

## KROLL Guillaume (1889 - 1973) Esch sur Alzette

## **Chronology of William Kroll's patents**

Since Kroll published his own biographical note in 1955, <sup>1</sup> quotes from this publication will be used hereafter in the context of his patent portfolio.

1910

"The laboratories of the Technische Hochschule in Charlottenburg, Germany, where I studied iron metallurgy from 1910 to 1917, were well equipped with all sorts of furnaces. I spent the years of the First World War there as an assistant to the professor of iron metallurgy, W. Mathesius, and worked on my doctoral thesis under K. A. Hofman on the production of pure boron."

#### 1916

Kroll, still doctoral student at the Technische Hochschule in Berlin-Charlottenburg, was in the process of finishing his thesis on the production of pure boron, a study he had started in 1910 under Professor K. A. Hofman. At the same time, he started investigating lead alloys under Professor W. Mathesius.

Kroll's interest was directed towards developing, in general, a process for making alloys of the alkaline-earth metals.  $^{\rm 2}$ 

Kroll's first patent related to calcium-lead alloys followed by a second patent relating to barium-lead and strontium-lead alloys.

The barium-lead alloys, in particular, became of great importance to the German railway industry during World War I, when they were used for making bearings.

The German company Metallbank & Metallurgische Gesellschaft A.G. (M&M), later called Metallgesellschaft, <sup>3</sup> was engaged in 1916 in developing these bearings, which later received the name of *"Lurgimetall*".

"Lurgimetall" is a lead-based alloy, nominally containing 96.3-97.3% lead, 2-3% barium, 0.4% calcium, and 0.3% sodium.

The following table lists the main patents relating to the "*Lurgimetall*" technology owned by M&M, including the two patents specifically designating Kroll as inventor. The patents are arranged in chronological order according to their filing dates.

<sup>&</sup>lt;sup>1</sup> Journal of the Franklin Institute, Vol. 260, September 1955, pages 169-192

<sup>&</sup>lt;sup>2</sup> beryllium, magnesium, calcium, strontium, barium, and radium

<sup>&</sup>lt;sup>3</sup> "Metallbank A.G." and "Metallurgische Gesellschaft" merged in 1910 and became "Metallgesellschaft" in 1928





Application date	Grant date	Patent No	Title	Inventor	Owner
13/09/1916	04/11/1922	DE363125	Blei-Kalzium-Legierungen	not named (DPA Register 1922, p. 1454	Metallbank & Metallurgische Gesellschaft A.G
02/12/1916	21/09/1923	DE381577	Verfahren zur Darstellung von Blei- Kalzium-Legierungen	DrIng. Wilhelm Kroll in Luxemburg	Metallbank & Metallurgische Gesellschaft A.G
28/12/1916	13/12/1923	DE386602	Verfahren zur Darstellung von Legierungen des Bariums und Strontiums mit Blei	DrIng. Wilhelm Kroll in Luxemburg	Metallbank & Metallurgische Gesellschaft A.G
18/01/1917	09/04/1921	DE301380	Bleilegierung	not named (DPA Register 1918, p. 847)	Metallbank & Metallurgische Gesellschaft A.G
31/10/1917	19/07/1921	DE307672	Bleilegierung	not named (DPA Register 1921, p. 775)	Metallbank & Metallurgische Gesellschaft A.G
15/04/1918	04/11/1922	DE363127	Bleilegierung	not named (DPA Register 1923, p. 1454)	Metallbank & Metallurgische Gesellschaft A.G

## Lead-calcium alloys

The 2 patents filed in December 1916, and naming Kroll as inventor, relate to a process for preparing lead-based alloys while the other 4 patents, which do not designate an inventor, cover various embodiments of the alloy itself.

The table shows that M&M had developed a lead-calcium alloy in 1916 (DE363125, filed on 13/09/1916 and granted on 04/11/1922).

The two "process" patents of 1916 were probably filed initially by Kroll in his own name and subsequently assigned to M&M when he took up employment with them.

Kroll stated in 1956 that he left the Technische Hochschule Charlottenburg in 1918 (towards the end of World War I), to take on a job with a "*deutsches Metallunternehmen*", i.e. M&M.<sup>1</sup>

The three later "product" patents do not mention an inventor. Kroll was probably not directly involved in these inventions as he took up employment with M&M in late 1918 only. There is no good reason to doubt that Kroll was involved in determining the formulation of the final composition, commercialised as "*Lurgimetall*". Kroll's exact involvement and the timing thereof is not known, but it must be kept in mind that he had invented a process for making the alloy and that he had applied for more patents in his own name in the field in 1917.

Katrin Steffen, in an article on Kroll's supervisor in M&M, Polish engineer Czochralski, wrote: 2

Im Frankfurter Labor der Metallgesellschaft, dem "industriellen Zwilling des KWI für Metallforschung", in dem es Czochralskis Aufgabe war, nach neuen Materialien für die Industrie, den Transport und das Militär zu suchen, erzielte er auf dem Gebiet der Materialforschung Fortschritte, die bedeutsam wurden, weil Deutschland noch vom Embargo für strategische Materialien betroffen war. Dazu gehörte vor allem das 1924 erlangte Patent auf eine Metalllegierung für das Eisenbahnwesen, die nicht mehr das teure und importabhängige Zinn enthielt. Dieses Patent wurde von der Reichsbahn gekauft, daher erhielt es den Namen «Bahnmetall». Auch diese «Erfindung» aber war der Vorarbeit und der Zusammenarbeit mehrerer Ingenieure in dem Frankfurter Labor zu verdanken. Die Lagermetall-Patente aus den Anfängen von Czochralskis Tätigkeit in Frankfurt beruhten auf den grundlegenden Vorarbeiten des Ingenieurs Wilhelm Kroll, einem Assistenten von Walther Mathesius aus Berlin, und dessen «Lurgimetall» genannter Legierung. Czochralski hatte das von Kroll als «halbe Improvisation» vorgeschlagene Lurgimetall, das von der Deutschen Eisenbahn im Ersten Weltkrieg erfolgreich verwendet wurde, durch genauere Eingrenzung des Verhältnisses zwischen Blei, härtenden Erdalkalien und kornverfeinerndem Alkali für Jahrzehnte standardisiert. Später wurde es durch die Hinzufügung von Lithium

<sup>&</sup>lt;sup>1</sup> d'Letzeburger Land, 9 March 1956, page 3

<sup>&</sup>lt;sup>2</sup> Katrin Steffen, Wissenschaftler in Bewegung: Der Materialforscher Jan Czochralski zwischen den Weltkriegen, Zeitschrift für moderne europäische Geschichte (2008), pp. 237-261

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modifiziert und mit Rücksicht auf den Hauptabnehmer «Bahnmetall» genannt. Es wurde ein durchschlagender Erfolg.

Das Bahnmetall-Patent wurde von den USA, Großbritannien, Frankreich und auch Polen abgenommen. Es brachte Czochralski beträchtliche finanzielle Mittel ein, denn er – sowie anteilig zwei seiner Mitarbeiter – erhielten zehn Prozent des Reingewinns aus dem Verkauf des nach dem Patent hergestellten Metalls.

It is very likely that Kroll was one of the beneficiaries of these royalties mentioned by Steffen.

The brochure entitled W.J. Kroll, A Luxembourg scientist <sup>3</sup> states that:

Kroll scored a first important professional success in the year 1918, when he invented a new, very efficient bearing alloy on the basis of lead, which was sold in large quantities under the name "Lurgimetall". This invention by itself laid already the foundation of his financial independence. Kroll developed this alloy while he was working at the lead refinery of Kall/Schleiden, Germany, then belonging to the Metallgesellschaft in Frankfurt/Main (MG-Lurgi).<sup>4</sup>

This last statement needs to be clarified: Kroll had invented his process before he joined M&M and, indeed, developed it further while working for M&M. His basic inventions are shown to predate the employment with M&M for the following reasons:

- the 2 above-mentioned patents were filed in 1916, more than a year before Kroll went to work for M&M.
- in these two patents he is reported as living in Luxembourg.

Katrin Steffen's statement reported above:

Die Lagermetall-Patente aus den Anfängen von Czochralskis Tätigkeit in Frankfurt beruhten auf den grundlegenden Vorarbeiten des Ingenieurs Wilhelm Kroll, einem Assistenten von Walther Mathesius aus Berlin, und dessen "Lurgimetall "genannter Legierung

supports the point of view that Kroll had made his first two inventions on the *Lurgimetall* before he joined M&M.

#### 1917

From French patent FR514099, it can be seen that Kroll had filed on 3 February1917, 11 June 1917, 3 September 1917 and on 5 September 1917 patent applications in Germany on making alloys of the alkaline-earth metals. These patent applications did not proceed to grant in Germany but formed the basis for a second family of patents which he filed in 1920 in his own name, after he had left M&M. Kroll licensed this technology to M&M.

German patent DE410533 filed on 23 November 1917, is Kroll's basic patent leading to the process of debismuthising lead, which he further developed after having left M&M. Kroll sold this technology later to the German companies Th. Goldschmidt A.G. and M. Lissauer & Cie.

#### 1918

"I was hired at the end of the war by the Metallgesellschaft in Frankfurt/Main, and sent to their lead refinery at Call/Eifel, in the mountains. There I put to practice an idea of mine, to produce calcium lead to be used as bearing alloy and as a substitute for scarce tin Babbitt metal. I tried first to react calcium carbide with lead, which worked fine in the laboratory, but I did not succeed on an industrial scale because of the high temperature involved when working in the absence of fluxes.

Then I decided to react fused sodium lead with calcium chloride but, to lower the melting point of the salts, I used a mixture of calcium/barium chloride and obtained a calcium/barium lead alloy, which was later sold in large quantities for bearings under the name "Lurgimetall".

The statement: ... "*There I put to practice an idea of mine*"...seems to refer to the "idea" which had already found its expression in the patent applications filed in 1916.

<sup>&</sup>lt;sup>3</sup> W.J. Kroll, A Luxembourg Scientist, Fondation Nicolas Lanners 1998, page 11

<sup>&</sup>lt;sup>4</sup> In the "Journal of the Franklin Institute, 1955, page 17" Kroll erroneously used the name Metallgesellschaft for his former employers and so does the brochure W.J. Kroll, A Luxembourg scientist of 1998.





It is interesting to note that Kroll received royalty payments from Metallgesellschaft (former M&M) until at least 1941. On 18 July 1941 the Continental Illinois National Bank and Trust Company of Chicago sent the following enquiry to the Luxembourg ambassador in Washington: <sup>5</sup>

"We have received a cable request from the Reichsbank, Berlin, Germany dated June 21 1941 to charge their dollar account with us \$373.36 and pay a like amount to Mr. W. Kroll, Red Coach Inn, Niagara Falls, New York by order of the Metallgesellschaft, Frankfurt A.M., representing license fees.

Mr. Kroll, he advised us that the amount represents license fees which are due to him for patent rights by Metallgesellschaft, Frankfurt a. M., Germany, for many years.

The patent concerns a process for making hard lead, which is used for bearing metal, and partly as a substitute for antimonial lead.

In view of Mr. Kroll's statements in connection with his interest in Luxembourg, we deemed it advisable to bring the circumstances to your attention and would appreciate your acknowledgment of the transaction for the completion of our files."

Thus the bank asked for clearance to transfer the relatively modest amount of \$373.36 <sup>6</sup> to be paid to Kroll. The basic *Lurgimetall* patents having already expired in 1937, the 1941 royalty payments were probably related to other patents in Kroll's name that he had licensed to Metallgesellschaft (M&M).

Kroll expressed his surprise at this query as he had received payments previously in the US, without requests for clarification.

# Process for the separation and recovery of metals from metal alloys

Application date	Grant date	Patent No	Title	Inventor	Owner
23/11/1917	09/03/1925	DE410533	Verfahren zum Ausscheiden einzelner Metalle aus Metallgemischen	Wilhelm KROLL	Th. Goldschmidt A.G.
21/09/1920	05/09/1922	US1428041	Process for the separation and recovery of metals from metal alloys	Guillaume Justine KROLL	Guillaume Justine KROLL
15/09/1921	25/12/1925	DE423245	Verfahren zum Ausscheiden einzelner Metalle aus Metallgemischen	Wilhelm KROLL	Th. Goldschmidt A.G.
17/04/1930	08/07/1935	DE615566	Verfahren zum Entwismutieren von Blei	Wilhelm KROLL	M. Lissauer & Cie
16/09/1930	21/11/1935	DE622135	Verfahren zum Entwismutieren von Blei mit Erdalkalimetallen	Wilhelm KROLL	M. Lissauer & Cie

## (Debismuthising of lead <sup>7</sup> & Deantimonising of tin alloys)

This table shows that Kroll assigned his German inventions to industrial companies, against up-front payments rather than keeping the property of the patents and granting licences.

"Then I discovered that aluminum can be used to deantimonise and dearsenise tin alloys, especially solder. This process was put to practice by Th. Goldschmidt Co. Essen, to which I sold this idea."

Refined lead is consumed in a number of end-uses, of which lead batteries constitute by far the most important market, accounting for 60% of total lead consumption.

Still at university, Kroll filed patent applications on the debismuthising of lead (later known as "Betterton-Kroll process").

<sup>&</sup>lt;sup>5</sup> Correspondence Kroll-Luxembourg ambassador Hugues Le Gallais (Archives nationales, cote AE-AW-0457)

<sup>&</sup>lt;sup>6</sup> some 7,000 \$ at today's inflation rate conversion (2021)

<sup>&</sup>lt;sup>7</sup> DE410533, DE615566, DE622135, US1428041 (according to Kroll in Journal of the Franklin Institute 1955)





"Als ich die Technische Hochschule Charlottenburg im Jahre 1918 verließ und bei einem deutschen Metallunternehmen Anstellung nahm, schrieb ich meinem Chef über die Möglichkeit, Blei mit Kalzium vom Wismut zu befreien, ein wichtiges Problem, da Wismut in geringsten Mengen Bleiweiß braun färbt. Mein Vorgesetzter war nun ganz erbost über diese Dreistigkeit und er empfahl mir, nachdem er mich vorgeladen hatte, mir erst einmal zwanzig Jahre Bleihütten-Praxis anzueignen, ehe ich in solchen Dingen mitreden könnte. Nun, er war im Unrecht, denn meine Erfindung als «Grüner» wird heute auf 15% der Weltbleierzeugung angewandt."

Czochralski, to whom Kroll refers as "*mein Vorgesetzter*", was recruited by M&M in June 1917 shortly before Kroll took up his appointment with the company. Kroll made the proposal to Czochralski to further develop the debismuthising process but the latter refused. <sup>8</sup>

The "Betterton-Kroll" process made it possible to remove bismuth from lead and thereby to refine lead for industrial use. Kroll's patent rights were bought by the company «*American Smelting and Refining Co* » around 1923, <sup>9</sup> suggesting that Kroll received at the time a substantial payment.

#### 1919

At the end of 1919 Kroll departed for Vienna to prepare for his new job in Hungary.

"After about one year spent in the lead plant in Call, to get under way the production of Ca/Ba bearing alloy, I accepted a mission to go to Vienna in 1919 to study a process whereby tin, silver and gold were extracted from antimonial copper tin residues, originating from church bells. With this knowledge I went to Hungary where I spent the years of 1920 and 1921 on behalf of the Hungarian Government and two other associated companies ..."

In a contribution to the L'Echo des naturalistes of 1962, <sup>10</sup> Kroll further explained:

"Un jour vers la fin de l'année 1919, quand on chantait encore dans les dancings "Yes we have we have no bananas", je travaillais humblement dans une pauvre usine à plomb de l'Eifel allemande. Je reçus alors inopinément la visite d'un grand chef d'entreprise qui me tint a peu près le langage suivant: "Nous désirons que vous alliez entreprendre tout de suite pour nous la construction et la direction d'une usine a Csepel, près de Budapest, pour y récupérer de l'étain et des métaux précieux contenus dans des résidus de traitement de cloches, appartenant au gouvernement hongrois. - Moi? dis-je tout étonné. Il doit y avoir erreur! Car je suis a peine sorti d'université. Je n'ai pas la moindre expérience pratique - et je n'ai jamais dirigé une usine." Mais le grand chef insista, me disant que sa compagnie avait pleine confiance en mes talents et que, d'ailleurs, il n'y avait personne d'autre pour cette noble tâche. Ceci naturellement me flattait énormément et je ne pus, hélas! résister à la tentation. Si seulement j'avais su, en ce moment, ce qui se préparait pour moi!"

#### 1920

In October 1920, Kroll moved from Vienna to Budapest and on New Year's Eve of 1920 he moved from Budapest to the « Manfred Weiss » industrial complex in Csepel where he stayed for 2 years.

In his contribution to the publication *L'Echo des naturalistes* of 1962, Kroll reflects on his stay in Hungary but does not mention any particular research work or any inventions that he may have made at the time. <sup>11</sup>

## Process for preparing alkaline-earth metal alloys

From a French patent that was granted to Kroll in 1920, we learn that he had been working, as of 1917, on a process for preparing alkaline-earth metal alloys.

Kroll filed in his own name French patent FR 514,099 entitled "*Procédé de fabrication pour les alliages des métaux alcalino-terreux*" on 19 April 1920, and mentioned that it was based on 6 German patent applications filed on much earlier dates, at least the 4 patent applications filed in 1917 predating his

<sup>8</sup> d'Lëtzeburger Land, 1956, No 10, page 3

<sup>&</sup>lt;sup>9</sup> Helmut Maier, 100 Jahre Deutsche Gesellschaft für Materialkunde (2019), p. 12

<sup>&</sup>lt;sup>10</sup> L'Echo des Naturalistes, No 3, 31 December 1962, pages 2-5

<sup>&</sup>lt;sup>11</sup> to be further investigated



employment with M&M:

3 February1917, 11 June1917, 3 September 1917, 5 September 1917, 5 December 1918 and 18 December 1918.

RÉPUBLIQUE FRANÇAISE.						
OFFICE NATIONAL DE LA PROPRIÉTÉ	INDUSTRIELLE.					
BREVET D'INVENTION.						
VIII. — Mines et métallurgie. 2. — Métallurgie.	N° 514.099					
Procédé de fabrication pour les alliages des métaux	alcalino terreux.					
M. GUILLAUME JUSTINE KROLL résidant au Grand-Duché de Luxemb	oourg.					
Demandé le 19 avril 1920, à 15 <sup>h</sup> 33 <sup>m</sup> , à Paris. Délivré le 8 novembre 1920. — Publié le 2 mars 1921.						
(6 demandes de brevets déposées en Allemagne les 3 février, 11 juin, 3 et 5 septembre 1917, 5 et 18 décembre 1918. — Déclaration du déposant.)						

The patent applications from which priority is claimed never issued in Germany, possibly as a result of the World War I disturbances, but more likely because the applications were withdrawn by Kroll and replaced by a single combined patent application filed on 3 January 1920 which issued on 14 September 1923 under patent number DE381049.



Kroll was at the time living in Vienna, but gave an address in Frankfurt (27 Humbold-Strasse) as his residence.

Additional patents on the same subject matter were filed in the first semester of 1920 in Austria, Canada, Denmark, Switzerland, United Kingdom and the U.S.A.

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Application date	Grant date	Patent No	Title	Inventor	Owner
19/04/1920	08/11/1920	FR514099	Procédé de fabrication pour les alliages des métaux alcalino-terreux	Kroll Guillaume Justine	Kroll Guillaume Justine
20/01/1920	14/09/1923	DE381049	Process for making alloys of the alkaline-earth metals	Kroll Guillaume Justine	Kroll Guillaume Justine
30/01/1920	23/11/1920	US1359813	Production of alloy of alkaline-earth metals	Kroll Guillaume Justine	Kroll Guillaume Justine
15/04/1920	22/07/1924	DE399399	Verfahren zur Herstellung von Legierungen der Erdalkalimetalle	Kroll Guillaume Justine	Kroll Guillaume Justine
19/04/1920	01/08/1922	CA221726	Production of alloys containing alkaline-earth metals	Kroll Guillaume Justine	Kroll Guillaume Justine
21/04/1920	17/04/1922	CH94260	Arbeitsverfahren zur Herstellung von Metallegierungen mit einem Gehalt an Erdalkalimetall.	Kroll Guillaume Justine	Kroll Guillaume Justine
27/04/1920	17/10/1921	DK28617	Fremgangsmaade til Fremstilling af Metallegeringer med et Indhold af Jordalkalimetal.	Kroll Guillaume Justine	Kroll Guillaume Justine
19/05/1920	16/06/1921	GB164608	Process for producing alloys containing alkaline earth metals	Kroll Guillaume Justine	Kroll Guillaume Justine
29/06/1920	29/06/1920	LU11816	Procédé de fabrication pour les alliages des métaux alcalino-terreux	Kroll Guillaume Justine	Kroll Guillaume Justine

Kroll even filed a corresponding patent application in Luxembourg on 29 June 1920, where the patent issued under number 11816. <sup>12</sup>

BREVETS D'INVENTION. 0 GRAND-DUCHE Procès-verbal de dépôt. Ng 11816. L'an mil neuf cent vingt- le vingt-neur du mois de Juin à 5 heures du aoir; Devant le Conseiller de Gouvenement souvsigné a comparu le sieur M. Brandenburger, , domicilié à Luxembourg au nom du sieur Guillaume Justine Kroll, domini à l'ana our l'autor d'antre froit, domini à l'autoritation de la la qu'il représente en veta d'ane presuration daire de la. le 5 avril 1920 - enregistré à l'autoritation de la la le 5 avril 1920 - enregistré à l'autoritation de la la delivrer en brevet d'invention pour a processi - a déclaré voubér se faire délivrer en brevet d'invention pour a processi de l'autoritation pour la all'anges **OFFICE DE BREVETS CH. DUMONT** des métaux alcalino-terreux", 32, rue Joseph II LUXEMBOURG Téléphone Nº 481 Le dédarant a dépoit en même temps deux exemplaires signés de lui 1º de la description en longue <u>pranquisis</u> de l'adjet de l'invention; 2º du desain en <u>o</u><u>feille</u>, qui accompagne cette description. Le dédarant fait élection de donicile, pour loi et pour son mandat. Brevets d'invention, marques de fabrique, modèles d'utilité, dessins et modèles industriels, droits d'auteur, en tous pays. Les brevets ci-après sont à vendre ou à céder par licences: 1) N° 11159. — Procédé de séparation des éléments de l'air. – L'air Liquide S. A. pour l'exploitation des procédés Georges à Luxembourg, en la demeure de M. Ch.DUMONT. Il justifie du puiement de la première annuité de la taxe par la quittance Lan Ekraverse Attache-ill periectionné. — S. A. des Automobiles & Cycles Pengeot.
3) N° 11432. — Nouvelle disposition d'engrenages de marche-arrière pour boiles de changement de vitesse. — 3) № 11432. — Notiveite de chargement de vitesse. — La même.
4) № 11690. — Perfects, aux fours à coke. — Soc. des Fours à coke, Semet, Solvay & Piette.
5) № 10154. — Perfects, apportés au mécanisme de centrage ou d'aiustage pour machines à couler ou à composer les ca-ractères. — Lanston Monotype Corp. Ltd.
6) № 9844. — Régulateur de vitesse automatique pour véhi-cules industriels. — S. A. des Automobiles & Cycles Pengeot.
7) № 11790. — Perfects, apportés à la fabrication d'un acier spécial à surface stable. — P. A. E. Armstrong.
8) № 11770. — Roue métailique pour véhicules automobiles et son procédé de fabrication. — Société Michelin & Co.
9) № 11816. — Procédé de fabrication pour les alflages des métanx alcalino-terreux. — G. J. Kroll.
10) № 11724. — Périects, aux rasoirs de sûreté. — Durham Duplex Razor Co. Le déposant, Le Conseiller de Gouvernement, mundelingus Minus

<sup>&</sup>lt;sup>12</sup> Kroll was represented by M. Brandenburger





In 1923 Kroll's patent agent in Luxembourg, Charles Dumont, published an advertisement in one of the local newspapers offering to license or to sell Luxembourg patent No 11816. <sup>13</sup> This would indicate that the invention subject of patent No 11816 was not in use at the time. However, it is also to be kept in mind that these kind of public patent "offerings" by patent agents were made to prevent the patents from falling into the public domain for non-use, a legal pitfall in the legislation at that time.

Some of the patents filed in the years 1920 to 1922 show that Kroll was living at the following addresses, probably in this order:

- Frankfurt am Main, Humboldtstr. 27, <sup>14</sup> January 1920
- Luxembourg, 12 boulevard Joseph II, <sup>15</sup> November 1920
- Luxembourg, 52 rue Schmitz, Hollerich, <sup>16</sup> <sup>17</sup> September 1922



52 rue Schmitz, Luxembourg-Hollerich (2020)

By September 1922 Kroll had thus returned to Luxembourg.

### 1922

Kroll reported leaving Hungary to briefly work in Baden-Baden. He did not reveal which company he worked for, as employee or consultant?

"After leaving Hungary in 1922, the tin job having been accomplished successfully, I associated for a short time with a small foundry in Baden-Baden, Germany, where I set up the rudiments of a research laboratory."

Kroll filed corresponding patent applications only in 1924 (see below).

<sup>&</sup>lt;sup>13</sup> L'Indépendance luxembourgeoise, 27/03/1923, page 3

<sup>14</sup> Patentblatt 1923, page 966

<sup>&</sup>lt;sup>15</sup> Home of his parents, although sometimes also referred to as "place Joseph II"

<sup>&</sup>lt;sup>16</sup> Renamed rue Albert Ier in 1925 and situated in Luxembourg-Hollerich

<sup>&</sup>lt;sup>17</sup> In a "d'Lëtzeburger Land" contribution of 9 March 1956 (p. 3), Kroll mentions the year 1928, which must be a printing error.





Although Kroll reports that he set up his private laboratory in 1923, it is difficult to bring this date in concordance with the fact that he bought the premises in Luxembourg-Belair, where he set up his laboratory, only in August 1924.

Répertoire.       Espace réservé aux écritares de l'acte. — Musifiqueille file ben gubait ber tithunde befinnent.         Vol       Case.       Nº 372, Kaufakt vom 27 August 1924.         Vor dem unterschriebenen Jules Hamélius, Notar m       dem Amtswohnsitze zu Luxemourg, im Beisein der beiment.         20       Coss.       am Schlusse benannten Zeugen,         Ist erschienen:       Herr Leopold Hemmer, Industriel, #ohnend zu Piek         Dieser Komparent erklart hiermit zu verkaufer       unter der gesetzlichen Ge#ahrleitsung frei von         Schulden, Hypotheken, Privilegien und sonstigen La       Dem hier enwesenden dies ennehmenden Herma	Dé	éposé le / Inscr // io	treule Aout 1924 , vol. 120 Nº 1394 du dépôt. iption d'office du privilège du vendeur, vol. Nº d. id. du droit de résolution réservé, vol. N° Droit et salaire perçus, fr. 4501.50
Vol.       Case.       Nº 372,Kaufakt vom 27 August 1924.         Vor dem unterschriebenen Jules Hamélius,Notar m       dem Amtswohnsitze zu Luxemourg, im Beisein der D         20       Cest       am Schlusse benannten Zeugen,         Ist erschienen:       Ist erschienen:         Mentions conf'allart. 17 de in builde 25 sept. 1905.       Mo         Mo       Herr Leopold Hemmer, Industriel, mohnend zu Piek         Dieser Komparent erklärt hiermit zu verkaufer       unter der gesetzlichen Gemährleitsung frei von         Schulden, Hypotheken, Privilegien und sonstigen La       Dem hier anwesenden dies annehmenden Herrn	Ré	épertoire.	Espace réservé aux écritures de l'acte. — Ausfchließlich für den Juhalt der Urtunde bestimmt.
Vor dem unterschriebenen Jules Hamélius, Notar m dem Amtswohnsitze zu Luxemourg, im Beisein der be am Schlusse benannten Zeugen, Ist erschienen: Herr Leopold Hemmer, Industriel, #ohnend zu Diek Dieser Komparent erklart hiermit zu verkaufen unter der gesetzlichen Gemährleitsung frei von Schulden, Hypotheken, Privilegien und sonstigen La Dem hier anwesenden dies annehmenden Herma	Vol	d. Case.	Nº 372,Kaufakt vom 27 August 1924.
dem Amtswohnsitze zu Luxemourg, im Beisein der be am Schlusse benannten Zeugen, Ist erschienen: Mentions confrå Part 17 de in lei de 25 sept 1905. Mo Mo Herr Leopold Hemmer, Industriel, wohnend zu Diek Dieser Komparent erklärt hiermit zu verkaufer unter der gesetzlichen Gewährleitsung frei von Schulden, Hypotheken, Privilegien und sonstigen La Dem hier anwesenden dies annehmenden Herma	DE TRANSCR		Vor dem unterschriebenen Jules Hamélius, Notar mit
20 20 20 20 20 20 20 20 20 20	PTION		dem Amtswohnsitze zu Luxemourg, im Beisein der beiden
Mentions conft à l'art. 17 de la bit du 25 sept. 1905. Mo Herr Leopold Hemmer, Industriel, mohnend zu Diek Dieser Komparent erklärt hiermit zu verkaufer unter der gesetzlichen Gemährleitsung frei von Schulden, Hypotheken, Privilegien und sonstigen La Dem hier anwesenden dies annehmenden Herma	IN EMBOUR		am Schlusse benannten Zeugen,
Mentions conf' à l'art. 17 de la loi du 25 sept. 1905.			Ist erschienen:
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unter der gesetzlichen Gewährleitsung frei von Schulden, Hypotheken, Privilegien und sonstigen La 144 176 Dem hier anwesenden dies onnehmenden Herma		-	Dieser Komparent erklärt hiermit zu verkaufen
Schulden, Hypotheken, Privilegien und sonstigen La 944 176 Dem hier anwesenden dies onnehmenden Herma			unter der gesetzlichen Gemährleitsung frei von
949 155 Dem hier anwesenden dies annehmenden Herma			Schulden, Hypotheken, Privilegien und sonstigen Lasten
	944	1 155	Dem hier anwesenden dies onnehmenden Herm
Guillaume Kroll, Ingenieur, wonnend zu Luxemburg			Guillaume Kroll, Ingenieur, wohnend zu Luxemburg, Josph

The villa carried the names of Villa Leclerc or Villa Madeleine. 18 19

The villa had been on offer for sale since 1920 and it is therefore possible that Kroll rented or was given the right to use the premises in 1923 pending the completion of the sale before notary Jules HAMÉLIUS <sup>20</sup> in 1924.

On 15 August 1924, 12 days prior to the signing of the notarial act, an official notice was posted on the gate of the Villa Leclerc announcing the opening of a "*Physikalisch-chemisches Laboratorium nebst Gießerei für Metalle und mechanisches Atelier*" and giving the public the possibility of objecting to the project within 6 days. <sup>21</sup> The matter gave rise to an exchange of communications between residents of Belair and Kroll in the *Luxemburger Wort ("Stimmen aus der Leserwelt"*). <sup>22</sup> Kroll never received an official authorisation to operate his laboratory. <sup>23</sup>

Kroll wrote the following: <sup>24</sup>

"Zur Berichtigung der verschiedenen in dieser Zeitung wiedergegebenen Zuschriften sei es mir gestattet, die etwas beunruhigte Nachbarschaft der Villa Madeleine aufzuklären. Keine Fabriken will ich am Bel'Air bauen, keine

<sup>&</sup>lt;sup>18</sup> Villa Leclerc or Villa Madeleine, the latter name having been derived from Madeleine Schreiner, wife of Nicolas Leclerc, who built the villa in 1906; Leopold Hemmer acquired the property in 1919 and sold it to Kroll in 1924.

<sup>&</sup>lt;sup>19</sup> see also: Isabelle BECKER (2024) Guillaume Kroll, un grand scientifique et son laboratoire à Belair

<sup>&</sup>lt;sup>20</sup> Kroll's brother François was married to Jules Hamélius' sister.

<sup>&</sup>lt;sup>21</sup> Henri Kugener, Ons Stad No 98, 2011, pages 42-43.

<sup>&</sup>lt;sup>22</sup> Luxemburger Wort, 18 August 1924, page 3; Luxemburger Wort, 20 August 1924, page 5.

<sup>&</sup>lt;sup>23</sup> d'Lëtzeburger Land, No 10, 9 March 1956, page 3.

<sup>&</sup>lt;sup>24</sup> Luxemburger Wort, 21 August 1924, page 2.





neuen Industrien will ich dort gründen. Es sei betont, daß ich weder unerträgliche Geräusche, noch gefährliche Dünste in jener Gegend zu erzeugen beabsichtige, die der Nachbarschaft berechtigten Grund zur Beschwerde geben und den Wert der anstoßenden Gebäude und Gelände herabsetzen würden.

Das neue Forschungslaboratorium, das ich in der Villa Madeleine einzurichten beabsichtige, nachdem meine Bemühungen einen Neubau zu demselben Zwecke an anderer Stelle zu errichten infolge mißlicher Umstände gescheitert sind, ist bei kleineren Abmessungen natürlich vergleichbar mit dem in Dommeldingen befindlichen Institut Metz. Das Metallurgische Laboratorium, das ich zu Privatforschungszwecken einrichten will, bezweckt die Erforschung von Metall-Legierungen. Zu diesem Zwecke werden Metalle in kleinen Mengen, meist nur einige hundert Gramm, zusammengeschmolzen und vergossen. Hierzu die Gießerei - die der Nachbarschaft offenbar den größten Schreck eingejagt hat - in der kleinere elektrische und andere Öfen verwendet werden. Die gegossenen Proben werden abgedreht, chemisch auf ihre Zusammensetzung geprüft und mechanisch und physikalisch weiter untersucht. Hierzu sind Feinmessapparate allerhöchster Präzision erforderlich, deren Empfindlichkeit es mir verbieten würde, schädliche Dünste oder Erschütterungen zu erzeugen, die der Nachbarschaft unangenehm sein könnten.

Eine Verschandelung der Villa Madeleine und eine Degradation zur Gießerei wie es die Einsender anzunehmen glauben, wird nicht erfolgen, wofür der zugezogene Architekt auch bürgen wird. Ähnliche Institute befinden sich in allen Großstädten in der Nähe der Universitäten und Hochschulen ohne daß die Nachbarschaft zu klagen hat. Große Kredite werden alljährlich in den benachbarten großen Kulturstaaten zu ähnlichen Zwecken von Staatsmitteln bewilligt. Es ist darum nicht einzusehen, warum gegen derartige Unternehmen bei uns opponiert werden soll.

Der Hinweis auf die Wohnungsknappheit ist auch nicht stichhaltig, denn es wird doch noch wohl möglich sein, die 5 Bewohner der Villa Madeleine, die sich durch freiwilligen Auszug demnächst auf 3 reduzieren werden, in der Stadt unterzubringen, insbesondere wo derartige größere Appartements zu haben sind.

Nach dieser Sachlage werden die Verfasser der Petition, die ich durch persönliche Rücksprache überzeugt zu haben glaube soweit ich sie erreichen konnte, erkennen, daß ich ihnen kein unerträglicher Nachbar sein werde, denn was ich zu errichten beabsichtige ist ein neues Institut und keine Industrie. Hiermit dürfte diese Angelegenheit geklärt sein, die auf einem Missverständnis beruht, das durch den in Stichworten gehaltenen Text der ausgehängten Bekanntmachung "de Commodo" hervorgerufen wurde."

## Process for desulferising iron and steel

In 1922 Kroll filed a patent application in Germany (and later in France) for desulferising iron and steel.

Application date	Grant date	Patent No	Title	Inventor	Owner
12/03/1922	25/08/1925	DE418074	Entschwefelungsmittel für Eisen- und Stahlbäder	Wilhelm Kroll	Wilhelm Kroll
28/11/1923	02/07/1924	FR573866	Agent de désulfuration du fer et de l'acier	Guillaume Justine Kroll	Guillaume Justine Kroll

#### 1923

In the year 1923 Kroll set up his laboratory in Luxembourg (Bel-Air). He filed the following patent application:

Application date	Grant date	Patent No	Title	Inventor	Owner
02/06/1923	03/04/1928	DE458237	Alloy for soldering copper		Wilhelm KROLL Dr Ing

Kroll also applied in 1923 for a patent for magnesium-base alloys containing cerium: <sup>25</sup>

<sup>&</sup>lt;sup>25</sup> "Germ. Pat. Appl. B11558 VI/40 b, publ. June 18, 1925" according to Kroll.





"I also developed then a magnesium-base alloy with high creep strength at medium temperatures which contained up to 6 per cent cerium or "Mischmetall" and I proposed it to the I. G. Farbenindustrie. The company produced the alloy and the good creep properties were confirmed. However, the firm refused to go ahead with production because of the high cost of cerium-Mischmetall."

Kroll gives a reference to a German patent application, but no corresponding granted patent can be located.

## Si-Al alloys (Alusil and Alsia)

## 1924

"After leaving Hungary in 1922, the tin job having been accomplished successfully, I associated for a short time with a small foundry in Baden-Baden, Germany, where I set up the rudiments of a research laboratory. The first experiments in this place were quite successful. They concerned the creation of a low expansion piston alloy with good wear resistance, good creep strength and light weight. I developed there the hyper-eutectic 23% Si-Al alloys with small additions of copper, sold later for many years as "Alusil" in Germany and as "Alsia" in France. Favourable circumstances permitted the production of this alloy since it was brought out just at the right moment when sintered carbide tools made possible the machining of grooves in pistons cast of this hard alloy."

Kroll filed corresponding patent applications at the beginning of 1924.

Application date	Grant date	Patent No	Title	Inventor	Owner
08/03/1924	02/07/1929	DE478462	Kolben von Kraftmaschinen	Wilhelm Kroll	Wilhelm Kroll
08/03/1924	22/09/1925	FR594851	Alliages d'aluminium à haute résistance mécanique dans la chaleur, pour pistons de moteurs et autres usages	Guillaume Kroll	Guillaume Kroll

1926

"Later I found that zinc also can be used to deantimonise solder providing any copper present is entirely removed before the operation. This process was used commercially for sometime."

"A substitution of titanium or aluminum for beryllium in nickel-bearing steels was also found to impart considerable age-hardenability."

Application date	Grant date	Patent No	Title	Inventor	Owner
05/02/1926		DE458493	Production of metallic calcium		Wilhelm Kroll Dr Ing
17/02/1926		DE604337	Process for increasing the hardness of Fe-Ti-alloys		Wilhelm Kroll Dr Ing
21/05/1926	27/07/1928	DE458590	Eisenberylliumlegierung		Wilhelm Kroll Dr Ing
28/09/1926	24/12/1929	US1740857	Process for the production of metallic beryllium	Wilhelm Kroll	
29/09/1926		DE480128	Herstellung von metallischem Beryllium durch Umsetzung von Beryllium-Alkali- doppelfluoriden mit einem anderen Metall in geschmolzenem Zustand		Wilhelm Kroll Dr Ing
17/11/1926	21/11/1929	DE487431	Deantinomising of tin (with zinc)		Wilhelm Kroll Dr Ing



1927

Application date	Grant date	Patent No	Title	Inventor	Owner
01/05/1927	13/08/1931	DE531506	Hochfrequenzofen zum Raffinieren von Metallen, Legierungen oder Metallgemischen durch Verfluechtigung der Metallbestandteile		Huettenwerke Trotha A.G. Wilhelm Kroll Dr Ing

## Iron, nickel, beryllium alloys

## 1928

Application date	Grant date	Patent No	Title	Inventor	Owner
14/02/1928	06/02/1934	US1945653	Alloy (iron, nickel, beryllium)	Georg Masing Wilhelm Kroll	Metal & Thermit Corp
14/02/1928	07/02/1929	LU16435	Legierung		Siemens & Halske A.G. Wilhelm Kroll
14/02/1928	18/11/1929	FR669551	Alliage (fer, nickel, glucinium)	Kroll Wilhelm	Siemens A.G.
14/02/1928	06/05/1930	CA299984	Alloy (iron, nickel, beryllium)	Georg Masing Wilhelm Kroll	Siemens & Halske A.G.
14/02/1928	08/10/1934	DE603810	Warmbehandlung von Eisen- Nickel-Beryllium-Legierungen	Georg Masing Wilhelm Kroll	Siemens & Halske A.G.
14/02/1928	09/05/1930	GB306035	An improved alloy (iron, nickel, beryllium)	Georg Masing Wilhelm Kroll	Siemens & Halske A.G. Wilhelm Kroll
17/03/1928	03/10/1934	DE603574	Verfahren zur Herstellung von Berylliumlegierungen im Schmelzfluss	Kroll Dr-Ing Wilhelm Fischer Dr Hellmut	Siemens & Halske A.G. Wilhelm Kroll Dr
20/10/1928	13/06/1930	FR683540	Procédé pour l'utilisation des alliages contenant du cuivre et difficiles à utiliser	Kroll Wilhelm	Huttenwerke Trotha A.G. Wilhelm Kroll Dr Ing
20/10/1928	21/01/1931	GB341889	Improvements in and relating to the treatment of copper containing alloys	Kroll Wilhelm	Huttenwerke Trotha A.G. Wilhelm Kroll Dr Ing
19/12/1928	30/09/1929	DE483431	Entfernen von Eisen aus eisenhaltigem Gut, insbesondere Legierungen		Wilhelm Kroll Dr Ing; M. Lissauer & Cie

From a Canadian patent filed by Kroll in 1929<sup>26</sup> we learn the name of (two of) his assistants, namely: Franz RIES and N. BARTHEL.

Two witnesses for Wilhem Kroll: Luxemburg, Junuary 12. .. !! !!! M. Bouthel, Wilhelm Kroll

<sup>26</sup> Canadian patent No CA299984





## Copper, titanium alloys

### 1929

"A substitution of titanium or aluminum for beryllium in nickel-bearing steels was also found to impart considerable age-hardenability."

Application date	Grant date	Patent No	Title	Inventor	Owner
01/01/1929	03/10/1929	DE484395	Durch Glühen, Abschrecken und Altern vergütbare magnesiumhaltige Aluminiumlegierung		Wilhelm Kroll
16/02/1929	09/09/1930	FR689556	Alliage de fer et de titane	Kroll Wilhelm	
16/02/1929	28/01/1930	LU17266	Eisen-Titanlegierung	Kroll Wilhelm	
16/02/1929	07/07/1931	GB352964	Process for improving iron- titanium alloys		Wilhelm Kroll
28/02/1929	28/05/1931	GB349142	Process for improving copper- titanium alloys	Meno Lissauer; Henry Lissauer; Bruno Griesmann; Wilhelm Kroll	Lissauer Wilhelm Kroll
28/02/1929	25/04/1931	AT122471	Process for improving copper- titanium alloys	Meno Lissauer; Henry Lissauer; Bruno Griesmann; Wilhelm Kroll	Lissauer Wilhelm Kroll
28/02/1929	12/02/1935	US1991162	Process for improving copper titanium alloys	Kroll Wilhelm	Metal & Thermit Corp
28/02/1929	23/09/1930	FR690503	Procédé d'amélioration de cuivre titanifère ou d'alliages de cuivre titanifères		Kroll Wilhelm Compagnie M Lissauer
28/02/1929	12/04/1932	CA321370	Copper-titanium alloy	Kroll Wilhelm	Kroll Wilhelm
28/02/1929	01/03/1934	DE593783	Copper-titanium		Wilhelm Kroll Dr Ing; Lissauer & Cie

Kroll had granted Siemens & Halske exclusive rights to utilise his copper-titanium patents for a royalty rate of 5 percent.  $^{\rm 27}$ 

<sup>&</sup>lt;sup>27</sup> Henry A.Carey, Jr., Edwin D.Hicks, J.Pierre Kolisch and Joseph Schulein vs The United States, Report of decisions of the Supreme Court in Court of Claims cases, 1964, page 331



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Application date	Grant date	Patent No	Title	Inventor	Owner
18/01/1930	21/07/1931	FR708194	Acier nitré et son procédé de fabrication	Wilhelm Kroll	
18/01/1930	04/02/1936	US2029724	Nitrided steel and a process for its production	Wilhelm Kroll	
21/01/1930	26/02/1936	DE626402	Verfahren zur Herstellung von Berylliumlegierungen	Wilhelm Kroll	Siemens A.G. Wilhelm Kroll Dr Ing
08/03/1930	01/01/1935	US1986585	Nickel alloy	Wilhelm Kroll	Siemens A.G.
08/03/1930	06/11/1931	DE537716	Vergütung von Nickellegierungen	Wilhelm Kroll	Siemens A.G.
17/04/1930	08/07/1935	DE615566	Verfahren zum Entwismutieren von Blei	Kroll Wilhelm ?	Lissauer & Cie
16/09/1930	21/11/1935	DE622135	Verfahren zum Entwismutieren von Blei mit Erdalkalimetallen	Kroll Wilhelm ?	Lissauer & Cie
22/10/1930	20/04/1934	DE595818	Verguetung von Nickel-Erdalkali- oder Nickel-Lithium-Legierungen	Wilhelm Kroll	Siemens A.G.
30/12/1930	30/03/1932	GB370033	Improvements in and relating to beryllium steels		Wilhelm Kroll

## 

Application date	Grant date	Patent No	Title	Inventor	Owner
03/03/1931	17/01/1933	CA329492	Nickel alloy	Kroll Wilhelm	Siemens & Halske A.G.
20/03/1931	07/11/1933	CA337012	Iron-nickel-beryllium alloy processing	Kroll Wilhelm	Siemens & Halske A.G.
20/03/1931	29/05/1936	DE630457	Verfahren zum Ausscheidungshaerten von Eisen-Nickel-Beryllium- Legierungen	Kroll Wilhelm	Siemens A.G.
05/11/1931	14/02/1941	DE702561	Verfahren zur Steigerung der mechanischen Härte von Aluminium und Nickel enthaltenden Eiesenlegierungen	Wilhelm Kroll Dr Ing	Wilhelm Kroll Dr Ing



### 1932

Application date	Grant date	Patent No	Title	Inventor	Owner
17/03/1932	07/02/1933	FR41570E addition to FR669551	Alliage	Kroll Wilhelm	Siemens & Halske A.G. Wilhelm Kroll
19/03/1932	25/05/1933	GB392711	Process for improving the mechanical and magnetic properties of iron-nickel-beryllium alloys		Siemens & Halske A.G. Wilhelm Kroll
17/03/1932	17/03/1932	LU18876	Verfahren zur Verbesserung der mechanischen und magnetischen Eigenschaften von Eisen-Nickel- Berylliumlegierungen	Kroll Wilhelm	Siemens & Halske A.G. Wilhelm Kroll
14/05/1932	21/10/1936	DE637125	Verfahren zur Herstellung von solchen Gegenständen, deren Oberfläche durch Nitrieren und deren Kern durch Ausscheidung gehärtet werden sollen		Wilhelm Kroll Dr Ing
28/07/1932	10/07/1934	DE599862	Verfahren zur Entfernung von Arsen, Phosphor und Stickstoff aus Metallschmelzen der Eisengruppe		Wilhelm Kroll Dr Ing
28/10/1932	30/04/1934	GB409355	Improvements in processes for improving alloys containing iron, aluminium and nickel		Kroll Wilhelm
01/12/1932	25/05/1934	FR764636	Procédé et dispositif d'affinage de métaux par traitement à chaud dans le vide	Kroll Wilhelm	

#### 1933-1936

Application date	Grant date	Patent No	Title	Inventor	Owner
01/01/1933	17/09/1935	CA353030	Metal refining method	Kroll Wilhelm	American Smelting Refining
29/04/1933		DE577637	Nitrierstahl und Nitrierverfahren		Wilhelm Kroll
24/09/1935	15/04/1937	FR811487	Procédé de fabrication de métaux alcalinoterreux, notamment de baryum pour transformation chimique dans le vide poussé et à haute température	Kroll Wilhelm	
21/05/1936	18/01/1938	DE655547	Verwendung von Kupfer-Eisen- Legierungen für Bauteile von Kraftmaschinen		Wilhelm Kroll Dr Ing



## Titanium

"In the autumn of 1938 I went on a visit to the U.S. A. to sell my titanium-reduction process."

#### 1937-1938

Application date	Grant date	Patent No	Title	Inventor	Owner
10/07/1937	25/06/1940	US2205854	Method for manufacturing titanium and alloys thereof	Wilhelm Kroll	Wilhelm Kroll
10/07/1937	18/04/1939	DE674625	Verfahren zur Gewinnung von reinem Titan	Wilhelm Kroll	Wilhelm Kroll
18/09/1937	24/03/1942	DE718822	Verwendung titanhaltiger Legierungen	Wilhelm Kroll	Wilhelm Kroll
11/07/1938	28/11/1949	GB632564	Improvements in or relating to the manufacture of titanium in a cold-malleable form	Wilhelm Kroll	Wilhelm Kroll

In 1937 Kroll filed his two first patent applications on the "titanium" process in Germany. The first application, filed on 10 July 1937 (K47211) claimed the use of calcium as a reducing agent for the tetrachloride of titanium and the second application, filed on 7 October 1937 (K148168), claimed the use of magnesium as a reducing agent. Only the first patent application issued as patent in Germany (DE674625). This is surprising as it is limited to the use of calcium and does not explicitly cover the use of magnesium as reducing agent.

The corresponding US application initially claimed the priority of both German applications but only the earlier Germany priority was maintained during prosecution of the application. The US Patent Office, however, allowed a broad patent claim for an "alkaline earth metal" as reducing agent, and, in particular, for magnesium.

Kroll also obtained a patent for his "titanium" process in the UK (GB632564). While the US patent application was filed on 6 July 1938, claiming German priority of 10 July 1937, the British application was filed on 11 July 1938, just one day outside the priority year, thereby forfeiting the benefit of the 10 July 1937 filing date. There is no good reason for explaining this late filing of the British application other than that the British agent missed filing the application within the priority year ...



The British patent issued on 28 November 1949, more than 11 years after its filing date, another surprising element in the British patent file. It was followed by a patent of addition (GB658213), filed on 12 April 1949 and granted on 3 October 1951, specifically claiming the use of helium rather than argon as a protective gas during the reduction process.





Finally, in the context of Kroll's "titanium" investigations in 1937, a further German patent (DE718822) needs to be mentioned, as it claims alloys of titanium with metals such as tantalum, niobium, molybdenum, tungsten, etc. as corrosion resistant high optical reflective power alloys, possibly for use as mirrors ...

## Manganese-base alloys

#### 1939

Application date	Grant date	Patent No	Title	Inventor	Owner
04/01/1939		US2246886	Manganese-base alloy and method of making and using the same	Wilhelm Kroll	
04/01/1939	04/01/1939	LU25780	Kaltverformbare Manganlegierungen	Wilhelm Kroll	
22/05/1939		US2287888	Manganese-base alloys	Wilhelm Kroll	Electro Metallurgical Co
23/05/1939	23/05/1940	LU26363	Kaltverformbare Manganlegierungen	Guillaume Kroll	
24/07/1939		US 2310094	Electrical resistance element	William Kroll	
24/07/1939	24/07/1940	LU26555	Manganlegierungen mit hohem elektrischem Widerstand, und niedriger Wärmeleitung.	William Kroll	
27/07/1939	21/04/1942	DE719979	Mangan-Legierungen mit hohem Ausdehnungskoeffizienten	Kroll Dr-Ing Wilhelm	Heraeus Vacuumschmelze
27/07/1939	24/07/1939	LU26560	Mangan-Legierungen mit hohem Ausdehnungskoeffizienten	Kroll Dr-Ing Wilhelm	Wilhelm Kroll

## Zirconium

While Kroll experimented in 1937 with the magnesium-based reduction process of titanium chloride he realised that the same process could be used for producing pure malleable zirconium from zirconium chloride. He expressed this clearly in his second German patent application for the production of malleable titanium (K148168, filed on 7 October 1937)<sup>28</sup> in the following terms:

Selbstverständlich können auch andere Metalle durch das erfindungsgemässe Verfahren aus ihren Chloriden reduziert werden, wenn nur ihre Chloride sich dem Magnesium gegenüber ähnlich verhalten wie Titanchlorid.

In 1937 Kroll also disclosed his method of producing malleable zirconium using calcium as reducing agent in a scientific publication. <sup>29</sup> A year later he managed to use the magnesium-based reduction process on zirconium chloride.

"On July 13, 1938 the first zirconium reductions were made with a similar equipment, provided with a ZrCl4 evaporator."

He applied for a corresponding patent in Luxembourg, but did not file a patent application in any other country, or, if he did, no equivalent patent was granted outside of Luxembourg.

Application date	Grant date	Patent No	Title	Inventor	Owner
04/01/1939	04/01/1940	LU25781	Verfahren zur Herstellung von kaltverformbarem Zirkon	Wilhelm Kroll	Wilhelm Kroll

<sup>28</sup> the patent never issued

<sup>&</sup>lt;sup>29</sup> Zeitschrift für anorganische und allgemeine Chemie, Band 234, 1937, pages 42-50

## **KROLL Guillaume**



	Erfindungspatente
Grossherzogtum UXEMBURG	Anmeldungs-Protokoll
Nº 25781	
Im Ja	hre tausend neunhundert neununddreissig , den 4.
Januar	um 11 Uhr vormittags,
Erscl Charles Mur	hien vor dem unterfertigten Regierungsrat Herr
wohnhaft i W <b>ilhel</b> m KRC	n Luxemburg , welcher namens des Herrn
d <sup>en</sup> er kr	aft einer vom 4.Januer 1939 in Luxemburg
datierten	und am 4.Januar 1930 zu Luxemburg einre-
gistrierte	en Vollmacht vertritt-Schriftstück, das diesem Pro-
tokoll be	igefügt verbleibt-erklärt hat, sich ein Erfindungs-
patent au	f: "Verfahren zur Herstellung von kaltverformbarem
Zirkon".	

One author <sup>30</sup> states that Kroll obtained substantial financial rewards for his work on producing malleable zirconium but it is not clear from Kroll's patent portfolio which essential patents he held to justify collecting royalties from the emerging zirconium industry in the 1940s and 1950s.

<sup>&</sup>lt;sup>30</sup> Robert Stumper, d'Lëtzeburger Land, No 15, 13 April 1973, page 4



## **Kroll's US patents**

While it is generally acknowledged that Kroll gained early financial independence in the 1920s through patent royalty revenues, it is often reported that he was unfairly treated in the United States in the 1950s, in particular as far as patent royalties for his "Titanium" patent were concerned.

In order to understand why Kroll ended up in a lengthy litigation against the government of *The United States*, extending over 23 years, it is important to study the sequence of events which took place between 1942 and 1965.

However, we need to go back further in time in order to fully understand what happened. In particular, we need to look at two contracts that Kroll signed with Siemens & Halske (S&H) in the years 1930 and 1934, which contracts played an important role in Kroll's US patent portfolio.

## **Contracts between Kroll and Siemens & Halske**

In 1955 Kroll wrote the following: <sup>31</sup>

My publication on beryllium electrolysis [1926] brought me in contact with the German firm Siemens & Halske which tried to develop the Stock-Goldschmidt method of beryllium production. We agreed to exchange knowledge. Later these relations brought about a contract for more intimate collaboration in the general field of rare metals. The company paid me a small retainer to keep an assistant but the bulk of the expense fell on me. I hoped to be refunded some day by the sale of patent rights.

Kroll explained in these terms the origin of his first contract with Siemens & Halske (S&H) of 1930.

In 1934 he signed a second contract with S&H. The exact content of the contracts is not known since only those clauses of the contracts that became relevant in 1947 were revealed in the course of the litigation which Kroll conducted against *The United States*.

### 1930 contract

On 23 December 1930 Kroll entered into a first agreement with S&H; the following details are known from a first court case: 32

"The contract relates to a specified field of plaintiff's [Kroll's] inventions, and provides for assignment of patents to the German Corporation to exploit by granting licenses, the inventor to share in the license fees and the contract to run for 13 years unless sooner terminated as therein provided."

Kroll thus committed to assign, i.e. transfer property of patents obtained by himself, to S&H in specific fields, but reserved his right to share in the royalty fees that the patents might generate. The contract was to run until 1943 unless sooner terminated. Kroll obviously was looking for the large German corporation to promote the use of his inventions and for himself to participate in the royalties.

The 1930 contract applied to the following patents (inventions made between 23 December 1930 and 26 March 1934, date of the second contract):

Alloy (iron, nickel, beryllium):

DE603810 with its counterparts US1945653, CA299984, GB306035, FR669551 and LU16435.

Nickel alloys:

DE537716 and its counterpart US1986585

Process for improving the mechanical and magnetic properties of iron-nickel-beryllium alloys: GB392711 and its counterpart LU18876

<sup>&</sup>lt;sup>31</sup> Journal of the Franklin Institute, Vol. 260, September 1955, page 180

<sup>&</sup>lt;sup>32</sup> KROLL v. McGRATH, U. S. Atty. Gen., United States District Court, District of Columbia. April 4, 1950. "91 F.Supp. 173 (1950)"





#### 1934 contract

In the second contract, which Kroll signed on 26 March 1934 with S&H, he modified his approach by retaining full property of any patented inventions made by himself under the contract and, in counterpart, granting exclusive licenses to S&H (with the right to grant non-exclusive sub-licenses) on any patents obtained under the cooperation.

Under this deal, Kroll's only reward was to obtain full royalties from S&H and half the royalties obtained from sub-licenses, to be granted only by S&H. The relevant clause of the contract was summarised by a US court as follows: <sup>33</sup>

"On March 26, 1934, Kroll entered into a contract with a German corporation called Siemens & Halske (hereinafter referred to as S&H) under which he was to collaborate with S&H in the field of thermal and electro-thermal refining and metal production processes, the manufacture of alloys, etc. The agreement provided that S&H was to receive an exclusive license on any patentable invention developed by Kroll and that S&H would also have the right to grant non-exclusive sub-licenses. The royalty rate payable was to be computed "depending on the importance of the invention". Any royalties paid by sub-licensees were to be divided equally between the parties, share and share alike.

... in case of disagreement there should first be arbitration by two arbitrators, one named by each party, and that if they could not agree, the question should be litigated in the courts of Berlin.

Kroll declared in 1947 that the contract had been cancelled in 1938 by mutual agreement with S&H. <sup>34</sup>

By the time he began work with Lanners <sup>35</sup>, preparatory to taking his samples to the United States, Kroll had cancelled his consulting contract with Siemens & Halske which had agreed to compensate him for his research by releasing all foreign rights to the titanium patent.

An article published in 1954 in a Luxembourg weekly paper reported the following: <sup>36</sup>

Nach der Anfrage des Patentes wollte Siemens sich nicht gegenüber Kroll verpflichten und die Firma gab ihm schriftliche Vollmacht um über die Erfinderrechte zu verfügen. <sup>37</sup>

However, when challenged in 1947 to prove the cancellation of the 1934 contract, Kroll was not capable of providing a document signed by S&H evidencing the cancellation.

It is difficult to understand *a priori* what motivated Kroll to enter into such an open agreement on future patentable inventions. Kroll provided the following explanation in 1955: <sup>38</sup>

A good introduction to vacuum techniques was brought about by a job I received from Siemens  $\mathcal{E}$  Halske, namely to produce a few kilos of barium, and to fill it into thin nickel tubes for getters.

In other words, Kroll needed to acquire knowledge on vacuum technology in order to progress in his quest for producing pure malleable titanium.

# The complicated life of Kroll's US patent applications and patents

### Vesting orders

Luxembourg was invaded and occupied by the German Army on 10 May 1940, and so Kroll's US patents fell under the "*Trading With the Enemy Act*" and became the property of the *Alien Property Custodian*, a US governmental body established on 11 March 1942 to administer seized (vested) "enemy" property.

<sup>35</sup> Nicolas Lanners was a Luxembourgish engineer who had founded in 1931 the company Cerametal in Bereldange; Cerametal was equipped for drawing molybdenum and tungsten filaments for use in incandescent light bulbs.

<sup>36</sup> d'Letzeburger Land, 1954, N° 50, pages 3-4, TITAN, das strategische Leichtmetall Nr. 1 und sein Pionier, der Luxemburger, GIG KROLL (author not mentioned, but article probably written by Robert Stümper, a close friend of Kroll)

<sup>37</sup> no evidence of such a written amendment to the original agreement was provided to the US courts

<sup>&</sup>lt;sup>33</sup> Cases decided in The United States Court Of Claims January 1, 1964, to February 28, 1964, page 322

<sup>&</sup>lt;sup>34</sup> Black Sand : "The history of titanium", Kathleen L. Housley, 2007, page 124, footnote 21

<sup>&</sup>lt;sup>38</sup> Journal of the Franklin Institute, Vol. 260, September 1955, page 178





The *Alien Property Custodian*'s Annual Report of 30 June 1944 shows the nationality of the owners whose property was seized:

## Table 5.—NET EQUITY VESTED IN WORLD WAR II, CLASSIFIED BY NA-TIONALITY OF FORMER OWNERS, AS OF DATES OF VESTING AND AS OF JUNE 30, 1944

	Net equity vested (in thousands of dollars)		Percent of total net equity vested	
Nationality of former owners	As of dates of vesting	As of June 30, 1944	As of dates of vesting	As of June
Total	197, 013	212, 426	100. 0	100. 0
German Japanese Italian Hungarian Roumanian Bulgarian Enemy-occupied	125, 598 52, 705 15, 019 2, 123 459 530 579	139, 398 53, 594 15, 242 2, 153 458 530 1, 051	63.7 26.8 7.6 1.1 .2 .3 .3	65. 6 25. 2 7. 2 1. 0 . 2 . 3 . 5

For the "Alien Property Custodian", Kroll was a national of Luxembourg and thus had the nationality of a citizen of an "Enemy-occupied" territory. The following orders were issued against him:

## Order 1

On 2 November 1942 a first general vesting order (Vesting Order 296)<sup>39</sup> was taken against all Luxembourg nationals having applied for patents in the USA, the order including two pending patent applications filed by Kroll.

	[Vesting Order Number 296]	
	E. MULLER, ET AL.	
	PATENT APPLICATIONS OF FOREIGN NATIONALS	
	Under the authority of the Trading with the Enemy Act, as amended, and Executive Order No. 9095, as amended, and pursuant to law, the undersigned, after investigation, finding that the property described as follows:	
	Patent applications listed and described in Exhibit A attached hereto and made a part hereof,	
	is property in which nationals of a for- eign country (Luxembourg), have inter- ests, and having made all determinations and taken all action, after appropriate consultation and certification, required by said Executive Order or Act or other- wise, and deeming it necessary in the national interest, hereby vests such prop- erty in the Alien Property Custodian, to be held, used, administered, liquidated, sold or otherwise dealt with in the in- terest of and for the benefit of the United States.	
322, 930   3/8/40   W. Kr 322, 931   3/8/40   W. Kr	oll Electrical resis oll Bimotallic elen	tance elements. Tents and alloys useful therein.

<sup>39</sup> Federal Register, Volume 7, No 232, 26 November 1942, page 9842





The order concerned Kroll's patent applications

- Nº 322930/1940 for "Electrical resistance element" (issued later as patent US2310094).
- N° 322931/1940 for "*Bimetallic elements and alloys useful therein*" (the patent application did not proceed to grant).

### Order 2

A general vesting order, Vesting Order 670 (5 April 1943), <sup>40</sup> was taken affecting all US patents in the name of Luxembourg entities, individuals or companies, which were in force at the time.

Kroll was the owner of two patents that were listed and formally seized:

• US Patent N° US2246886: "Manganese base alloy and method of making and using the same"

2,246,886. Manganese base alloy and method of making and using the same. Kroll William (inventor). Issued 6-24-41.

• US Patent N° US2505854: Method for manufacturing titanium and alloys thereof.

2,205,854. Method for manufacturing titanium and alloys thereof. Kroll Wilhelm (inventor). Issued 6-25-40.

#### Order 3

Another US patent of 1935 based on an invention by Kroll which had been assigned to the German company Siemens & Halske (S&H, see above) was seized by the US authorities through Vesting Order 152 (17 September 1942): <sup>41</sup>

• US Patent N°US1986585: *Nickel alloy.* 

<sup>&</sup>lt;sup>40</sup> Federal Register, Volume 8, No 76, 17 April 1943, pages 5003-5004

<sup>&</sup>lt;sup>41</sup> Federal Register, Volume 7, No 202, 14 October 1942, page 8322





 [Vesting Order 152]
 Executive Order No. 9095, as amended,<sup>1</sup>

 PATENTS OF ENEMY NATIONALS
 and pursuant to law, the undersigned, after investigation, finding that the property described as follows:

 Under the authority of the Trading with the enemy Act, as amended, and
 ervy described as follows:

 17 F.R. 1971.
 Image: Note that the property described as follows:

 17 F.R. 1971.
 Image: Note that the property described as follows:

 1,980,685
 1/1/35
 W. Kroll.

The vesting order specifically mentions W. Kroll as inventor.

#### Order 4

Vesting Order 2193 (12 October 1943) <sup>42</sup> was directed towards:

• US Patent N° US2029724 (nitrided beryllium steels)

[Vesting Order 2193]

SIEMENS AND HALSKE A. G., ET AL. Re: Interests of Siemens & Halske A. G., Heraeus-Vacuumschmelze A. G., and Alfred Stock, in a contract relating to patents.

Under the authority of the Trading with the Enemy Act, as amended, and Executive Order No. 9095, as amended, and pursuant to law, the undersigned, after investigation, finding;

1. That Siemens & Halske A. G. and Heraeus-Vacuumschmelze A. G. are corporations organized under the laws of and having their principal places of business in Germany and each of them is a national of a foreign country (Germany); (d) A letter from Heraeus-Vacuumschmelze A. G. to The Beryllium Corporation, dated January 25, 1934;)

by and between The Beryllium Corporation, Siemens & Halske A. G., and Heraeus-Vacuumschmelze A. G. relating among others to Patent No. 2,029,724, dated February 4, 1936, inventor Wilhelm Kroll, for Nitrided Steel and Process for Its Production.

Pa	tented Feb. 4, 19	36		2,029,724
	UNITED	STATES	PATENT	OFFICE
	UNITED	2.029.7	24	011102
	N	ITRIDED STEEL AND A PRODUCT	A PROCESS FOR ITS TION	<b>j</b>
		Wilhelm Kroll, Luxem	burg, Luxemburg	
	N	o Drawing. Application . No. 506,973. In German	January 6, 1931, Serial ny January 18, 1930	L
		14 Claims. (Cl	L 148—16)	•

The patent had issued to Kroll, but according to Vesting Order 2193, Kroll had assigned his patent rights to Siemens & Halske A.G., Heraeus-Vacuumschmelze A.G. and Alfred Stock who in turn had granted a license to the US company Beryllium Corporation. <sup>43</sup>

<sup>&</sup>lt;sup>42</sup> Federal Register, Volume 8, No 208, 13 October 1943, page 13987

<sup>&</sup>lt;sup>43</sup> Presumably pursuant to his 1930 contract with Siemens & Halske



## Order 5

Vesting Order 2444 (12 October 1943) <sup>44</sup> was directed towards:

• US Patent N° US1945653:



The patent had issued to Metal & Thermit Corporation, but according to Vesting Order 2444, it had been further assigned to Siemens & Halske A.G.  $^{45}$ 

The vesting order specifically mentions W. Kroll as co-inventor.

## **Appeal by Kroll**

Kroll immediately appealed against the "vesting order" imposed on his patent application 322931 (*Bimetallic elements and alloys useful therein*), see "Order 1" above.

The appeal consisted in an administrative procedure before the Office of the *Alien Property Custodian*. Kroll's appeal led to "*Divesting order 8*" issued on 19 August 1943. <sup>46</sup>

<sup>&</sup>lt;sup>44</sup> Federal Register, Volume 8, No 238, 1 December 1943, page 16224

<sup>&</sup>lt;sup>45</sup> This patent, filed prior to 1930 did not fall under the scope of Kroll's 1930 contract with Siemens & Halske

<sup>&</sup>lt;sup>46</sup> Federal Register, Volume 8, No 208, 13 October 1943, page 13991





[Divesting Order 8] PATENT APPLICATION OF WILLIAM KROLL Under the authority of the Trading with the Enemy Act, as amended, and Executive Order No. 9095, as amended, and pursuant to law, the undersigned: 1. Having, on November 2, 1942, vested, by Vesting Order No. 296, as property in which a national or nationals of a foreign country (Luxembourg) had interests, the property identified as follows: Patent application identified as follows: Serial Number, Filing Date, Inventor, and Title 322,931, 3-8-40, William Kroll, Bimetallic Elements and Alloys Useful Therein.

Kroll thus recovered full property of one of his pending patent applications. 47

Kroll did not appeal against the seizure of his second patent application which issued as patent No US2310094, "vested in the Alien Property Custodian". <sup>48</sup>



There is no reason to doubt that the grounds developed by the Custodian in Divesting Order 8, admitting an error ("... *the error committed in vesting said property should be corrected* ..."), could also have justified a "divesting" decision for all of Kroll's patent interests in the USA, including his granted patents.

The "divesting order" namely reads as follows:

1. ...

- 2. Having determined, before issuing said Vesting Order No. 296, that William Kroll was a resident of Luxembourg and was a national of a foreign country (Luxembourg):
- 3. Having thereafter received an executed claim by or on behalf of William Kroll, residing at Niagara Falls, New York, hereinafter called claimant, in which it was recited that the above entitled property was on the date of vesting owned by the said claimant;
- 4. Finding, as a result of further investigation, conducted subsequent to the date of vesting, that said property and all right, title and interest therein were at the time of vesting owned by claimant, and that the said claimant was at that time, and at all times since then has been and now is an individual residing in the United States;
- 5. Determining upon the basis of the facts at present known to the Alien Property Custodian that claimant is not a national of a designated enemy country;

<sup>&</sup>lt;sup>47</sup> The patent was never granted (withdrawn or refused?)

<sup>&</sup>lt;sup>48</sup> It is possible that Kroll appealed, but that the Custodian's decision to return the patent application to Kroll did not reach the US Patent Office in time before the grant date of the patent.





- 6. Determining that the aforesaid vesting was effected by the undersigned under mistake of fact.
- 7. Having received no other claim or notice of claim on Form APO-1 or otherwise to the said property or to any Interest therein, or arising as a result of said vesting order, and having no knowledge of any interest in such property held by any national of any foreign country;
- 8. Having neither assigned, transferred, or conveyed to anyone the said property or any part thereof or any interest therein, nor issued any license with respect thereto, nor in any manner created any right or interest in any person whomsoever;
- 9. Determining that the error committed in vesting said property should be corrected by assigning and conveying said property to said claimant, and that such disposition of the said claim, being for the purpose of correcting a mistake in vesting such property originally, does not require the filing of any further claim, nor any further hearing;

Kroll, however, waited until 1947 to reclaim full property of his two most important US patents, namely the "Nickel alloy" patent and the "Titanium" patent. He probably expected to recover his rights automatically after the war.<sup>49</sup>

## Life of the US patents after the vesting orders

The "Nickel alloy" patent (US1986585)



Under Kroll's contractual obligations with S&H (see contract of 1930 above) the patent had been assigned to S&H and it issued therefore in the name of S&H, but naming Kroll as inventor.

As described above, shortly after the creation of the *Alien Property Custodian*, US patent 1986585 was seized on 17 September 1942 under Vesting Order 152 <sup>50</sup> directed towards all US patents of S&H.

The Nickel alloy patent was important to Kroll since he still wished to settle a dispute he had with the *International Nickel Company* which had been using his invention without license for many years. Kroll wrote the following in 1965: <sup>51</sup>

... Looking for a substitute for beryllium in age-hardenable nickel-base alloys, I discovered one day a considerable precipitation hardening with commercial nickel to which I had added 0.2 per cent magnesium for deoxidation ... I disclosed this fact in 1932 to the International Nickel Company, which later used this alloy for many years and sold it under the name Z-Nickel for corrosion-free springs to be used especially in fine machinery. A license agreement was ready in 1940 but the outbreak of war and seizure by the Alien Property Custodian put an end to this attempt at legalising an infringement situation.

<sup>&</sup>lt;sup>49</sup> In 1951, in a letter to the Luxembourg ambassador in Washington, Kroll complained about the difficulties he encountered for retrieving his patent rights after the war, and in this context he wrote: "... vous vous rappellerez que les intérêts du pétrole dès 1945 récupérèrent sans aucune difficulté leurs droits communs avec des firmes allemandes." Kroll probably alluded to cases where some US and German (oil?) companies were autoinatically reinstated in their rights after the War.

<sup>&</sup>lt;sup>50</sup> Federal Register, Volume 7, No 202, 14 October 14 1942, page 8322

<sup>&</sup>lt;sup>51</sup> Journal of the Franklin Institute, Volume 260, No 3, September 1965, pages 169-192.





According to the 1930 contract with S&H, Kroll had retained some rights under the patent, namely the right to regain the property of the patent after 13 years. Kroll decided to enact this clause. <sup>52</sup>

## Kroll's claim to the patent

In 1947 (probably in August) Kroll thus filed a claim with the *Alien Property Custodian* for the return of property of the patent, and in support of this claim he submitted a copy of the contract dated 23 December 1930 between him and S&H for evidencing his rights to the patent as of 24 December 1943.

The contract related to a specified field of his inventions, and provided for assignment of patents to  $S \mathcal{E} H$  to exploit by granting licenses, the inventor to share in the license fees and the contract to run for 13 years unless sooner terminated. <sup>53</sup>

The question arises as to why Kroll waited until 1947 to take action.

There are several plausible explanations:

- he knew that 30 April 1949 was the deadline set for appealing against vesting orders
- he expected to retrieve his patent rights automatically after the war, in 1945/46
- he did not have at his disposal the S&H agreement of 1930 <sup>54</sup>
- the "Nickel alloy" patent was going to expire on 13 March 1948 which could have prompted Kroll in 1947 to try to regain property of the patent prior to its expiry date.
- one Luxembourg author reports that Kroll was encouraged by his employer, the Bureau of Mines, to file a claim against the Custodian, at least as far as the "Titanium patent" was concerned.  $^{55}$

The *Alien Property Custodian*, having been alerted of the 1930 S&H agreement, issued almost immediately Vesting Order 10558 <sup>56</sup> on 9 February 1948, based on patent N° US1986585, but also referring to all of Kroll's patents possibly falling under the 1930 S&H agreement ...

<sup>&</sup>lt;sup>52</sup> The US authorities did not know about this particular clause of the agreement since Kroll did not have to produce a copy of the agreement with S&H when he assigned his patent rights to S&H in 1930.

<sup>53</sup> Kroll v. McGrath, 91 F. Supp. 173 - Dist. Court, Dist. of Columbia 1950

<sup>&</sup>lt;sup>54</sup> d'Letzeburger Land of 10/12/1954, page 4: "in 1947: Gig Kroll kehrte nach Luxemburg zurück und es gelang ihm eine Abschrift seines Kontraktes mit Siemens aufzustöbern, welche er der Sequesterverwaltung sogleich übergab." (Kroll left the USA for Luxembourg in August 1947 and returned to the USA in February 1948.)

<sup>&</sup>lt;sup>55</sup> d'Letzeburger Land of 10/12/1954, page 4: "Kroll ist als echter Wissenschaftler nicht sonderlich um seine materiellen Interessen besorgt. Über den Arbeiten am Magnesium und Zirconium vergaß er die Sache mit dem Titanpatent. Doch inzwischen hatte die Titanherstellung gewisse Ausmaße genommen. 1947 besprach Kroll die Sache mit den Leitern des Bureau of Mines."

<sup>&</sup>lt;sup>56</sup> Federal Register, Volume 13, No 61, 27 March 1948, page 1635





#### Vesting Order 10558

[Vesting Order 10658]

BIEMENS & HALSKE A. G. AND DR. ING. W. KROLL

In re: Rights and interests created in Siemens & Halske Aktiengesellschaft of ment dated December 23, 1930, with Dr. Ing. W. Kroll, Luxembourg.

Under the authority of the Trading With the Enemy Act, as amended, Executive Order 9193, as amended, and Executive Order 9788, and pursuant to law, after investigation, it is hereby found:

1. That Siemens & Halske Aktiengesellschaft is a corporation organized under the laws of Germany, having its principal place of business in Germany, and is a national of a foreign country (Germany);

2. That the property described as follows: All interests and rights (including all royalties and monies payable or held with respect to such interests and rights, and all damages for breach of the agreement hereinafter described, together with the right to sue therefor) created in Siemens & Halske Aktiengesellschaft by virtue of an agreement dated December 23, 1930, by and between Siemens & Halske Aktiengesellschaft and Dr. Ing. W. Kroll, Luxembourg, which agreement relates, among other things, to United States Letters Patent No. 1,986,585,

is property payable or held with respect to patents or rights related thereto in which interests are held by, and such property itself constitutes interests held therein by, the aforesaid national of a foreign country (Germany).

All determinations and all action required by law, including appropriate con-

Siemens & Halske A. G. and Dr. Ing. W. Kroll

sultation and certification, having been made and taken, and, it being deemed necessary in the national interest.

There is hereby vested in the Attorney General of the United States the property described above, to be held, used, administered, liquidated, sold or otherwise dealt with in the interest of and for the benefit of the United States.

The term "national" as used herein shall have the meaning prescribed in section 10 of Executive Order 9193, as amended.

Executed at Washington, D. C., on February 9, 1948.

For the Attorney General.

[SEAL] DAVID L. BAZELON, Assistant Attorney General, Director, Office of Alien Property.

[F. R. Doc. 48-2735; Filed, Mar. 26, 1948; 8:49 a. m.]

In re: Rights and Interests created in Siemens & Halske Aktiengesellschaft of Berlin, Germany, by virtue of an agreement dated December 23 1930, with Dr. Ing. W. Kroll, Luxembourg.

... the property described as follows: All interests and rights (including all royalties and monies payable or held with respect to such interests and rights, and all damages for breach of the agreement hereinafter described, together with the right to sue therefor) created in Siemens & Halske Aktiengesellschaft by virtue of an agreement dated December 23, 1930, by and between Siemens & Halske Aktiengesellschaft and Dr. Ing W. Kroll, Luxembourg, which agreement relates, among other things, to United States Letters Patent No. 1986585, is property payable or held with respect to patents or rights related thereto in which interests are held by, and such property itself constitutes interests held therein by the aforesaid national of a foreign country (Germany).

All determinations and all action required by law, including appropriate consultation and certification, having been made and taken, and, it being deemed necessary in the national interest.

There is hereby vested in the Attorney General of the United States the property described above to be held, used, administered, liquidated, sold or otherwise dealt with in the interest of and for the benefit of the United States.

On 20 September 1949, almost 20 months after "Vesting Order 10558", Kroll filed an appeal before the Washington District Court (District of Columbia) ("action for the recovery of United States Letters Patent No. 1,986,585").<sup>57</sup>

The appeal was rejected on 4 April 1950, primarily on the grounds that the appeal had been filed outside the "general" statutory time limit, which had expired on 30 April 1949. Kroll's legal advisers must have been of the opinion that the appeal could be filed within the "specific" 2-year time limit from the vesting order date, i.e. up to 9 February 1950. The Court disagreed. <sup>58</sup> No further appeal was filed.

57 Kroll v. McGrath, 91 F. Supp. 173 - Dist. Court, Dist. of Columbia 1950

<sup>&</sup>lt;sup>58</sup> Clearly a fault of his legal advisers for ignoring the statutory time limit: the decision subject of the appeal was dated 9 February 1948





## The "Titanium" patent (US2205854) 59

In 1947 (probably in August, at the same time as the "Nickel alloy" appeal), Kroll applied to the Washington District Court for retrieving the full property of his "Titanium" patent. The appeal was filed timely (i.e. before the statutory limit of 30 April 1949), but it is not known on which grounds Kroll claimed the return of his patent.

Was the claim based only on the fact that his patent had been seized in error, in that he was not "a *national of a designated enemy country*"?

While it had been necessary to disclose the 1930 contract in the "Nickel alloy" appeal, there was no need for Kroll to reveal the 1934 contract with S&H, under which the "Titanium" patent initially fell. In Kroll's view the contract had been cancelled in 1938 so that S&H no longer had any rights to this patent.

However, by revealing the existence of the 1930 agreement in the "Nickel-alloy" case, Kroll and his advisers must have anticipated that the Alien Property Guardian would immediately apply the content of this agreement to the "Titanium" patent as well.

In any case, from the ensuing Vesting Order 10554 (see below) it becomes apparent that the US authorities "learnt" about the existence of the 1934 agreement.

Two court decisions of the ensuing litigation give an indication on the sequence of events:

• a court decision of 1962 states: <sup>60</sup>

In 1947 Kroll instituted a suit in the United States District Court for the District of Columbia, ..., seeking the return of his property on the ground that he was not an alien enemy. The Custodian by that time had learned of Kroll's contract with the German firm, S&H.<sup>61</sup>

• a court decision of 1964 states: 62

When Kroll initiated action to obtain the return of his vested patent, the Custodian became aware of the existence of the contract between Kroll and S&H., involved in the present suit.

The first decision would indicate that Kroll did not mention the 1934 contract with S&H.

There are a couple of reasons, however, why Kroll had an interest in disclosing the existence of the 1934 contract:

- the Alien Property Custodian was aware of Kroll's 1930 agreement with S&H and might have been tempted to apply it to the titanium patent (to Kroll's disadvantage, the 1934 agreement being more favourable to Kroll);
- failing to disclose the existence of the 1934 agreement could have had dramatic legal consequences and entailed a total loss of the patent ("violation of duty of disclosure") ...

Further research may clarify this situation. In any case, the *Office of Alien Property* (successor to the *Alien Property Custodian*) became aware of the 1934 S&H agreement and issued a new vesting order.

### Vesting Order 10544

The Attorney General, as Director of the Office of Alien Property and as successor to the Alien Property Custodian, issued Vesting Order 10544 on 29 January 1948 claiming to have certain rights to the patent under the 1934 S&H agreement.

<sup>&</sup>lt;sup>59</sup> The file history of the "Titanium" patent is summarised in the annex below

<sup>60</sup> American Federal Tax Reports, Vol 10, 1965, pages 5659-5664

<sup>&</sup>lt;sup>61</sup> The phrase: "The Custodian by that time had learned" would suggest that Kroll did not declare the existence of the 1934 agreement with S&H, but that the Custodian was aware only of the 1930 agreement which formed the basis for reclaiming the property of the "Nickel-alloy" patent.

<sup>&</sup>lt;sup>62</sup> Henry A.Carey, Jr., Edwin D.Hicks, J.Pierre Kolisch and Joseph Schulein vs The United States, Report of decisions of the Supreme Court in Court of Claims cases, 1964, pages 304-332

#### **KROLL** Guillaume



[Vesting Order 10544]

which interests are held by, and such property itself constitutes interests held therein by, the aforesaid national of a foreign country (Germany). SIEMENS & HALSKE A. G. AND DR. ING. W. KROLL In re: Rights and interests created in Siemens & Halske Aktiengesellschaft of Berlin, Germany, by virtue of an agreement dated March 26, 1934, with All determinations and all action required by law, including appropriate con-sultation and certification, having been made and taken, and it being deemed Dr. Ing. W. Kroll, Luxembourg. Under the authority of the Trading necessary in the national interest There is hereby vested in the Attorney With the Enemy Act, as amended, Execu-tive Order 9193, as amended, and Execu-General of the United States the property described above, to be held, used, admindestribut above, to be left, bed, admin-istered, liquidated, sold or, otherwise dealt with in the interest of and for the benefit of the United States. The term "national" as used herein shall have the meaning prescribed in tive Order 9788, and pursuant to law, after investigation, it is hereby found 1. That Siemens & Halske Aktiengeelischaft is a corporation organized under the laws of Germany, having its principal place of business in Germany, section 10 of Executive Order 9193, as and is a national of a foreign country amended. (Germany) Executed at Washington, D. C., on January 29, 1948. 2. That the property described as follows: All interests and rights (including all royalties and monies payable or held with respect to such interests and rights, and all damages for breach of the agree-For the Attorney General. [SEAL] DAVID L. BAZELON. Assistant Attorney General, ment hereinafter described, together with the right to sue therefor) created Director, Office of Alien Property. [F. R. Doc. 48-1532; Filed, Feb. 19, 1948; 8:56 a. m.] in Siemens & Halske Aktiengesellschaft by virtue of an agreement dated March 28, 1934, by and between Siemens & Aktiengesellschaft and Dr. Ing. W. Kroll, Luxembourg, which agreement re-lates, among other things, to United States Letters Patent No. 2,205,854, is property payable or held with respect to patents or rights related thereto in

In 1948, as soon as the vesting order became known to Kroll, he instituted a suit against the Attorney General in the relevant Court (Washington District Court) for the full return of the patent, i.e. without an exclusive licence attached thereto held by a third party, i.e. the *Attorney General* of the United States.

Essentially, Kroll argued that the contract with S&H was void under German law, but in any event that any rights of S&H in the patent were yet to be agreed since he and S&H had not completed certain arrangements which Kroll asserts were conditions precedent to creation of a completed license.

Kroll submitted further that the 1934 contract with S&H had been cancelled in 1938 by mutual agreement. However, the Court considered that Kroll could not substantiate this claim as he could not present a copy of a written agreement, which was one of the conditions for amending the 1934 agreement. 63

On 3 April 1951, the United States District Court concluded: 64

... the Attorney General, as successor to the Alien Property Custodian was entitled to retain an exclusive license in the Kroll patent, a right to sub-license others under the patent, a right to share equally with Kroll in the royalties from sub-licensees, and a right to bring other actions to protect the patent. The District Court held that the royalty rates at which the Attorney General could grant sub-licenses were to be agreed to by Kroll and the Attorney General or were to be set by a court order. This was in line with the original agreement between Kroll and S&H, the main difference being that the Washington Court was to replace the Berlin Court.

The District Court further held that the Attorney General was to return to Kroll title to the patent subject to the rights and interests of the Attorney General specified above, and held that Kroll was to pay to the Attorney General one-half of the compensation already received by Kroll from E. I. du Pont de Nemours & Company for a release for past infringement of the Kroll patent.

Although Kroll retrieved the property of his patent, this court decision was very damaging to him. It was not only damaging from a financial point of view but it also had a demoralising effect on Kroll. He felt discriminated against as a non-US citizen.

On 14 June 1951 he wrote to Hugues Le Gallais, Luxembourg's ambassador in Washington:<sup>65</sup>

<sup>63</sup> Kroll v. McGrath, 199 F.2d 187 (1952)

<sup>&</sup>lt;sup>64</sup> Henry A.Carey, Jr., Edwin D.Hicks, J.Pierre Kolisch and Joseph Schulein v. The United States, Report of decisions of the Supreme Court in Court of Claims cases, 1964, pages 304-332

<sup>65</sup> Archives Nationales, AE-AW-0457





J'ai perdu ma cause contre le Alien Property Custodian, quant à mes droits de brevet dans le procédé pour faire du titane. Je dois m'arranger avec lui, et il prendra 50% de mes revenus. Cependant ni lui ni moi n'est satisfait du jugement et nous allons tous deux en appel. Ce jugement de trois pages m'a coûté 38,000 payés à mes avocats, et l'appel en coûtera bien encore une vingtaine de mille. Je ne sais pas si je pourrai tenir jusqu'au bout. Ceci est un cas très net, où l'étranger est étranglé par des avocats gouvernementaux, qui veulent se faire une carrière et qui emploient tous les moyens les plus inavouables à leurs fins. Cependant vous vous rappellerez que les intérêts du pétrole dès 1945 récupérèrent sans aucune difficulté leurs droits communs avec des firmes allemandes.

He further stated:

J'ai été invité de faire une conférence devant la Société Française de Métallurgie à Paris, et devant l'"Institute of Metals" à Milan en septembre prochain. La plus grande difficulté est d'obtenir le visa d'impôts payés. J'ai dû me rendre à Buffalo pour cela et la torture à laquelle j'ai dû me soumettre n'est pas encore terminée. Cela ne concerne que les étrangers. Les citoyens américains peuvent quitter sans rapporter à la commission des impôts fédéraux.

This perceived discrimination against a non-US citizen must have prompted Kroll to apply without delay for US citizenship, which he obtained in 1952.

## **Appeal by Kroll**

Both parties appealed to the Court of Appeals of the District of Columbia.

The decision of the lower Court was upheld and confirmed as such on 17 July 1952 and the parties were called to agree within 30 days of the judgement on the rate of the licensing fees. The parties could not agree. The Court therefore set the fees the following year.

On 1 December 1953, the United States District Court authorised the Attorney General: <sup>66</sup>

to grant sub-licenses under the Kroll patent

- at the rate of 5 percent of the gross sales price of the first 50,000 pounds of titanium, in sponge, powder and ingot form, produced in accordance with the process claimed in the Kroll patent,
- at the rate of 3 percent on the next 50,000 pounds, and
- at the rate of 1 percent on all in excess of 100,000 pounds.

The court order provided that the above 5-3-1 percent rates applied to production after 3 April 1951, and that each licensee should pay one-half of said sub-license royalty direct to Kroll.

On 15 March 1954 Kroll complained to the Luxembourg ambassador: 67

Hélas, pour ce qui est de la rémunération monétaire de mon travail, il en est autrement. Le gouvernement des Etats Unis s'approprie d'abord 50% des redevances de mon brevet concernant la production de titane, puis l'impôt fédéral prend 85%, l'Etat de l'Orégon 5% de sorte qu'il me restera 5% du total. En outre l'impôt fédéral n'a accordé que 450 dollars par an comme capitalisation de mes frais de recherche. Le journal "Modern Metals" a fait savoir ces choses au public. <sup>68</sup>

In an interview published in the US newspaper "*Henderson Home News*" in 1954 the local reporter - who met with Kroll during his visit to the Henderson titanium factory - reports as follows: <sup>69</sup>

Dr. Kroll smiles wryly when the matter of his long fight with the US Alien Property Custodian regarding royalty rights is mentioned. This episode reveals that a patent, no matter how important and valid, can sometimes become an expense and a liability to the owner.

He explains that presently, under the government's decision he would have to pay 90 per cent of royalties as federal tax and 5 per cent as state taxes.

After explaining this, he shrugs and remarks. "S-o-o!"

<sup>&</sup>lt;sup>66</sup> Kroll v. Herbert Brownell Jr., Attorney General, Civil Action 4845-48.

<sup>&</sup>lt;sup>67</sup> Archives Nationales, AE-AW-0457

<sup>68</sup> Modern Metals, January 1954, pages 498 ??? (could not be located)

<sup>&</sup>lt;sup>69</sup> Henderson Home News, 25 March 1954, page 1



Kroll was bitter about the final decision and gave an additional interview to the *New York Times*, published in 1954. <sup>70</sup> He seemed to be resigned and wished to leave the whole matter behind.



Virtually all of the commercial production of titanium so far has been by the Kroll process, but its inventor has yet to receive a penny in royalties.

Dr. William J. Kroll of Luxembourg, a quiet genius of modern metallurgy, tried repeatedly in the late Nineteen Thirties to interest American companies in the strong, lightweight metal titanium, but without success. Nevertheless, just before Hitler invaded Luxembourg in 1940, Dr. Kroll disposed of his laboratory there and brought his titanium work to the United States.

Here his patents were confiscated by the Alien Property Custodian, and Dr. Kroll has been engaged for the last six years in litigation to clarify their status.

Recently the United States Court of Appeals ruled in effect that the inventor was entitled to only half of the royalties on his process. It ruled that a German concern under whose auspices the process was developed had never actually signed all of the patent rights over to Dr. Kroll but had merely indicated its intent to do so. The court also fixed the royalty rate at 1 per cent of the sales price of titanium metal sponge, now \$4.46 to \$4.72 a pound.

Dr. Kroll, a shy and scholarly man who speaks excellent English with just a trace of accent, said the other day that royalty negotiations with the titanium producers were well advanced and he hoped within a few weeks to be paid his one-half of 1 per cent, retroactively.

"I don't expect the amount to cover the litigation costs and the \$250,000 of my own funds I invested in developing the titanium reduction process," he said.

Then he added sadly: "It is the wasted time I mind most. I've had neither the time nor the funds to continue my research while this litigation was dragging on. Six years is a long stretch when one is 65 and eager to get on with his work."

## Sale of the patent

On 11 August 1954 Kroll "sold" his patent and thereby assigned all of his patent rights (patent ownership and royalties due from the exclusive license held by *The United States*) to the largest titanium production licensee in the U. S. A., Titan Metals Corporation, a Nevada corporation. <sup>71</sup>

On 6 August 1954 Titan Metals Corporation changed its name to Vista Corporation. Vista Corporation was dissolved in November 1955 and the stockholders of Vista Corporation acquired Kroll's patent

<sup>&</sup>lt;sup>70</sup> New York Times, 21 November 1954, page 12

<sup>(</sup>N.B. : The title of the article : Titanium genius still to be paid, metallurgist who invented way to produce it has received nothing in royalties is misleading. Kroll had probably not as yet received royalties from the Government but had received a compensation from Du Pont de Nemours for past infringement of his patent since 1948, see above.)

<sup>&</sup>lt;sup>71</sup> The conditions of this sale are not known but reports about the outcome of a suit filed by the new owners against the US State relating to licensing fees under the patent indicate that Kroll shared in the financial awards finally imposed by the Court in 1965.





rights in their personal names.

The new owners of patent US2205,854 were:

Henry A. CAREY, Jr., Edwin D. HICKS, J. Pierre KOLISCH and Joseph SCHULEIN. 72

At that time the US Government decided to promote the production of titanium which was needed for jet planes, etc. It was the time of the Korean war.

In May 1954 the Business and Defence Services Administration issued an order, requiring producers of titanium to channel all of their output to defence contractors in accordance with allocations and priorities set up by this agency.  $^{73}$ 

The patent expired on 25 June 1957. By that time the exclusive licensee of the patent and its sublicencees had paid the amount of \$1,786,083 to Kroll and his successors.

On 15 March 1958, after the expiry of the patent, the 4 owners, Carey et al. (successors to Kroll), filed a suit against *The United States* claiming that the State had not paid the correct royalties during the period extending between 1 August 1951 and 25 June 1957.

On 6 April 1960, the Court had to look at two issues: 74

1) who was the beneficiary of the titanium produced under Kroll's "Titanium" patent?

So the test is, whether the production is by the original licensee (exclusive license) or for the use of the original licensee (sub-license) or for the sub-licensee himself or for someone else.

Plaintiffs [Carey et al.], on the other hand, contend that the manufacturers produced titanium on behalf of the Government and completely for its purpose. Therefore, they conclude that the production by the contractors was production by defendant itself [The United States] and, hence, defendant is bound to pay the full royalty to the owners of the patent.

The Court agreed with the plaintiffs (Carey et al.) and essentially decided that the total amount of titanium produced was to the benefit of *The United States*, whether produced directly by it or commissioned from sub-licensees. The full royalties had therefore to be paid to the patent owners.

2) which royalty rate was to be applied?

Beginning in 1951, defendant [The United States]entered into a series of contracts with private manufacturers under which these producers would construct or expand facilities for producing titanium by the Kroll process. There were a total of eleven separate agreements made with five domestic producers.

The parties agree that, during the period here involved, these various producers paid \$1,786,083 to Kroll and his successors in title and a like amount to the United States.

The parties agree on the total quantity produced but they disagree on the question of a proper royalty under the contract. The agreement between Kroll and  $S \mathcal{B} H$  expressly left this matter for future determination; Article 5 provides that "The amount of the royalties to be paid by  $S \mathcal{B} H$  to Dr. Kroll is to be computed depending on the importance of the invention."

We remanded the case to our Commissioner to determine: (a) a proper royalty under the contract; (b) whether all the titanium was produced under the exclusive license or all or a part under sub-licenses granted by the exclusive licensee; and (c) the total amount of production by the patented process.

Our Commissioner, acting pursuant to the terms of the reference, heard testimony and received other evidence pertaining to the proper amount of a royalty for use of the Kroll process.

He found that the graduated 5-3-1 percent royalty rate fixed by the District Court in 1953, when applied to the prices received by defendant's licensees throughout this period, produced an average royalty of 1.14 percent.

<sup>&</sup>lt;sup>72</sup> Schulein was an academic at the Oregon State University and well known to Kroll:

<sup>&</sup>quot;En février 1951, Kroll s'associa au professeur Schulein pour continuer ses recherches en métallurgie à Oregon State University. Ayant acheté une maison à Cornvallis (Oregon), Kroll y créa la Métal Research Foundation dotée largement par les revenus de ses brevets. " (L'Athénée et ses Grands Anciens, 2003, Volume II, page 364)

<sup>&</sup>lt;sup>73</sup> Carey, et al. v. United States, 149 Ct.Cl. 587 (1960)

<sup>74</sup> Carey, et al. v. United States, 149 Ct.Cl. 587 (1960)

## **KROLL Guillaume**





He concluded that this royalty rate was a proper one, considering "the importance of the invention", and should be applied to all production during the relevant period, even though such production was pursuant to defendant's exclusive license.

The average royalty rate of 1.14 percent of the sale price, based on the graduated 5-3-1 percent sub-license royalty rate authorised in 1953 by the U.S. District Court, is a proper royalty rate for application in the present case, considering the importance of the Kroll invention noted in finding 8 and considering the volume of titanium production summarised in Table B.

Application of the 1.14 percent royalty rate and the average \$4.05 price per pound to this figure produces a total royalty of \$1,510,106.98.

The Court concluded:

Plaintiffs are entitled to recover \$850,562.60, and judgment will be entered in their favour for this amount.

In 1965 Kroll - having already left the US for Belgium - commented on the final decision as follows: 75

There was also a human side to this story, that of the seizure by the United States Government of my titanium patent rights, and the subsequent seven years of prolonged litigation. This ended recently with a judgement of the Court of Claims, which gave me a partial satisfaction for the time lost, and stated that the Government could not take royalties on any titanium sponge bought for the stockpile or produced by the Government itself.

According to a US publication, Kroll received in 1965 "royalties said to total more than \$200,000"<sup>76</sup> and the publication adds: "which he donated to several US and European universities for research and scholarships". <sup>77</sup>

## Tax Court decision of 24 July 1962

The 4 owners of the "Titanium patent", Henry A. CAREY, Jr., Edwin D. HICKS, J. Pierre KOLISCH and Joseph SCHULEIN, appealed against an assessment by the US Tax Authority of the value of the Kroll patent when they bought it in 1954. The case ended in a US Tax Court in 1963. <sup>78</sup> The facts listed in the Tax Court's decision provide a very comprehensive summary of Kroll's case against *The United Sates*.

It also contains the following sentence which explains Kroll's disappointment and frustration in relation with his invention made back in 1937. Although the US Government had started using Kroll's process in 1951 it had not as yet paid any license fees up to 1954:

Prior to the August 11, 1954 contract between William Kroll and Titan Metals Corp., the inventor had received no royalties from said patent and had incurred substantial expenses in connection therewith.

## **Final personal note**

The decision to claim the property of the "Nickel-alloy" patent in 1947 on the basis of the 1930 contract with Siemens & Halske (S&H) was the start of Kroll's problems with *The United States*.

The fact of revealing the existence of his first contract with S&H of 1930 put him in a position forcing him to bring forward the second contract with S&H of 1934 as well. In Kroll's view the 1934 contract had been cancelled in 1938 and S&H did not have any rights to his "Titanium" patent. The US Courts interpreted the contract (which obviously had been poorly drafted) in a very restrictive and legalistic manner to the disadvantage of Kroll.

In 1943 the *Alien Property Custodian* (in Divesting Order n° 8) conceded that Kroll's property should not have been seized and that he was therefore entitled to regain his patent property in the USA. Kroll could have avoided the legal problems with the "Titanium" patent, if he had not tried to claim back the "Nickel-alloy" patent; in the end, he did not even succeed in the latter

<sup>&</sup>lt;sup>75</sup> Journal of less common metals 1965, pages 361-367

<sup>&</sup>lt;sup>76</sup> some \$ 1,700,000 at today's rate (2021)

<sup>77</sup> Modern Metals 1965, page 98

<sup>&</sup>lt;sup>78</sup> American Federal Tax Reports, Volume 2; Volume 10 - Prentice-Hall, 1963, Schulein vs U.S., page 5659 ff (case 10 AFTR 2d 5659)





action and had to wait until 1965 to obtain the final backdated royalties for the "Titanium" patent.

It must be concluded that Kroll was ill advised by his legal team.

The fact that the US Government was determined to pay as little as possible to Kroll is understandable as well since the Government invested a lot of financial means into perfecting Kroll's invention of 1938 into a viable commercial process as late as 1951.

The following quote of Kroll's involvement in the litigation speaks for itself: 79

Kroll ist als echter Wissenschaftler nicht sonderlich um seine materiellen Interessen besorgt.

In the end the "Titanium" patent generated a total of \$2,636,645.60<sup>80</sup> in royalties to Kroll and the 4 associates to whom he sold the patent in 1954.

<sup>&</sup>lt;sup>79</sup> d'Letzeburger Land, 10 December 1954, page 4

<sup>&</sup>lt;sup>80</sup> around \$ 20,000,000 at today's rate (2021)