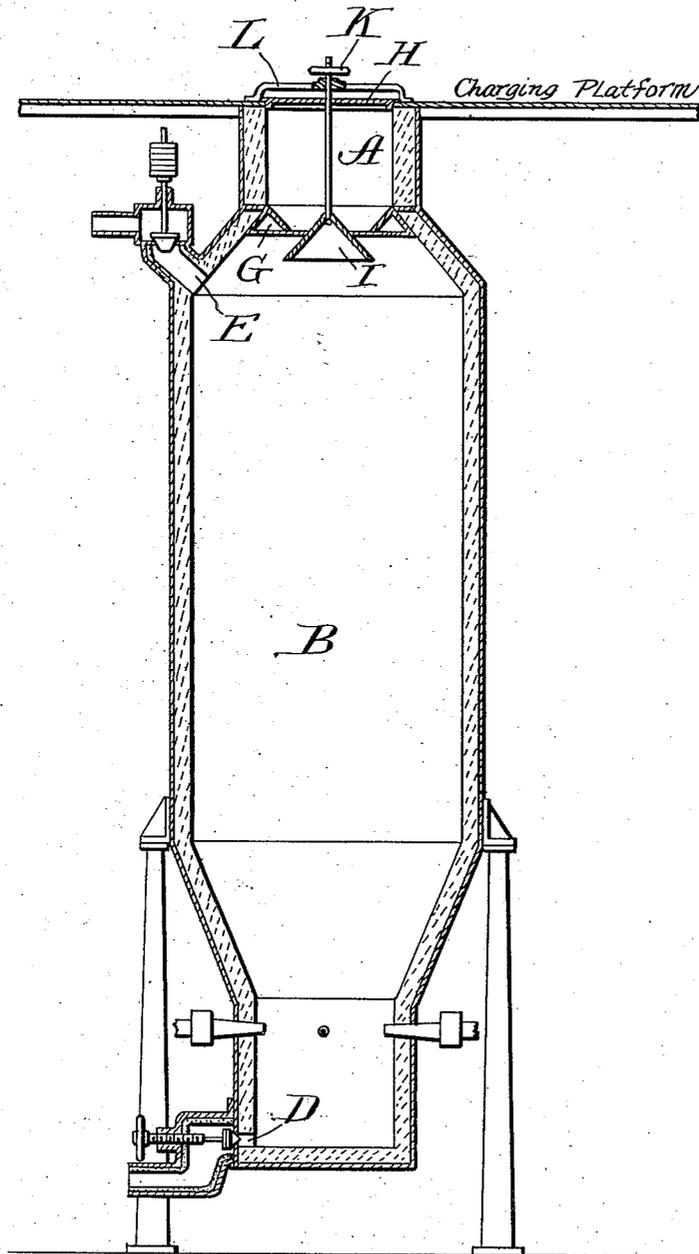


E. B. CUTTEN.
PROCESS OF REDUCING ZINC COMPOUNDS.
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1,080,102.

Patented Dec. 2, 1913.



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UNITED STATES PATENT OFFICE.

ELISHA B. CUTTEN, OF ERIE, PENNSYLVANIA.

PROCESS OF REDUCING ZINC COMPOUNDS.

1,080,102.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, ELISHA B. CUTTEN, a citizen of the United States, residing at Erie, in the county of Erie and State of Pennsylvania, have invented a certain new and useful Process of Reducing Zinc Compounds, of which the following is a specification.

My invention relates to the production of metallic zinc, and especially to a furnace process of effecting the reduction of zinc oxid.

Metallic zinc has heretofore been obtained by the reduction of zinc ore in the well known retort furnace and condensing the vapor. The objections to this process, due to the expenses for fuel and repairs and the losses due to the breakage of retorts which rapidly deteriorate in use, especially when working on ores containing lead and iron, have led to frequent proposals to smelt zinc ores in cupola furnaces. All such attempts as have been made I believe to have been unsuccessful, because the vapor of metallic zinc has been reoxidized before it could be collected; and because the fluxing material necessarily present prevents precipitation of the zinc.

According to my process I employ zinc oxid free from gangue and other bodies as the substance to be reduced, and effect its reduction in a cupola or low blast furnace in a reducing atmosphere under pressure, collecting and drawing off the liquid zinc from beneath the charge.

The zinc oxid for the charge, free from gangue and compounds of other metals, may be obtained in any desired way. For instance a substantially pure zinc oxid may be obtained as follows: Thoroughly roasted, (oxidized) sulfid ore or a carbonate ore containing zinc is treated with a cold, dilute solution of an acid, such as sulfuric or hydrochloric acid, and the mixture allowed to stand until cold, then, if the quantity of acid be properly proportioned to the contained zinc the solution on being drawn off will be found to be substantially free from other sulfates; and if there be traces of other metals they may be removed in any suitable way known to those skilled in the art. This solution of zinc sulfate may then be treated with ammonia which will precipitate zinc hydrated oxid that may be separated from the solution in a filter press. This hydrated oxid is then preferably dried and

heated to form the oxid before use. Should objectionable traces of iron or other metals be present they may be removed in any well known way. Any other preferred method of obtaining zinc oxid may be employed. The zinc oxid, however, obtained, is mixed with coke or coal, and preferably briqueted in any well known way. The briquets, however, should not contain any material quantity of slag forming, or other inert matter, as they would if clay were used as a binder. This mixture of zinc oxid and coke or coal constitutes the charge of any form of furnace capable of withstanding internal pressure. The furnace having been charged, liquid or gaseous fuel with air, both under high pressure, are admitted to the bottom of the charge and ignited; and the pressure of the gases of combustion contained in the furnace raised as soon as possible to from twenty (20) to sixty (60) pounds to the square inch, or even higher, and this pressure should be maintained throughout the reduction operation. The object of this high pressure is to prevent vaporizing the metallic zinc. The use of liquid or gaseous fuel may be omitted, air only under proper pressure being introduced at the twyers, and the carbon mixed with the zinc oxid and in combustion being depended upon both for the heat requisite for the operation as well as for the chemical reaction, *i. e.*, the combustion of the oxygen with the carbon, which passes off as carbon monoxid. If fluid fuel with air be forced in at the bottom of the charge, as will be preferably done, it will be found advantageous to force them in quantities so proportioned as to produce a reducing flame at that point. By this procedure the possibility of having oxidizing gases within the furnace chamber, as might be the case if a neutral flame were employed at this point, is prevented, since if any carbonic oxid (CO_2) were formed by the reduction of the zinc oxid, it would itself be reduced by the carbon of the charge into carbon monoxid (CO) before it had an opportunity of reoxidizing any of the reduced zinc. It is thought, however, that with a flame of that character no formation of carbonic oxid (CO_2) could occur. Operating in this way, it will be found that the zinc oxid will be reduced and that metallic zinc in a liquid form will collect beneath the furnace charge, and may be drawn off at the termination of the process or preferably, from time to time.

In the accompanying drawing I show in sectional elevation a form of furnace which may be employed in the process.

A is a charging chamber, beneath which is the reducing chamber B of the furnace. The furnace is formed of an iron casing of the necessary strength lined with fire brick. At or near the bottom of the reducing chamber is located the blast and fuel channel with which communicate the usual blast or fuel pipes and at another point a tap hole D. E communicates with the upper portion of the reducing chamber and is provided with a weighted valve adjusted to maintain the desired pressure in the furnace. The charging chamber is provided with a water cooled bell seat G in its bottom and a cover H on its top provided with any securing means. The bell I is provided with a stem movable through the cover H and screw threaded at its upper end to receive the hand nut K, resting on standard L.

In starting or "blowing in" the above described furnace it might be well to start the blast and obtain the pressure in the reducing chamber, before charging, but if there should be any reoxidation of zinc then, or at any time, from failure to maintain the prescribed conditions, it would do no harm as the reduction would be subsequently effected when the proper conditions were established. It will generally be found that before the reducing temperature is reached.

While I have heretofore referred only to and preferably used as the reducible zinc compound, the oxid, other reducible zinc compounds such as the sulfate or carbonate may be used.

The process herein described is radically distinguished from those heretofore proposed in which it has been suggested that

refractory zinc ore be charged with fluxing material in a cupola furnace. Such a process is not capable of practical operation for reasons well understood. In my process no fluxing material is required and if used would be present as mere inert matter detrimental to the operation and impairing its efficiency.

I claim:

1. The process of reducing zinc compounds free from slag forming materials which consists in subjecting them in the absence of fluxing material but in the presence of carbon to a temperature ordinarily sufficient to vaporize metallic zinc, and under a pressure sufficiently high to prevent such vaporization, the zinc being thereby precipitated as molten metallic zinc, substantially as set forth.

2. The process of reducing zinc compounds free from slag forming materials which consists in subjecting them to reducing gases under pressure and at a reducing temperature and to a solid reducing agent, substantially as described.

3. The process of reducing zinc oxid free from slag forming materials which consists in subjecting it in presence of carbon to a high temperature and high pressure, substantially as described.

4. The process of reducing zinc oxid free from slag forming materials which consists in subjecting it to reducing gases under pressure at a reducing temperature and to a solid reducing agent substantially as described.

In testimony whereof, I have hereunto subscribed my name.

ELISHA B. CUTTEN.

Witnesses:

LLOYD B. WIGHT,
A. N. MITCHELL.