

UNITED STATES PATENT OFFICE.

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TREATMENT OF ZINC ORES BY THE PRECIPITATION PROCESS.

975,217.

Specification of Letters Patent.

Patented Nov. 8, 1910.

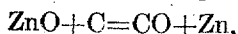
No Drawing.

Application filed December 6, 1909. Serial No. 531,592.

To all whom it may concern:

Be it known that I, ADOLPHE DESGRAZ, engineer, residing at 66 Sedanstrasse, at Hanover, Germany, a citizen of the Swiss Republic, have invented a new and useful Treatment of Zinc Ores by the Precipitation Process, of which the following is a specification.

In various previous patents it has been shown that it is possible to replace, industrially, the indirect slow and progressive reaction of carbon on roasted blende, which can be represented by the equation



by the instantaneous and direct reaction of precipitation or of substitution



(M being a metal having greater affinity for sulfur than zinc), on condition that the blende be brought to a fluid state or fluidified in the presence of the re-acting metal. With this end, several processes obtaining this result have already been described: all of them are based on the employment of a "dissolvent" for the zinc ore; said dissolvent is a substance, or a mixture of substances, capable of fluidifying the blende at a relatively low temperature and to bring it into a special and characteristic state in which it becomes extremely sensitive to the action of the re-acting metal: preferably said metal is iron in the state of cast iron.

A mixture, formed of an earthy base (lime or calcined dolomites) and of oxid of iron or of manganese was first proposed as a dissolvent for blende; at same time it was pointed out that the two latter oxids might be used simultaneously with the lime and the dolomite. Secondly, a mixture of peroxid of iron and monosulfid of iron was indicated as a dissolvent; said mixture allowed the recuperation of the products of the reaction. Later on this second mixture was discovered to be applicable to the treatment of oxidized zinc ores. Lastly, peroxid of iron alone, was recommended as a dissolvent of blende and of mixed ores in which the zinc is in a state of oxidized combinations, with a view of pre-melting the ore before putting it into contact with the re-acting metal.

All above methods require the employment of natural or artificial chemical prod-

ucts having a certain intrinsic value, and which, in addition, are not generally found on the spot or even in the neighborhood of the mine. It is therefore most advantageous to do away, whenever possible, with the use of said substances, the cost price and conveyance of which, though small, are sufficient to be considered; and to substitute materials of no value, and the removal of which is desirable, which are frequently at hand or are found in proximity to the mine. Lead slag, that is the product of the reducing of lead ores in blast furnaces, is such a material. It has been discovered that such slags make an excellent dissolvent for blende, that is, allow of fluidification at the same relatively low temperatures as the bodies previously used, and that the blende in that state offers the same facilities for being attacked by iron as when treated by the other dissolvents. Said slag, the composition of which varies according to circumstances, is however formed of certain principal elements which are found in the majority of them; it has been found that slags constituted of silica and alumina, oxids of iron and manganese, of lime and various sulfids, give good results. In addition, lead slags usually contain zinc in greater or less quantity; now, by reason of the fused state said zinc, whether it be in the form of sulfid, oxid or silicate, is attacked by the re-acting metal; consequently, independently of the zinc in the ore treated, the zinc held in the slag is also recovered which, up to now, could not be industrially and economically extracted by known metallurgical processes on account of its small quantity; said slags also contain lead which is precipitated in same way and can be collected separately.

As an example and to better fix ideas, lead slags, such as those of Broken Hill, may be cited as being a good dissolvent of blende; the composition of these approximates the following:

SiO ₂	24	100
FeO.....	31	
MnO.....	6	
CaO.....	13.5	
Al ₂ O ₃	5.5	105
ZnO.....	12.5	
Oxid of lead.....	2.7	
Sulfids, &c.....	4.8	

Freiberg lead slags can also be indicated as being approximatively of the following composition:

5	SiO ₂ -----	24
	FeO-----	44
	MnO-----	1
	CaO-----	4.75
	MgO-----	0.5
10	Al ₂ O ₃ -----	4.5
	ZnO-----	15
	PbO-----	3
	Sulfids, &c-----	3.25

The slags of Laurium may also be pointed out; these are generally admitted to possess a composition between limits of:

	SiO ₂ -----	27.50-35.70
	Fe ₂ O ₃ -----	14.00-25.00
20	CaO-----	10.00-28.00
	MnO-----	1.00-3.00
	Al ₂ O ₃ -----	3.00-9.00
	ZnO-----	2.00-9.00
	PbO-----	8.00-15.36

25 Independently of the use of ordinary fluxes necessitated by the gangue special to each ore, the process is reduced to the addition to the blende of lead slags which allow of its fluidification and consequent attack
30 by the re-acting metal, preferably cast iron; sometimes said lead slags may facilitate the fusion of the gangue of the blende, which should be taken into consideration when determining amount of flux required.

35 The details of carrying out the process, which are necessary to bring the ore to the proper fluid condition and into contact with the reagent, may be effected by any suitable apparatus and the operation may be either
40 continuous or intermittent. However, it may be stated that the method of premelting indicated previously for the treatment of similar ores, offers, with lead slags, the same advantages as with peroxid of iron as a dis-
45 solvent; therefore, generally, the mode of operation is as follows: in a melting furnace

of any known convenient pattern, the blende, with the addition of a proper quantity of lead slag, is melted; the quantity of slag depends on its nature and on that of the 50 gangue of the ore: said pre-melting is preferably done in a closed vessel and allows of the gangue being separated from the fluidified ore so that this latter is alone introduced into the precipitating chamber conveniently 55 fed with the re-acting metal; under these conditions, the zinc ore treated and the zinc compounds of the slag are energetically, rapidly and completely attacked. The pre-melting and the precipitation which follows 60 it can be, as has been stated, effected either with continuous apparatus or by intermittent ones.

Having now particularly described and ascertained the nature of our said invention 65 and in what manner the same is to be performed, I declare that what I claim is:

1. A process for the extraction of zinc from zinc sulfid ores which consists in employing lead slag as a dissolvent for the 70 ore and subsequently precipitating the zinc by a re-acting metal having a greater affinity for sulfur than has zinc.

2. A process for the extraction of zinc from zinc sulfid ores, which consists in heating 75 the ore with a suitable quantity of lead slag and a suitable flux until said ore becomes fluid, then precipitating the zinc from the fluid ore by a re-acting metal having a greater affinity for sulfur than has zinc. 80

3. A process for the extraction of zinc from zinc sulfid ores, which consists in heating 85 the ore with a suitable quantity of lead slag and a suitable flux until said ore becomes fluid, then precipitating the zinc from the fluid ore by the addition of cast iron.

In testimony whereof I affix my signature in presence of two witnesses.

ADOLPHE DESGRAZ.

Witnesses:

W. W. TEHORE,

R. PAUL THOMPSON.