

# UNITED STATES PATENT OFFICE.

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## PROCESS OF TREATING SULFID ORES.

SPECIFICATION forming part of Letters Patent No. 665,744, dated January 8, 1901.

Application filed June 28, 1900. Serial No. 21,988. (Specimens.)

*To all whom it may concern:*

Be it known that I, HUGH FITZALIS KIRKPATRICK-PICARD, a subject of the Queen of England, residing at London, England, have  
5 invented a certain new and useful Process of Treating Sulfid Ores, (for which I have made application for Letters Patent under No. 2,151, dated February 2, 1900,) of which the following is a specification.

10 This invention has for its object the treatment of what are commonly known as "complex sulfid ores"—i. e., those containing as chief constituents zinc, lead, gold, silver, and sulfur—of which type of ores the Broken Hill  
15 sulfid ores are good examples.

The novelty of my invention consists in the manner in which these known reactions are practically applied to smelting these complex ores, whereby commercially successful results  
20 are obtained.

My process is briefly described as follows: The ore is first finely ground in any suitable mill and is then submitted to an oxidizing roast in a reverberatory furnace with the object of producing the maximum amount of  
25 oxids of lead and zinc and the minimum amount of sulfates. The sulfurous gases produced during the roast may be collected and utilized in any of the ordinary well-known ways. Inasmuch as it is impossible in ordi-  
30 nary roasting practice to entirely convert all the lead sulfid present to lead oxid means must be taken to reduce to a minimum the amount of sulfate produced, and I find it useful after the first stage of roasting is finished,  
35 with the object of getting the ore as far as possible in the form of oxids, to mix a small amount of coal-slack or other carbonaceous material with the roasted charge while still in  
40 the furnace and to reheat the mixture for the further decomposition of such sulfates. By these means a high percentage of the lead sulfid is converted into lead oxid, and for practical purposes the amount of lead sulfate  
45 left in the charge is of no importance. The amount of carbonaceous material added will vary according to the composition of the ore, but will rarely exceed ten per cent. of the ore charge. The roasted ore after removal from  
50 the furnace is mixed with coal or mixture which on carbonization will produce a coke

and submitted to a zinc-distilling temperature in a retort or muffle-furnace in such a way that the flames or gases from the furnace shall not come into direct contact with the  
55 ore charge. This operation may conveniently be carried out in an ordinary zinc-distilling furnace. The result of this treatment is the production of metallic zinc and metallic lead. At the temperature of the furnace zinc is given  
60 off in the form of vapor, which is condensed to metal in the usual way. The lead, gold, silver, iron, and silica are left behind in the retort and suspended or hung up in a carbonaceous sponge or skeleton to be subsequently  
65 smelted.

In order to prevent the deleterious effect of the lead upon the retorts used, it is necessary to use an amount of coal of a bituminous character in considerable excess of the  
70 amount theoretically required to reduce the oxids; but its actual amount will vary with the different ores under treatment. The carbonaceous material cokes and forms a spongy matrix in which the particles of metallic lead,  
75 iron silicates, or other fusible substances are retained, so that their harmful action upon the retort is prevented.

I find it greatly advantageous to "briquet" the charge of roasted ore and carbonaceous  
80 material before charging the same into the furnace, with the object of coking the mixture into coherent masses. For this purpose bituminous coal or charcoal, anthracite, or similar material, in conjunction with a coking  
85 or binding material—such as tar, molasses, or pitch, or similar suitable material—may be employed. When briqueting is employed, a less excess of carbonaceous material may  
90 be used.

By means of briqueting the reducing agent is more intimately brought into contact with the oxids than can be effected by the best possible mixture of the dry powders. Further, each briquet becomes an independent  
95 distilling center, and the zinc vapor has no great distance to force its way out, as it would in the case of mixed powders in bulk. Briqueting also prevents the reduced lead  
100 particles from running together, and in consequence of the metal being held in the form of minute particles throughout the coke there



is no danger of this metal attacking the re-  
tort-walls, which otherwise, in the case of di-  
rect distillation of the powder, tends to hap-  
pen with harmful results.

5 The residue after extracting the zinc by  
distillation, as hereinbefore described, is  
smelted by any well-known method for the  
recovery of the lead and gold and silver and  
the separation therefrom of iron, silica, and  
10 other impurities that may be present.

Should any small amount of zinc be left in  
the residue, this will largely be recovered  
with the subsequently-smelted lead and will  
serve a useful purpose in desilverizing the  
15 latter according to what is known as "Parkes's  
method."

If the complex lead-zinc ore to be treated  
is considered too poor in either constituent  
for practical smelting purposes, under this  
20 invention it may be initially enriched to the  
required extent by the addition before grind-  
ing of galena or zinc-blende.

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

The process of treating sulfid ores con- 25  
taining silver, zinc and lead which consists  
in roasting the ore to the form of oxids, mix-  
ing the roasted product with carbonaceous  
material suitable for coking, forming the  
mixture into briquets, and distilling the bri- 30  
quets under such conditions that they are  
first coked into coherent masses and finally  
the zinc reduced and volatilized while the  
lead is reduced and the lead and silver re-  
tained in minute particles throughout the 35  
coke.

In testimony whereof I have signed my  
name to this specification in the presence of  
two subscribing witnesses.

HUGH FITZALIS KIRKPATRICK-PICARD.

Witnesses:

HAROLD WADE,  
HARRY DRIDGE.