

# UNITED STATES PATENT OFFICE.

ANSON G. BETTS, OF TROY, NEW YORK.

## PROCESS OF SMELTING LEAD SULFID.

No. 816,772.

Specification of Letters Patent.

Patented April 3, 1906.

Application filed May 26, 1905. Serial No. 262,489.

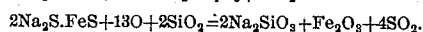
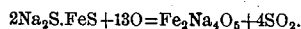
*To all whom it may concern:*

Be it known that I, ANSON GARDNER BETTS, a citizen of the United States, residing at Troy, in the county of Rensselaer and State of New York, have invented certain new and useful Improvements in Processes of Smelting Lead Sulfid, of which the following is a specification.

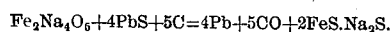
This process relates to combining the sulfur of lead sulfid at a smelting-heat with iron or similar metal and an alkali metal, as iron-alkali matte, leaving the lead in the free condition, and in recovering useful products from the matte.

In my application, Serial No. 208,946, filed May 20, 1904, I described a process of smelting lead sulfid with sodium carbonate, carbon and iron oxid, or manganese oxid. By using a well-proportioned furnace charge and a moderately-high heat three separate products may be obtained instead of two—namely, lead, matte, and slag. Samples of the matte have shown by analysis: S thirty-six per cent.; iron, 33.3 per cent.; lead, two per cent.; sodium, twenty-nine per cent.; calcium, .4 per cent., while the slag produced at the same time showed on analysis: FeO, 7.2 per cent.; SiO<sub>2</sub>, thirty-nine per cent.; CaO, 13.5 per cent.; MgO, .6 per cent.; Al<sub>2</sub>O<sub>3</sub>, 23.3 per cent.; Na<sub>2</sub>O, 17.7 per cent. In my application, Serial No. 262,490, filed herewith, for improvements in "Smelting lead sulfid," I have shown and claimed methods of smelting lead sulfid, producing similar heavy metal-alkali metal mattes and slags low in iron. By recovering the sodium of the matte from such processes as a compound not containing sulfur it can be used over again as desulfurizing agent, and by recovering the iron as oxid it, too, can be used over again as desulfurizing agent. The recovery of the iron and sodium of the matte in useful form I most suitably carry out by "converting" or "bessemerizing" the fluid matte by blowing a current of air through it or over it. When air is blown through the melted matte, the temperature goes up to a white heat, and large quantities of sulfurous acid are given off under the oxidizing influence of the air. Numerous chemical changes take place, and these may be altered intentionally by

changing the working temperature, speed of working, and additions to the charge, &c. Examples of the reactions probably taking place are



To induce the latter reaction, silica or slag should be in contact with or added to the molten matte being oxidized according to any of the well-known methods. The products can be used for making caustic alkali, alkali carbonate, water-glass, &c.; but it is especially suitable for smelting fresh quantities of lead-sulfid-containing materials. Sodium ferrite (Fe<sub>2</sub>Na<sub>4</sub>O<sub>6</sub>) and carbon probably react with lead sulfid in smelting, as follows:



In this process sodium is replaceable by potassium and perhaps by alkaline-earth metals and iron, in part, at least, by manganese, and perhaps by other metals.

Either hot or cold blast may be used in oxidizing, and the air-blast may either play on the surface of the melted matte or be blown through it.

It will be noticed that if silica is present in the converting process applied to the matte it combines with the alkali metal; but this does no harm, for the silica in the product, if it be used in smelting lead ore, becomes eliminated in the slag.

The liberated sulfur dioxid and sulfur trioxid may be utilized in the manufacture of sulfuric acid by well-known methods.

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

1. The process of converting lead sulfid into metallic lead and sulfurous gas which consists in reacting on it with materials containing an alkali metal and a heavy metal other than lead, producing metallic lead, and a heavy metal-alkali-metal matte, and eliminating a large part of the sulfur in combination with the alkali metal by air oxidation.

2. The process of converting lead sulfid into metallic lead and sulfurous gas which consists in reacting on it with materials containing an alkali metal and a heavy metal other than lead, producing metallic lead, and

a heavy metal-alkali-metal matte, and eliminating a large part of the sulfur from the fused matte by air oxidation.

3. The process of converting lead sulfid  
5 into metallic lead and sulfurous gas which consists in reacting on it with materials containing an alkali metal and a heavy metal other than lead, producing metallic lead, and a heavy metal-alkali-metal matte, and eliminating sulfur from the fused matte with an  
10 air-blast.

4. The process of converting lead sulfid into metallic lead and sulfurous gas which consists in reacting on it with materials containing an alkali metal and a heavy metal  
15 other than lead, producing metallic lead, and a heavy metal-alkali-metal matte, and eliminating sulfur from the fused matte by blowing a current of air through it when melted.

20 5. The process of converting lead sulfid into metallic lead and sulfurous gas which consists in reacting on it with materials containing an alkali metal and iron, producing metallic lead and an iron-alkali-metal matte,

separating the lead and some slag from the 25 matte, and oxidizing the fused matte by blowing a current through it when melted.

6. The process of converting lead sulfid into metallic lead and sulfurous gas which consists in reacting on it with materials containing iron and sodium, producing metallic  
30 lead and an iron-sodium matte, separating the lead, and blowing a current of air through the melted matte.

7. The process of smelting lead ore which  
35 consists in reacting on it with materials containing iron and sodium, producing metallic lead and an iron-sodium matte, separating the lead, blowing a current of air through the melted matte, and using the product in  
40 smelting lead ore.

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

ANSON G. BETTS.

Witnesses

MARY BATES PARKS,  
W. B. BARNHISEL.