M. RUTHENBURG.

APPARATUS FOR MANUFACTURING IRON AND ITS ALLOYS.

APPLICATION FILED JUNE 10, 1905.

995,636. Patented June 20, 1911.

3 SHEETS—SHEET 1.

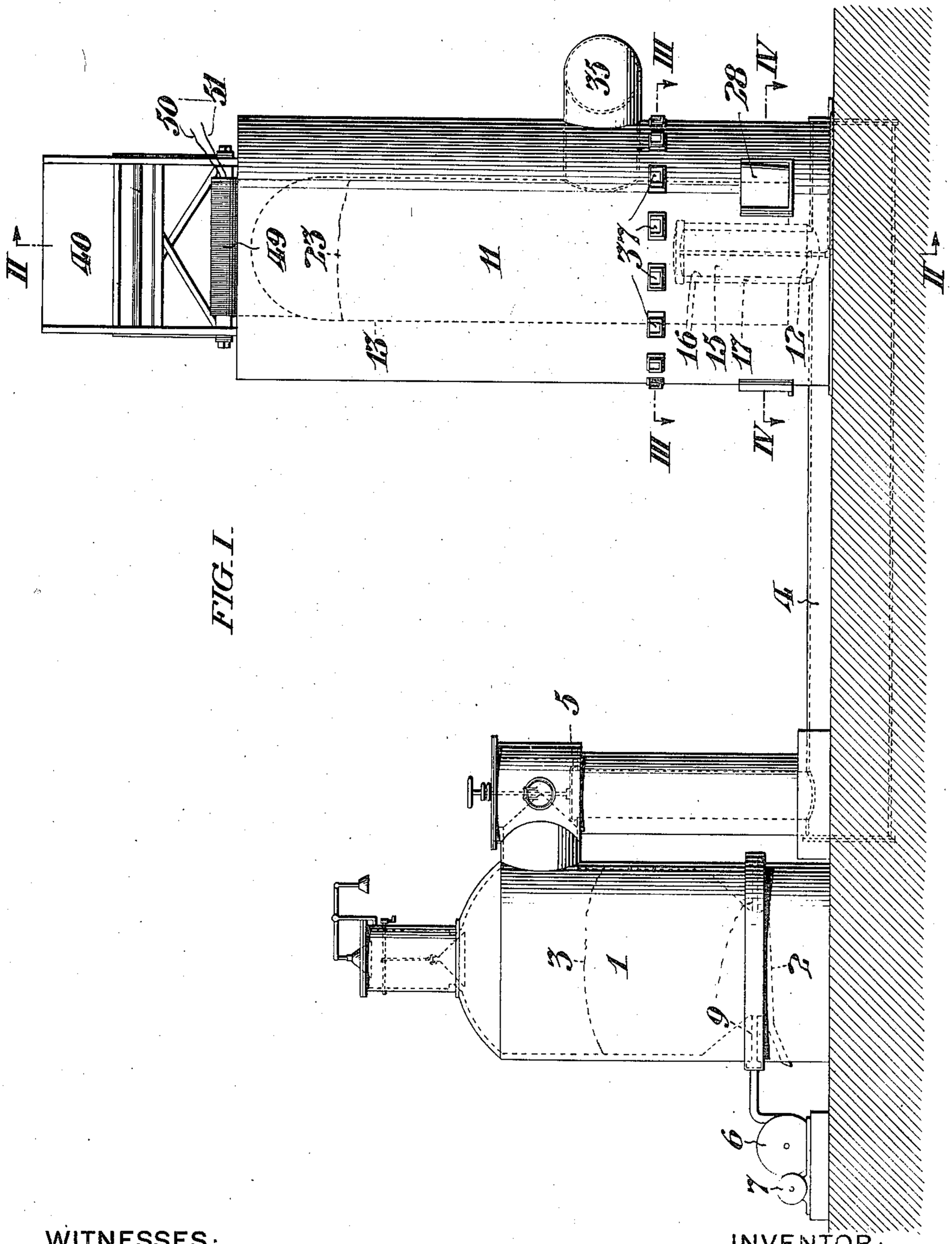

FIG. I.

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3 SHEETS—SHEET 2.

FIG. V.

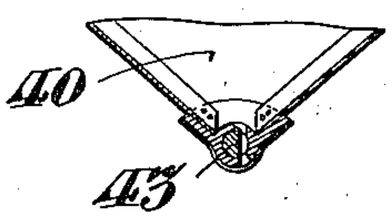


FIG. II.

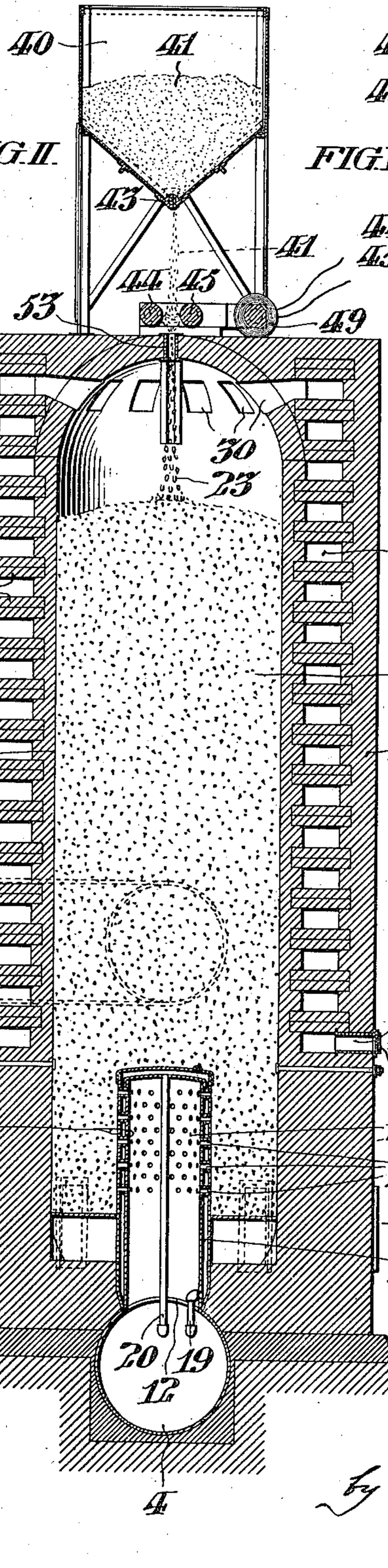
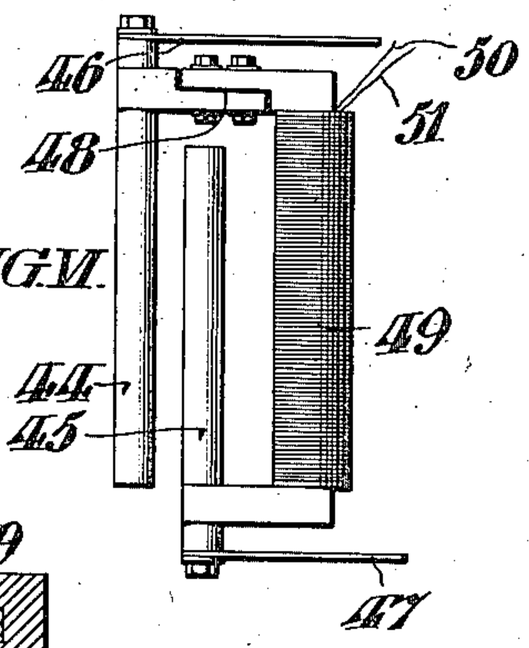


FIG. VI.



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3 SHEETS—SHEET 3.

FIG. III.

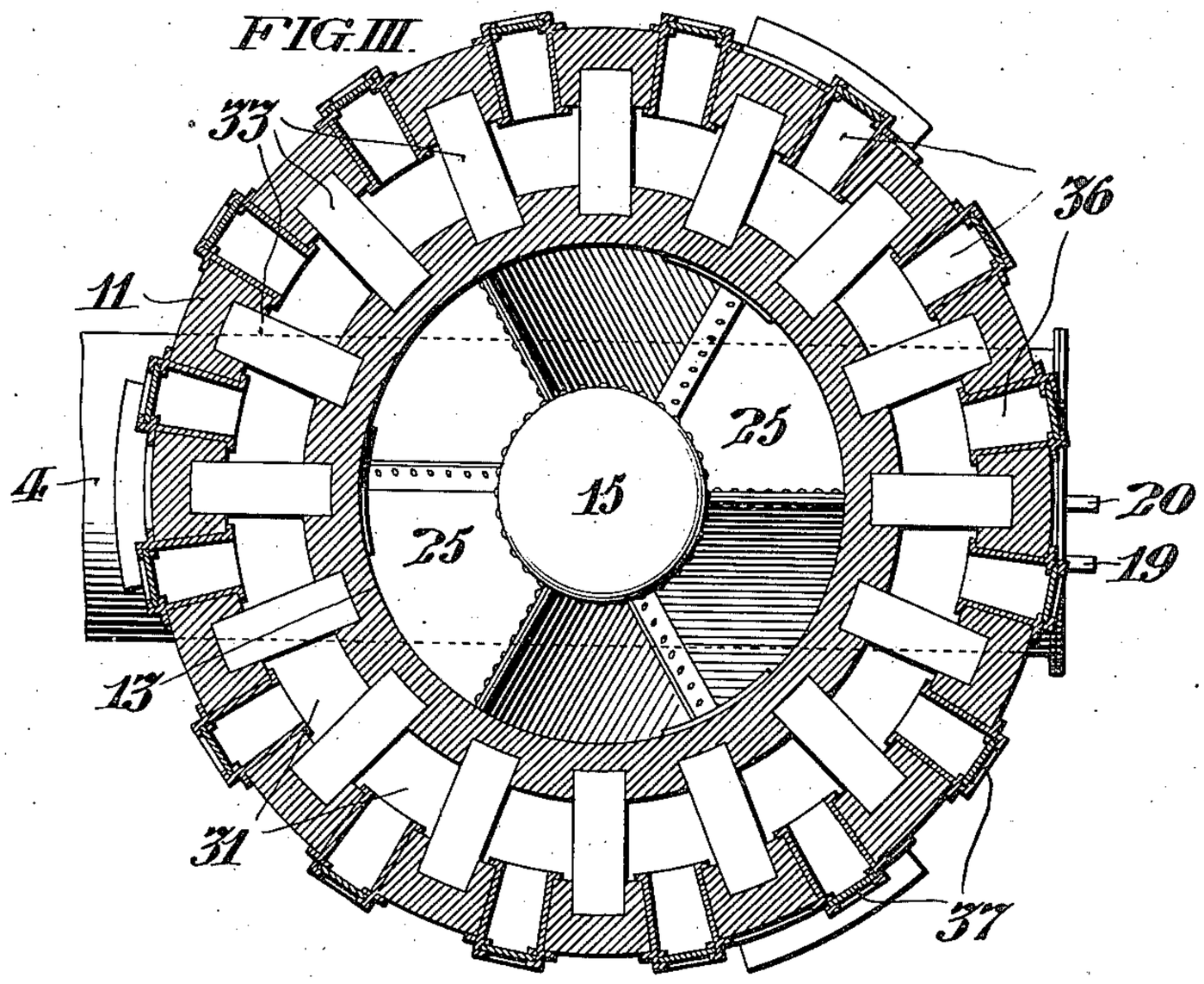
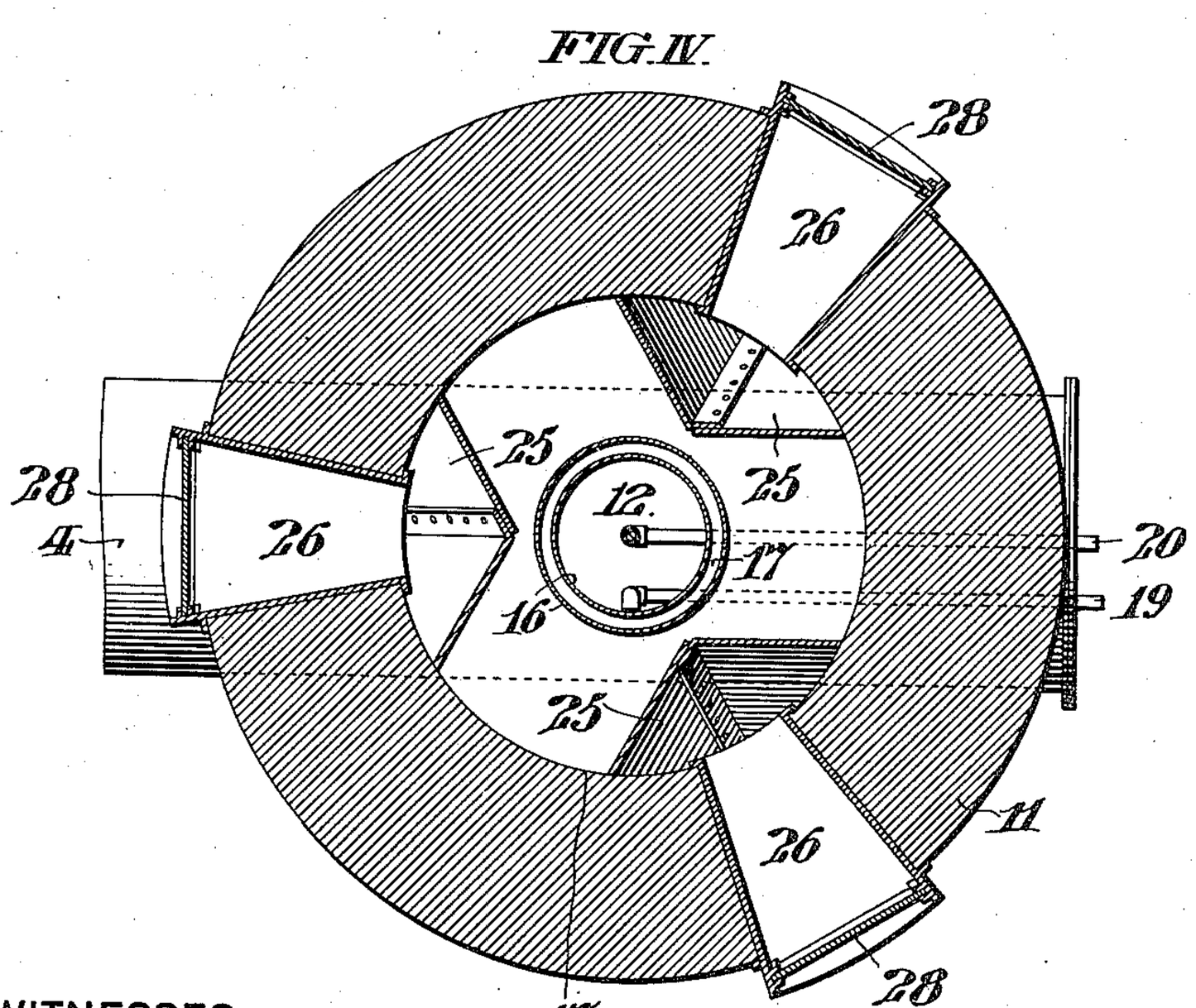


FIG. IV.



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UNITED STATES PATENT OFFICE.

MARCUS RUTHENBURG, OF LOCKPORT, NEW YORK.

APPARATUS FOR MANUFACTURING IRON AND ITS ALLOYS.

995,636. Specification of Letters Patent. Patented June 20, 1911.

Application filed June 10, 1905. Serial No. 264,604.

To all whom it may concern:

Be it known that I, MARCUS RUTHENBURG, of Lockport, in the State of New York, have invented certain new and useful Improvements in Apparatus for Manufacturing Iron and Its Alloys, whereof the following is a specification, reference being had to the accompanying drawings.

The present invention is arranged to utilize the method forming the subject matter of my Letters Patent of the United States #641,552 dated January 16, 1900 whereby comminuted ore or concentrate such as magnetite is assembled in the path of an electric current so proportioned as to frit and agglomerate the ore particles in coherent porous lumps of the character contemplated in my Letters Patent of the United States #688,699 dated December 10, 1901.

Hitherto in employing the patented inventions aforesaid, I have made iron or steel from comminuted ore such as magnetite, by mixing with the particles of ore, before the fritting operation, a deoxidizing or reducing agent such as coal tar, lamp black, molasses or oil, in which case the coherent porous lumps produced are only partially reduced to a metallic state and require a second operation, distinct and separate from said fritting operation, to effect their complete reduction. Said ordinary method of manufacture is wasteful in that the heat resultant from the fritting operation is lost in the interval between the two operations, and, considerable heat is also required to reraise the deoxidizing agent to the proper temperature, in addition to the heat primarily required to produce it.

The present invention provides apparatus which can be utilized to effect by one continuous operation, the complete reduction to the metallic state of any comminuted ore or concentrate of the class contemplated, such reduction being effected by a deoxidizing gas without wasting any of the heat resultant from the preliminary fritting operation and without wasting any of the heat required for the production of said gas; the economy incident to the manufacture of the reducing gas apart from the chamber in which the reduction of the ore is effected being also retained, and, the product being not only reduced to the metallic state but at such a temperature as to be readily melted for commercial use.

As hereinafter described the economy of heat above contemplated is attained by locating the fritting device aforesaid in such relation to the reducing furnace chamber as to discharge the hot fritted ore therein, and by locating a gas producer in such relation to said reducing chamber as to discharge hot deoxidizing gas therein through an assembled mass of fritted lumps. Moreover, the waste gas which escapes from said reducing chamber is further utilized to maintain the temperature in said chamber by being caused to traverse the wall of said chamber exterior thereto before its discharge into the atmosphere.

In the operation hereinafter described, a mass of porous lumps is progressed downwardly through the reducing chamber at such a rate that complete reduction of the component parts thereof is effected during their traverse from the top to the bottom of said chamber; the reduced portions of the mass being withdrawn from the bottom thereof, and the hot unreduced portions being added at the top thereof, so as to produce metallic iron or steel from finely comminuted ore, by a single operation which may be carried on continuously.

My invention comprises the various novel features of construction and arrangement hereinafter more definitely specified.

In the accompanying drawings, Figure I, is a side elevation of an apparatus conveniently embodying my improvements. Fig. II, is a vertical sectional view of the furnace, taken on the line II, II in Fig. I. Fig. III, is a plan sectional view, taken on the line III, III, in Figs. I and II. Fig. IV, is a plan sectional view, taken on the line IV, IV, in Figs. I and II. Fig. V, is an enlarged fragmentary sectional view of the hopper shown in Fig. II. Fig. VI is a plan view of the electro-magnet shown in section in Fig. II.

In the drawings, 1, is the producer casing inclosing the hearth 2, upon which the combustion of the fuel 3, is effected in such manner as to produce gas which is delivered through the conduit 4, controlled by the valve 5; the desired pressure of the gas being attained by the blower 6, operated by the electric motor 7, and having air blast inlets 9, in said casing 1. Said conduit 4, extends beneath the circular furnace casing 11, to the gas inlet 12, opening into the reduction chamber 13. Said inlet 12, is provided with the perforated gas distributing dome 15, ex-

tending upwardly in concentric relation with said casing 11, and comprising double walls 16, inclosing a water jacket space 17, having suitable inlet and outlet connections 19, and 20, whereby water or any other cooling medium may be circulated through to prevent the destruction of said dome by the temperature to which it is subjected. Said dome walls 16, are conveniently connected by nozzle tubes 21, through which the hot deoxidizing gas is delivered within the reduction chamber 13. Said chamber 13, contains a mass of lumps of ore 23, supported by the floor which as indicated in Figs. III and IV, comprises three radial sheds 25, the lower portions of which register with the outlets 26, provided with the removable doors 28, through which the reduced metal may be withdrawn. The gas is forced through said mass of ore lumps 23, within the chamber 13, by the pressure due to the operation of the blower 6, and effects the reduction of said mass to the metallic state during its traverse from the top to the bottom of said chamber 13, the proper temperature being maintained by the preheated condition of said gas and the preheated condition of the ore, the latter being attained as hereinafter described.

The waste gas escapes at the top of the chamber 13, through the gas outlets 30, into the annular flue chamber 31, which is provided with checker work of tiles or bricks 33, arranged in staggered relation in successive courses. Said flue chamber 31, is provided with the chimney vent 35, and is also conveniently provided with the dust outlets 36, having doors 37.

The ore is preheated as follows:—The hopper 40, receives the finely comminuted ore 41, which is discharged therefrom, in a thin stream, through the rotary valve 43, at the bottom of said hopper so as to fall between the opposed cylindrical terminals 44, and 45, of the electric circuit 46, and 47. Said terminals 44, and 45, are so coupled by the insulating connections 48, as to constitute opposed poles of an electro-magnet, which is energized by the coil 49, having the circuit connections 50, and 51, shown in Fig. VI. The effect of the magnetization of said terminals 44, and 45, is to bridge the gap between them with the particles of comminuted ore 41, which are thus detained a sufficient length of time to heat and frit said particles in coherent porous lumps 23, which then fall through the ore inlet 53, in the top of the reduction chamber 13, and are assembled in a mass, as indicated, in the confined heated atmosphere within said chamber through which they subside as the reduced metal is withdrawn from the bottom through the discharge outlets 26, shown in Fig. IV.

It is to be understood that I do not desire to limit myself to the precise details of construction and arrangement herein set forth, as various modifications may be made therein without departing from the essential features of my invention.

I claim:—

1. A furnace comprising a circular chamber having a central fluid fuel inlet; a fuel distributing dome comprising double walls in concentric relation with said chamber and inlet and having radial perforations leading from said inlet to said chamber; means arranged to direct fluid fuel through said inlet and perforations to said chamber; and means arranged to circulate a cooling medium between said dome walls, including two pipes inclosed by said dome and leading to the space between said walls respectively at the top and at the bottom thereof.

2. In apparatus for making iron and its alloys, the combination with a furnace casing comprising a reduction chamber having an ore inlet, a gas inlet, and respective outlets for the reduced metal and waste gas; of a gas supply conduit leading to the lower portion of said reduction chamber; a gas distributing dome in said reduction chamber at said gas inlet, comprising double walls having perforations connected by nozzle tubes; and, means arranged to circulate a cooling medium between said walls, substantially as set forth.

3. In apparatus for making iron and its alloys, the combination with a furnace casing comprising a reduction chamber having an ore inlet, a gas inlet, and respective outlets for reduced metal and waste gas; of means arranged to frit and deliver comminuted ore to said chamber through said ore inlet, while charged with the heat of said fritting operation; and, means arranged to produce and deliver deoxidizing gas to said chamber through said gas inlet, while charged with the heat of its production, substantially as set forth.

4. In apparatus for making iron and its alloys, the combination with a furnace casing comprising a reduction chamber having an ore inlet, a gas inlet, and respective outlets for the reduced metal and waste gas; of an ore fritting device comprising terminals of an electric circuit located upon opposite sides of said ore inlet; and, means arranged to supply hot deoxidizing gas to said chamber through said gas inlet, substantially as set forth.

5. In apparatus for making iron and its alloys, the combination with a furnace casing comprising a reduction chamber having an ore inlet, a gas inlet, and respective outlets for the reduced metal and waste gas; of an ore fritting device comprising terminals of an electric circuit located upon opposite sides of said ore inlet; and, a gas producer arranged to deliver deoxidizing gas to said chamber through said gas inlet, while

charged with the heat of its production, substantially as set forth.

6. In apparatus for making iron and its alloys the combination with a furnace casing comprising a reduction chamber having an ore inlet, a gas inlet, and respective outlets for the reduced metal and waste gas; of an ore fritting device comprising terminals of an electric circuit located on opposite sides of said ore inlet; a gas producer; a gas conduit leading from said producer to said reduction chamber, terminating in a perforated gas distributing dome, within said chamber; and, means arranged to control said gas conduit, substantially as set forth.

7. In apparatus for making iron and its alloys, the combination with a furnace casing comprising a reduction chamber having an ore inlet; a gas inlet, and respective outlets for the reduced metal and waste gas; of an ore fritting device comprising terminals of an electric circuit located upon opposite sides of said ore inlet; a hopper above said terminals arranged to deliver comminuted ore between them; and, means arranged to supply hot deoxidizing gas to said chamber through said gas inlet, substantially as set forth.

8. In apparatus for making iron and its alloys, the combination with a furnace casing comprising a reduction chamber having an ore inlet, a gas inlet, and respective outlets for the reduced metal and waste gas; of an ore fritting device comprising terminals of an electric circuit located upon opposite sides of said ore inlet; means arranged to deliver comminuted ore between said terminals, comprising a hopper above said fritting device having an outlet in registry with the ore inlet in said casing; a rotary valve arranged to control said hopper outlet; a gas producer; a conduit leading from said producer to said gas inlet in the reduction chamber; a valve controlling said conduit; a gas distributing dome within said reduction chamber, at said gas inlet, comprising double walls and nozzle tubes extending through said walls; and, means arranged to circulate a cooling medium between said walls, substantially as set forth.

9. In apparatus for making iron and its alloys, a furnace casing inclosing a reduction chamber and a flue chamber surrounding said reduction chamber; said reduction chamber having a waste gas outlet in its upper portion leading to said flue chamber, an ore inlet in its upper portion, a gas inlet in its lower portion, an outlet for the reduced metal in its lower portion, and a gas inlet in its lower portion; in combination with means arranged to supply hot ore to said reduction chamber through said ore inlet; and, means arranged to supply hot deoxidizing gas to said reduction chamber through said gas inlet, substantially as set forth.

10. In apparatus for making iron and its alloys, a furnace casing inclosing a circular reduction chamber and an annular flue chamber in concentric relation with said reduction chamber; said reduction chamber having a waste gas outlet in its upper portion leading to said flue chamber, an ore inlet in its upper portion, an outlet for the reduced metal in its lower portion, and a gas inlet in its lower portion; said fluse chamber inclosing checker work, and having a chimney vent in its lower portion; in combination with means arranged to supply hot ore to said reduction chamber through said ore inlet; and, means arranged to supply hot deoxidizing gas to said reduction chamber through said gas inlet, substantially as set forth.

11. A furnace comprising a chamber having a fluid fuel inlet; a fuel distributing dome comprising double cylindrical walls in concentric relation with a vertical axis and in connection with said inlet and having perforations leading from said inlet to said chamber; double substantially horizontal walls at the top of said dome; and, means arranged to circulate a cooling medium through the space between said cylindrical walls in communication with a space between said substantially horizontal walls.

In testimony whereof, I have hereunto signed my name at Lockport, in the State of New York, this second day of June, 1905.

MARCUS RUTHENBURG.

Witnesses:

CHARLOTTE E. SPALDING,

J. FRANK SMITH.