

UNITED STATES PATENT OFFICE.

HENRY SPENCER BLACKMORE, OF MOUNT VERNON, NEW YORK.

PROCESS OF REDUCING METALS.

SPECIFICATION forming part of Letters Patent No. 685,198, dated October 22, 1901.

Application filed March 22, 1901. Serial No. 52,391. (No specimens.)

To all whom it may concern:

Be it known that I, HENRY SPENCER BLACKMORE, a citizen of the United States, residing at 206 South Ninth avenue, Mount Vernon, in the county of Westchester and State of New York, have invented certain new and useful Improvements in Processes of Reducing Metals; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

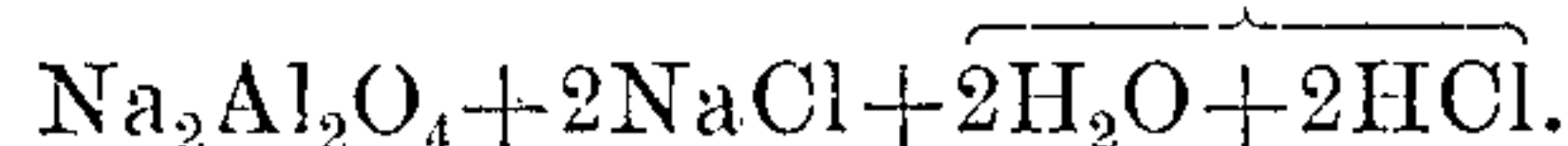
The object of my invention is to reduce metals from their double oxids—such as aluminates, titanates, chromates, manganates, &c.—in a rapid, efficient, and economical manner; and it consists, essentially, in exposing compound oxids of the character aforementioned to the action of metallic carbid in a heated or molten condition, substantially as hereinafter set forth.

My invention relates particularly to the reduction of aluminium and production of alloys therewith from metallic aluminates by the action of a metallic carbid, such as calcium carbid, but is not confined to the reduction of aluminium and production of alloys therewith, but may be applied to the reduction of many other metals, such as chromium, manganese, titanium, &c.

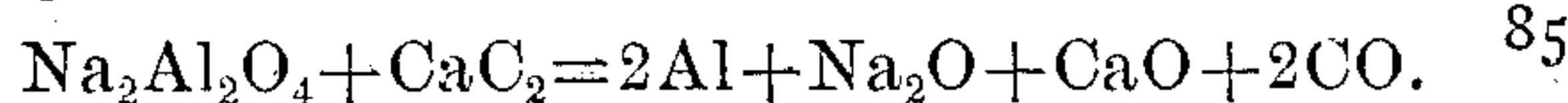
It is well known that many attempts have been made to reduce aluminium oxid by heating with carbon; but it is found that the great amount of heat required to be supplied to perform the reaction volatilizes the metal thus reduced. I have found, however, that by combining the aluminium oxid with an oxid of another metal forming aluminates—such as sodium aluminate, potassium aluminate, &c.—that the aluminium oxid combined therewith can be readily reduced to a metallic state by exposing the aluminate in a molten condition to the action of calcium carbid.

The manner in which I prefer to carry out my process on a practical basis is to melt a mixture of chlorid of sodium and potassium in proportion of about two parts, by weight, of chlorid of sodium with one part, by weight, of chlorid of potassium and add thereto aluminium hydroxid. Thereupon a reaction takes place liberating hydrochloric acid and

producing a mixture of potassium and sodium aluminate which remains in a molten condition, or, in case of excess of the molten chlorids, remains dissolved in or mixed therewith. The aluminate thus produced forms the subject-matter of Letters Patent No. 618,772, issued to me on January 1, 1899. The reaction which takes place may be illustrated by the following chemical formula or equation:



I then add to this molten bath of alkali-metal aluminate or molten alkali chlorids containing alkali-metal aluminate an equivalent of calcium carbid, at which time a reaction takes place, finally producing aluminium, calcium oxid, alkali-metal oxid, and carbonic oxid. If, however, the calcium carbid is in excess of that necessary to reduce all of the aluminium oxid present in the compound, an alloy of calcium and aluminium results. It is not necessary to state that other metallic carbids may be employed—such as magnesium carbid, aluminium carbid, &c.—so long as the carbon content of the carbid employed has greater affinity for the oxygen content of the compound to be reduced, in which case aluminium or alloys with the metallic base of the carbid employed may be obtained. The reaction which takes place may be illustrated by the following chemical formula or equation:



It is obvious also that I may reduce other metals—such as manganese, titanium, chromium, &c.—by employing a double oxid of said metals with an alkali metal forming manganates, titanates, chromates, &c., it being noted that the oxid of the heavier metallic base of the compound exists as an acid constituent of the salt employed. I can also employ alkali-metal aluminate direct—i. e., not produced during the process of production—without departing from the spirit of my invention.

The term “metallic carbid” as employed in this specification and claims is intended to include any mixture of combination of carbids as well as a simple carbid *per se*, and

the term "metallic oxid" relates to oxid of a metal naturally existing in liquid or solid form under ordinary atmospheric pressure and temperature before oxidation.

5 It is obvious that I can perform the reduction of the compound of metallic oxid with alkali metal *per se* in molten condition by the action of metallic carbid, or I can employ in conjunction therewith other compounds
10 which may facilitate the fusion or reduction by dissolving or suspending the same in a state of fusion, the object being to reduce the compound of metallic oxid with alkali metal in a state of fusion by action of a metallic carbid. I can also mix the ingredi-
15 ents and expose them to a heat capable of fusing the compound to be reduced or add either or both the compound to be reduced and reducing agent after fusion or during
20 fusion, or I can add to the fused bath more compound to be reduced and reducing agent from time to time as desired, making the process continuous, withdrawing the reduced metal at intervals, without departing from
25 the spirit of my invention, which consists in reducing a fused compound of alkali metal with metallic oxid by the action of metallic carbid.

30 Having now described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The process of reducing metals which consists in exposing a compound of a metallic oxid with an alkali metal in a molten state

to the action of a metallic carbid capable of 35 reducing said compound.

2. The process of reducing metals which consists in exposing a molten bath containing a compound of a metallic oxid with an alkali metal, to the action of a metal carbid 40 capable of reducing said compound.

3. The process of reducing aluminium which consists in exposing an aluminate in a molten state to the action of a metallic carbid capable of reducing said compound. 45

4. The process of reducing aluminium, which consists in exposing a molten bath containing aluminate to the action of metallic carbid capable of reducing said compound.

5. The process of reducing aluminium 50 which consists in exposing a molten bath containing an alkali-metal aluminate to the action of a metallic carbid capable of reducing said compound.

6. The process of reducing aluminium, 55 which consists in exposing an aluminate in a molten state to the action of calcium carbid.

7. The process of reducing aluminium which consists in exposing a molten bath containing sodium aluminate to the action of calcium carbid. 60

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

HENRY SPENCER BLACKMORE.

Witnesses:

C. C. WRIGHT,
WARREN C. STONE.