

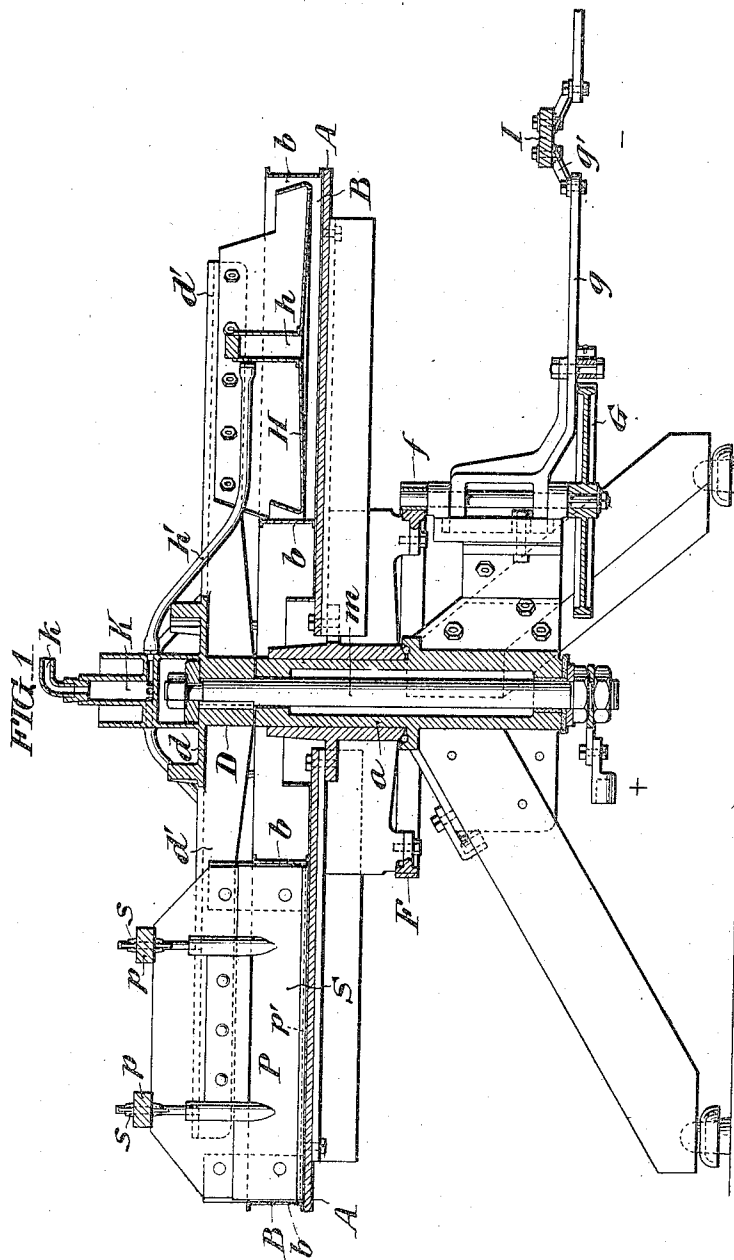
No. 778,901.

PATENTED JAN. 3, 1905.

P. G. SALOM.
PROCESS OF REDUCING LEAD ORES.

APPLICATION FILED APR. 17, 1903.

2 SHEETS—SHEET 1.



WITNESSES:

Arthur E. Paige
James H. Bell

INVENTOR:

Pedro G. Salom,
By Haley & Paul
attorneys.

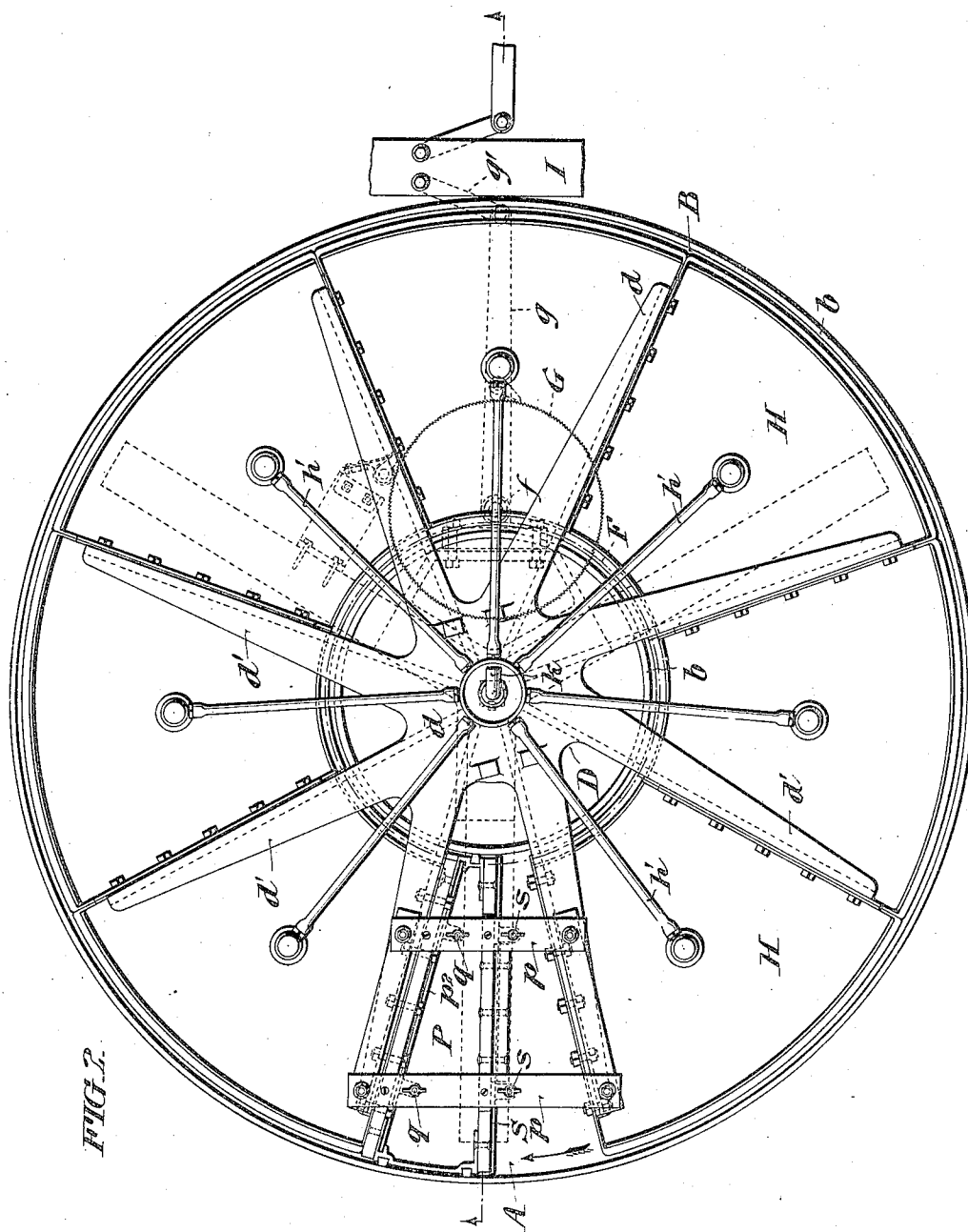
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UNITED STATES PATENT OFFICE.

PEDRO G. SALOM, OF PHILADELPHIA, PENNSYLVANIA.

PROCESS OF REDUCING LEAD ORES.

SPECIFICATION forming part of Letters Patent No. 778,901, dated January 3, 1905.

Application filed April 17, 1903. Serial No. 153,047.

To all whom it may concern:

Be it known that I, PEDRO G. SALOM, a citizen of the United States, residing at No. 4702 Chester avenue, in the city of Philadelphia, county of Philadelphia, and State of Pennsylvania, have invented a certain new and useful Improved Process for the Reduction of Lead Ores, of which the following is a specification, reference being had to the accompanying

drawings.
My process is applicable to the reduction of a variety of lead ores, including also argentiferous lead ores; but I will describe it as applied to the reduction of the sulfid of lead commonly known as "galena." By my process I place the lead ore in contact with a cathode and in the presence of an electrolyte, such as dilute sulfuric acid, and as the reduction which occurs upon the passage of the electric current proceeds I continuously remove the resulting spongy lead from the cathode, replacing it by a continuous supply of the ore.

Although my process is independent of any particular form of apparatus, I have illustrated in the drawings and will first describe an apparatus which I have found a convenient one to employ in the practice of my process.

In the accompanying drawings, Figure 1 is a vertical central section of this apparatus, and Fig. 2 is a plan view of the same.

The apparatus consists of a rotating circular table A; supported by a fixed central post *a*.

B is an annular electrolytic cell supported upon the rotating table and concentric therewith. It has inner and outer peripheral walls *b b*. This cell is preferably composed of antimonial lead. It is constituted a cathode by electrical connections through the central post, which is insulated from the floor on which it rests. The post *a*, around which this table swings, carries above the table a spider-frame D, insulated from the post, consisting of a central disk *d* and radial arms *d' d'*. This spider-frame supports within the electrolytic cell B an anode in the form of an annulus, which is incomplete to the extent of one of the spaces between the arms of the spider-frame. This anode is made up of a series of segmental anode-plates H, each plate

bridging a space between the arms of the spider-frame and all being supported by their contact with the arms of the frame. The anode-plates are also preferably made of antimonial lead. Each anode-plate has its under surface slightly dishd upward and has a central aperture *h*, leading to a short pipe, from which a small rubber tube *h'* leads to a chamber K, mounted on the upper end of the central post. By means of these tubes *h'* the gaseous products of electrolysis throughout the entire electrolytic cell are lead to the chamber K, from whence they are removed by a pipe *k*. The entire series of anode-plates is constituted a single anode by means of electrical connections through the spider-frame by way of a central insulated spindle *m*.

Thus far the parts which have been described constitute an annular electrolytic cell of which the bottom forms a cathode-plate. Continuous rotation is imparted to this annular cathode by means of a gear F, formed thereon, which meshes with a pinion *f*, fastened upon a shaft, which also carries the ratchet-wheel G, to which motion is imparted by a pawling-lever *g*, which in turn is slowly oscillated by means of a link connection *g'*, running to an oscillating bar I, by which, if desired, a whole series of apparatus similar to the one now being described may be kept in motion.

I will now describe those parts of the apparatus which have for their function to continuously spread upon the cathode-plate at the bottom of the cell the lead ore and also to continuously remove therefrom the spongy lead which is formed on the cathode by the electrolytic action.

A supply-box P in the form of a narrow segment is supported from two short bridge-pieces *p p*, which bridge the aperture between the arms of the spider-frame, from which, as before explained, the anode-plates are lacking, all connections between the box and the spider-frame being insulated. The side wall of the box P, away from which rotation of the cathode occurs, does not reach quite to the bottom of the cell, thus leaving a feeding-slot *p'* beneath it, the aperture of which is controlled by a sliding plate *p''*, adjustable vertically by set-screws *q q*.

Outside of the side wall of the box P, toward which rotation of the cathode occurs, is mounted a vertically-sliding scraper-plate S, the position of which may be adjusted by set-screws s s.

The peculiarity of my process is that the supply of ore to the cathode is continuous and likewise the removal of the resulting spongy lead from the cathode, both taking place at a rate corresponding to the time which is required to completely reduce the lead in accordance with the conditions under which the process is practiced. To accomplish this, I feed continuously to the box P a supply of properly-concentrated finely-ground galena of a grade averaging from seventy to eighty per cent. of metallic lead. The electrolytic cell is filled with an electrolyte—say dilute sulfuric acid (about ten-per-cent. solution)—enough being always present to cover the ore and the anode. The feed of the ore is at about the rate of ten pounds per hour for a current density of fifteen hundred amperes, distributed so as to provide about sixty amperes per square foot of active cathode-surface. The width of the feeding-slot is so adjusted that the total amount of ore resting on the cathode at any one time is about fifteen pounds. For this purpose the slot 9' at the bottom of the box is so adjusted that as the cathode revolves in the direction of the arrow in Fig. 2 a fine layer—say from one-tenth to one-thirtieth of an inch thick—of the powdered ore is continuously spread over the bottom of the cell. The rate of rotation is about one turn in an hour and a half. The current passing between the electrodes reduces the lead sulfid to metallic lead, which appears as a spongy mass varying in consistency according to the fineness of the ore. It is very porous and spongy if the ore be ground fine and more or less plastic if the ore be ground coarse. As rotation continues the spongy lead thus formed at the bottom of the cell meets as rapidly as the reduction process is completed the advancing edge of the scraper-plate S and is by it scraped from the cathode. As this mass accumulates against the scraper it occupies the space in front of it and is from time to time removed from this space without interrupting the process. By thus spreading the ore very thinly and evenly over the cathode there results a very complete reduction. This makes possible the use of larger current densities—say sixty amperes per square foot of cathode-surface—thereby hastening the reduction process. There is no loss of time and energy such as occurs in processes where the electrodes must from time to time be removed in order to get at the product of the electrolysis. Neither do the workmen experience any of the disagreeable or

dangerous effects common among those who are required to handle and remove electrodes in electrolytic lead processes; but it will be understood that although I have described a preferred form of apparatus for the practice of my process and have instanced the use of lead sulfid as the ore to be treated my invention is not limited either to this apparatus or this ore.

My process consists, broadly, in passing a current between two electrodes in the presence of a suitable electrolyte and in continuously spreading a thin layer of the lead ore which is to be reduced upon the negative electrode and as continuously scraping off the spongy lead which forms upon this electrode as a result of the electrolysis as rapidly as reduction is completed. By so doing the ore becomes practically itself the negative electrode or pole and the current in passing through the same decomposes it (forming sulfureted hydrogen at the pole, if the ore be lead sulfid) and leaving the lead in a spongy metallic condition. So far as I am aware, this continuous spreading of ore upon an electrode for the purpose of effecting its reduction and as continuous removal of the reduced product as soon as it is reduced has not heretofore been practiced.

I therefore claim—

1. The process of reducing lead ore which consists in continuously spreading the ore in a finely-ground condition upon the surface of a suitable cathode, in the presence of a suitable electrolyte and a suitable anode; maintaining the ore upon the cathode until complete reduction has occurred; and then continuously removing the resultant mass of spongy lead from the cathode-plate at a rate corresponding to the rate at which the ore is spread, substantially as described.

2. The process of reducing lead sulfid which consists in continuously spreading the sulfid in a finely-ground condition upon the surface of a cathode of antimonial lead, in the presence of an electrolyte of dilute sulfuric acid and a suitable anode; maintaining the ore upon the cathode until complete reduction has occurred; and then continuously removing the resultant mass of spongy lead from the cathode-plate at a rate corresponding to the rate at which the ore is spread, substantially as described.

In testimony whereof I have signed my name to this specification, this 15th day of April, 1903, in the presence of two subscribing witnesses.

PEDRO G. SALOM.

Witnesses:

JAMES H. BELL,
M. K. TRUMBORE.