

UNITED STATES PATENT OFFICE.

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METALLURGICAL PROCESS.

963,345.

Specification of Letters Patent.

Patented July 5, 1910.

No Drawing.

Application filed April 26, 1909. Serial No. 492,359.

To all whom it may concern:

Be it known that we, THOMAS L. WILLSON and MAXIMILIAN M. HAFF, subjects of the King of Great Britain, residing in Ottawa, in the county of Carleton, Province of Ontario, Canada, have invented certain new and useful Improvements in Metallurgical Processes, of which the following is a specification.

The invention aims to provide certain processes for securing silicids of calcium and one or more additional metals. Such products are useful in desulfurizing, dephosphorizing and deoxidizing metals, and especially in the refining and treatment of iron and steel: and the improved process permits the obtaining of such products in large quantities, and at comparatively low cost.

We have discovered that by smelting a mixture of compounds of silicon, and one or more compounds of additional metals, with calcium carbid a double or multiple silicid of the calcium and the additional metals are obtained. In this way the silicon may be utilized as a means for combining metals which it has heretofore been difficult or impossible to combine, such for example as calcium on the one hand, and iron, aluminium, magnesium, tungsten, vanadium, nickel and analogous or other metals. The smelting is preferably performed by exposing the mixture in the presence of carbon to the action of an electric arc, although other methods of supplying the necessary heat units may be used. As specific examples of the process of obtaining the silicids, the following descriptions refer to processes which we have carried out:—

Example I: A mixture of calcium carbid (CaC_2) containing probably a certain amount of a compound of magnesium, ground sandstone containing oxids of aluminium, silicon and magnesium and iron, and coke were fed to an electric arc furnace and subjected to a current of comparatively low voltage and high amperage. The coke and the carbon of the carbid apparently combined with the oxygen of the several oxids, leaving a silicid which including the slag

of unreduced materials gave the following analysis:—

Silicon	37.2	per cent.	
Calcium	23.3	"	"
Iron	4.4	"	"
Aluminium	2.74	"	"
Magnesium	4.96	"	"
Silica (SiO_2)	16.80	"	"
Carbid (CaC_2)	10.9	"	"

Example II: With materials similar to those used in Example I the product was formed into a pig. Analysis was made of part of the pig taken from the inside, a second sample taken from the outside layer and a third sample that leaked away from the furnace during the run, the quantities being illustrated in the first, second and third columns respectively. The analysis showed the following quantities:

	No. 1.	No. 2.	No. 3.
Silicon	54.57	76.20	47.60
Calcium	31.12	11.44	40.44
Iron	4.71	9.40	7.87
Aluminium	2.83	3.30	2.12
Magnesium	Undeter- mined.	Undeter- mined.	Undeter- mined.

The sand used in these two examples analyzed as follows:

Silica (SiO_2)	96.55
Lime (CaO)	0.77
Iron oxid (Fe_2O_3)	0.75
Alumina (Al_2O_3)	0.82
Magnesia (MgO)	0.28

The current measured 40 volts, and 6000 amperes.

The metals other than calcium which appear in the product may have been introduced to a greater or less extent either as impurities of the coke or as unreduced magnesia, or other impurities of the carbid.

The quantities of the metals other than calcium which are desired in the final product may be secured by properly selecting substitutes for or additions to the sand indicated in the above examples. For example, a higher percentage of magnesium

in the product may be secured by adding to the sand a certain quantity of magnesia, preferably in the form of magnesite. The percentage of aluminium in the final product
5 may be increased by substituting for sand an ordinary clay containing substantial quantities of both silica and alumina. Similarly the iron content of the product can be increased or a suitable content of tungsten,
10 vanadium, nickel and other metals may be obtained in the product by the introduction in addition to the silica, of iron ores, wolframite and oxids, or other compounds of vanadium, nickel and other desired metals.
15 The invention is applicable to original materials of various compositions to obtain correspondingly varying products; and it is to be understood that the compounds referred to may be either natural or artificial
20 and may contain other elements than those specifically referred to.

What we claim as our invention is:

1. Smelting a mixture of compounds of silicon and at least one of the compounds of the following metals, namely, iron, aluminium and magnesium with calcium carbid to obtain a silicid of the calcium and the above named additional metal or metals. 25

2. Smelting a mixture of compounds of silicon, carbon and at least one of the compounds of the following metals, namely, iron, aluminium and magnesium, with calcium carbid to obtain a silicid of the calcium and the above-named additional metal or metals. 30 35

It witness whereof we have hereunto set our hands in the presence of two witnesses.

THOMAS LEOPOLD WILLSON.
MAXIMILIAN MATTHIAS HAFF.

Witnesses:

RUSSEL S. SMART,
PEARLE CARROW.