No. 607,497. Patented July 19, 1898.

G. M. WESTMAN.

PROCESS OF AND APPARATUS FOR PYRITIC SMELTING.

(Application filed Feb. 1, 1897.)

(No Model.) 2 Sheets—Sheet 1.

FIG. 1.

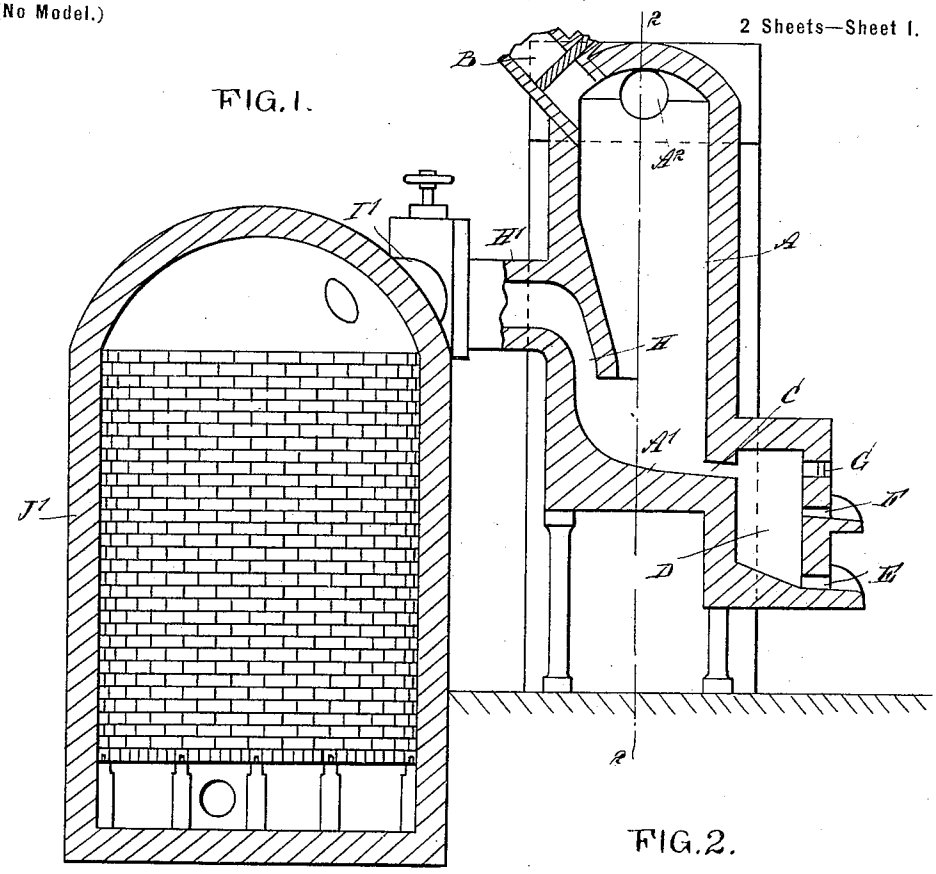
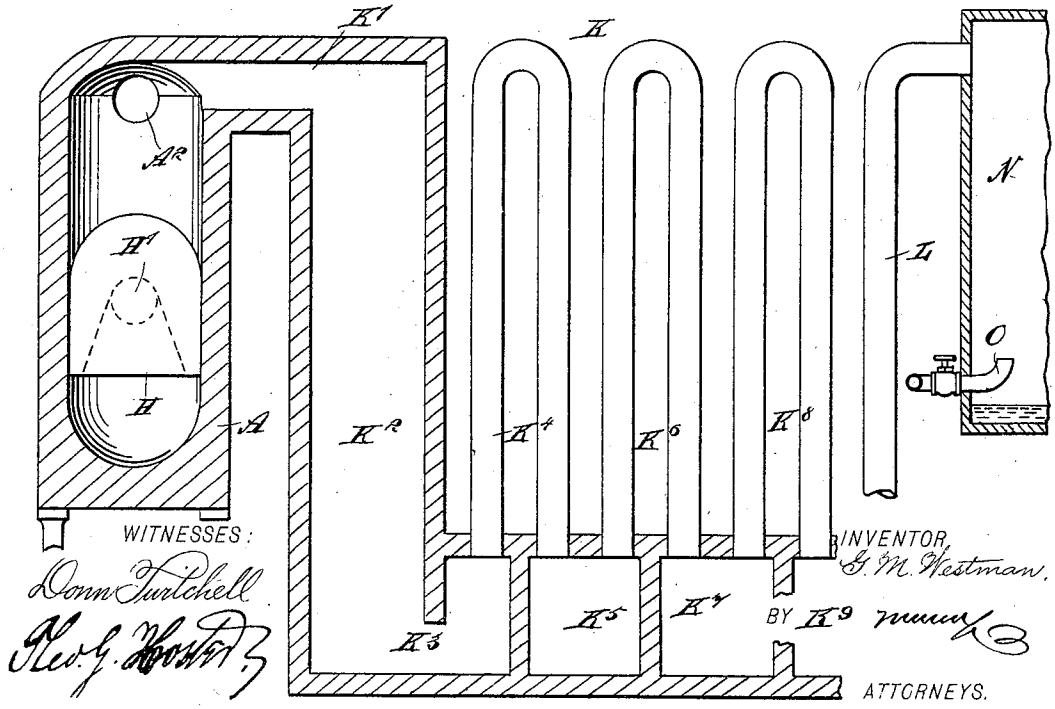


FIG. 2.



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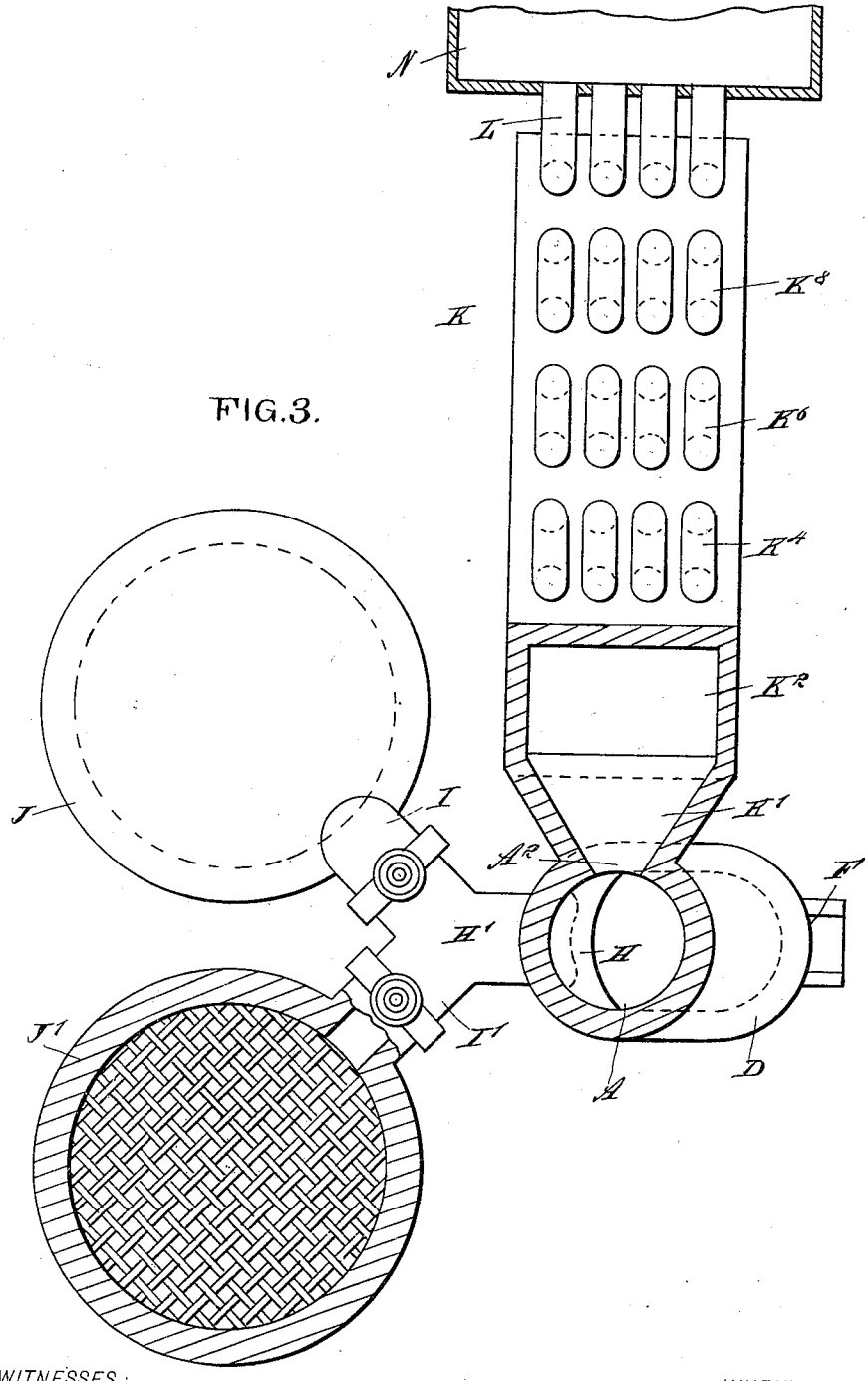
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FIG. 3.



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PROCESS OF AND APPARATUS FOR PYRITIC SMELTING.

SPECIFICATION forming part of Letters Patent No. 607,497, dated July 19, 1898.

Application filed February 1, 1897. Serial No. 621,516. (No model.)

To all whom it may concern:

Be it known that I, GUSTAF M. WESTMAN, a subject of the King of Sweden and Norway, residing in the city, county, and State of New York, have invented a new and Improved Process of and Apparatus for Pyritic Smelting, of which the following is a full, clear, and exact description.

The object of the invention is to provide a new and improved process of and apparatus for treating sulfureted ores which may contain precious metals in such a manner that the precious metal is taken up by the iron or copper matte while the zinc and lead sulfurets are converted into oxids at such a temperature as to become volatilized and discharged from the furnace in a gaseous state, together with sulfurous acid, and finally precipitating the zinc and lead oxids in a condenser and treating the remaining gases in a lead-chamber to form sulfuric acid.

The invention will be hereinafter fully described, and pointed out in the claims.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the figures.

Figure 1 is a sectional side elevation of the apparatus. Fig. 2 is a transverse section of the same on the line 2 2 of Fig. 1, and Fig. 3 is a plan view of the same with parts in section.

The apparatus is provided with a shaft-furnace A, provided at its upper end with a suitable filling device B for introducing the materials into the furnace in the usual manner. From the bottom A′ of the furnace A leads an opening C into a forehearth D, extending below the bottom of the said furnace, as plainly shown in Fig. 1, to allow the iron or copper matte and molten slag to flow, assisted by the blast from the bottom of the furnace, into the forehearth D, so as to fill the same. The forehearth is provided at its lower end with the usual tap-hole E and with a slag-discharge F, located above the tap-hole E, to run off the slag whenever necessary. Above the slag-hole F and directly opposite the opening C is arranged a peep-hole G to allow the operator to examine the working of the furnace. Into the lower end of the furnace A opens the downwardly-extending channel H, connected at its upper end by a pipe H′ with the valved pipes I and I′, opening into the upper ends of the regenerators J and J′, respectively, of any approved construction. The air passing through one of the regenerators is heated to a very high degree and is then passed by the branch pipe I or I′ to the pipe H′, to finally pass through the channel H in a downward direction into the half-molten mass in the bottom A′ of the furnace A.

The bottom A′ of the ore-chamber slopes to the discharge-opening C, and its rear wall is curved upward to the point where it meets the channel H, so that hot air discharging from the latter passes directly downward in contact with such curved wall and is guided by it into the bottom A′ and into the base of the ore column, where it promotes oxidation and the flow of matte and slag through passage C.

Now it is evident that as the materials are burning in the furnace the zinc and lead sulfurets are oxidized and finally volatilized, so as to separate from the iron or copper matte and to rise in this volatilized state within the furnace, to finally pass out of the same, at the upper end thereof, through an opening A^2 into a condenser K for precipitating the lead and zinc oxids. The copper and iron matte and slag pass through the opening C into the forehearth D, in which the slag separates and is run off through the slag-hole F, while the matte is discharged from time to time by way of the tap-hole E into a suitable receptacle. The condenser K, previously mentioned, is provided with a channel K′, leading from the opening A^2 to a vertically-disposed shaft K^2, terminating at its lower end in a chamber K^3, connected at the top by a series of U-shaped pipes K^4 with a chamber K^5, connected in a similar manner by U-shaped pipes K^6 with a chamber K^7, which in turn is connected by U-shaped pipes K^8 with a chamber K^9. From this latter chamber K^9 extends a series of pipes L, opening into the lead-chamber N, provided with a steam-pipe O, connected with a suitable source of steam-supply to permit of introducing steam into the lead-chamber to readily form sulfuric acid by the gases passing through the pipes L into the said chamber and taking with them the necessary amount of nitric acid.

The volatile zinc and lead oxid, as well as the sulfurous acid, together with the nitrogen formed in the shaft A, in passing through the condenser K cause a precipitation of the oxid impurities in the bottom of the shaft K^2 and a precipitation of the lead oxid in the bottom of the chamber K^3. The zinc oxid is precipitated in the following chambers K^5, K^7, and K^9, and the remaining gases finally pass from this chamber K^9 by the pipes L into the lead-chamber N, to be converted therein into sulfuric acid, as before stated. The precious metals pass through the matte into the fore-hearth D and are discharged from the latter by the tap-hole E into a suitable vessel, as before mentioned, and in order to obtain the precious metals I prefer to place lead shavings upon the molten metal in the vessel, so that the lead is melted and descends, owing to its specific gravity, into the matte to take up the precious metals in its descent. The lead containing the precious metal is then separated from the iron or copper matte and is then treated in the usual manner to separate the precious metal from the latter.

In order to gain the high temperature necessary to volatilize zinc oxid and lead oxid, the heated blast is directed toward the bottom of the furnace, and consequently the heat is there concentrated as much as possible. In order to make the oxidizing power as great as possible, the bottom is always kept free from molten metal, which, on account of the inclined bottom and the direction of the blast, is forced out of the furnace as soon as it is in liquid state, whereby the blast has free access to the sulfurets for oxidation, the sulfurets being at this time at the bottom in a half-molten condition. If, on the contrary, the overheated slag should surround these half-molten sulfurets, they would not be oxidized, and consequently would enter the slag, whereby a loss of heat, sulfurous acid, and metallic oxids would follow.

It is understood that when the highly-heated air passes through the channel H in a downward direction into the lower end of the shaft-furnace A then the whole energy of this air acts on the ore on the bottom A′ and on the slag, which trickles down from above, as well as on the middle of the sulfurets, so that all the zinc and lead acted on by the air is formed into oxid and volatilized and forced upward in the shaft-furnace, to finally pass into the condenser, as previously explained.

The mouth of the channel H is preferably in segmental shape, as indicated in Fig. 3, and extends inside of the wall of the furnace, so as to cause the air to act in the proper direction on the material in the furnace for the purpose above described. The air is preferably heated to about 1,000° centigrade, and one regenerator is in use for heating the air while the other is heated by suitable means and is cut off during this time from the pipe H′.

By having two regenerators the operation, as above described, is rendered continuous, it being understood that the material is constantly charged into the furnace A at the filling device B, and the matte is removed from time to time from the hearth D, as above described.

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

1. The herein-described process for pyritic smelting, consisting in forcing highly-heated air free from products of combustion into and up through a column of sulfids free from carbonaceous fuel, and thereby converting these sulfids into oxids and volatilizing the oxids, with the production of matte and slag, drawing off the gaseous portion and volatilized products and condensing the oxids, conducting the remaining gases, consisting of nitrogen and sulfurous acid, into a lead-chamber, to form sulfuric acid, drawing off the matte and slag continuously from the base of the ore column, and separating the matte from the slag, as described.

2. The combination of the regenerator and hot-air conductor with the shaft-furnace having a side channel H, which communicates with the aforesaid conductor and extends vertically downward as shown, its mouth being located within the ore-chamber and directly over the rear side of the bottom thereof which slopes from that point, as shown and described.

3. The shaft-furnace having the following parts and features of construction, namely: a sloping bottom whose lateral mouth is at its lowest point, the rear side of said bottom which is directly opposite said mouth being curved upward; a hot-air channel arranged vertically in the side of the ore-chamber and opening at the upper end of the curved portion of the bottom, as shown and described, whereby hot air discharged from said channel is directed downward in contact with the curved wall and guided thereby to the bottom of the ore-chamber, where it acts on the material and promotes the flow of the molten mass through the discharge-opening, as shown and described.

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