

H. SPECKETER.

PROCESS OF AND APPARATUS FOR PRODUCING ZINC AND OTHER SIMILAR METALS.

APPLICATION FILED MAY 6, 1912.

1,099,211.

Patented June 9, 1914.

2 SHEETS—SHEET 1.

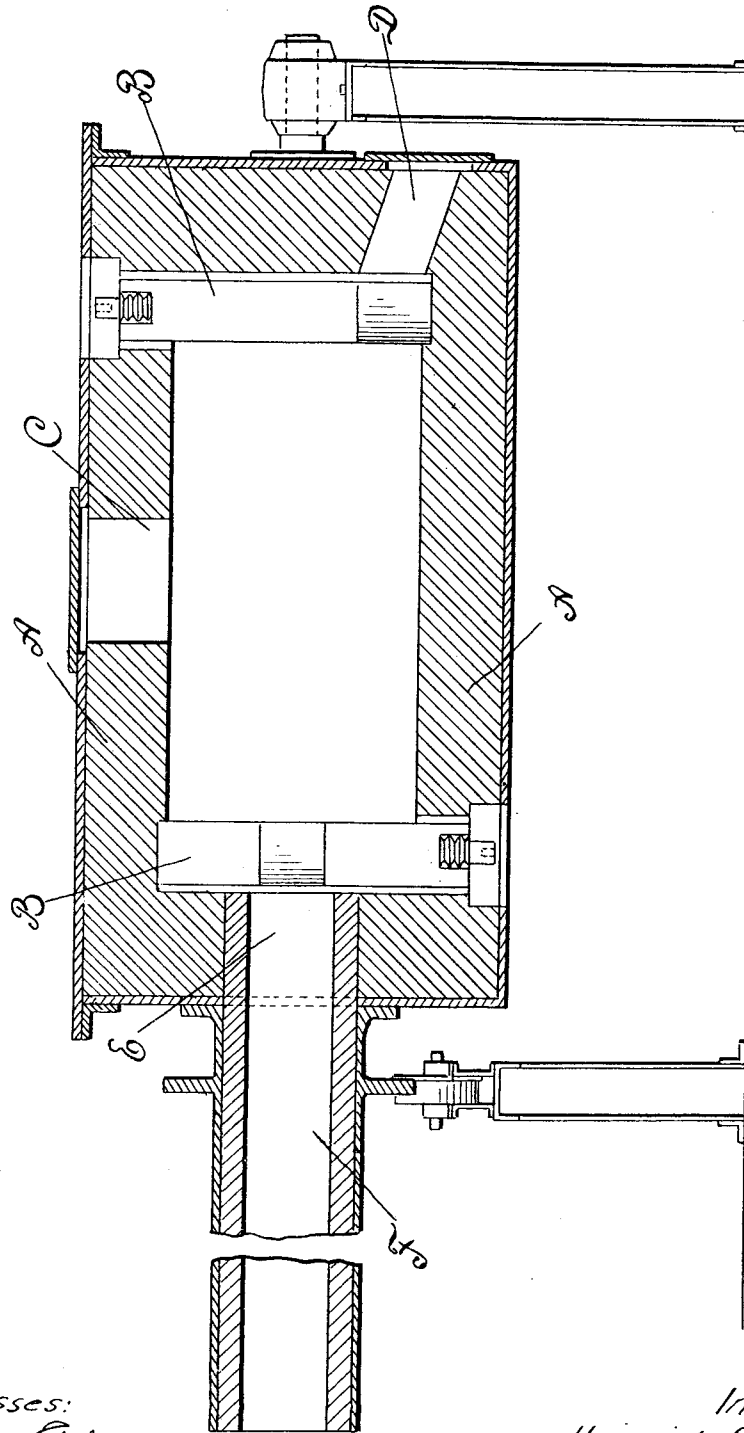


Fig. 1.

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Inventor:
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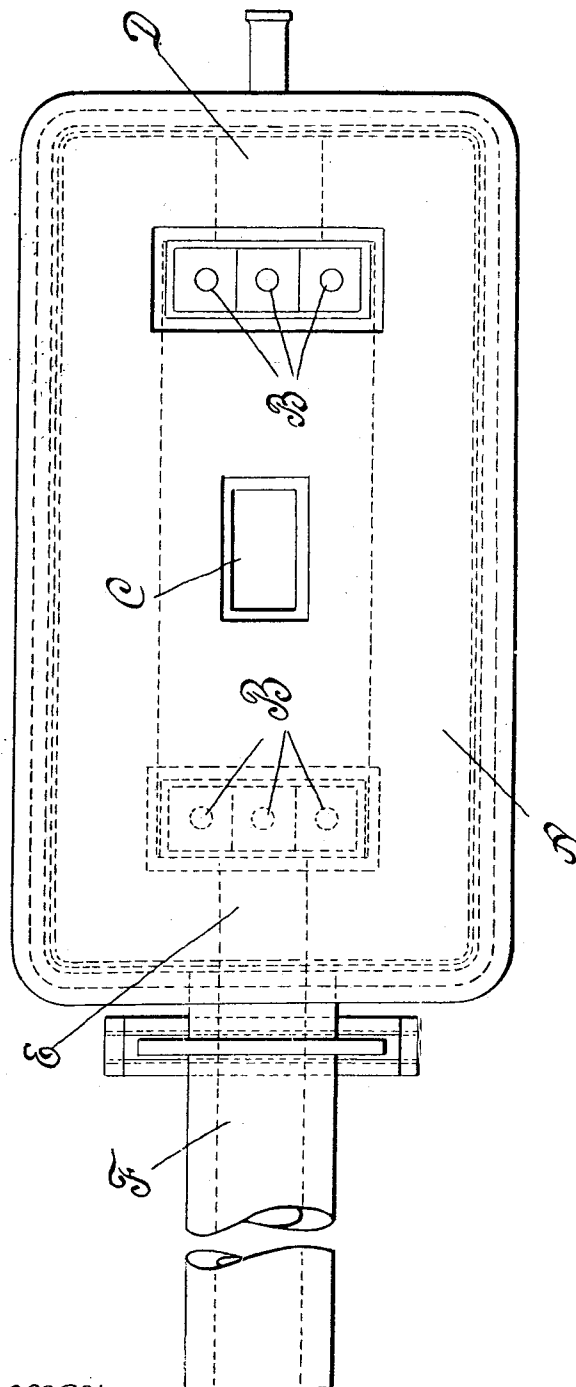


Fig. 2.

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UNITED STATES PATENT OFFICE.

HEINRICH SPECKETER, OF GRIESHEIM-ON-THE-MAIN, GERMANY.

PROCESS OF AND APPARATUS FOR PRODUCING ZINC AND OTHER SIMILAR METALS.

1,099,211.

Specification of Letters Patent.

Patented June 9, 1914.

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To all whom it may concern:

Be it known that I, HEINRICH SPECKETER, chemist, of Griesheim-on-the-Main, Germany, a subject of the German Emperor, have invented certain new and useful Improvements in Processes of and Apparatus for Producing Zinc and other Similar Metals, of which the following is a specification.

According to the usual method of producing zinc in an electric furnace wherein the charge is employed as resistor, the material to be treated is fed into fixed retorts or chambers between the electrodes, and, without being agitated, is heated by the passage of the electric current therethrough. The current flows chiefly through that portion of the charge which offers the least resistance, namely the bottom layers of the charge; such portion, owing to the pressure exerted by the overlying layers, being of greater density and consequently containing more conducting material (reduction carbon) per unit of volume than the upper layers. The result is that the bottom layers are heated more intensely and therefore the reduction therein takes place first and with greater intensity. The reduction and volatilization of the zinc increase the concentration of the remaining coal of the bottom layers and thereby raise the conductivity of the latter, thereby further increasing the tendency of the current to confine itself to the bottom layers, while the upper layers, still richer in zinc, are only traversed by the electric current and heated to a minor extent. Under these circumstances, the elimination of the zinc is very incomplete in the top layers, unless an excessive amount of current would be applied to develop in the upper layers the temperature necessary for complete reduction. In that case however the bottom layers easily become overheated so as to be brought to sintering and smelting, which is detrimental to the operation. Moreover the furnace lining if exposed to an unnecessarily high temperature is more quickly destroyed.

The present invention is directed to the removal of these inconveniences and consists essentially in replacing from time to time the lower layers of the pulverulent charge by other portions thereof. To this end the charge is frequently turned or upset during the operation. For instance the

charge may be turned over by means of a shaft provided with blades or arms; or the furnace may be rotated continuously or intermittently or may be tilted to and fro. The use of a revolving furnace is preferred in the present instance and offers the further advantage that those parts of the furnace which are most exposed to the highest temperature, are allowed to cool from time to time, the furnace lining being thereby preserved from destruction.

In carrying out my invention, any known type of revolving or tilting furnace rotatable about a horizontal or slightly inclined axis may be used.

The accompanying drawing shows, by way of example, one suitable form of furnace; Figure 1 being a longitudinal section, and Fig. 2 a plan-view.

The furnace A is preferably box-shaped. A furnace of angular section is preferable to one of cylindrical section, as adapted to prevent the material under treatment gliding over the surface of the lining and to insure its falling freely and becoming more thoroughly turned over. The furnace consists of an iron casing and an inner lining. It is pivotally arranged and rotatable around a horizontal or slightly inclined axis either by hand or mechanically. Toward the opposite ends of the furnace are arranged the electrodes B. The points of introduction of the electrodes and their connections to the circuit are preferably so disposed that their distance upon the circumference of the furnace is 180°.

C is the feed opening with cover, D the discharge opening for the residues and E an opening for the escape of the gases and vapors to the condenser F.

In order to insure the charge always remaining in contact with an equally large portion of the surface of the electrodes, the latter are arranged in such a manner that the whole charge lies between the electrodes. To this end, the electrodes are preferably disposed close to the two opposite ends of the furnace. As the zinc contained in that portion of the charge which is near the gas outlet E will first become volatilized and liberated, such portion will be sooner deprived of its zinc contents than the portion lying at the opposite end of the furnace; whereupon the proportion of reduction coal present in this part of the

charge becomes in excess, and the conductivity thereof is increased. Were the electrodes arranged in such a manner in relation to the escape opening that the latter lies between the electrodes, as shown in dotted lines in Fig. 2, more current would pass through that portion of the charge lying nearly at the escape opening than through the other portions of the charge. The latter would not be heated enough, whereas the former would become overheated. Such distribution of the heat would however be very detrimental. In the foremost portions of the charge already poorer in zinc, the high temperature is not only unnecessary, but even injurious, as the charge would easily sinter together and become not only impermeable to gases and fumes but also more unfit for reduction. In the remoter portions of the charge on the contrary, relatively richer in zinc, the low temperature prevents complete reduction. In order to avoid these inconveniences, the electrodes are, according to the present invention, so placed that the current traverses the charge in the direction from the escape opening E of the gases and fumes toward the opposite end of the furnace or inversely; one of the electrodes being placed close to the escape opening E and the other at that end of the furnace opposite to the escape opening D as shown in Fig. 1. The effect of this arrangement is that when the conductivity of the charge located near the electrode placed in front of the escape opening E increases, the resistance of the charge will be diminished and hence the temperature lowered in these layers; whereas in the more remote parts, owing to the greater resistance, the temperature will be raised. Furthermore, by arranging the contacts for the electrodes B at an angle of 180° relatively to one another, as shown in the drawings appended hereto, the tendency of the current to short-circuit through the furnace lining is avoided or diminished.

The process may be carried out as follows: The charge consisting for instance of a preheated mixture of zinc oxid and reduction coal in a pulverulent condition, is introduced into the furnace through the feed opening C which is then closed. The current having been applied, the gases developed and the zinc fumes escape by the opening E to the condensing tube F where the zinc fumes are liquefied. During the heating, the furnace is continuously or intermittently rotated, whereby the particles of the charge are gradually displaced, so the bottom layers are continuously renewed and new portions of the furnace lining constantly come into contact with the zone of highest temperature. Care must be taken to prevent too quick rotation of the furnace, as resulting in the formation

of dust and the risk of portions of the charge being thrown out into the condenser. The furnace may be rotated in either direction or alternately in opposite directions. As the electrodes extend over the whole furnace section and have the whole charge between them, the latter remains during the rotation in uniform contact with the electrodes, thus securing an uninterrupted passage of the current through the charge and a uniform heating thereof. If the direction of rotation be alternated, a partial rotation in each direction will suffice, preferably to an angle of 180°. After the charge is deprived of its greater portion of its zincous contents, fresh material may be added and the operation continued. When the charge is wholly freed from its zinc, the residues are removed through the discharge opening C.

With a view to facilitating the displacing or upsetting of the charge, its sintering or smelting must as far as possible be avoided. To this end, it is advisable to control the temperature of the charge while under treatment, so that it does not exceed 1300° C.

The process not only allows of treating oxidized ores and products, but also materials containing zinc in the form of sulfid. In treating such substances the charge requires the addition, besides the reducing agent, of sulfur-binding fluxes.

The process may also be employed for the recovery of metals other than zinc, but possessing similar properties.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I claim:

1. The process of producing zinc and other similar metals, which consists in charging a conductive mixture of zinciferous material and reducing agents into a furnace, directing an electric current through this mixture which acts as resistance, and turning over this mixture while it is maintained in an unsmelted condition, so that its lowest layers are replaced from time to time without leaving the furnace by other portions of the mixture.

2. The process of producing zinc and other similar metals which consists in charging a conductive mixture of zinciferous materials and reducing agents into a suitable furnace, directing an electric current through this mixture which acts as resistance, and giving the furnace such a movement as to turn over the mixture while it is maintained in an unsmelted condition so that its lowest layers are replaced from time to time without leaving the furnace by other portions of the mixture.

3. The process of producing zinc and other similar metals which consists in charging a conductive mixture of zinciferous materials and reducing agents into a re-

volving furnace, directing an electric current through this mixture which acts as resistance, rotating the furnace intermittently and thereby turning over the mixture while it is maintained in an unsmelted condition, so that its lowest layers are replaced from time to time by other portions of the mixture, without leaving the furnace.

4. The process of producing zinc and other similar metals, which consists in charging a conductive mixture of zinciferous materials and reducing agents into a revolving furnace, directing an electric current through this mixture which acts as resistance, rotating the furnace intermittently at an angle of 180° and thereby turning over the mixture while it is maintained in an unsmelted condition so that its lowest layers are replaced from time to time without leaving the furnace by other portions of the mixture.

5. The process of producing zinc and other similar metals, which consists in charging a conductive mixture of zinciferous material and reducing agents into a furnace, directing an electric current through this mixture which acts as resistance, turning over the mixture while it is maintained in an unsmelted condition, so that its lowest layers are replaced from time to time without leaving the furnace by other portions of the mixture, adding, after the mixture is partially freed from the zinc contents a portion of fresh mixture, and con-

tinuing the operation until the mixture is wholly freed from zinc contents.

6. The process of producing zinc and other similar metals, which consists in charging a conductive mixture of zinciferous material and reducing agents into a furnace, directing an electric current through this mixture which acts as resistance, turning over the mixture while it is maintained in an unsmelted condition, so that its lowest layers are replaced from time to time without leaving the furnace by other portions of the mixture, and maintaining the temperature of the mixture at about 1300°C .

7. An electric rotatable furnace for producing zinc and other similar metals, having an angular section relatively to its rotating axis, and provided with two electrodes, one of which is arranged close to the escape opening for the metallic fumes and gases, and the other of which is arranged at the end of the furnace opposite this escape opening, both electrodes extending over the whole inner section of the furnace, and having their connections to the circuit disposed at 180° apart around the circumference of the furnace.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

HEINRICH SPECKETER.

Witnesses:

ROBERT ENGLER,
JEAN GRUND.