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METHOD OF PRODUCING ZINZ OR ZINC AND LEAD

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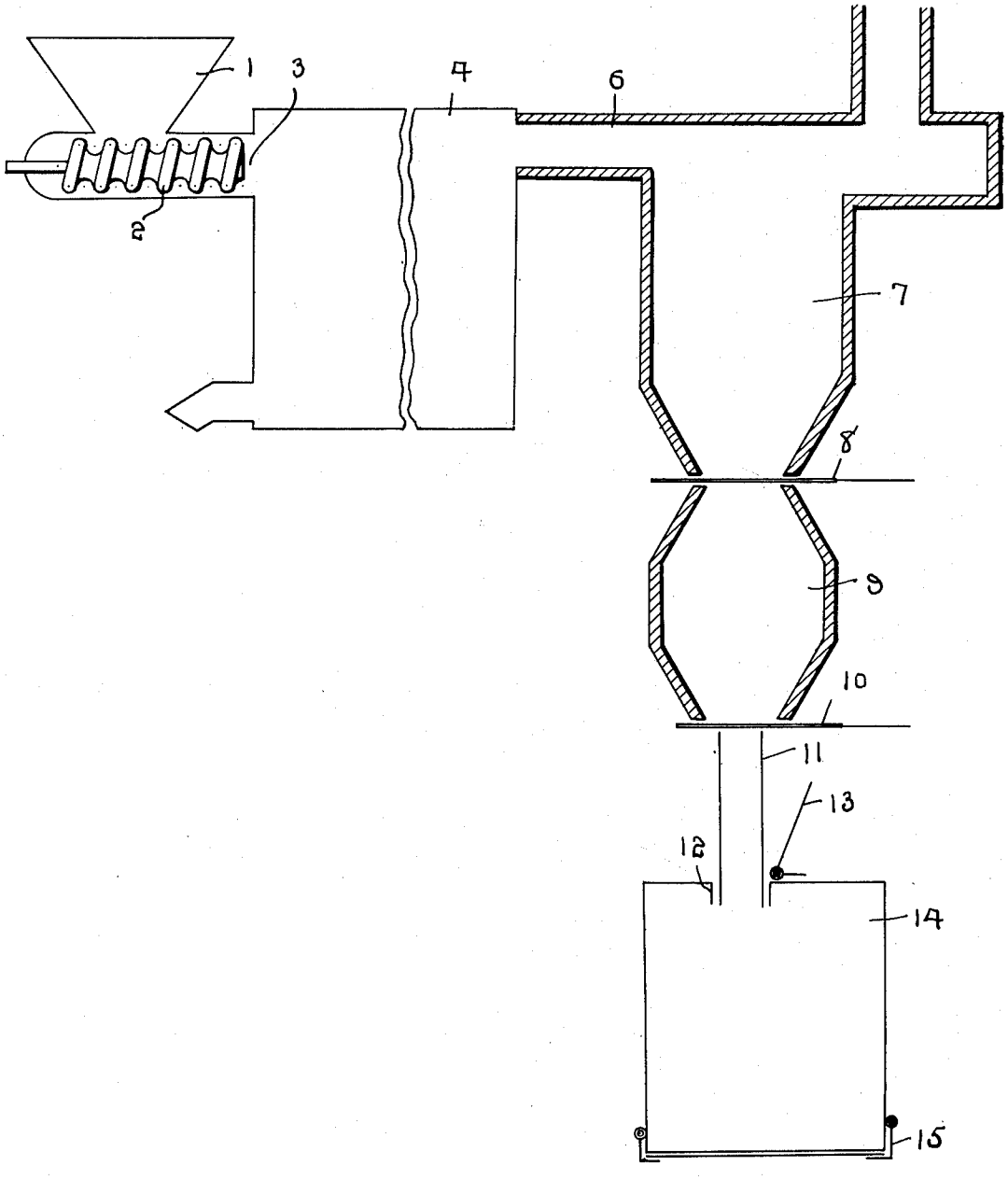

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UNITED STATES PATENT OFFICE.

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METHOD OF PRODUCING ZINC OR ZINC AND LEAD.

Application filed July 27, 1921. Serial No. 487,990.

To all whom it may concern:

Be it known, that I CORNELIUS ERIK CORNELIUS, a subject of the King of Sweden, residing at Stockholm, Sweden, have invented certain new and useful Improvements in Methods of Producing Zinc or Zinc and Lead, of which the following is a specification.

As is well known it has hitherto been practically impossible to obtain the entire quantity of metal coming from a zinc reduction furnace in a liquid state. This is essentially due to the fact that it is practically impossible to control the temperature of the condenser and that the zinc vapors are always more or less diluted by a quantity of hydro-carbons and carbon oxides, (mono and dioxides) which counteract the formation of liquid zinc. The zinc vapors from the distilling furnace, which, due to the above mentioned reasons, are not obtainable as liquid metal are however condensed in the form of metallic dust, poussière or powder, the product being commerically known as zinc dust or blue powder.

Many unsuccessful attempts have been made to minimize the formation of the blue powder and also to recover the zinc in the same by heating it separately by process where the expensive redistilling could be avoided. Since the inventon of S. Huldt disclosed in U. S. Patent No. 1,266,808, however, any powder containing zinc in the free metallic state, that is powder containing zinc not chemically combined with any other elements can, depending on the amount of the free metallic content, largely be converted to the liquid state.

As this invention solves the problem of converting the major portion of blue powder into liquid metal in a convenient and economcal way the formation of blue powder may no longer be looked upon as undesirable but rather in many cases as a desirable product in the production of zinc.

The present invention is a process for making zinc or spelter or zinc-lead characterized by the fact that the metallic vapors coming from a reduction furnace are exposed to a sufficiently low temperature to convert the vapors to a powder without any formation of liquid zinc, and by the fact that this powder is transferred to a suitable device in order to convert the free metallic content of the same to the liquid state.

In conveying the blue powder to this device it should as much as possible be protected against the air in order to avoid any unnecessary oxidation of the metallic zinc.

My invention differs from any previous practice in the art in that it is aimed to condense as much as possible of the zinc into powder, in order to convert the free metallic content of the powder into liquid zinc, whereas in all previous practice it was the object to condense as little as possible of the zinc into powder to ultimately produce liquid zinc.

I am aware that zinc is sometimes intentionally condensed as far as possible in the form of powder, but this has been done for the purpose of producing a commercial product known as zinc dust or zinc grey in which connection it is an object to keep the oxidation of the zinc within the narrow limits fixed by the trade. My present invention differs from that practice in that the final product is liquid zinc or spelter or zinc-lead and in that while oxidation of the zinc condensing as blue powder is undesirable it need not be confined within narrow limits.

My invention may be applicable to most existing processes for making zinc but it has its greatest application in connection with the continuously operated furnaces or retorts, that is, in a process where the reduction of the ore or the zinkiferous material and the distilling of the metal are effected in a continuous operation.

The accompanying drawing illustrates the method of continuously charging the zinc material, and its continuous reduction, its continuous vaporizing and the continuous condensation of the reduced zinc vapors.

1 indicates a hopper for the zinc containing material, 2 a conveyor for transporting the charge through the opening 3, 4 the furnace or retort, in which the reduction is carried out, 5 the tapping hole for slag and matte, 6 the channel between the reduction furnace 4 and the cooled condenser 7.

Between the condenser 7 and the receiver 9 is provided a damper 8, and the receiver 9 is closed by an adjustable damper 10. The condenser 7 may be emptied by opening the damper 8, and the condensed zinc powder transmitted to the receiver 9. Said receiver may be put in communication with the removable receiver 14 through the pipe 11.

The receiver 14, which receives the powder from the receiver 9 by opening the damper 10 and placing the receiver 14 with its opening 12 beneath the pipe 11, may be carried over to a suitable apparatus for the extraction of the metal from the powder. By closing the shutter 13 the air is prevented from coming in contact with the powder in the receiver during the transport of the same. By opening the shutter 15, the receiver 14 will be emptied and its content of powder will be withdrawn.

Preferably the ore or zinkiferous material that is to be treated is mixed with the necessary proportion of solid carbonaceous material, such as coke, breeze, or fines, to effect reduction of the zinc; and if the gangue of the ore does not contain the requisite quantities of silica, iron and lime, wherewith to combine in the formation of a proper slag, additions of fluxes for that purpose are made. The charge of ore, or zinkiferous material, thus prepared, is subjected to combined smelting and distillation in a suitable furnace, which is heated electrically or in any convenient manner. The smelting and distillation proceed in accordance with well known metallurgical principles. The silica, iron and lime, together with other basic elements, combine in a slag, which becomes molten, while iron, copper and sulphur unite in the formation of a matte, which collects the major part of the gold and silver if such metals exist in the ore. The slag and matte may be tapped from the bottom of the furnace in the usual manner, well known to those versed in the art of smelting. The zinc of the ore, and the lead also if it be present, are reduced and volatilized to the major extent, only small proportions of these metals entering the slag. It has been found in practice that to accomplish the best results with respect to extraction of the zinc in this way it is desirable so to flux the ore to be treated that the slag will be highly silicious. In practice a slag containing about 50% silica has been found to be most advantageous.

In this case it has been found by experience in many experimentations that in such a method of reduction and distillation only a rather small amount of the vapors will be converted into liquid zinc, the major part will condense as blue powder which has to be charged into the furnace again for redistilling of the zinc.

In order to produce merely a powder the free metallic content of which in another process may be turned into liquid zinc, the products coming from the continuously operated distilling furnace have to be sharply cooled. This cooling of the gas and vapor coming from the reduction furnace may be effected in any suitable way, but in practice I have found it preferable to accomplish this by introducing the gas and vapor into and passing them through channels or tubes or the like, which are cooled externally by means of water or air, or by means of both simultaneously.

The design of the condenser may provide for internal cooling or for arrangement of parts that will occur to persons experienced in the art of zinc metallurgy.

The zinc obtained in the condenser is accumulated in a receptacle thereof, from which it may be drawn for use in the form of powder, for any purpose, but from which in the common practice of my invention it is drawn and conveyed to a furnace wherein it is largely converted into a liquid state by heating it in a furnace wherein it is subjected to a rubbing or attritionary action.

The carbonaceous gases out of which the condensed zinc is dropped escape through an outlet from the condenser and may be caused to pass through a water trap or any filtering device whereby any condensed zinc that has failed to deposit itself is caused to settle and falls down into a receptacle.

The reduction furnace from which the zinc vapors are produced may be interiorly or exteriorly heated by any suitable means such as with electricity, fuel or both simultaneously.

As the zinc ores and zinkiferous material generally used in connection with this process also contain lead, this invention evidently refers also to the production of lead and the treatments of such products from a reduction furnace as contain lead.

In the case of a zinc ore containing lead, a considerable proportion of the lead content thereof will distil with the zinc, and will collect and will be condensed with the blue powder, and the product from such a powder will be a leady spelter.

In my application 292,952 filed April 26, 1919, of which the present application is a continuation in part, I have disclosed but not so much in detail the process of the present application.

What I claim as my invention, and desire to secure by Letters-Patent is:

1. The method of producing volatile metals consisting in generating metal vapors by a reduction process, then conducting the vapors without allowing their contact with the air and subjecting them to a temperature sufficiently low to convert substantially the whole bulk of condensible vapors into a powdered state, then conducting said powder avoiding its contact with the air and subjecting the powder to a heating and mechanical action to convert the same into a liquid state.

2. The method of producing zinc, or zinc-lead, consisting in the continuous reduction and distillation of zinc, or zinc-lead, in a heated furnace or retort, and subjecting the gases and vapors as they come from the fur-

nace or retort, without allowing their contact with air, to a temperature sufficiently low to convert substantially all of the vaporized metals into powdered state, and subjecting the powder to a heating and mechanical action to convert the same into a liquid state.

3. The method of producing zinc or zinc-lead, consisting in the continuous reduction and distillation of zinc, or zinc-lead, in a furnace or retort, heated electrically, and subjecting the gases and vapors as they come from the furnace or retort, without allowing their contact with air, to a temperature sufficiently low to convert substantially all of the vaporized metals into a powdered state, and subjecting the powder to a heating and rubbing or attrition action to convert the same into a liquid state.

4. The process of smelting zinc ore, or zinkiferous material, consisting in adding carbonaceous material for reduction of zinc and proper materials for fluxing the gangue, heating the mixture in a furnace to such temperature as to produce a slag and to reduce and volatilize zinc, conveying the zinc vapor into a suitable apparatus for condensation, condensing the zinc vapor by a sudden chilling to cause it to precipiatate mainly in the form of powder, and transfering the condensed and precipitated powder to another furnace and subjecting the same to a mechanical action to convert it largely into liquid form.

5. The process of smelting zinc ore, or zinkiferous material, consisting in adding carbonaceous material for reduction of zinc and proper material for fluxing the gangue, heating the mixture in a furnace to such temperature as to produce a slag and to reduce and volatilize the zinc, conveying the zinc vapor into a suitable apparatus for condensation, condensing the zinc vapor by a sudden chilling to cause it to precipitate mainly in the form of powder, washing or filtering the effluent gas, and transferring the condensed and precipitated powder to another furnace and subjecting the same to a mechanical action to convert it largely into liquid form.

6. The process of smelting zinc ore, or zinkiferous material, consisting in adding carbonaceous material for reduction of zinc and proper materials for fluxing the gangue, subjecting the mixture continuously in a furnace, electrically heated, to such temperature as to produce a slag and to reduce and volatilize the zinc, conveying the zinc vapor into a suitable apparatus for condensation, condensing the zinc vapor by a sudden chilling so as to cause it to precipitate mainly in the form of power, washing or filtering the effluent gas, and transferring the condensed and precipitated powder to another furnace and subjecting the same to a heating and mechanical action to convert it largely into liquid form.

In testimony whereof I affix my signature.

CORNELIUS ERIK CORNELIUS.