UNITED STATES PATENT OFFICE.

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PROCESS OF REFINING ZINC.

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To all whom it may concern:

Be it known that I, JOSEPH WILLIAM RICHARDS, of Philadelphia, in the State of Pennsylvania, have invented a certain new and useful Process of Refining Zinc Spelter, whereof the following is a specification.

My process is especially adapted for reclaiming zinc from waste, such as scrap, dross spelter, waste from galvanizing-pots, &c.; but it is also available for the refining of the metal under all circumstances where it is associated with impurities, metallic or otherwise, which are capable of separation by subsidence.

In the ordinary method of refining zinc, technically known as "liquation," the metal is allowed to stand in a melted condition until the impurities separate therefrom, the heavier (such as finely-divided iron) sinking to the bottom of the bath and the lighter ones (such as metallic oxides) floating upon the surface. After the exposure is deemed sufficient the floating impurities are skimmed off, and the upper stratum is ladled out or drawn off for casting into ingots until a depth is reached at which the impurities are so manifest as to render the metal unfit for commercial purposes. Under practical limits as to time, &c., this process, as ordinarily conducted, does not yield more than forty or fifty per cent. of the metal in sufficiently pure form to be utilized, and there is no clearly-defined depth down to which it is of any uniform fineness. A certain percentage of impurities is found even in the uppermost stratum of the metal, and this increases rapidly downward through the bath in such an indeterminate manner that the depth to which the zinc can be drawn off can only be arbitrarily ascertained. Even where ancillary processes are used to separate the heavy impurities by forming chemical combinations thereof, though the yield of available metal may be higher than that above mentioned, yet the percentage of unseparated impurities in the metal still remain comparatively high.

By my present invention I am enabled to reclaim a maximum percentage of the zinc with such a sharp definition between the stratum of refined metal and the stratum of impurities as to render the bath practically uniform down to the level of the latter, and, furthermore, I greatly reduce the percentage of contained impurities in the refined metal itself.

My process consists, essentially, in adding metallic aluminum to the bath of melted zinc, diffusing it throughout the same, and permitting the composite bath to subside or settle under the conditions brought about by said addition. The quantity of aluminum required for this purpose may be exceedingly minute, since the process is not directed toward the formation of an alumino-zinc alloy as its final product; but as the diffusion of such a small percentage of aluminum throughout the bath might involve practical difficulties were the metal used in its pure or uncombined form, I prefer to accomplish this by first using the metallic aluminum in combination with a suitable vehicle.

The conduct of the process in this, its preferred form, will now be described. I first prepare an alloy of aluminum and zinc in the proportions, say, of two per cent. aluminum and ninety-eight per cent. of zinc by melting the aluminum in a suitable crucible, and then adding the zinc until a uniform alloy is formed, which is then cast in small bars for convenience of handling. This primary product is utilized in the ultimate refining process as follows: I first melt in a suitable furnace the spelter or the scrap or other impure zinc in the usual manner. I then add thereto from one to four pounds of the above-mentioned alumino-zinc alloy to the ton of metal contained in the bath. The alumino-zinc alloy should be added in small quantities of about one ounce at a time, and the amount thereof will vary with the amount of impurities contained in the bath. After gradual additions in the manner stated and the allowance of the usual time for subsidence, samples of the bath may be tested, and, though taken from near the surface, will render a substantially correct estimate of the purity throughout the whole available portion of the bath. When a sufficient standard of purity has been reached, the lighter or floating impurities are skimmed off and the stratum or refined zinc below that is ladled out or drawn off into molds of the ordinary shape and size. Upon reaching a certain depth, which will of course depend upon the amount of contained heavy impurities, said impurities will be found at a

quite sharply-defined line, and will be in the form of a dense and hard mass, instead of in the slushy and pasty condition which characterizes them under ordinary circumstances of liquation, and which is due to the imperfect separation therefrom of a quantity of metallic zinc which otherwise would be available.

I have instanced the above as the best method known to me of conducting the refining process; but I wish it to be understood that I do not limit my claim to the use of aluminum in combination with a vehicle, since any practicable method of diffusing the necessary percentage of aluminum throughout the bath is the equivalent of the described method. Furthermore, I wish it to be understood that the object of my process is not the formation of an alumino-zinc alloy as such, and that the process may be practiced in such a manner as to leave scarcely any appreciable percentage of contained aluminum in the final product and yet have the beneficial results due to the presence of aluminum at the time when the impurities are separated.

The proportions above given may be varied without affecting the substantial nature of the process, and, in fact, should vary with the amount of contained impurities. Thus where the zinc was fairly pure to commence with, I have obtained good results with one five-hundredth of one per cent. of metallic aluminum to the total metal of the bath, and have in other cases used as high as two per cent. with like good results.

The present high price relatively of aluminum, and the fact that in some cases a very high percentage thereof might not be desirable in the final product, fix a maximum limit, as it is not likely that the operator will add more than is necessary to refine the zinc up to the desired standard. Hence the above-described minimum and maximum amounts (viz., one five-hundredth of one per cent. and two per cent.) give a fair statement of the practical range of proportions which in my judgment will be found commercially available.

I am aware that an alloy of aluminum and zinc is not, broadly speaking, new, and I do not claim the same, nor the process of manufacturing such an alloy, the description of the mode of forming the alumino-zinc alloy in the foregoing specification being merely ancillary to the description of my real invention and with a view to indicating the best method of presenting the aluminum to the zinc bath in a highly-diffusible condition.

Having thus described my invention, I claim—

The hereinbefore-described process of refining zinc, which consists in diffusing metallic aluminum throughout a bath of melted zinc, permitting said composite bath to stand in a melted condition for the subsidence of impurities, and finally removing the stratum of refined zinc, substantially as set forth.

JOSEPH WILLIAM RICHARDS.

Witnesses:
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