PATENT SPECIFICATION

Application Date: March 23, 1937. No. 8489/37. **485,318**
„ „ March 23, 1937. No. 8490/37.

(Complete Specification divided out of the Complete Specification of Application No. 8105/37).

One Complete Specification Left: Aug. 28, 1937.

(Under Section 16 of the Patents and Designs Acts, 1907 to 1932).

Specification Accepted: May 18, 1938.

PROVISIONAL SPECIFICATION

No. 8489 A.D. 1937.

Improvements in and relating to the Treatment of Materials containing Tantulum and/or Niobium

I, WILLIAM WARREN TRIGGS, of the firm of Marks & Clerk, of 57 & 58, Lincoln's Inn Fields, London, W.C.2, a British subject, do hereby declare the nature of this invention, (a communication to me from abroad by Societe Generale Metallurgique de Hoboken, a Belgian Limited Company, of Hoboken-lez-Anvers, Belgium) to be as follows:—

This invention relates to the treatment of materials, such as ores or metallurgical by-products, containing tantalum and/or niobium.

The object of the invention is to extract the tantalum and/or niobium in the form of alloys.

The invention consists in subjecting the primary material to a reducing operation with one or more of the elements Al, Si, Ca, Mg, alloyed or combined with one or more metals as characterized below, in order to substantially separate the whole or the major part of the niobium or tantalum when one alone of said elements is present, or the niobium and tantalum together, when both are present, from the impurities.

The metals which are added to the reducing agents are such metals whose alloying or combination reaction with the aforesaid reducing agents develops heat so that the metallothermic power of a given quantity of these reducing elements is smaller in the obtained alloy or combination than the same quantity in the elementary state. Among these metals, nickel, cobalt, iron, are more particularly contemplated.

The raw material containing the tantalum and/or niobium may be subjected inside any suitable metallurgical apparatus, for instance in an electric furnace, to a reducing operation, with one or more of the elements Al, Si, Ca, Mg, alloyed or combined to nickel and/or cobalt and/or iron.

The reagents used may be in liquid or solid form.

The invention enables to obtain:

1) an alloy containing the major part of the reduced tantalum and/or niobium alloyed to the metal which has been used for reducing the thermal activity of the reducing agent, that is in the particular case alloyed to one or several of the elements nickel, cobalt, iron,

2) a slag rich in tantalum and/or niobium, which may be treated by any known process for the recovery of tantalum and/or niobium.

Dated the 23rd day of March, 1937.

MARKS & CLERK.

PROVISIONAL SPECIFICATION

No. 8490 A.D. 1937.

Improvements in and relating to the Treatment of Materials containing Tantulum and Niobium

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This invention relates to the treatment

of primary materials, such as ores or metallurgical by-products, containing niobium and tantalum.

The object of the invention is to concentrate the Nb in a product (alloy for instance) in which the ratio Nb/Ta is higher than that of the primary material.

The invention consists in subjecting the primary material to a selective reduction in the presence of one or several of the following reducing elements: Ca, Al, Si, Mg, alloyed or combined with one or more metals as characterised below, so as to obtain a product (alloy for instance) in which the ratio Nb/Ta is higher than that of the primary material. The amount of reducing element should be insufficient completely to reduce both the metals tantalum and niobium.

The metals which are added to the reducing agents are such metals whose alloying or combination reaction with the aforesaid reducing agents develops heat so that the metallothermic power of a given quantity of these reducing elements is smaller in the obtained alloy or combination than the same quantity in the elementary state. Among these metals, Nickel, Cobalt, Iron, are more particularly contemplated.

For carrying the invention into effect, the primary material containing tantalum and niobium may be subjected inside a suitable metallurgical apparatus, such as an electric furnace, to a selective reduction in the presence of one or more of the elements Si, Ca, Al, Mg, the thermic capacity of which has been diminished by alloying or combining them to other metals such as Ni, Co, Fe. The amount of reducing agent may be so calculated that the major part of the Nb contained by the primary material is reduced and passes into an alloy in which the ratio Nb/Ta is higher than that of the primary material. The other component elements of the alloy are the metal or metals used for lowering the thermic capacity of the reducing agent.

By the process according to the present invention, an alloy is obtained in which the ratio Nb/Ta is higher than that of the primary material, and also a slag is obtained in which the ratio Ta/Nb is higher than that of the primary material. The slag may be treated by any suitable known process with a view to recovering the tantalum and niobium.

The reagents used may be in solid or liquid form.

Dated the 23rd day of March, 1937.

MARKS & CLERK.

COMPLETE SPECIFICATION

Improvements in and relating to the Treatment of Materials containing Tantulum and/or Niobium

I, WILLIAM WARREN TRIGGS, of the firm of Marks & Clerk, 57 & 58, Lincoln's Inn Fields, London, W.C.2, a British subject, do hereby declare the nature of this invention (a communication to me from abroad by Societe Generale Metallurgique de Hoboken, a Belgian Limited Company, of Hoboken - lez - Anvers, Belgium) and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to an improved process for the recovery of tantalum and/or niobium in the form of metals or alloys from their ores, or from metallurgical by-products such as those in which the said elements may be found in the form of oxide compounds, free or combined.

According to the present invention, the primary material is subjected to a reduction in the presence of one or several of the following reducing elements: Ca, Al, Mg, alloyed or combined with at least one of the following metals: Ni, Co, Fe.

In this way it is possible to obtain a product (alloy for instance) in which the ratio Nb/Ta is higher than that of the primary material.

The metals which are added to the reducing agents are such metals whose alloying or combination reaction with the aforesaid reducing agents develops heat so that the metallo-thermic power of a given quantity of these reducing elements is smaller in the obtained alloy or combination than the same quantity in the elementary state.

For carrying the invention into effect, the primary material containing tantalum and/or niobium may be subjected inside a suitable metallurgical apparatus, such as an electric furnace, to a selective reduction in the presence of one or more of the elements Ca, Al, Mg, the thermic capacity of which has been diminished by alloying or combining them to one or more of the metals: Ni, Co, Fe. The composition and amount of reducing agent may be so calculated that the major part of the Nb contained by the primary material is reduced and passes into an alloy in which the ratio

Nb/Ta is higher than that of the primary material. The other component elements of the alloy are the metal or metals used for lowering the thermic capacity of the reducing agent.

By the process according to the present invention, an alloy may be obtained in which the ratio Nb/Ta is higher than that of the primary material, and also a slag may be obtained in which the ratio Ta/Nb is higher than that of the primary material. The slag may be treated by any suitable known process with a view to recovering the tantalum and niobium.

Example:

A concentrate is treated having the following analysis:

Fe% 9,04, Mn 8,59, TiO_2 3,48, Ta_2O_5 29,78 (or Ta% 24,45), Nb_2O_5 35,42 (or Nb% 24,80), SiO_2 4,25, Al_2O_3 6,36. CaO + MgO 1,00 –

Ratio $\frac{Nb}{Ta}$ = 1,01.

Composition of the charge:

Concentrate	1000	kilos
Alloy Al-Fe	325	,,
Lime	100	,,
Fluorspar	32	,,
	1457	kilos

The above Al-Fe alloy contains: Fe% 30, Al 70.

Products obtained: Alloy 465 kilos, Slag 930 kilos.

Analysis of the alloy:

Fe% 38,26, Mn 6,44, Al 0,40, Si 0,95, Ta 15,03, Nb 38,27, Ti 0,32.

Analysis of the slag:

Ta_2O_5% 21,27 (or Ta 17,46,) Nb_2O_5 10,01 (or Nb 7,07) TiO_2 3,07, SiO_2 1,80, MgO 12,25, CaO 8,43, MnO 3,52, Al_2O_3 38,64.

In my previous patents Nos. 467,483 and 467,484 relating to the recovery of tantalum and niobium from primary materials containing the same, I have claimed the addition of iron to the charge or to the reacting mass containing calcium or/and aluminium so as to obtain a final alloy of iron with tantalum and niobium.

According to the present invention however, the iron is alloyed or combined with the reducing element or elements when added to the charge.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

A process for the treatment of materials containing tantalum and/or niobium, for obtaining the Ta and/or Nb in metal or alloy form, in which the primary material is subjected to a reducing operation with one or more of the elements Al, Ca, Mg, characterised in that the reducing element or elements is or are alloyed or combined with at least one of the metals nickel, cobalt, iron.

Dated this 1st day of March, 1938.

MARKS & CLERK.

Exd. WL.

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Nb/Ta is higher than that of the primary material. The other component elements of the alloy are the metal or metals used for lowering the thermic capacity of the reducing agent.

By the process according to the present invention, an alloy may be obtained in which the ratio Nb/Ta is higher than that of the primary material, and also a slag may be obtained in which the ratio Ta/Nb is higher than that of the primary material. The slag may be treated by any suitable known process with a view to recovering the tantalum and niobium.

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Ratio $\frac{Nb}{Ta}$ = 1,01.

Composition of the charge:

Concentrate - - - - -	1000	kilos
Alloy Al-Fe - - - - -	325	,,
Lime - - - - - - -	100	,,
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	1457	kilos

The above Al-Fe alloy contains: Fe% 30, Al 70.

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In my previous patents Nos. 467,483 and 467,484 relating to the recovery of tantalum and niobium from primary materials containing the same, I have claimed the addition of iron to the charge or to the reacting mass containing calcium or/and aluminium so as to obtain a final alloy of iron with tantalum and niobium.

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