UNITED STATES PATENT OFFICE.

FREDERICK M. BECKET, OF NIAGARA FALLS, NEW YORK.

PROCESS OF REDUCING METALLIC SULFIDS AND PRODUCING VANADIUM.

No. 876,313. Specification of Letters Patent. Patented Jan. 14, 1908.

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To all whom it may concern:

Be it known that I, FREDERICK M. BECKET, a subject of the King of Great Britain, residing at Niagara Falls, in the county of Niagara and State of New York, have invented certain new and useful Improvements in Process of Reducing Metallic Sulfids and Producing Vanadium, of which the following is a specification—

In the production of metals and alloys, for example vanadium or ferro-vanadium, from sulfid ores, it is customary to first roast the sulfid to an oxid and to then subject the roasted product or a concentrate therefrom to the action of a reducing agent.

According to the present process sulfid ores of vanadium and other metals are directly reduced by silicon and carbon, preferably in chemical combination as silicon carbid or carborundum.

The chief reaction which presumably occurs in the reduction of vanadium sulfid may be expressed by the following general equation:

$$4VxSy + ySiC = 4xV + ySiS_2 + yCS_2$$

Various intermediate and subsidiary reactions may take place and the process is not limited to the precise reaction or reacting proportions indicated in the equation.

The materials constituting the charge are mixed and heated to the requisite temperature, preferably in an electric furnace. By using a closed furnace and maintaining non-oxidizing conditions, both the silicon and carbon disulfids may be collected. Or these products may be burned with air to recover the sulfur contents as sulfur dioxid.

In the production of alloys of the vanadium or other reduced metal with iron, nickel or other metal, the alloying metal may be directly added to the charge or may be reduced from its compound added to the charge, simultaneously with the reduction of the metal of the sulfid.

By this process vanadium or vanadium alloys containing a very low percentage of carbon and merely a trace of sulfur may be produced from sulfid ores in a single operation by the use of a relatively cheap reducing agent.

I claim:

1. The process of reducing metallic sulfids, which consists in smelting a charge containing the sulfid, and a reducing agent comprising silicon and carbon.

2. The process of reducing metallic sulfids, which consists in smelting a charge containing the sulfid and a compound of silicon and carbon.

3. The process of reducing metallic sulfids, which consists in smelting a charge containing the sulfid and carborundum.

4. The process of producing alloys, which consists in smelting a charge containing a sulfid of one of the alloying metals, silicon, carbon, and a source of the other alloying metal.

5. The process of producing alloys, which consists in smelting a charge containing a sulfid of one of the alloying metals, a compound of silicon and carbon, and a source of the other alloying metal.

6. The process of producing alloys, which consists in smelting a charge containing a sulfid of one of the alloying metals, carborundum, and a source of the other alloying metal.

7. The process of reducing vanadium sulfid, which consists in smelting a charge containing the sulfid, silicon and carbon.

8. The process of reducing vanadium sulfid, which consists in smelting a charge containing the sulfid and a compound of silicon and carbon.

9. The process of reducing vanadium sulfid, which consists in smelting a charge containing the sulfid and carborundum.

10. The process of producing vanadium alloys, which consists in smelting a charge containing vanadium sulfid, silicon, carbon, and a source of the alloying metal.

11. The process of producing vanadium alloys, which consists in smelting a charge containing vanadium sulfid, a compound of silicon and carbon, and a source of the alloying metal.

12. The process of producing vanadium alloys, which consists in smelting a charge containing vanadium sulfid, carborundum, and a source of the alloying metal.

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

FREDERICK M. BECKET.

Witnesses:
D. BURGESS,
CHAS. F. RANSOM.