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Case No. 14,407.

UNITED NICKEL CO. v. HARRIS ET AL.

{15 Blatchf. 319; 3 Ban. & A. 627; 17 O. G. 325.}[1]

Circuit Court, S. D. New York. Oct. 30, 1878.

PATENTS—NICKEL PLATING—CLAIMS—SOLUTIONS.

1. The letters patent granted to Isaac Adams, Tr., August 3, 1869. for an "improvement in the electro deposition of nickel," are valid, the first, third and fourth claims of the patent being: "(1) The electro deposition of nickel by means of a solution of the double sulphate of nickel and ammonia, or a solution of the double chloride of nickel and ammonium, prepared and used in such a manner as to be free from the presence of potash, soda, alumina, lime or nitric acid, or from any acid or alkaline reaction." "(3) The methods herein described, for preparing the solution of the double sulphate of nickel and ammonia, and the double chloride of nickel and ammonium. (4) The electroplating of metals with a coating, of compact, coherent, tenacious, flexible nickel, of sufficient thickness to protect the metal upon which the deposit is made from the action of corrosive agents with which the article may be brought in contact"

{Cited in United Nickel Co. v. Pendleton, 15 Fed. 740.}

2. The first claim is a claim to the electro deposition of nickel by means of any solution of the double sulphate of nickel and ammonia, or of any solution of the double chloride of nickel and ammonium, however such solution may be prepared, provided such solution is so used as to be free, while the electro deposition of the nickel is going on, from the presence of potash, soda, alumina, lime or nitric acid, or from any acid or alkaline reaction.

3. Although a sulphate or a chloride of potash or soda may be introduced into a solution of the double sulphate of nickel and ammonia, or into a solution of the double chloride of nickel and ammonium 728 yet, if the solution is so used, in the electro deposition of nickel, that the sulphate or the chloride will not he decomposed, the first claim is infringed.

4. The fourth claim is a claim to the product or coating named in it, having the qualities described in it, when such

product or coating is produced by employing the invention covered by the first claim.

{This was a bill in equity by the United Nickel Company against George J. Harris and Edward Weston.}

Dickerson & Beaman, for plaintiff.

Frost & Coe and Charles F. Blake, for defendants.

BLATCHFORD, Circuit Judge. This suit is brought on two patents granted to Isaac Adams, Jr., one on the 3d of August, 1869 {No. 93,157}, and the other on the 10th of Hay, 1870 {No. 102,748}, each for an "improvement in the electro deposition of nickel." In the proofs, no evidence is given as to any infringement of the patent of 1870. The case rests on the patent of 1809 alone. The specification says: "It has long been well known that nickel possesses certain qualities which would render it of great value in the arts, if it could be readily and surely deposited by the battery in such a manner as to make those qualities available. These qualities are, first, its infusibility; second, its color, which is nearly that of silver; third, its hardness, which is nearly equal to that of steel, and by reason of which it resists wear and abrasion to a much greater degree than silver; fourth, its power of resisting oxidation and the tarnishing and corrosive effects of many gases and liquids. The two last named qualities render it, for many purposes, greatly superior to silver, which it much resembles in appearance, for electroplating other metals, and for making articles of solid metal. To these advantages should be added its cheapness, as compared with silver. It has long been known that nickel could be deposited from certain solutions by electricity, but the character of the deposits has been such that the valuable qualities of the metal could not be secured to such an extent as to render it practically useful for general purposes. The difficulties in the way of its deposition have arisen mainly from the character of the solutions employed,

and the nature of the nickel used for anodes in the depositing cell. I have discovered the causes of certain difficulties in the practical deposition of this metal, and am able to remove them, and to point out methods of preparing solutions, and the conditions which they must satisfy, and under which they must be used, so that solid, coherent, tenacious and flexible nickel can be deposited to any desired amount. I can thus render the electrodeposition of nickel practically valuable, not only for electroplating other metals, but for that branch of the art of electrodeposition known as electrotyping, that is, the deposition of nickel upon a surface, not to remain upon it as a permanent coating, but to be removed and used independently of it. My improvements relate, first, to the method of preparing certain solutions from which the nickel is to be deposited, and to the properties and conditions which such solutions must possess; second, to a method of preparing nickel plates for the anodes of the depositing cell; third, to the character of the deposits obtained. In order to explain fully the nature of my invention, it is necessary to refer to certain facts relating to the electro-deposition of metals generally, which have been long known. It is well known that metals are deposited in three conditions, viz., first, as a black powder; second, in a state called reguline metal, that is, in a condition which exhibits the ordinary qualities of the metal; third, in a hard, crystalline condition. For most purposes in the arts, it is necessary that the metals should be deposited in the reguline state, the applications which are made of the powdery or crystalline deposits being very few. There are two applications of the art of electro-deposition which are usually recognized as two distinct branches of the art, and which embrace nearly all its practical uses. One is called electroplating, and consists in depositing a coating of one metal upon another metal, to remain upon it as a permanent coating. The other application

is called electrotyping, and consists in depositing one metal upon another, or upon a prepared surface of some other substance, from which it is to be removed, to be used separately from the surface upon which the deposit is made. For each of these purposes the metal must be deposited in the reguline state. It has long been known that the metals differ greatly in the facility with which they can be deposited by the electric current, especially in the reguline form. So, also, different solutions of the same metal differ greatly in respect to the deposits which may be obtained from them. With some solutions it is difficult, if not impossible, to obtain a deposit of reguline metal under any circumstances. The difficulty seems, in some cases, to be inherent in the character of the solution itself. In other cases, it is due to the presence of foreign elements, or to the density or temperature of the solution, or to the density of the current employed. Different solutions also differ greatly in the amount of metal which can be deposited with a given strength of current. Some solutions give a deposit of metal which is the full chemical equivalent of the electricity passing through the solution, while others fall far below it. Solutions also differ within wide limits in respect to the intensity and density of the current required to give a reguline deposit. The differences in solutions, in these respects, are of great importance with reference to the cost of depositing the metals. The higher the intensity required to effect 729 the deposition of the metal, the greater the cost; and it is obvious that the cost of the deposit will increase in proportion as it falls short of the full amount due to the electricity passing through the solution. Another circumstance is of great importance in the depositing of metals. It often happens that a thin film may be obtained of one metal upon another, but that the process of deposition cannot be carried on to such an extent as to obtain a coating of any appreciable

thickness. As soon as the metal to be coated has received a mere film, the conditions are so changed that the deposit is practically stopped. A characteristic of this filmy deposit is, that, though the particles of the metal adhere separately to the metal on which the deposit is made, the deposit is so thin that the particles of the deposit have no such coherence among themselves as will allow the deposit to be removed from the surface on which it is deposited, nor will such a deposit afford any substantial protection against abrasion or the ordinary wear to which most plated articles are subjected, nor to the action of corrosive agents It is obvious, therefore, that it is impossible to make electrotype plates from such deposits, and that such deposits are practically useless for most purposes to which electroplating is applied. Although it has long been known that nickel could be deposited to some extent from various solutions, yet I believe, that, prior to my improvements, it has not been practicable to obtain deposits of such character and thickness as are required for electrotyping or even for most of the purposes of electroplating. The solutions from which nickel has been heretofore most successfully deposited, are, I believe, the chloride of nickel, the cyanide of nickel and potassium, the double sulphate of nickel and ammonia, and the double chloride of nickel and ammonium. Of these solutions, as heretofore prepared, I believe the chloride is the best, but the deposits obtained from it are very far from what is required for the general purposes to which the electro-deposition of this metal may be applied.

The specification then points out the difficulties attendant and consequent in the use of the chloride of nickel and of the cyanide of nickel and potassium. It then proceeds: "Neither of these solutions, so far as I have seen them used, gives, for any great length of time, the full equivalent of metal for the electricity employed; and, so far as I have been able to discover,

these two solutions are inherently incapable of giving a coherent, tenacious, flexible metal, such as is required in the arts of electrotyping and electroplating. Of the other two solutions named, I believe that, before my improvements, the best results were obtained from the double chloride of nickel and ammonium. But the metal deposited from it is of such a character as to be worthless when deposited to any appreciable thickness. It is accompanied with the deposit of the peroxide, and is, therefore, black or brown. It is extremely liable to split up into thin scales, which may be rubbed off even with the hand. This want of coherence and tenacity unfits it for the requirements of the arts. The metal deposited from the double sulphate of nickel and ammonia is substantially the same as the above, but it is not so easily obtained. If, with these solutions, a battery power is used of an intensity of two Grove cells or thereabouts, a white deposit may be obtained of considerable thickness, but still with such a tendency to split up in scales, that it is practically useless; and neither solution gives the full equivalent due to the current I have discovered, however, that the difficulties attending the use of these last named solutions and the character of their deposits are not inherent in the nature of the solutions, but are due to the modes of preparing them, or to the presence, in minute quantities, of certain substances which are generally, and, I believe, universally employed in making them, or in the reduction of the nickel used in making them. In order, therefore, to prepare these solutions in such a manner as to give the results I have reached, it is necessary to adopt processes in their preparation and observe precautions, which shall either dispense with the use of the substances altogether, or shall effectually remove them if they are employed, and which are wholly unnecessary in their preparation for any other use with which I am acquainted. In preparing my solution, I prefer to use

pure nickel, but commercial nickel may be used. Commercial nickel almost always contains more or less of the reagents employed in the purification or manufacture of the metal, such as sulphate of lime, sulphide of calcium, sulphide of sodium or potassium, chloride of sodium and alumina. When any of these substances are present, it is necessary to remove them."

The specification then describes how this may be done, and also how zinc, copper, arsenic and antimony can be removed from the nickel. It then describes the patentee's method of preparing the double sulphate of nickel and ammonia, by first preparing a solution of the sulphate of nickel, and then a solution of the sulphate of ammonia, and then uniting the two and diluting the mixture with sufficient water to leave one and a half to two ounces of nickel to each gallon of solution. Specific directions are given how to prepare the solution of the sulphate of nickel, and how to prepare the solution of the sulphate of ammonia. The patentee's mode of preparing the solution of the double chloride of nickel and ammonium is then described. It is then stated that another important part of the patentee's invention is the preparation of the nickel plates to be used as anodes in the depositing cells. This consists in preparing an anode of nickel combined with iron, to prevent the copper and arsenic which are present in almost all commercial nickel from being 730 deposited with the nickel, or injuring the solution. It is further set forth, that, when copper and zinc are present to any considerable extent in nickel, it may be melted in a crucible and east into plates for anodes, and a mode of doing this is described; and that "it is necessary to melt commercial nickel, not only to cast it into plates for anodes and combine it with iron, when copper and arsenic are present, but to remove any potash, soda, lime or alumina left adhering to it in the process of reduction, these substances being removed, as before stated, as slag." One of

the methods before described in the specification, for purifying commercial nickel for use in making the patentee's solutions, so as to remove the re-agents before mentioned, was to melt the nickel, whereby "the foreign substances collect on the top of the melted nickel in the form of a slag."

The specification proceeds: "Having prepared the solutions and anodes, as herein described, nickel may be readily deposited, but, in order to carry on the deposition continuously, it is necessary to observe certain precautions: First, the use of a battery of too high an intensity must be avoided. An intensity of two Smee cells is sufficient. A high intensity decomposes the solution and liberates free ammonia, thus rendering the solution alkaline and impairing its value. Whenever the smell of free ammonia arises from the decomposing cell, the operator may be certain that the solution is being injured. It is important that the depositing shall not be forced by the use of too strong a current. Second, it is important that great precaution should be used to prevent the introduction into the solution of even minute quantities of potash, soda or nitric acid. When an article to be coated is cleaned in acid or alkaline water, or is introduced into it for any purpose, the greatest care must be taken to remove all traces of these substances before the article is introduced to the nickel solution, as the introduction of the most minute quantities of acids or alkalies will surely be injurious. It is important that the solution be kept free from all foreign substances, but its purity from those above named is especially important. Third, the anode of the depositing cell should present a surface to the action of the solution somewhat larger than the surface upon which the deposit is being made, particularly in the double sulphate solution. The reason is, that nickel dissolves so slowly, that, if the exposed surface is not larger than the surface on which the deposit is made, the solution will not

keep saturated. On the other hand, if the anode is very much larger than the positive pole, it tends to give a deposit of black powder. Fourth, if zinc is to be coated, it should first be coated with copper, as it is difficult to make nickel adhere to zinc, and there is danger that the zinc may be acted on and injure the solution. With solutions and anodes thus prepared and used, the deposition of nickel can be carried on continuously and almost as surely and certainly as the deposition of copper from the common sulphate solution, though the limits of the battery power which may be used are narrower. The metal deposited is compact, cohesive and tenacious. It may be deposited of nearly uniform thickness over any surface, however large. The deposited metal is capable of being annealed by a heat below a red heat. It then becomes flexible, malleable and ductile. The deposit may be made of any required thickness, either to furnish effectual protection to the metal on which it is deposited, or to be removed and used separately from the surface on which it may be deposited. Thus, electroplate of nickel may be produced, either as copies of irregular surfaces which it is desired to reproduce, or as plain sheets of nickel, which, after being annealed, may be rolled, hammered or spun into a variety of forms or articles. These solutions also give the full equivalent of nickel for the electricity employed. I believe deposits possessing these qualities were never produced except by means of my improvements. I therefore claim: (1) The electro-deposition of nickel by means of a solution of the double sulphate of nickel and ammonia, or a solution of the double chloride of nickel and ammonium, prepared and used in such a manner as to be free from the presence of potash, soda, alumina, lime or nitric acid, or from any acid or alkaline reaction. (2) The use, for the anode of a depositing cell, of nickel combined with iron, to prevent the copper and arsenic which

may be present from being deposited with the nickel or from injuring the solution. (3) The methods herein described, for preparing the solution of the double sulphate of nickel and ammonia, and the double chloride of nickel and ammonium. (4) The electroplating of metals with a coating of compact, coherent, tenacious, flexible nickel, of sufficient thickness to protect the metal upon which the deposit is made from the action of corrosive agents with which the article may be brought in contact. (5) The deposition of electrotype plates of nickel, to be removed from the surface on which the deposit is made and used separately therefrom."

Only the first and fourth claims of the patent are alleged to have been infringed by the defendants. The principal contest is as to the first claim.

The third claim is a claim to "the methods herein described, for preparing the solution of the double sulphate of nickel and ammonia, and the double chloride of nickel and ammonium." This is the same thing as a claim to each solution prepared by the method described for preparing each. The specification sets forth, that the solutions prepared by the methods described in it will be free from the presence of potash, soda, alumina, lime and nitric acid, and from everything which will cause an acid or an alkaline reaction. The means of securing this result, by removing from commercial nickel, when employed 731 in making the solutions by the patentee's methods, the re-agents named in the specification, are set forth. If these re-agents are removed, and the directions given as to the removal of the other foreign substances mentioned are followed, the solutions made by the patentee's methods will be free from the presence of the injurious substances mentioned in the first claim. But, the properties and conditions mentioned in the specification as those which solutions prepared according to the patentee's methods will possess, are

stated in the specification to be properties and conditions which must be possessed, not only by solutions prepared according to the patentee's methods, but by all solutions of the double sulphate of nickel and ammonia, and all solutions of the double chloride of nickel and ammonium, so far as regards freedom from the presence of the substances mentioned in the first claim; and, in respect to the use of solutions of such double sulphate and of solutions of such double chloride, it is stated, not only that the solutions prepared by the patentee's methods must be so used as to be free, in and during the operation of plating, from the presence of the substances mentioned in the first claim, but that all solutions of such double sulphate, and all solutions of such double chloride, by whatever method prepared, must be so used as to be free, in and during the operation of plating, from the presence of such substances. Thus, the specification states that the patentee has discovered that the difficulties which he mentions as attending the use of a solution of the double sulphate of nickel and ammonia, and the use of a solution of the double chloride of nickel and ammonium, are due to the presence of certain substances employed in making the solutions, or in reducing the nickel used in making them. It also states, substantially, that such employment of those substances results in producing solutions, in which, in and through their use, the substances mentioned in the first claim will be present, while the electro-deposition of the nickel is going on. It states, also, that, in order to prepare the solutions in such manner as to give the results which the patentee has reached, the substances referred to as employed in making the solutions, or in reducing the nickel used in making them, must either not be so employed, or must be effectually removed if they are employed. These substances are enumerated as sulphate of lime, sulphide of calcium, sulphide of sodium, sulphide of potassium, chloride of sodium

and alumina. But, it is also further stated, that no quantity, however minute, of potash, soda or nitric acid, or of any acid or alkali, must be allowed to be present in the solution; and then the claim states, that the solution used must be free from the presence of potash, soda, alumina, lime and nitric acid, and from every thing which will produce an acid or an alkaline reaction, while the electro-deposition of nickel is going on. Lime, soda and potash are likely to be produced in the solution, while the electro-deposition is going on, if the sulphate of lime and the sulphide of sodium and the chloride of sodium and the sulphide of potassium are employed in making the solutions, or in reducing the nickel used in making them, and are not removed. So, they may be produced in using a solution, if the sulphate of lime and the sulphide of sodium and the chloride of sodium and the sulphide of potassium are introduced into the solution after it is prepared. But, if those substances are introduced into a solution, and then the solution is used under such conditions that those substances remain inert, so far as the production in the solution of free lime or free soda or free potash is concerned, and no free lime or free soda or free potash is produced, then none is present, and the solution is used in such manner as to be free from the presence of those articles.

Viewed in the light of these considerations, it is manifest that the first claim is a claim to the electro-deposition of nickel by means of any solution of the double sulphate of nickel and ammonia, or of any solution of the double chloride of nickel and ammonium, however such solution may be prepared, provided such solution is so used as to be free, while the electro-deposition of the nickel, is going on, from the presence of potash, soda, alumina, lime or nitric acid, or from any acid or alkaline reaction. This is a valid claim, and the invention covered by it is a patentable invention, if the patentee was the first

discoverer of the fact, that the difficulties in the way of securing proper results in the electro-deposition of nickel with the two solutions in question, were due to the existence or development in them, while being used, of the substances named in the claim, and if he describes methods of making such solutions which will secure the absence of such substances. A person learning, from the specification of the patent, what such difficulties are, may proceed to make the solutions by other methods than those described by the patentee and covered by the third claim; but, if he avails himself of the knowledge imparted by the specification, that he must take care to secure the absence of the substances named in the first claim, and prepares solutions which, in use, are free from those substances, and then practises the electro-deposition of nickel by means of such solutions, he infringes the first claim of the patent. So, too, a person infringes such claim, who, taking such solutions made by another person, by such other methods, practises the electro-deposition of nickel by means of them, provided he so uses such solutions, that, in use, they are free from the substances named in the first claim, and thus avails himself of such knowledge imparted by the specification.

The patent being based on the discovery by the patentee, that the difficulties he sets forth 732 are due to the presence, in the use of the solutions in question, in the electro-deposition of nickel, of the substances named in the first claim, the evidence shows satisfactorily, that such difficulties existed and were due to the causes assigned; and that the patentee discovered, and was the first to discover, what such causes were. It also shows, that he invented and described practical methods of getting rid of such causes. As a consequence, he was the first person who obtained, as practical results in the electro-deposition of nickel, the results set forth in the specification as

those due to the use of the invention covered by the first claim.

On the question of infringement, the defendants claim, that, if they introduce into a solution of the double sulphate of nickel and ammonia, or into a solution of the double chloride of nickel and ammonium, a sulphate or chloride of potash or soda, they do not infringe the first claim. The evidence shows, that these sulphates and chlorides may be introduced into the solutions, and that then the solutions may be so used, in the electro-deposition of nickel, that the sulphate or the chloride will not be decomposed, and there will not result, from such introduction, the presence of potash or soda, in the sense in which the word "presence" is used in the first claim. The injurious substance is inert, by being in the chemical state of a sulphate or a chloride, as inert as if it were enclosed in an impervious bottle. The defendants used solutions which were free from the substances named in the first claim, otherwise than as such solutions had in them the sulphate or the chloride of potash or soda, and, in the use of the solutions, the presence of such sulphates or chlorides had no more effect to cause free potash or soda to be present, than if such sulphates or chlorides had not been introduced. If the introduction of such sulphates or chlorides is otherwise of any benefit, their use is but an improvement, and the invention of the patentee is availed of, notwithstanding their introduction.

On the question of the novelty of the invention covered by the first claim of the patent, I am of the same opinion announced by Judge Shepley, in his decision in the case of United Nickel Co. v. Anthes [Case No. 14,406], in May, 1872, that, prior to the discoveries of the patentee, the electro-deposition of nickel, by means of such solutions as are described in his patent, "prepared and used in the described manner, so as to be free from foreign substances and

acid or alkaline reactions, which would interfere with the uniform, continuous and coherent deposition of the metal, was unknown in any practical application of it to the useful art of electroplating metals with nickel." I concur, also, on all the evidence in this case, in what was said by Judge Shepley, in his decision in the case of United Nickel Co. v. Keith {Id. 14,408}, in February, 1874, that, prior to the discoveries of the patentee, "electroplaters and electro-metallurgists well understood how desirable a result it would be to be able to plate the surface of baser metal with a coating of nickel, resembling silver in lustre and color, without its liability to tarnish on exposure to the air," but that, after great research and investigation, it has not been shown that the electroplating of metals with nickel had any practical existence as a useful art, accessible or beneficial to the public, before the date of the inventions of the patentee; while, on the contrary, he was the first person who effected "the uniform, continuous and coherent deposit" of nickel upon the surface of other metals, "so as to produce a coating of the desired thickness, purity, uniformity, coherence and permanency of adhesion." In saying this, I have not overlooked the additional evidence in this case, as to what was done by Remington, nor the Muspratt-Stohmann publication. I do not find in the evidence, on the point of novelty, any thing which shows that the invention covered by the first claim of the patent, as I have construed that invention, was not new with the patentee, or existed before he made such invention.

Great stress is laid, by the defendants, on the view, that the patentee describes his own methods of preparing the solutions referred to, as the only methods by which the injurious substances named in the first claim can be excluded from the solutions; that he does not state that there are other methods than those which he describes, by which the solutions may be so prepared as, when prepared, to be free

from such injurious substances; and that he does not show how when the solutions are used, they are to be used so as to prevent the development or presence of such injurious substances. The answer to this view is, that the patentee sets forth clearly that the substances he names in his first claim are injurious, that the solutions should be prepared by such methods as not to use what may produce such substances, or to remove what is so used, and then, that care should be taken not to introduce into the solution, after it is prepared, and while it is being used, any of the injurious substances, and not to use a battery of too high intensity. The evidence shows, that what is so not to be used in preparing the solution, or, if used, is to be removed, is something which, if decomposed, will produce the injurious substances, and that the directions of the patent, if followed, will prevent such decomposition, and the consequent production of the injurious substances, in the use of the solution in the electro-deposition of the nickel.

The proper construction of the fourth claim of the patent of 1869 is, that it is a claim to the product or coating named in it, having the qualities described in it, when such product or coating is produced by employing 733 the invention covered by the first claim. Under this construction, the novelty of the fourth claim is not successfully attacked. As the defendants have infringed the first claim, they have also infringed the fourth claim. There must be the usual decree for the plaintiff on these two claims.

[1] [Reported by Hon. Samuel Blatchford, Circuit Judge, reprinted in 3 Ban. & A. 627, and here republished by permission.]