G. F. RENDALL.

ORE REDUCING FURNACE.

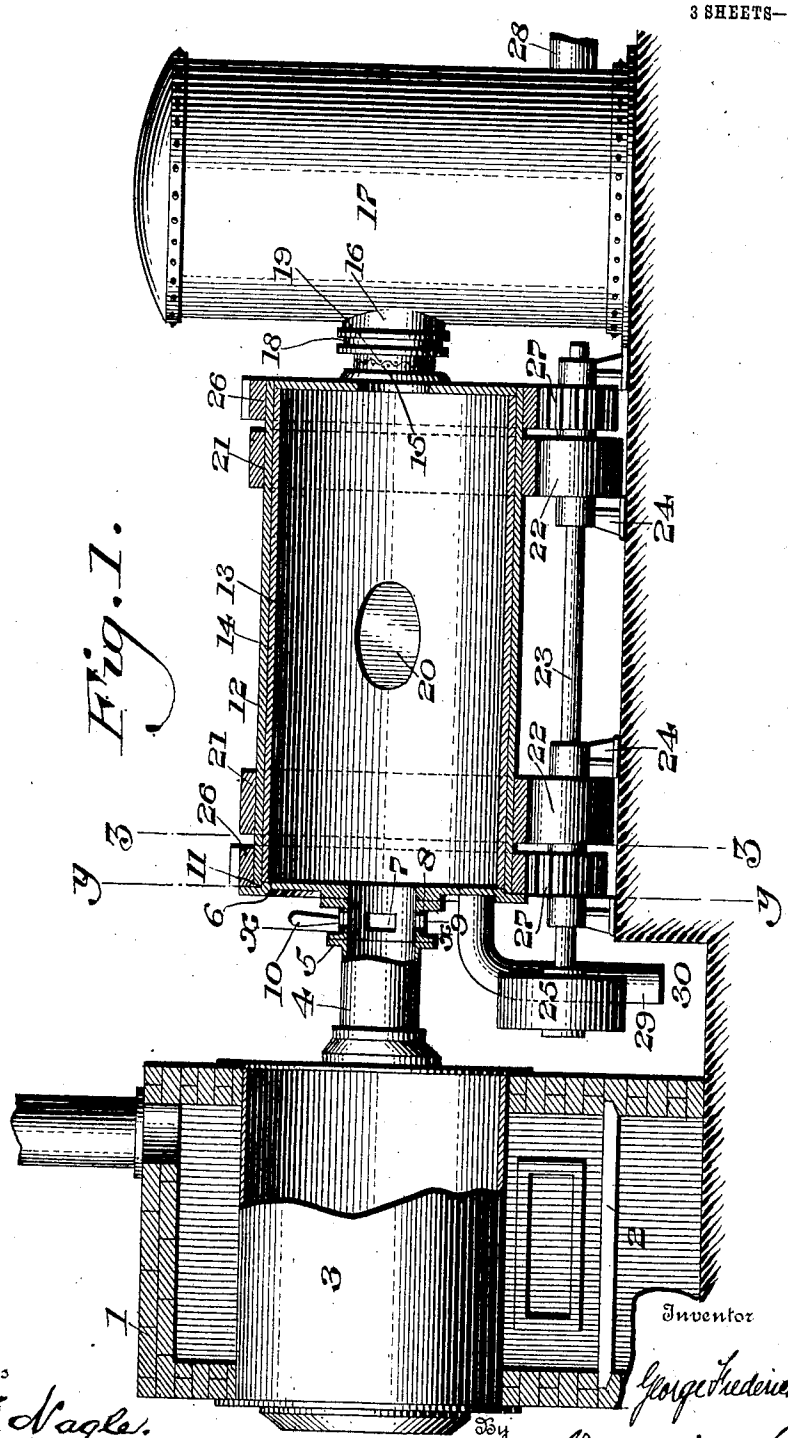
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916,487.

Patented Mar. 30, 1909.

3 SHEETS—SHEET 1.

Fig. 1.



Witnesses

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3 SHEETS—SHEET 2.

Fig. 4.

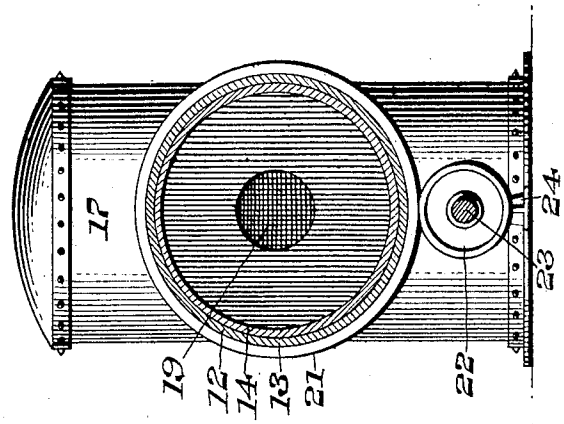


Fig. 3.

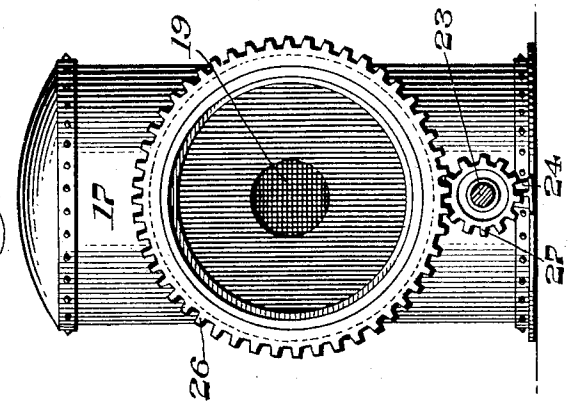
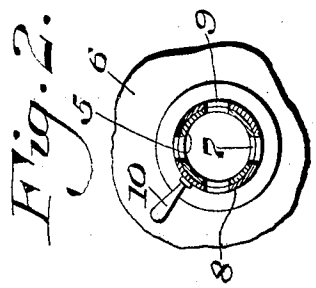


Fig. 2.



Witnesses

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3 SHEETS—SHEET 3.

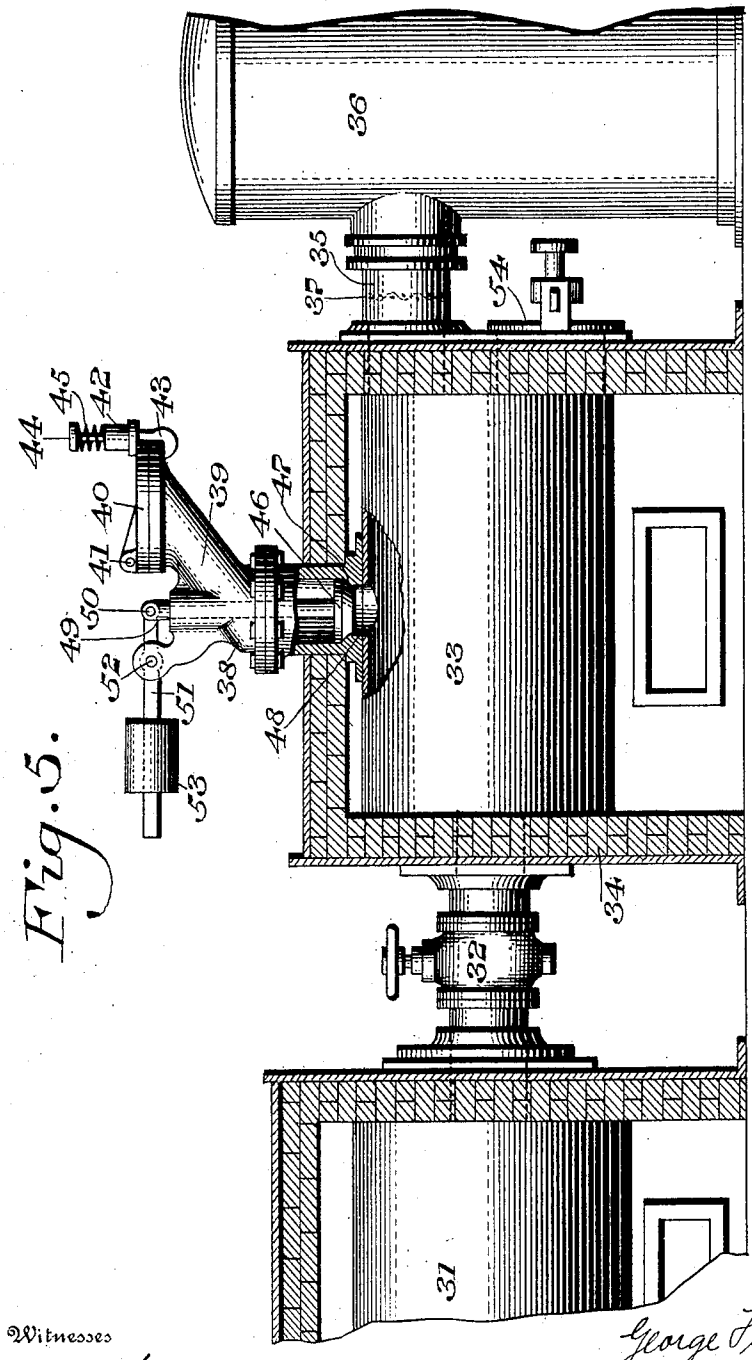


Fig. 5.

Witnesses

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UNITED STATES PATENT OFFICE.

GEORGE FREDERICK RENDALL, OF NEW YORK, N. Y., ASSIGNOR TO AMERICAN REDUCTION COMPANY, A CORPORATION OF NEW JERSEY.

ORE-REDUCING FURNACE.

No. 916,487. Specification of Letters Patent. Patented March 30, 1909.

Application filed November 20, 1906. Serial No. 344,265.

To all whom it may concern:

Be it known that I, GEORGE FREDERICK RENDALL, a subject of Great Britain, residing in the city and county of New York, State of New York, have invented a new and useful Ore-Reducing Furnace, of which the following is a specification.

The object of my present invention is to produce a novel and useful construction of an ore reducing furnace in which I am enabled to calcine the ores with gas, utilize the residual material from which the gas is made and subsequently recover the gas after it has effected the desired results in eliminating sulfur, phosphorus and other similar compounds from the ore.

It further consists of a novel construction and arrangement of an ore heating chamber and its adjuncts, a gas producing retort and a gas holder.

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 those embodiments which best illustrate the principle thereof, although the various instrumentalities of which my invention consists can be variously arranged and organized and it is to be understood that my invention is not limited to the exact arrangement and organization of these instrumentalities as herein shown.

Figure 1 represents a sectional elevation of an ore roasting furnace embodying my invention. Fig. 2 represents a sectional view on line *x—x*, Fig. 1. Fig. 3 represents a sectional view on line *y—y*, Fig. 1. Fig. 4 represents a sectional view on line *z—z*, Fig. 1. Fig. 5 represents a sectional view of another embodiment of my invention.

Similar numerals of reference indicate corresponding parts in the figures.

Referring to the drawings:—1 designates a furnace provided with a grate 2, whereby the gas retort 3 may be externally heated, said retort having therein wood, peat or any other suitable gas producing compound in order that the gas may be generated therein.

4 designates a pipe or conduit leading from the gas retort 3 and connected with a flanged collar 5 which is connected with a disk or casing head 6. The collar 5 is provided with apertures 7 extending therethrough and between the flanges of said collar a sleeve 8 is mounted, said sleeve having apertures 9 therethrough adapted to register with the apertures 7 on the rotation of the sleeve 8, it being noted that the sleeve 8 is also provided with an actuating handle or lever 10. The disk or head 6 is provided with an annular recess 11 with which the outer member 12 of the ore furnace 13 is adapted to engage, it being noted that the inner lining member 14 of the ore furnace is adapted to engage with the inner face of the head 6, as is clearly indicated in Fig. 1. 15 designates a conduit or pipe extending from the opposite end of the furnace 13, said conduit having a bearing in the conduit or projection 16 communicating with the gas holder or container 17, it being noted that a stuffing box 18 is provided whereby a fluid tight joint is formed between the coöperating parts 15 and 17.

19 designates gauze, very fine wire or similar material located in the conduit 15 which acts as a safety device and prevents any combustion between the gases contained in the furnace and the gases contained in the gas receiver 17.

20 designates a manhole through which the furnace 13 may be charged with ore.

21 designates bearing rings carried by the ore furnace 13 and adapted to engage and co-act with rollers 22 mounted on a shaft 23 journaled in brackets 24, which latter are supported in any suitable manner.

25 designates a pulley mounted on the shaft 23 whereby said shaft is adapted to be driven by any suitable type of driving mechanism. The ore furnace 13 has also mounted thereon gears 26 which co-act with driving pinions or gears 27 mounted on the shaft 23, it being noted that the gears 26 contiguous the head 6 are in close proximity to the recess 11 therein.

The gas receiver or container 17 is provided with a suitable discharge pipe 38.

29 designates a discharge pipe extending through the head 6 and communicating with the interior of the ore furnace 13, the end of said pipe being deflected so that when the ore is calcined it passes through this pipe and is discharged into a chamber 30 formed by the brick or other wall which supports the ore roasting furnace and the wall of the gas producing furnace 1, it being understood that this pipe when desired may be sealed in any suitable manner.

The operation of this embodiment of my invention will be readily apparent:—The retort 3 is filled with wood, peat, coal or other suitable material and then externally heated whereupon the gas generated passes from the retort 3 through the conduit 4 and is discharged into the shell 13 which has been previously charged with ore through the manhole 20. If it is desired to have internal combustion in the shell 13, the handle 10 is actuated whereupon the ports 7 and 9 will register with each other and air or oxygen may pass into the furnace and provide for the combustion therein.

The pulley 25 is driven by any suitable means thus causing the shaft 23 to rotate and owing to the provision of the gears 27 on said shaft and the gears 26 carried by the shell 13, said shaft may be rotated as desired so that the gas will come into intimate contact with all of the ore. The gauze or fine wire 19 in the conduit 15 will prevent any combustion between the gases contained in the shell 13 and the gases contained in the gas receiver 17.

In the embodiment seen in Fig. 5, I have shown a slightly modified construction in which the shell 13 is stationary. In this embodiment 31 designates a gas generating retort which is connected by means of a valve conduit 32 with the ore roasting furnace retort 33 which is surrounded by a suitable casing or shell 34 and adapted to be heated by any suitable source of heat. The shell or roasting furnace 33 is connected by means of a conduit 35 with a gas receiver or container 36. 37 designates gauze or fine wire inserted in the conduit 35 in a similar manner to that already described in connection with Fig. 1, said gauze serving the same purpose of preventing any combustion between the gases in the furnace and gas receiver. 38 designates a charging device having a hopper 39 which is closed by means of a cover 40 hinged thereto at 41. 42 designates an apertured lug carried by the cover 40 and through which passes a pin or bolt 43 pivotally secured to the hopper 39 and provided with a nut 44 between which and the apertured lug 42 is interposed a spring 45. 46 designates a valve adapted to engage a seat 47 and control a passage 48 which communicates with the hopper 39 and the interior of the ore heating retort 33. 49 designates a valve stem which has pivoted thereto at 50 a lever 51 fulcrumed at 52 and provided with a weight 53. In this construction the ore is removed from the furnace 1 through a gate or door 54 carried by the furnace wall 34 so that communication may be had with the interior of the ore furnace retort 33.

The ore is heated to a low red heat at temperatures varying from 800° to 1,200° F. In this condition the ore becomes porous and readily amenable to a gas treatment, and if said gas carries a percentage of hydrogen it will reduce the metals contained therein to elementary condition, carrying off sulfur or volatile ingredients initially combined in the ore. Ordinary roasting requires combustion and admission of oxygen which converts the metallic particles into oxids. Under my system of reducing, the gas carries an excess of hydrogen which prevents formation of oxids and reduces the ore to elementary condition. Actual tests have shown that great heat is not required to accomplish this result, tests having been made at 600° F. and the maximum required is not over 1,200° F. The gas after being passed through the ore can be used as fuel.

It will be apparent to those skilled in this art that the ore roasting furnace shown in Fig. 1 is supported by the rollers 22 so that the conduit 15 may readily turn within the conduit 16 projecting therefrom and in connection with the gas receiver or container 17 and that the friction between the shell or furnace 13 and the head 6 is reduced to a minimum since it is only essential to have at these points a gas tight union. It is to be understood that any desired form or type of packing material may be employed to render these parts gas or fluid tight.

The furnace may be operated with or without the admission of atmospheric air and owing to the controlling mechanism therefor the amount of air passing into the furnace may be accurately controlled at all times.

It will now be apparent from the foregoing that I have produced a novel and useful construction of an ore reducing furnace embodying the features of advantage enumerated as desirable in the statement of invention and the above description and while I have in the present instance shown and described those embodiments thereof which have been found in practice to give satisfactory and reliable results, it is to be understood that they are susceptible of modification in various particulars without departing from the spirit and 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. In a furnace for calcining ores having a chamber for heating the ore, a gas holder, and means connected therewith for admitting the gas thereto without danger of combustion in said holder.

2. In a furnace for calcining ores having a chamber therein for heating the ore, an externally heated retort for producing the gas, a valve for admitting air into said furnace, a holder for receiving the gas, and means between the furnace and holder for the prevention of combustion.

3. In a furnace for calcining ores, a rotatable chamber in which the ore is adapted to be heated, means for rotating said chamber, an externally heated retort for producing gas, a gas holder for receiving the gas and means between the chamber and holder for preventing combustion in the latter.

4. In a device of the character described, an ore furnace, rotatably mounted, means for rotating said furnace, a gas generator, a conduit connecting said generator and said furnace, means for admitting air into said conduit, a gas holder connected with said furnace, and means for preventing combustion in said gas holder.

5. In a device of the character described, a furnace casing, rings carried thereby, supporting rollers, co-acting with said rings, gears carried by said casing driving means for said gears, a gas generator operatively connected with said casing, a gas holder connected with said casing and means between the casing and gas holder for the prevention of combustion in the latter.

6. In a device of the character described, a furnace casing, rings carried thereby, supporting rollers, co-acting with said rings, gears carried by said casing, driving means for said gears, a gas generator operatively connected with said casing, a gas holder connected with said casing, said casing having a stationary head, a discharge pipe connecting with the furnace through said head, and means for admitting air to the gas entering said furnace casing.

7. In a device of the character described, a furnace casing having a stationary head, a discharge conduit carried by said head, supporting rollers for said casing, gears carried by said casing, driving means for said gears, a gas generator communicating with said casing through said head, and adjustable means for admitting air to said furnace casing.

GEORGE FREDERICK RENDALL.

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