(No Model.)

H. O. REINHARDT.

APPARATUS FOR ROASTING ORES.

No. 255,537. Patented Mar. 28, 1882.

FIG:4

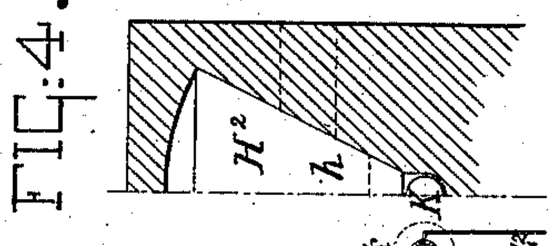

FIG:1.

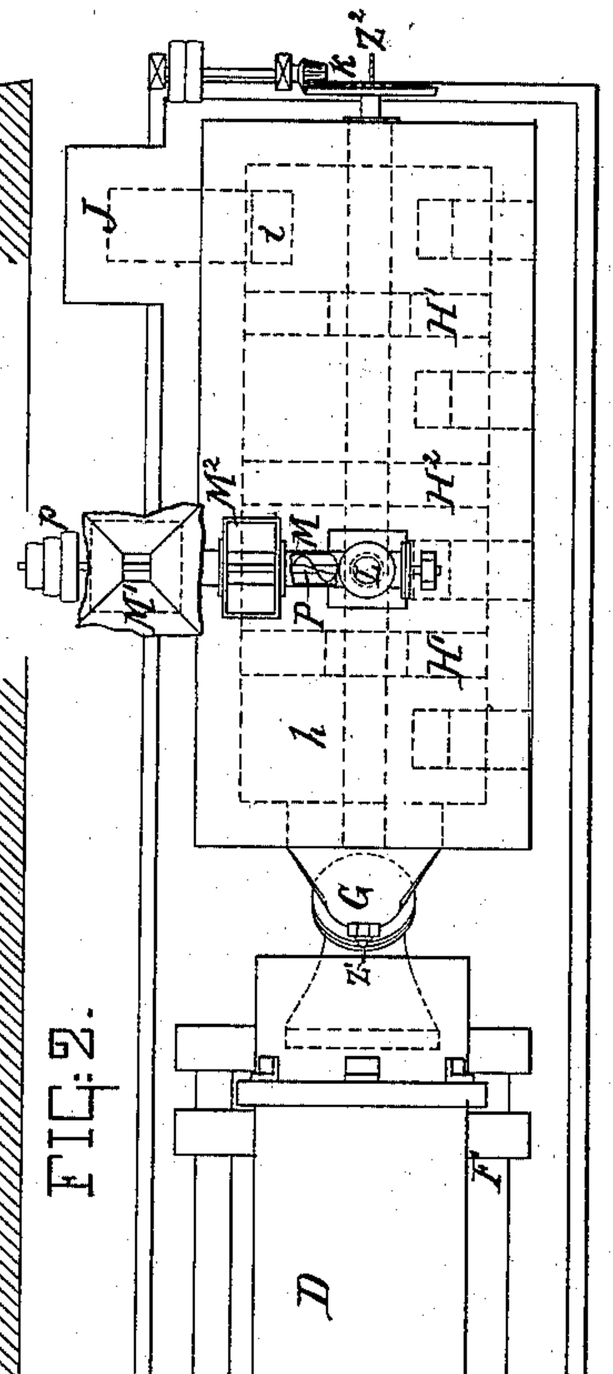

FIG:2.

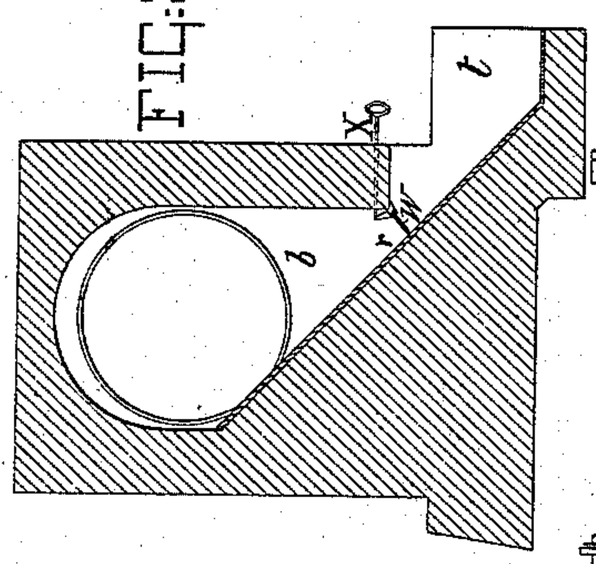

FIG:3.

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HERMANN O. REINHARDT, OF ARLINGTON, NEW JERSEY.

APPARATUS FOR ROASTING ORES.

SPECIFICATION forming part of Letters Patent No. 255,537, dated March 28, 1882.

Application filed August 4, 1881. (No model.)

To all whom it may concern:

Be it known that I, HERMANN O. REINHARDT, of Arlington, in the county of Hudson and State of New Jersey, have invented certain new and useful Improvements relating to Apparatus for Roasting Ores, of which the following is a specification.

The invention is adapted for the treatment of ores of any metals or mixtures of metals which require to be heated and exposed to a current of air preliminary to the subsequent reducing treatment. I will describe it as applied to the roasting of ores containing gold or silver, or both intimately combined with obstinate sulphur compounds, as pyrites, &c.

The ores should be previously disintegrated by any suitable mill (not shown) to a size which will pass through a screen having forty (40) meshes to the inch. I employ a revolving roaster, through which a current of hot gases from an adjacent furnace is conducted, and in which the ore is tumbled and agitated in contact with such gases, which should contain a liberal amount of free oxygen to burn away the sulphur. I provide for raising the temperature of the finely-broken ore to nearly the point required for desulphurization before it is fed into the revolving part of the apparatus. I feed forward the ore in a chamber, where it is subjected to the spent heat from the furnace, and automatically supply it therefrom to the end of the revolving roaster farthest from the fire. The ore is by the tumbling action in the revolving roaster moved gradually toward the other end—that nearest the fire. I provide for its movement by gravity to one side after it emerges from the hottest end of the roaster. It is received in a pocket at one side of the apparatus, from which it may be taken out by any appropriate means. I effect the preparatory heating in what also serves as the dust-chamber or settling-chamber, for collecting the finest ore blown away by the current of air and gases, such dust forming usually the richest part of the ore. I feed the material by endless screws. One screw moves it horizontally into a position approximately central over the dust-chamber, and discharges it downward through a tube or hand-passage. The other screw lies in a V-shaped channel in the base of the chamber, and feeds the fine material steadily toward the fire. With all ordinary qualities of ore the rising of the temperature of the finely-broken material in my preparatory chamber reduces its tendency to be blown away by the gases. This tendency is still further reduced by the fact that the feeding of the fresh material containing coarser particles takes place in the same preparatory chamber, and that this fresh material in mixing with the light dust protects it against the current of hot air and gases of combustion, which tends to blow it away. I supply air in nicely-adjustable quantities over the fire in such position that it aids to complete the combustion of the fuel and supplies free oxygen at a high temperature in quantities which may be varied within wide limits, so as to give the best conditions.

The accompanying drawings form a part of this specification, and represent what I consider the best means of carrying out the invention.

Figure 1 is a longitudinal section of the apparatus, partly in elevation. Fig. 2 is a plan showing part of the revolving cylinder broken away. Fig. 3 is a transverse section through the furnace on the line S S in Fig. 1; and Fig. 4 is a cross section of one side of the dust-chamber, taken on the line T T in Fig. 1.

Similar letters of reference indicate like parts in all the figures.

The furnace *a*, equipped with grates, fire-brick lining, &c., for the production of intense heat, communicates with a combustion-chamber, *b*, into which air is admitted through a passage, *b'*, controlled by a register, C, which may be adjusted to allow fresh air to enter and complete the combustion of the gaseous portions of the fuel. Whether or not there is combustible material in the gas, sufficient air should be admitted to supply the gases with sufficient free oxygen to treat the ores—that is to say, to burn off or burn out the sulphur from the ore under treatment.

D is a revolving roaster, supported on rollers E, turned by gearing, and consequently imparting a corresponding slower rotation to the roaster. The rollers E are carried on shafts *e*, which turn in properly-constructed bearings resting on a cradle, F, which, by means of wedges F', may be adjusted up and down, so as to afford facilities for truing the roaster D whenever it sags or gets by any chance out of center at either end. This roaster is slightly

inclined to induce the ore which is tumbled within it to move gradually toward the hottest end and be discharged. The gases from the fire, re-enforced with fresh air through the register C, move through the roaster D, keeping the whole interior at a high temperature and burning out the sulphur from the material tumbled therein. The roaster is lined with fire-brick *d*, some of which project inward, as indicated by *d'*, to induce a thorough agitation of the ore. The end nearest the fire matches approximately close within a cylindrical opening in the masonry. The other end is equipped with a circular partition, loosely fitted inside, which is supported on and surrounds an inclined passage, G, formed in two sections bolted together by their flanges, as shown, this construction allowing the ready exchange of the lower part when it becomes deteriorated by its exposure to heat and to destructive gases. This passage G is formed with two ways or channels—one, *g*, presenting in cross-section a considerable area for the passage of the gases from the roaster, and the other, *g'*, below *g*, for feeding the broken ore into the roaster. This passage G leads by a quick incline from a more elevated dust-chamber, *h*, which is equipped with bridges or partial partitions H' H², arranged as shown. A liberal passage, *i*, leads from the farther end of the chamber *h* to a stack, J. The chamber *h* is V-shaped in cross-section, as indicated in Fig. 4. In the lower edge or angle lies an endless screw, K, turned with a continuous rotary motion by the gearing *k*. This agitates and feeds toward the hotter portion of the apparatus all the ore which is thrown into the chamber or allowed to deposit there from any source.

L is a pipe extending downward through the top of the dust-chamber *h*, open at the bottom. Its upper end communicates with a horizontal pipe, M, which incloses an endless screw, P, turned by a belt on one of the pulleys *p*. The horizontal pipe M is provided with a hopper, M', adapted to receive the ore, and with an additional hopper or supplying apparatus, M², adapted to receive and feed into the passage a different material, as any salts or chemicals required for chlorination of the ore.

The belt (not shown) may be shifted onto either of the several pulleys *p* to vary the rate at which the screw P is turned, and consequently the rate at which the material is fed along through P and caused to descend through L into the dust-chamber *h*, where it is seized and carried forward again by the endless screw K. The joints between the revolving roaster D and the fixed portions, and also the joints around the shafts of the feeding-screws K and P, being made approximately tight, a good draft in the stack J causes a vigorous induction of air through the register C; but care must be taken to control this so that it shall not greatly lower the temperature of the gases. The air in the products of combustion attacks the sulphur at the high temperature to which it is raised by the treatment, and the ore escapes in a well-roasted condition from the roaster D into the chamber *b*. The base of this is inclined laterally, and communicates with a pocket, *t*, through an aperture, *r*, more or less closed by a valve, W, controlled by a rod, X. This valve W is set so as to allow the ore to slide freely down the incline into the pocket *t* without much admission of air.

The ore may be taken from the pocket *t* by means of shovels, or in any other appropriate manner, and after being allowed to cool may be introduced in the amalgamators or any other apparatus for subsequent treatment.

It is important to preserve a low temperature in the feeding-screw K. For this purpose it is made hollow or tubular, and each end of it is equipped with a tight-fitting connection, which communicates with one of the pipes Z' Z², through the first of which water is supplied from an elevated reservoir, (not shown,) and through the last of which the same is conveyed away, with its temperature more or less raised, after having passed through the whole length of the endless screw.

The vertical pipe L is made telescopic to allow of adjustment of its length. It is well to shorten this by elevating its sections as much as is allowable without a large proportion of the thin ore being blown away and carried past one or more bridges in the chamber *h*, and finally carried up the stack. Whenever there are indications of this evil the pipe L should be lowered a little. A point will soon be found with each ore to which the several adjustable elements of the mechanism may be set—that is to say, the register C may be set just sufficiently open and the hanging-pipe L may be adjusted down to extend just sufficiently low.

Modifications may be made in many of the details. Some parts of the invention may be used without the whole. I have described the apparatus with the dust and feed chamber situated at a higher level than the roaster, because this position allows a very convenient and simple arrangement for the feeding apparatus; but it is evident that the dust and feed chamber may be at the same level as, and even at a lower level than, the roaster, and that the material fed into the said chamber, or driven into it out of the roaster by the current of hot air and gases of combustion, may be lifted by means of an elevator or other appropriate means to a higher level and passed from there into the roaster. The dust-chamber *h* may be lengthened or shortened. The stack may be connected on the opposite side or at the end. The number of bridges H' H² may be increased. The position of the pipe M and its contained feed-screw P, and also the connected delivery-pipe L, may be varied within wide limits. The hopper M² may be closed and disused altogether with some kinds of ores. In other cases it may be used to supply a variable quantity of a different kind of ore, or the same ore broken and screened to a different degree of fineness.

It will be understood that the belts operat-

ing the several parts of the apparatus may be actuated by suitable pulleys and counter-shafts from a single engine or water-wheel; or they may be actuated by independent means, so that their rate of operation may be varied independently of each other without the trouble of shifting the belts upon the several pulleys.

I claim as my invention—

1. In an apparatus for roasting ores, the chamber *h*, having partial partitions H′ H² and means for supplying fresh ore and allowing the escape of the gases from the roaster, mounted higher than the roaster and connected by one or more inclined passages, in combination with the revolving roaster D, furnace *a*, and stack J, as herein specified.

2. In an apparatus for roasting ores, the chamber *h*, having the partial partitions H′ H², with liberal spaces to allow the settling of the dust, in combination with the feeding means K, arranged in the contracted base thereof, and with the duplex inclined passage *g g′*, revolving roaster D, furnace *a*, and stack J, as herein specified.

3. The transverse feeding-screw P and its inclosing pipe M and one or more feed-hoppers thereon, in combination with the dust-chamber *h*, having partial partitions H′ H², and with the feeding-screw K in the base of said chamber, as herein specified.

4. The descending pipe L, in combination with the dust-chamber *h*, having partial partitions H′ H², bottom screw, K, top screw, P, connections G, and revolving roaster D, as herein specified.

In testimony whereof I have hereunto set my hand, at New York city, this 2d day August, 1881, in the presence of two subscribing witnesses.

H. O. REINHARDT.

Witnesses:

F. H. McDOWELL,

FRANK E. PECK.