

PITTSBURGH REDUCTION CO. v. COWLES ELECTRIC SMELTING  
& ALUMINUM CO.

(Circuit Court, N. D. Ohio, E. D. January 20, 1893.)

No. 4,869.

## 1. PATENTS FOR INVENTIONS—ANTICIPATION—ALUMINUM BY ELECTROLYSIS.

Letters patent No. 400,766, granted April 2, 1889, to Charles M. Hall, for an improved process of reducing aluminum by electrolysis, which process consists in dissolving alumina in a fused bath of the fluorides of aluminum and of some metal more electro-positive than aluminum, and then passing an electric current through the fused mass, whereby the aluminum of the alumina is precipitated at the cathode and its oxygen liberated at the anode; the bath meanwhile being unaffected as to its chemical composition. One De Ville, in a work on aluminum, published in 1859, described a process of coating copper with aluminum, in which the bath is the double chloride of aluminum and sodium, the cathode a bar of copper, and the anode a bar of aluminum. When the current is passed through the bath the chloride of aluminum is decomposed, the aluminum is deposited on the copper, and the chlorine gas, freed at the anode, attacks the bar of aluminum, and forms the chloride again, thus keeping the bath constant. *Held*, this was clearly no anticipation of Hall's patent.

## 2. SAME.

De Ville described a modification of this process, in which the bath is cryolite,—a double fluoride of aluminum and sodium,—and the anode a compact mixture of carbon and alumina, which, upon the passage of the current, gives the following reaction: The fluoride of aluminum is decomposed, its aluminum precipitated at the cathode and the fluorine at the anode, where it combines with the aluminum of the alumina, to form again the fluoride, and sets free its oxygen, which combines with the carbon to form carbonic oxide. *Held*, that this is not an anticipation of the Hall patent, inasmuch as the electrolyte is not dissolved alumina, as in the patent, but is the fluoride of aluminum,—one component of the bath itself; and the bath does not remain constant, but requires continuous renewal by the electro-chemical solution of the alumina of the anode.

## 3. SAME.

Even though the alumina from the anode in the De Ville process was dissolved in the bath and electrolyzed, he made no note of the fact, and it must be deemed an accident, which he failed to observe, and therefore it would not constitute any anticipation of the patented process.

## 4. SAME.

In order to show that the Hall process was identical with that of De Ville, the theory was advanced that in the former the electrolyte is not the dissolved alumina, but the fluoride of aluminum of the bath; and that, when this fluoride is decomposed, the fluorine attacks the dissolved alumina, drives off the oxygen to the anode, and unites with the aluminum remaining, thus restoring the bath. *Held* that, even if this were true, the Hall process would still be patentable for the regeneration of the bath accomplished by it is complete, and free from the escape of the corrosive fluorine gas, which renders the De Ville process a failure for commercial purposes.

## 5. SAME.

This theory of the reactions in the Hall process is, however, shown to be invalid by the facts that the alumina dissolves without any evidence of chemical action; that the action of the current gives no evidence of other products of decomposition than aluminum and oxygen; and that, as soon as the alumina is exhausted, the resistance to the current is doubled, indicating that the electrolyte has been changed; and, moreover, the theory contains a contradiction, in assuming, on the one hand, that the dissolved alumina will be decomposed by the fluoride of aluminum, and,

on the other, that the alumina is a more stable compound when electrolysis ensues so that the fluoride becomes the electrolyte.

6. SAME—"OXYFLUORIDE OF ALUMINUM."

The theory that when the alumina is dissolved in the bath in Hall's process there is found "an oxyfluoride of aluminum," which becomes the electrolyte, cannot avail to affect the validity of the patent, for it does not appear that any chemist has ever isolated any such compound, or known that it exists.

7. SAME.

Hall's claim to be the discoverer of the fact that cryolite will freely dissolve alumina to the extent of 10 to 25 per cent. of its own weight is not prejudiced by the fact that it had been used to wash off the film of alumina adhering to the globules of aluminum produced by De Ville's chemical process, for it appears that it was so used only as a substitute for fluoride of sodium or fluoride of calcium, either of which will dissolve no more than 1 per cent. of its own weight of alumina.

8. SAME.

Knowledge of this solubility of alumina in cryolite is not shown by the fact that in several English patents issued for the De Ville electrolytic process the anode of carbon and alumina is described as "soluble," for the anode of pure aluminum is likewise called "soluble," and the term is indicative only of the action of the fluorine gas in attacking the aluminum of the anode and forming the fluoride.

9. SAME.

A French patent was granted to one Fuerst August 8, 1884, for an electrolytic process of producing aluminum from alkaline aluminates in solution or fusion, alumina being added to regenerate the bath. The process, as described by him, was admitted to be inoperative; but he mentioned as one of the "indifferent or auxiliary bodies" that might be present in his hypothetical electrolyte, hydrofluoric acid; and it was shown by experiment that, if there be added to aluminate of soda eight times its weight of hydrofluoric acid, there would result a double fluoride of aluminum and sodium, which, upon the addition of alumina, and the passage of the current, would give the Hall process exactly. *Held*, that this experiment cannot avail to show an anticipation by Fuerst, for his mention of hydrofluoric acid as an "indifferent or auxiliary body" will not cover its use in excess, as herein; and, moreover, the experiment violates his express injunction that these foreign bodies, whatever they may be, shall not produce decomposition of the aluminates employed.

10. SAME—PROCESS—IMPROVEMENTS IN METHOD.

The means described in Hall's patent for effecting the process covered by it included the fusion of the bath by external heat before the current was passed through it to decompose the alumina, and a plant was constructed and successfully operated upon this method. It was subsequently discovered that the resistance of the components of the bath to a current sufficiently strong to accomplish electrolysis produced heat enough to maintain the fusion without the aid of external heat, a possibility suggested by Hall in his first specifications. *Held* that, even though the use of internal heat as a means of fusing the bath and carrying out the process might be such an improvement on the use of external heat as to render business competition between the two methods impossible, nevertheless the process was the same, and, as the method with external heat did accomplish a useful result, Hall, as the patentee, was entitled to the exclusive right of his process, whatever were the subsequent improvements on his method or apparatus for carrying it out.

11. SAME—ELEMENT OF CLAIM—ABANDONMENT.

Hall used a carbon anode in his experiments before applying for a patent, but in his application he stated that there were certain disadvantages incident to its use, and it was not embodied in his amended claims until more than two years thereafter, when it had been included in the claims of a pending application for a patent for the same process, which was refused upon an interference with Hall's patent. *Held*, that

this did not amount to an abandonment to the public of the carbon anode.

**12. SAME—SPECIFICATION—DISCLAIMER.**

The Hall patent claimed a bath "composed of the fluorides of aluminum and a metal more electro-positive than aluminum." In his specification he described a bath composed of fluorides of aluminum and sodium, "these salts being preferably mingled together in the proportions of 84 parts of sodium fluoride and 169 parts of aluminum fluoride. A convenient method of forming the bath consists in adding to the mineral cryolite 338-421 of its weight of aluminum fluoride to secure in the bath the proper relative proportions of the fluorides. Such proportions may be varied within certain limits without materially affecting the operation or function of the bath, as, in fact, any proportions which may be found suitable may be employed." *Held*, that this could not be construed as a disclaimer of the use of cryolite alone (which is a double fluoride of aluminum and sodium) for the bath, and that the patent covers every double fluoride of aluminum and sodium which can be made to produce aluminum when used as a bath in the Hall process.

**13. SAME—LIMITING CLAIMS.**

The facts that Hall in his specifications describes an apparatus for fusing the bath by external heat, and that the claim speaks of dissolving alumina in the fused bath, "and then passing an electric current," do not limit him to the use of external heat as against the heat developed by the current itself, for the claims contain nothing as to the production of the heat, and the patent states that the apparatus described therein forms no part of the invention. Following *Tilghman v. Proctor*, 102 U. S. 707.

**14. SAME—CONSTRUCTION OF CLAIM.**

The claim in the Hall patent of a "carbonaceous anode" covers both anodes made partly of carbon and those composed wholly of that substance.

In Equity. Bill to restrain infringement of patent. Decree for complainant.

George H. Christy and W. Bakewell & Sons, for complainant.

Henry S. Sherman, Leggett & Leggett, and Frederick S. Betts, for defendant.

Before TAFT, Circuit Judge, and RICKS, District Judge.

TAFT, Circuit Judge. This is a suit in equity by the Pittsburgh Reduction Company against the Cowles Electric Smelting & Aluminum Company, to restrain the infringement of a patent process for reducing aluminum by electrolysis, (letters patent No. 400,766,) owned by the complainant under an assignment from the original patentee, Charles M. Hall. The patent was applied for July 9, 1886, and was granted April 2, 1889. The defenses to the suit are: First, that the patent is invalid for want of novelty; and, second, that the defendant does not infringe.

Electrolysis is a process for separating a chemical compound into its elements by passing through it an electric current. The current is effective for this purpose only when the compound is reduced to a liquid state, either by solution or fusion. The compound which is decomposed by the current is called the "electrolyte."

Aluminum is a metal which was first isolated by Wohler in 1827. There is great difficulty in obtaining the pure metal from its compounds because of the tenacity with which it unites with other