass the material of higher heat-conductivity, mixing the preheated materials, and electrically heating the mixture to the required temperature, as set forth.

10. The process of smelting metallic compounds, which consists in preheating the compound by the direct action of products of combustion, preheating a reducing agent out of contact with products of combustion, mixing the preheated materials, and electrically heating the mixture to the required temperature, as set forth.

11. The process of smelting metallic compounds, which consists in preheating the compound by showering it through a hot atmosphere, preheating a mass of a reducing agent out of contact with products of combustion, mixing the preheated materials, and electrically heating the mixture to the required temperature, as set forth.

12. The process of producing calcium carbid, which consists in preheating a calcium compound reducible by carbon by the direct action of products of combustion, preheating carbon out of contact with products of combustion, mixing the preheated materials, and electrically heating the mixture to the required temperature, as set forth.

13. The process of producing calcium carbid, which consists in preheating a calcium compound reducible by carbon by showering it through a hot atmosphere, preheating a mass of carbon out of contact with products of combustion, mixing the preheated materials, and electrically heating the mixture to the required temperature, as set forth.

14. The process of producing calcium carbid, which consists in preheating a calcium compound reducible by carbon by the direct action of products of combustion, preheating carbon under non-oxidizing conditions, mixing the preheated materials, and electrically heating the mixture to the required temperature.

In testimony whereof, I affix my signature in presence of two witnesses.

EDGAR F. PRICE.

Witnesses:

HARRY L. NOYES,

F. B. O'CONNOR.