H. H. HUGHES.

FURNACE FOR VOLATILIZING ZINC FROM ITS ORES.

APPLICATION FILED FEB. 11, 1910.

980,640. Patented Jan. 3, 1911.

2 SHEETS—SHEET 1.

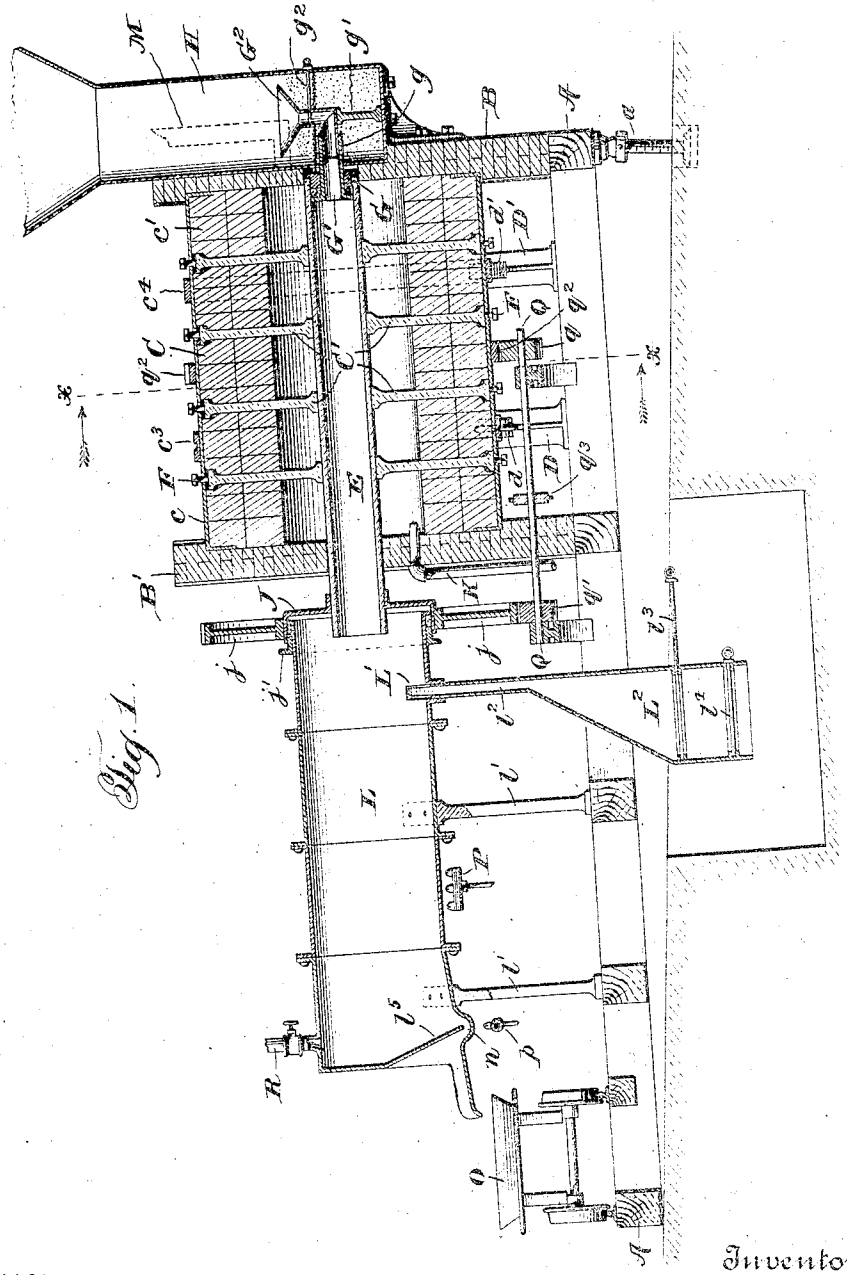

Fig. 1.

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2 SHEETS—SHEET 2.

Fig. 2.

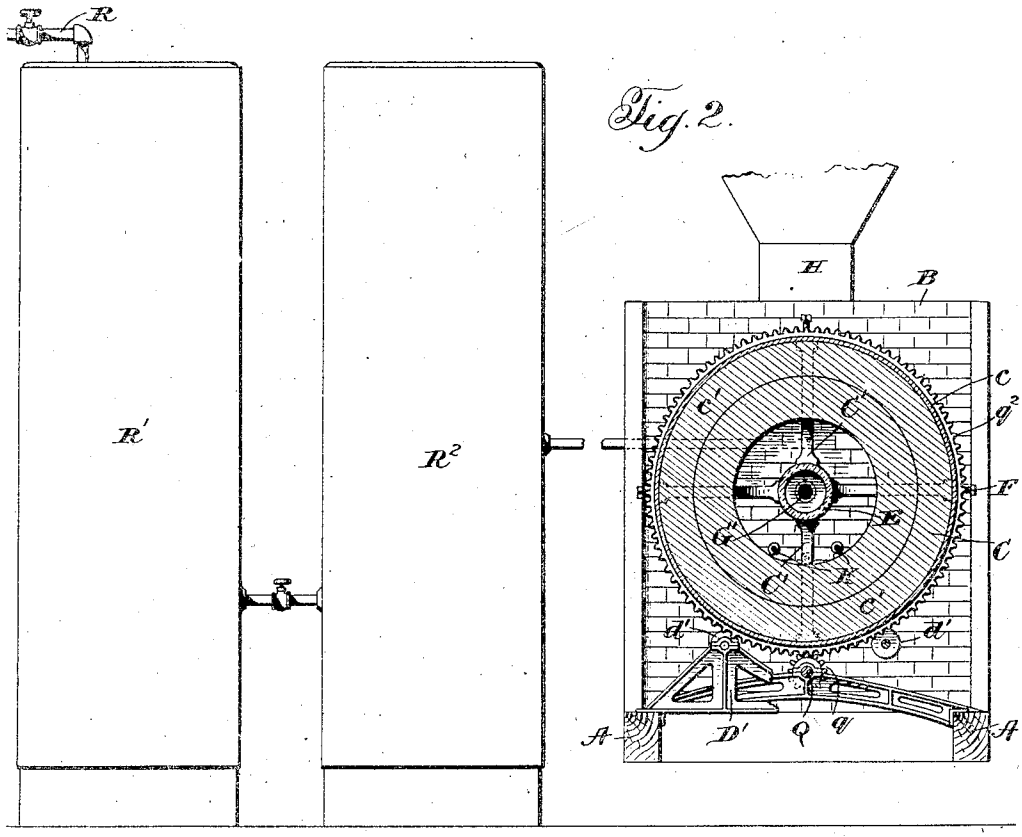
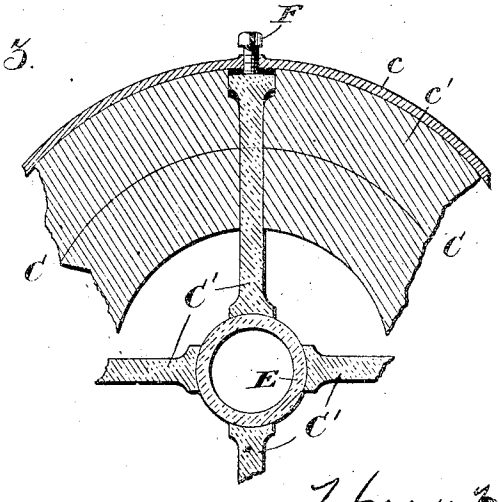


Fig. 3.



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FURNACE FOR VOLATILIZING ZINC FROM ITS ORES.

980,640. Specification of Letters Patent. Patented Jan. 3, 1911.

Application filed February 11, 1910. Serial No. 543,366.

To all whom it may concern:

Be it known that I, HARRY H. HUGHES, a citizen of the United States, residing at Springfield, in the county of Greene and State of Missouri, have invented certain new and useful Improvements in Furnaces for Volatilizing Zinc from Its Ores, of which the following is a specification, reference being had therein to the accompanying drawing.

This invention relates to an improvement in furnaces for volatizing zinc from its ores, and pertains more particularly to an improvement in that form of furnace illustrated and described in U. S. Letters Patent No. 922,906, issued to me on the 25th day of May 1909.

In the furnace specifically described in my aforementioned patent, the so-called or therein stated condenser member was designed to be connected with the retort and to be rotated with the retort. While such a construction would operate satisfactorily, I have ascertained that to preserve the retort in its proper shape and to prevent straining and thereby cracking, it is more advantageous to apply to the retort, substantially direct, the outer rotating instrumentalities. I have also ascertained that the condenser can be a fixed member, as distinguished from a rotating member, and serve its purpose equally as well. I find, however, that in connection with the condenser of the stationary type heretofore referred to, it is advisable to have the internal area thereof greater than that of the retort and to eliminate or extract the residue or non-volatile matter at a point well in advance of the outlet from the condenser.

By the employment of a relatively large condenser an expansion is permitted which results in the more complete separation of the vapor from the non-volatile matter, and that by removing the non-volatile matter as a preliminary step to the final condensation of the volatile material a more perfect separation of the metallic zinc is secured than heretofore.

There are other specific features of construction in the present invention which differ somwhat from that of my former patented invention, all of which will be hereinafter more fully described and claimed.

The invention, while being directed to an apparatus also comprehends a method or a series of steps of operation differing from the prior art and which method will hereafter be more fully explained and defined in the claims.

The general objects of the present invention are substantially those stated in the patent heretofore referred to, that is to say, a substantially perfect separation of the metallic zinc from its ores with expedition and at greatly reduced cost.

The invention may be properly classified as one wherein a continuous process is carried out without the necessary constant hand manipulation as has been the practice heretofore.

In the accompanying drawings, the apparatus is shown somewhat diagrammatically, but it is to be understood that the illustrative representations are employed herein for the purposes of specifying and defining the invention, and that therefore the invention is not necessarily limited to specific details, as it is obvious that many minor changes can be made without departing from the nature and principle of the invention.

In the drawings: Figure 1 is a longitudinal central sectional view of the apparatus showing parts in elevation, Fig. 2 is a cross sectional view on the line *x*—*x* of Fig. 1, and Fig. 3 is an enlarged detail section of a portion of the revolving furnace.

A designates a supporting base comprising generally speaking, a framework, one end of which is supported directly on the supporting surface, while the other end is carried conveniently by adjusting jacks, one of which is shown in Fig. 1 and designated by the letter *a*. By this means the frame is allowed to be adjusted up and down to vary its inclination with a view of securing a proper and uniform feed of the material through the retort hereinafter referred to.

Mounted on the forward end of the frame are two upright end wall members B, B′ formed of cement or brickwork, as may be desired. The opposing faces of these walls are formed with circular recesses into which the ends of the revolving furnace member C, are loosely fitted. The revolving furnace comprises an outer metallic shell C, an inner non-combustible lining, preferably of fire clay *c*′, and a series of radial retort supports C′. The furnace is supported for ro-

tation, conveniently on standards D—D′, each of which are provided with anti-friction rollers d, d', the former having a central rib fitting in a groove in the surrounding track plate c^3, while the latter are engaged by the track plate c^4 on the furnace wall.

E designates a cylindrical retort, conveniently formed of fire clay or other heat-resisting material. This retort is conveniently cylindrical throughout, and the walls are relatively thin so that the interior of the retort can be promptly highly heated by the fire contained within the furnace. To support the retort within the revolving furnace, the lower ends of the retort supports C′ are formed with suitable saddles or seats conforming to the curvature of the outer face of the retort, as shown in Fig. 3. These radial supports being conveniently made of fire clay or other suitable material, are adjustable inwardly by suitable set screws F, entering through threaded openings in the steel or metal casing of the furnace. The outer ends of the radial supports are seated in recesses in the fire brick lining of the furnace which recesses are sufficiently deep to permit of a radial movement of the supports. This feature of the invention is important inasmuch as any variations in temperature or expansion of materials may be taken up and properly accounted for by the adjustments of the supports, thereby maintaining the cylindrical retort in its proper position and preventing initial strains being placed thereon during rotation. The forward end of the retort is capped by a suitable cap G through which a feed pipe G′ extends, which pipe carries at its outer end an upstanding portion communicating with and supporting a supplemental feed hopper G^2. The feed G′ is protected by a sleeve g which extends from the retort through the forward furnace wall and terminates adjacent the hopper end of the feed.

H designates the main feed hopper which is in the form of a receptacle supported on and secured to the front base of the furnace wall B. This receptacle H is of a diameter greater than that of the supplemental hopper G^2, thereby forming between the edges of the latter and the walls of the receptacle a space through which fine ore may pass and collect below the supplemental hopper and around the joint between the feed and the retort extension.

I have found that it is not necessary to employ a screw feed, as shown in my former patent, and therefore have provided a straight gravity feed, as above described. The feed may be supported by suitable standards g', and is controlled by a slide cut-off g^2 or by any other convenient means. The rear end of the cylindrical retort projects through the rear furnace wall and has attached thereto a metallic cap J to which is keyed or otherwise conveniently attached a driving gear j.

To supply the interior of the furnace with proper fuel, a supply pipe K is provided leading from any suitable source and terminating in a burner projected through the end wall of the furnace into the combustion chamber. The exhaust is in the form of a flue leading through the forward end of the wall of the furnace, as indicated in dotted lines in Fig. 1 at M.

Any suitable form of burner may be employed, either for gas or liquid.

L designates the condenser, the same being in the form of a metal cylinder of a diameter greater than that of the retort. This condenser is elongated and its forward end is projected into the cap J, the joint being sealed by a suitable stuffing box j' so as to permit the proper rotation of the cap relative to the condenser cylinder. The condenser is supported on uprights l' and adjacent its forward end, at the bottom thereof, is an opening L′ extended somewhat up the sides of the cylinder. This opening communicates with a discharge l^2, the lower end of which communicates with a hopper L^2. The lower end of the hopper is provided with two separated discharge gates 13, 14, of a character similar to those shown in my former patent so that by the opening of the upper gate the material collected in the hopper will descend into the space between the gates and thereafter by closing the upper gate and opening the lower gate the material may be discharged into a suitable receptacle. The condenser is provided with a discharge end, the forward end of which is formed with a downwardly curved part constituting a trap, as at n into which projects the end wall 15 of the condenser, the edge of this end wall projecting below the plane of the bottom of the condenser.

O represents the receiving pan for the condensed metal, the same being conveniently mounted on a truck. Should it be found necessary to increase the temperature of the condenser, a suitable gas burner such as P may be provided, and also a suitable burner or heater as p may be positioned below the outlet trap of the condenser.

To rotate the furnace any suitable gearing may be employed, but conveniently a shaft Q is mounted in suitable bearings and carries on its opposite ends pinions q, q'. The former meshes with the rack q^2 on the revolving furnace, while the latter meshes with the large gear i mounted on the cap which is connected to the protruding end of the retort. The shaft Q may be driven from any suitable source through a suitable sprocket or other wheel, as at q^3. The carbon gases escaping from the condenser may be led through the valved exhaust pipe R

into receiving tanks R′, R², from whence they may be withdrawn either directly into the combustion chamber of the furnace or for any other use desired.

In operation, the ore mixed with the carbon in the usual manner, and crushed, is fed into the supplemental hopper from whence it is discharged into the cylindrical retort. As the retort is highly heated and rotated, the ore is constantly agitated and new surfaces presented to the heated walls of the retort continuously until the same is discharged from the end of the retort. During the heating interval, the metallic vapors are generated and pass from the retort into the enlarged condensing chamber while the residue or non-volatile material flows from the end of the retort immediately into the bottom of the condensing chamber. Owing to the inclination of the apparatus the residue will immediately pass into the discharge l^2 and be collected in the discharging hoppers therebelow, while the vapors will expand in the condensing chamber and there meeting with a reduced temperature be condensed in the remoter portions of the chamber, collecting in the bottom and escaping through the escape or discharge. Owing to the sealing of the discharge and to the sealing of the other joints in the apparatus, air is prevented from entering the furnace during operation. This is important, as is well known to those skilled in the art. When it is desired to remove the gases contained within the condenser, the valve in the discharge J is opened and the gases allowed to pass into the storage tanks, or to any other point for subsequent use.

By making the retort cylindrical I have found that the same may be constructed more economically and with greater uniformity as to thickness of material. I have also found that the cylindrical retort is more easily and accurately adjusted in the center of the furnace. The driving wheel K, as will be observed, is of the same diameter as the rack q^2 on the furnace, and inasmuch as the driving pinions are of the same diameter, a uniform speed will be acquired by the furnace and retort, thus preventing the friction which is created at the protruding end of the retort from tending to turn or twist the retort and thus crack the same.

Having thus described the invention, what is claimed is:

1. In a furnace for volatilizing metallic zinc from its ore, the combination with a revoluble retort, means for revolving the retort, a stationary condenser coupled directly to the retort and adapted to receive the volatile ore and residue therefrom, and means for feeding material to the revolving retort.

2. In a furnace for volatilizing zinc from its ores, a revoluble retort, means for revolving the retort, a stationary condensing chamber communicating directly with the retort, a discharge means at the forward end of the condenser, and a discharge means at the rear end of the condenser.

3. In a furnace for volatilizing zinc from its ores, the combination of a furnace, of an inclined revoluble retort, means for turning the retort, and a stationary condenser connected directly with the discharge end of the retort and adapted to receive the volatile ore and residue therefrom, and means for feeding material to the retort during rotation.

4. In a furnace for the continuous volatilization of zinc from its ores, the combination with a revoluble retort, a condenser and of a capacity greater than that of the retort coupled to the end of the retort so as to receive the volatile ore and residue therefrom, means for revolving the retort, and means for feeding material to the retort.

5. In a furnace for volatilizing zinc from its ores, the combination with a revolving furnace, a cylindrical retort mounted therein, means communicating with the forward end of the retort for continuous feeding ore thereto during rotation thereof, a condenser coupled to the rear end of the rear end of the retort and of a capacity greater than that of the retort, and a sealed discharge for the condenser.

6. In a furnace for volatilizing zinc from its ores, the combination with a revolving furnace, of a cylindrical retort mounted within the furnace, a feed for the forward end of the retort, a stationary condenser connected to the rear end of the retort, said condenser having a discharge at its forward end for the non-volatile material, and a discharge for the condensed material at the opposite end.

7. In a furnace for volatilizing zinc from its ores, the combination with a revolving furnace, of a retort mounted therein, means for feeding material into the front end of the retort, a condenser into which the rear end of the retort leads, said condenser having a discharge at its forward end, and a discharge for the condensed material at its rear end.

8. In a furnace for volatilizing zinc from its ore, the combination with a revolving furnace, of a retort centrally located therein, and adjustable means for supporting the retort in the furnace.

9. In a furnace for volatilizing zinc from its ores, the combination with a revolving furnace, of a series of radial supports therein, means for adjusting the supports and a retort carried by said support.

10. In a furnace of the character described, a revoluble retort, a condenser into which the retort discharges, a cap having connection with the retort and engaging the

condenser, means associated with the cap for assisting in driving the retort, and means for driving the retort associated with said first mentioned means.

11. In a furnace for volatilizing zinc from its ores, the combination with a revoluble retort and a furnace therefor, means for feeding the ore into the front end of the retort, a condenser into which the rear end of the retort discharges, said condenser being provided with an opening in the bottom thereof adjacent its forward end, a hopper communicating with the opening, and a sealed discharge at the rear end of the retort.

12. In an apparatus for volatilizing zinc from its ores, the combination with a furnace, of a retort within the same arranged to discharge the non-volatile material beyond the furnace, means for feeding the material to the retort, a condenser with which the retort communicates, discharge means for the metal in the condenser and discharge means for the non-volatile material located adjacent the discharge end of the retort.

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

HARRY H. HUGHES.

Witnesses:
H. E. PATTON,
W. E. BLANTON.