

UNITED STATES PATENT OFFICE.

ANSON GARDNER BETTS, OF TROY, NEW YORK.

PROCESS OF SMELTING LEAD-SULFID ORES.

No. 821,330.

Specification of Letters Patent.

Patented May 22, 1906.

Application filed May 20, 1904. Serial No. 208,946.

To all whom it may concern:

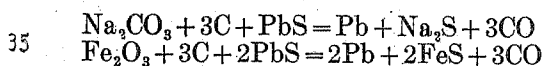
Be it known that I, ANSON GARDNER BETTS, a citizen of the United States, residing at Troy, county of Rensselaer, and State of New York, have invented certain new and useful Improvements in Processes of Smelting Sulfid Lead Ores, of which the following is a specification.

This invention relates to a process of desulfurizing galena by the combined action of carbon or carbon compounds and iron oxids with or without the assistance of basic sodium compounds, but always in presence of sodium sulfid or of substances yielding sodium sulfid.

The principal object of my invention is to smelt lead ore without requiring the admixture of silicious ores and to reduce the losses of lead in smelting.

To carry out my invention in its preferred form, I prepare a smelting charge consisting of approximately sixty-five parts lead sulfid, twenty parts siderite or limonite or the equivalent amount of other iron oxids free from or containing water, twenty parts sodium carbonate, which may be in part replaced by the equivalent amount of caustic soda, and twelve to fifteen parts fine coal or coke. In general the mixture will contain some silica, blende, pyrite, limestone, or other gangue of the lead-sulfid ore.

The principal reactions which take place when the mixture is heated are



The mixture is preferably smelted in an ordinary reverberatory smelting-furnace.

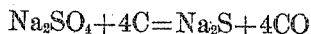
The fusion takes place at a moderate temperature, yielding nearly all the lead of the ore as metal and an easily-fusible iron-sodium matte.

Loss by volatilization of lead scarcely takes place at all when the charge is covered with a little coal or the flame in the furnace is reducing, I having observed that lead is only volatilized when oxidizing-gases come in contact with the charge.

The mixture can be smelted in a blast-furnace, which should be run so that there is an excess of carbon monoxid in the escaping gases. Success is attained by proportioning the furnace charge so that the matte produced contains considerable proportions of both iron sulfid and sodium sulfid, for the reason that the mixed sulfids melt at a compara-

tively low temperature and the mixture does not hold in igneous solution appreciable quantities of metallic iron or lead, which is the case with iron sulfid alone. Sodium sulfid alone is difficultly fusible. The matte, leaving out of consideration silica, zinc, &c., best approximates in composition the formula $\text{Na}_2\text{S} \cdot \text{FeS}$. As iron is a cheaper agent than soda, it is usually more economical to use more iron and less sodium than this formula requires. Iron ores containing manganese are equally as good as pure iron ores, as manganese acts analogously to iron.

When sodium sulfate or sodium sulfid are available at a low price, I can replace sodium carbonate as desulfurizer with iron oxid and add enough sodium sulfate or sulfid to reduce the percentage of iron sulfid in the matte to a desirable figure. When sodium sulfate is used, this reaction occurs:



Pyrite mixed with the galena can be figured as yielding sulfur and ferrous sulfid, which latter forms part of the matte.

Lead oxid if present in raw or roasted ore is directly reduced by carbon and takes no part in the formation of matte. Lead sulfate, if present, should be allowed for by allowing enough carbon to reduce it to lead sulfid, and then the lead sulfid produced should be figured as so much galena.

When I have specified iron in the claims, it is to be understood that iron is replaceable by manganese. It is also to be understood that sodium carbonate containing sodium hydroxid is available as sodium carbonate, for the result is the same.

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

1. The process of reducing lead sulfid which consists in smelting it with a carbon-reducing agent, iron oxid, and a suitable oxygenated sodium compound, in proportions to produce metallic lead, and an iron-sodium matte, as set forth.

2. The process of reducing lead sulfid which consists in smelting it, with a carbon-reducing agent, and basic compounds of iron and sodium, in proportions to produce metallic lead, and an iron-sodium matte, as set forth.

3. The process of reducing lead sulfid which consists in smelting it by radiated heat with carbon and basic compounds of iron and sodium in proportions to produce metallic lead, and a fusible iron-sodium matte, as set forth.

4. The process of reducing galena which consists in smelting it with carbon, iron oxid and a basic sodium compound, to produce metallic lead, and a fusible iron-sodium
5 matte, as set forth.

5. The process of reducing lead sulfid which consists in smelting it with carbon, iron oxid and sodium carbonate, to produce metallic lead and an iron-sodium matte in which iron
10 and sodium sulfids are present in approxi-

mately the proportion given by the formula $\text{Na}_2\text{S} \cdot \text{FeS}$.

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

ANSON GARDNER BETTS.

Witnesses:

EDWARD F. KERN,

WILLIAM VALENTINE.