

# United States Patent Office.

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## IMPROVED PROCESS OF REFINING LEAD.

The Schedule referred to in these Letters Patent and making part of the same.

### TO ALL WHOM IT MAY CONCERN:

Be it known that I, OSCAR WASSERMANN, of Call, in the Kingdom of Prussia, have invented a new and useful Process for Refining Work Lead; and I do hereby declare the following to be a full, clear, and exact description of this invention, which will enable those skilled in the art to make and use the same.

My invention consists in a new process for refining work lead after the same has been desilvered by means of metallic zinc, said process being based upon the application of chemical products. The process of desilvering work lead, or lead enriched by the Pattinson method, by means of metallic zinc, is already in practice. But the reason why this method has as yet been but little applied, is to be found in the not inconsiderable loss of metal occasioned by the process of separating the desilvered lead and zinc. This separation of the desilvered lead from the zinc was hitherto effected by smelting in a reverberatory furnace, or by smelting with iron dross in a vertical furnace. In the first case a product of oxidation is received, which contains, beside oxide of lead, most of the extraneous admixtures. As this mass, produced by oxidation, must again be reduced to metallic lead, the consequence is a loss of lead amounting from one and a half to one and three-quarters per cent. On the other hand, the zinc contained in the lead, in the shape of oxide of zinc, is absorbed by the dross, whereas all the other constituents, as iron and antimony, are not expelled, for which reason a special treatment of the lead in reverberatories becomes necessary to clear it of these parts. Here the same loss of lead results as with the first refining process.

Deviating from the various methods hitherto applied, I have invented a new process, by which the loss of lead is avoided, and the zinc employed for the abstraction of the silver is separated, and can be used over and over again, which latter never is the case with the other methods.

My process consists in submitting red-hot desilvered lead, containing zinc, iron, and antimony, to the action of chloride of lead. The chlorine of the chloride of lead combines with the zinc and iron, whilst the lead of the chloride of lead is combined with the lead to be refined. In practice the process is as follows: The desilvered lead is melted in crucibles or pans constructed of cast or wrought iron, the forms and sizes of which are immaterial. The larger in general these crucibles or pans are, in proportion to their depths, the more adaptable they become for my process. They are filled almost up to the brim, and the surface of the molten lead is subsequently covered with two-thirds of the requisite quantity of chloride of lead, and the temperature increased till the formation of chloride of zinc begins, which can be observed by the production of a liquid dross. This temperature is to be maintained, and after a lapse of three-quarters of an hour all the chloride of lead is decomposed, and the lead covered with a layer of protochloride of zinc. This dross is taken off by means of a spoon, and now the remaining third of the chloride of lead is added to the lead. After this quantity of chloride of lead has operated from one hour and a half to two hours on the impure lead, it has freed the latter of all the iron and zinc it contained. As it is the custom to apply a little more chloride of lead than is theoretically requisite for the purification, this last dross still contains some undecomposed chloride of lead, and is therefore saved and again used in the next melting process. The lead is, however, fully cleared of zinc and iron, as also of copper, the latter having, during the operation of desilvering, combined with the zinc dross saturated with silver. The antimony that is, perhaps, contained in the lead, is not fully expelled by the chloride of lead, and to clear the lead of this metal too it is treated with soda or potash (*Natrium causticum* or *Kalium causticum*) in like manner as described above for the chloride of lead, without, however, allowing the temperature to surmount the melting point of the lead. Hence antimoniate of soda or antimoniate of potash is formed, which substance is taken off and used either for producing antimony-metal or for other purposes. (Hitherto antimony could only be ejected by melting.)

After the addition of the last quantity of chloride of lead, it is inevitable that, through the high temperature, part of the chloride of zinc evaporates, and it therefore becomes necessary to make provisions for the reception of these vapors and the protection of the workmen. This is accomplished by means of a bell of iron plate which covers the pans or crucibles, and connects at the same time with a pipe conducting into a condensing-chamber. The quantity of the chloride of lead to be employed for clearing the desilvered lead amounts to about two and three-quarters to three per cent. For the purpose of clearing the zinc dross enriched with silver, a greater quantity of chloride of lead is necessary, corresponding to the percentage of zinc, and this, with refer-



ence to the work lead, amounts from four and a half to five per cent., provided the work lead contains two hundred and fifty to one thousand grammes silver in one thousand kilogrammes lead.

It is evident that to purify a very poor lead, for economy's sake, a chloride of lead must be selected as void of silver as possible. Such a poor chloride of lead can be gained out of the not oxidated quick powder, consisting mostly of sulphuret and carbonate of lead collected in the chambers of lead-smelting furnaces, by treating it with hydrochloric acid. Beside its use, the advantage is attained that this quick powder wants not to be treated as ordinarily, and is refined without any loss of lead and other expenses, so that the expenses for muriatic acid are thus more than reimbursed. In separating the zinc from the zinc dross containing much silver, it ought to be observed that a chloride of lead as rich as possible must be employed, else the percentage of silver contained in the lead reduced from the zinc dross would be decreased by the lead in the chloride of lead. But since, for the production of such a chloride of lead, the proper compound of lead is difficult to be had, the zinc dross is treated directly with muriatic acid. It must, however, be freed from lead to such a degree that it has the appearance of a crumbling mass. By this treatment chloride of zinc and lead are the principal results, whereupon the mass is put in a pan or crucible to be melted down. Thus a dross of chloride of zinc is again formed, which is taken off, and the remainder of the lead, rich of silver, is put in a refining furnace for the production of the silver. The total loss of lead in the purifying method above described, including the loss originating through the process of refining the enriched lead, and again smelting the oxidized products, does not amount to one-quarter per cent. of the work lead. The dross of chloride of zinc, if it contains lead, is put on an inclined plane, and the effects of the open air allowed to operate on it. The chloride of zinc then absorbs water and runs down as a solution; it is then collected in vessels and used. The residuum rich of lead is worked for lead.

The expenses in melting down and treating the impure lead for its refinement are balanced by the value of the chloride of zinc, so that in calculating the expenses of the desilvering and refining process, only those costs come into consideration which are attendant to the desilvering process and one-quarter per cent. loss of lead besides. The special expenses of the desilvering for work lead of two hundred and fifty to one thousand grammes silver in one thousand kilogrammes of lead, amount to ten cents; one-quarter per cent. loss of lead, one cent; eleven cents total amount of expenses. As in the methods hitherto applied, and especially in the concentrating process of Pattinson so generally in use, the expenses of producing silver from work lead, as also for producing a pure lead for trade, amount to more than twenty-two cents per hundredweight of the work lead above described, a hundredweight of work lead is, by this new method, desilvered and refined more than eleven cents cheaper than could be accomplished by any other process known to me. If it is considered that in Pattinson's concentrating process the lead produced for trade always has a quantity of silver of at least twenty grammes in one thousand kilogrammes of lead, as a further refining of silver would not be economical, and that in comparison to this method my desilvering process, by means of zinc, is almost a perfect one, and a mechanical removal of lead and silver is less attendant by the very trifling formation of oxidized products, it is clearly evident that the production of silver here is much more favorable. A special advantage is also attained by the circumstance that the work lead can always be quickly consumed without being dependent upon the large masses of not perfectly refined lead attending Pattinson's process. As all zinc and iron are abstracted from the poor lead by the chloride of lead, and all antimony by the soda and potash, the lead produced for trade is free from all metals it generally contains, and can be used as chemically pure lead, which advantage is certainly very important.

Should the work lead contain any antimony, the expenses for refining it become still less, as the antimoniate of soda and potash has a considerably greater value than the soda or potash employed for the removal of the antimony out of the lead. The new method of refining work lead desilvered by zinc metal is therefore based on the application of the two chemical products, chloride of lead and soda, for which method in the annexed application I beg to request a patent.

Having now described the nature of my said invention, and in what manner the same can or may be performed, I wish it to be distinctly understood that I do claim as new, and desire to secure by Letters Patent—

1. Treating work lead, which has been desilvered by the aid of zinc, with chloride of lead, substantially as and for the purpose described.

2. Treating work lead, which has been desilvered by the aid of zinc, with chloride of lead and alkalies, such as soda or potash, substantially as and for the purpose set forth.

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Witnesses:

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W. H. VESEY.