

UNITED STATES PATENT OFFICE.

WILLIAM H. GREENE AND WILLIAM H. WAHL, OF PHILADELPHIA,
PENNSYLVANIA.

PROCESS OF PRODUCING METALS.

SPECIFICATION forming part of Letters Patent No. 688,510, dated December 10, 1901.

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To all whom it may concern:

Be it known that we, WILLIAM H. GREENE and WILLIAM H. WAHL, citizens of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have jointly invented a new and useful Process of Producing Metals, of which the following is a specification.

The principal object of our invention is to provide a simple, expeditious, commercial, and comparatively inexpensive method for the production of metals and metallic alloys.

To this end and stated in general terms our invention comprises the reduction of metallic oxides or a mixture of oxides by means of silicon compounds, commonly called "silicids," or a mixture of silicids, and for our purpose we find that the silicids of magnesium, calcium, aluminium, barium, strontium, &c., are well adapted for reducing the said oxides to the metallic state, as described.

For the purpose of our invention we prepare, for example, a silicid of aluminium by any of the methods at present known and described. The silicids of this class, which are produced by the electrothermic or electrolytic methods, serve our purpose satisfactorily, and we have found that the highly-siliciferous aluminium obtained from crude or unrefined bauxite or other siliciferous ores of aluminium by the electrolytic method and which is apparently unsuited for any other metallurgical purpose answers the requirements of our process.

For example, let it be assumed that the object in view is to produce a practically carbonless iron suitable for castings. The procedure would according to our invention be as follows: The siliciferous aluminium above referred to would be incorporated with the proper quantity of iron oxid, preferably magnetite, to satisfy the reducing energy of both the aluminium and the silicon and heated in the presence of a suitable flux to the temperature needed for reaction. Lime and fluor-spar may be mentioned as fluxes which may be used. This temperature will vary according to the nature of the oxid employed. When the temperature reaches the point at which reaction can take place, the aluminium, in

virtue of its greater chemical energy, will first reduce its quota of the oxid, the reduced iron uniting with the silicon of the aluminium silicid forming a silicid of iron. This is the first stage of the operation. The superior affinities of the aluminium now being satisfied, it having been converted into alumina which has separated as slag, the charge at this stage of the operation consists of a more or less rich silicon iron and the surplus iron oxid. The affinities of the silicon of the siliciferous iron now have opportunity to exert themselves, and the reaction of the silicon with the oxygen of the remaining iron oxid takes place. This is the second and final stage of the operation, the result being the formation of silica, which enters into the slag, and a low-carbon iron in a state of very liquid fusion from the extreme heat liberated in these several reactions and in proper condition to afford clean and sharp castings. Other metallic oxides or mixtures of them may be substituted for the iron oxid.

The foregoing procedure is given simply as an illustration of the general applicability of our process.

In the foregoing operations it is obvious that where the character of the product makes it necessary to avoid the introduction of carbon they should be carried on in crucibles or furnaces lined with magnesite or other suitable materials; also, that fluxes suited to the nature of each case should be used to facilitate the proper fusion of the resulting metals or alloys.

Having now described our invention and given examples of its applications, we claim as our invention and desire to secure by Letters Patent—

1. The herein-described method which consists in incorporating silicids with metallic oxides, the heat of formation of which is less than that of the oxides of either element of the silicids, and subjecting the mass to heat, and thereby effecting the primary reduction of the oxides by the chemical energy of both elements of the silicids, substantially as described.

2. The herein-described method which consists in incorporating the silicid of aluminium

with metallic oxids, of which the heat of formation is less than that of the oxids of either element of the said silicid, and subjecting the mixture to heat and thereby effecting the primary reduction of the oxids by the chemical energy of both elements of the silicid, substantially as described.

In testimony whereof we have hereunto signed our names.

WM. H. GREENE.
WM. H. WAHL.

In presence of—

FRANK A. EISENBREY,
FRANK P. O'DONNELL.