

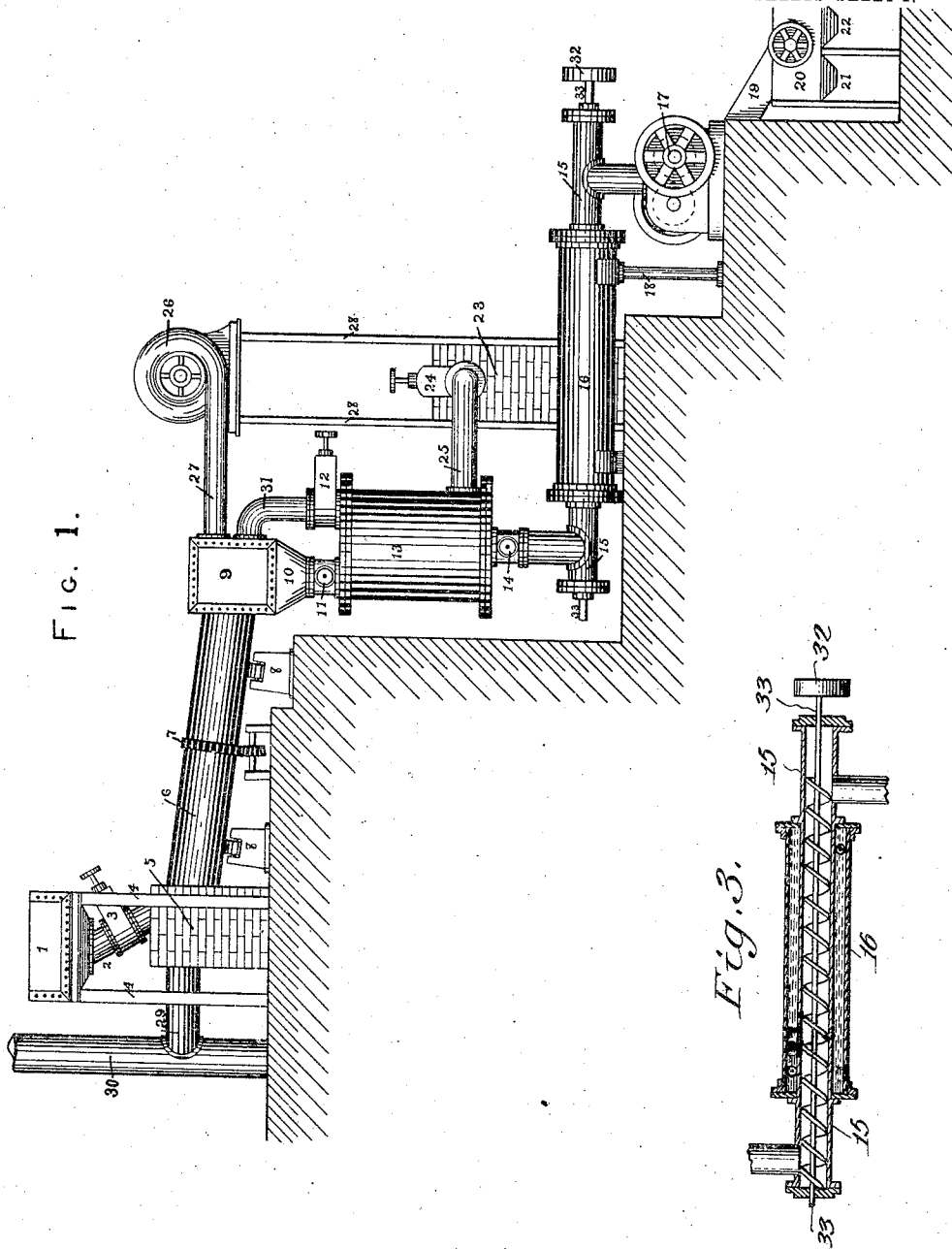
G. F. RENDALL.
FURNACE FOR REDUCTION OF ORES.

APPLICATION FILED JUNE 23, 1908; RENEWED JULY 2, 1912.

1,053,435.

Patented Feb. 18, 1913.

2 SHEETS—SHEET 1.



Witnesses
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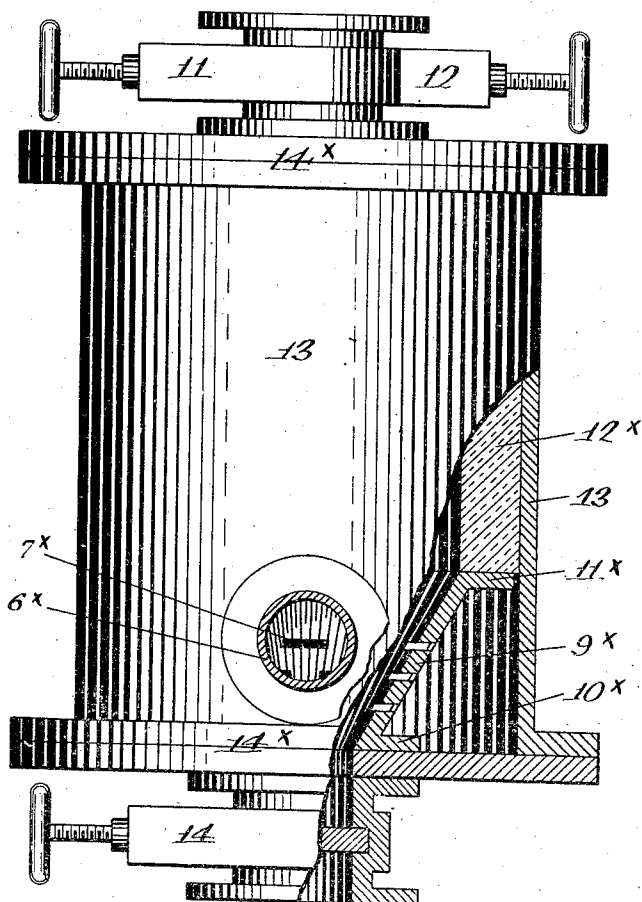
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Fig. 2.



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UNITED STATES PATENT OFFICE.

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FURNACE FOR REDUCTION OF ORES.

1,053,435.

Specification of Letters Patent.

Patented Feb. 18, 1913.

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To all whom it may concern:

Be it known that I, GEORGE FREDERICK RENDALL, a citizen of the United States, residing in the city and county of New York, State of New York, have invented a new and useful Furnace for Reduction of Ores, of which the following is a specification.

This invention relates to a plan for the reduction of ores wherein the ore is first heated and roasted in order to remove sulfur and other volatile products, after which the said ores are deoxidized in order to prepare them for separation.

It consists more particularly of a furnace in which the ore is preheated and delivered to a novel form of reducing furnace, from which it is removed in a substantially porous state, then cooled and crushed and brought into a condition in which it may be readily acted upon to separate the metal from the impurities.

It further consists of other novel features of construction, all as will be hereinafter fully set forth.

For the purpose of illustrating my invention, I have shown in the accompanying drawings one form thereof which is at present preferred by me, since the same has been found in practice to give satisfactory and reliable results, although it is to be understood that the various instrumentalities of which my invention consists can be variously arranged and organized and that my invention is not limited to the precise arrangement and organization of these instrumentalities as herein shown and described.

Figure 1 represents a side elevation of a plant embodying my invention. Fig. 2 represents a detailed view of the reducing furnace forming a part of the apparatus shown in Fig. 1. Fig. 3 represents a section through the cooling cylinder.

Similar numerals of reference indicate corresponding parts in the figures.

Referring to the drawings:—1 designates an ore bin adapted to receive ore as it is delivered from the mine car, secured to which is a chute 2 controlled by a valve 3. Of course it will be understood that the bin 1 is supported in any desired manner, as by the uprights 4. The valve 3 controls the flow of ore into the chamber 5, from which it is delivered to a furnace 6, which is preferably of the rotating type. This furnace may be

rotated in any desired manner, but is preferably provided with a gear 7 thereon and suitably driven, the body of the furnace being supported at suitable intervals on bearings 8.

9 designates the combustion chamber into which the ore in passing through the furnace 6, is delivered and through which gas from a suitable source is directed from a furnace to be presently described.

10 designates a funnel shaped discharge connected to the furnace 9, the same being controlled by a valve 11 to admit the ore into a reducing furnace 13. This furnace 13 is adapted to receive a gas adapted to deoxidize the ore therein, the discharge pressure at which the gas is supplied to the furnace being under the control of the valve 12. After the ore has been treated in the reducing furnace 13, it passes through a valve 14, descending automatically upon a conveyer 15, preferably of spiral type, a portion of which is surrounded by a cylinder 16 forming a water jacket around the conveyer 15.

17 designates a plurality of rollers suitably positioned adjacent the discharge end of the conveyer 15, the said conveyer end being supported in any suitable manner, as by a standard 18. Adjacent the rollers 17 is a pipe 19 which carries the ore in its finely crushed state into proximity to a separator 20, preferably of magnetic type and by means of which the dross is separated from the iron particles.

21 and 22 designate separate bins adapted to receive the metal after action by the separator 20, the metallic particles being drawn off into one bin and the dross into another.

The gas used in the deoxidizing process and which is passed through the reducing chamber 13, is generated in a retort chamber 23 and passes through a control valve 24 by a pipe 25 communicating with the reducing chamber 13.

26 designates a fan blower adapted to blow air through the pipe 27 into the preheating furnace 6, from which it passes by the exhaust pipes 29 and 30.

28 designates suitable supports for the fan 26. The gas after passing through the reducing chamber 13 is drawn off through control valve 12 to supply pipe 31, which delivers it into the preheating furnace 6.

Of course it will be understood that the conveyer 15 is provided with suitable driving mechanism, which in the present instance consists of a suitable driven pulley 32 fixedly mounted on the conveyer shaft 33.

Referring to Fig. 2, 13 designates a shell preferably of cylindrical shape and formed of steel having therein a brick lining 12*. 14* designates heads secured to the ends of said shell 13 and having secured thereto inlet and outlet openings controlled, respectively, by valves 11 and 14, a third valve 12 being provided adjacent the inlet valve 11 to control the supply of gas. 7* designates openings located in the inclined wall 9* within the shell 13, whereby gas which passes therethrough is properly commingled with the ore supplied through the valve 11, it being noted that a suitable lining 6* is provided. This construction of a novel inclined wall is important in that it properly directs the gas to the center and to all parts of the ore which is passing through the interior of the furnace. Suitable flanges 10* and 11* are preferably formed integral with the wall 9* to form a suitable support and shelf upon which the lining material 12* rests.

In the operation of my apparatus the ore is delivered to the bin 1 and passes therefrom through the valve 3 into the furnace, 6, in which it comes into contact with the gas discharged from the reducing chamber 13 and with which the air is mixed to produce an inflammable condition and after the ore has been thus subjected to a preheating, it is delivered to the reducing furnace 13. Through this furnace it is passed and subjected to treatment by gases under pressure which contain a large amount of hydrocarbon and the action of which is to remove the oxygen contained in the ore, thus leaving it composed substantially of silica in combination with the metal in elementary condition. After contact with the gas the ore descends by gravity into position to be engaged by the conveyer 15 during the passage through which it is cooled and then is deposited upon the rollers, which crush it to a state suitable for action of the separator 20. It will be understood that this separa-

tion may be either magnetic or mechanical, depending of course on the ore treated.

It will now be apparent that I have devised a novel and useful construction which embodies the features of advantage enumerated as desirable in the statement of the invention and the above description and while I have in the present instance shown and described the preferred embodiment thereof which has been found in practice to give satisfactory and reliable results, it is to be understood that the same is susceptible of modification in various particulars without departing from the spirit or scope of the invention or sacrificing any of its advantages.

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

1. The combination of a preheating furnace with a reducing furnace, a combustion chamber between said furnaces, an ore outlet from said combustion chamber, communicating with said reducing furnace, a gas outlet from said reducing furnace communicating with said combustion chamber, a valve for each outlet, and an ejector conveyer to which the ore is delivered from said reducing furnace.

2. The combination of a preheating furnace with a reducing furnace, a combustion chamber between said furnaces, means to supply air to said combustion chamber, an ore outlet from said combustion chamber communicating with said reducing furnace, a gas outlet from said reducing furnace communicating with said combustion chamber, a valve for each outlet, and an ejector conveyer to which the ore is delivered from said reducing furnace.

3. In a reducing furnace comprising a shell having an ore inlet and outlet and a gas inlet and outlet, an inclined wall in said shell converging to said ore outlet, a lining supported by said wall, and means to limit the admission of gases to said shell.

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