EDISON ELECTRIC LIGHT CO. *v.* UNITED STATES ELECTRIC LIGHTING CO.

(*Circuit Court of Appeals, Second Circuit.* October 4, 1892.)

1. PATENTS FOR INVENTIONS—INVENTION—INCANDESCENT ELECTRIC LAMPS.
   The second claim of letters patent No. 223,898, issued to Thomas A. Edison, January 27, 1880, for an incandescent electric lamp, consisting of a combination of carbon filaments with a receiver made entirely of glass, from which the air is exhausted, and conductors passing through the glass, is valid, since, in view of the prior state of the art, it required invention to substitute a carbon filament for the platinum wire of his prior French patent, (No. 130,910, May 28, 1879,) and so combine it with a vacuum vessel as to prevent the disintegration of the carbon by "air washing."
2. SAME—SUFFICIENCY OF DESCRIPTION.
   The word "filament," used as descriptive of the size of the burner, is sufficiently definite, in view of illustrations in the specification, and it is not necessary that its maximum and minimum dimensions should be specified, especially since defendant's burners indisputably lie wholly on one side of the dividing line between rods and filaments.
3. SAME.
   The fact that the patent did not detail the method always used by the patentee, of passing a current through the filament during the process of exhausting the bulb, does not render the patent void for want of a sufficient description to enable a person skilled in the art to construct a successful lamp; for the patent called for a nearly perfect vacuum, and this process of obtaining it had been described in Edison's French platinum patent, and the necessity for it, in order to obtain a perfect vacuum, had been pointed out by Sawyer and Man, and would therefore naturally be resorted to by one familiar with these publications.
4. SAME—RESULTS NOT FULLY UNDERSTOOD.
   The fact that this process produces a carbonization of the filament, and is now used as part of the process of carbonization, whereas the patent merely directs that the filament be "properly carbonized," does not show a suppression of a necessary element of the invention, or a want of sufficient description; for, it being apparent that one skilled in the art would use this method, it is immaterial that its full beneficial effect was not understood at the time of the application.
5. SAME—LIMITATION BY FOREIGN PATENT.
   A prior Canadian patent, issued for 5 years, and extended for the further period of 10 years, should be regarded as having a continuous term for the entire period, and as not limiting the United States patent to any shorter term. *Refrigerating Co.* v. *Hammond*, 9 Sup. Ct. Rep. 225, 129 U. S. 164, followed.
6. SAME.
   The Canadian patent act, which provides that "when a foreign patent exists, the Canadian patent shall expire at the earliest date at which any foreign patent for the same invention expires," refers only to foreign patents which exist before the issue of the relevant Canadian patent.
7. SAME—LIMITATION ON FACE OF PATENT.
   The failure to limit the patent on its face to a shorter term than 17 years, so as to expire at the same time with the prior foreign patent having the shortest term, does not affect its validity. *Refrigerating Co.* v. *Hammond*, 9 Sup. Ct. Rep. 225, 129 U. S. 164, followed.
8. SAME—CERTIFICATE OF CORRECTION BY COMMISSIONER.
   The commissioner of patents has no jurisdiction to alter a patent by a certificate of correction. Such a certificate is wholly void, and the patentee's request to have the same made cannot be considered as a surrender of the original patent.
9. SAME—ABATEMENT BY DISSOLUTION OF COMPLAINANT.
   Notwithstanding the merger of the complainant with another company into a new corporation, the law of the state of New York, providing that pending suits shall not be deemed to have been abated or discontinued by reason of any such consolidation, is effective to prevent such abatement in a federal court.

Appeal from the Circuit Court of the United States for the Southern District of New York.

In Equity. Bill by the Edison Electric Light Company against the United States Electric Lighting Company. The suit was originally

brought on the three following patents: No. 223,898, issued January 27, 1880; No. 227,229, issued May 4, 1880; and No. 265,777, issued October 10, 1882. But by stipulation the bill was amended by withdrawing the last two patents. As to the other the circuit court found infringement of the second claim, and accordingly rendered a decree for injunction and an accounting. 47 Fed. Rep. 454. Defendant appeals. Affirmed.

For opinions rendered in the circuit court on questions relating to the production of documents, see 44 Fed. Rep. 294 and 45 Fed. Rep. 55.

Kerr & Curtis, *Edward Wetmore*, *Samuel A. Duncan*, and *Frederic H. Betts*, for appellant.

Eaton & Lewis, *C. A. Seward*, *Grosvenor P. Lowrey*, *S. B. Eaton*, *Albert H. Walker*, and *Richard N. Dyer*, for respondent.

Before LACOMBE and SHIPMAN, Circuit Judges.

LACOMBE, Circuit Judge. On January 27, 1880, under an application filed November 4, 1879, letters patent No. 223,898 were issued to Thomas A. Edison, and by subsequent assignments passed to the complainant. The four claims of the patent are as follows:

"(1) An electric lamp for giving light by incandescence, consisting of a filament of carbon of high resistance, made as described, and secured to metallic wires, as set forth. (2) The combination of carbon filaments with a receiver made entirely of glass, and conductors passing through the glass, and from which receiver the air is exhausted, for the purposes set forth. (3) A carbon filament or strip coiled and connected to electric conductors so that only a portion of the surface of such carbon conductors shall be exposed for radiating light, as set forth. (4) The method herein described of securing the platina contact wires to the carbon filament, and carbonizing of the whole in a closed chamber, substantially as set forth."

In the lamp made by defendant the carbon conductor is not coiled as indicated in the third claim, nor is it secured as indicated in the fourth, nor does complainant contend that either of these claims is infringed. The circuit court held that the first claim was by its phraseology limited to lamps in which (among other things) the leading-in wires are "secured to the filament according to the method of the patent, that is, by cement carbonized *in situ*," and that as defendant uses clamps for this purpose it does not infringe. This construction of the first claim has been acquiesced in by the complainant, which has not appealed from the decision. There remains for consideration only the second claim.

The defendant's burner is of carbon, so small in cross section that, by the ordinary usage of common speech, it may be fairly called a "filament." The receiver, which contains the burner, is made entirely of glass. The conductors, which connect with the burner, pass through the glass, and from the receiver the air is exhausted. Defendant contends, however, that the specifications of the patent and the prior state of the art require that this second claim be so limited in construction that defendant's apparatus will not fall within its terms, and that, unless so limited, such claim is directly anticipated, or untenable as not involving patentable novelty.

Lamps devised to give light by means of the electric current are broadly divided into two groups, the arc and the incandescent. In the former two conductors or electrodes are so arranged that, when in operation, they are slightly separated, with their axes in the same vertical line. The current leaps across the intervening space, tearing off and partially vaporizing particles from the opposed ends of the electrodes, and developing heat and light in the ends of the electrodes and in the flying particles between them. In order to provide a current which shall be as effective as possible at the place where it develops light, not only the conductors, which bring it from the source of supply, but also the electrodes themselves, forming part of the conducting circuit, are devised to present but small resistance to the passage of the current. The effective resistance begins when the break in the circuit is reached. In an incandescent lamp there is no break in the circuit, but there is introduced into it a piece of poorly conducting material, which is so arranged that its resistance to the passage of the current will develop heat sufficient to bring it to a state of incandescence. The wires which conduct the current to the place where it is thus developed by resistance are so devised as to present but small resistance to its passage. The effective resistance begins where the piece of poorly conducting material (the burner or illuminant) is placed, and the lamp expires when the burner is consumed, breaks or wears away. The longer the life of the burner the longer the life of the lamp, and the more available it becomes for practical electric lighting. The selection of materials for the various parts of the circuit thus formed, their manipulation, arrangement, and operation, have for many years occupied the attention of experimenters, and the results of their labors, made public from time to time, constitute the state of the art of incandescent electric lighting.

The patent sets forth that "the object of the invention is to produce electric lamps giving light by incandescence, which lamps shall have high resistance, so as to allow of the practical subdivision of the electric light." By the phrase "subdivision of the electric light" is meant such a subdivision of the electric current that at several illuminating *foci*, supplied from the same source of electricity, there shall be developed lights of moderate intensity,—comparable to those given out by ordinary gas jets,—and the problem to be solved required a system and apparatus which would admit of the development of these moderate lights in sufficient number, and at so low a cost, as to be commercially useful.

Prior to 1879 experimenters seemed to have reached the conclusion that success was to be attained, if at all, by modifications of the arc lamp, but up to that time no lamp, arc or incandescent, had been given to the public, which, with the means then existing for generating and distributing the electric current, accomplished this result. Since the date of the patent in suit electric lighting by lights of moderate intensity has become a commercial success. Subsequent improvements in the lamps and in other parts of the system have undoubtedly contributed materially to its development, but the record abundantly shows that with lamps such as the patent describes, constructed with the skill then known to the art,

and operated under the conditions admitted by the generating and conducting apparatus then existing, it became practical for one generator to operate a considerable number of lamps, located at reasonable distances from it, and which at the same time were economical, durable, and cheap enough to be commercially useful, and so simple and reliable that they could be manipulated by the public. In view of the utter failure of the prior art to produce any such subdivision of the electric light, a lamp of this kind, which was capable of economical use in factories, large buildings, and in smaller buildings contiguous to each other,—in other words, available for isolated lighting,—should be considered commercially successful, though further development were needed to enable it to compete with gas for domestic lighting on even approximately equal terms. What, then, was the contribution to this solution of the problem which Edison gave to the world by the patent in suit?

Commercial and domestic exigencies required that the lamps should be so arranged that each derived its power independently from a common source, and not through another lamp, so that they could be individually lighted or extinguished at will, and the breaking down of a single lamp would not break the circuit. This is effected by what is called the "multiple arc" arrangement, the wires leading to and from each light being so connected with the main conductors as to form a separate circuit for each light. In this arrangement no greater electromotive force is required for a large number of translating devices than for a single one, the current being graduated to the number employed. The lower the resistance of each illuminating conductor, the greater the current it requires, and as their number is increased, their individual resistances remaining constant, the size of the main conductors must be likewise increased, an increase which, in the prior art, soon involved such an expense for main conductors as to preclude commercial success. The amount of heat developed by the passage of an electric current is greater as the flow of the current is greater. It is also greater as the resistance of the conductor is greater, and all electric conductors vary in resistance directly as their lengths and inversely as their cross sections. Conductors of different materials have also different specific resistances. The quantity of heat developed in a translating device is independent of, but the degree of heat (*i. e.*, the temperature) is dependent on, the extent of radiating surface. In the lamp shown in the patent these laws are availed of; the ratios of resistance of the burner to the resistance of the entire circuit and to its own radiating surface being so graduated that a light of the required intensity is produced by the expenditure of so small an amount of current at each illuminant focus as to admit of main conductors sufficiently small, and therefore sufficiently low priced, to warrant the introduction of the system into public use.

It is not necessary to enter into any elaborate discussion of the prior state of the art, so far as it bears upon the question of the patentable novelty of such embodiment of the principle of high resistance and small radiating surface. Irrespective of all patents or publications of others, the philosophy of that method of producing light is undoubtedly found stated clearly and sufficiently, and applied to the production of an in-

candescent platinum burner, in Edison's French patent, No. 130,910, taken out May 28, 1879. Whether, under section 4887 of the Revised Statutes, that patent, embodying as it does his own invention, is or is not, so far as Edison is concerned, a part of the prior art, and to what extent, in view of the prior art, that patent discloses patentable invention, need not be determined upon this appeal, inasmuch as we are satisfied that there was invention in the substitution of the carbon of the patent in suit for the platinum of the French patent, even though all knowledge as to what should be the ratio of resistance to radiating surface were pointed out, either in the French patent or elsewhere in the art. As stated above, conductors of different materials have different specific resistances. Without going into details, it may be stated that among the metals platinum (including its alloys) is the only one which seems to have given promise of success for incandescent lamp burners. With a method of preparation intended to remedy some of its defects, it is the material of the French patent, although the first claim of that patent is, generally, for a continuous metallic conductor. The specific resistance of platinum is sufficiently high to admit of its being raised to incandescence by the electric current. When so raised it is not consumed in the presence of oxygen, but is fusible at a temperature slightly higher than that at which it becomes incandescent. To produce light it has to be maintained so near the melting point that a slight fluctuation of the current above the normal strength destroys it, and a large part of the French patent is devoted to the description of methods and a complicated apparatus called the "Thermal Regulator," intended to regulate the current so as to avoid any such raising of the temperature.

In his invention, as described in the French patent, Edison departed from the existing idea of burners of low resistance, declared the commercial and scientific necessity of burners of high resistance, although they must be slender and presumably fragile, and attempted to find a method of protecting them from the effects of heat and of the atmosphere. It is said that the theretofore known laws of electricity should have taught every one that an electrical incandescent lamp must have a burner of small cross section and small radiating surface. The electrical laws had been known and had been recognized, but they did not tell how to protect the materials which would make efficient burners from the destructive effect of other forces than electricity to which they must be subjected; in other words, they did not tell how to construct a lamp. Edison, in his French specification, followed the principle of high resistance to an extreme, made platinum burners with a resistance of 200 to 300 ohms, and described the method by which they were to be prevented from speedy deterioration, "by destroying or intercepting the atmospheric action." He freed them from occluded gases by subjecting them to a high degree of electrical heat in a vacuum, and subsequently sealed them also in a vacuum. The platinum lamp, however, did not achieve success.

Inasmuch as carbon has a specific resistance from two to four hundred times that of platinum, (hard, dense carbon having a lower resistance than porous carbon,) is practically infusible, had been long before

suggested as a translating device, and used as such in many of the lamps devised by the prior art, it might be supposed that when one skilled in that art was seeking a substitute for the platinum wire,—something which would, by reason of high resistance and small radiating surface, apply the philosophy disclosed in the French patent, and yet admit of operation at higher temperature without melting,—he would have turned to carbon. But the record in this case clearly establishes the converse of that proposition. Carbon, when exposed to the air at a temperature sufficient to produce incandescence, undergoes combustion. To remedy this difficulty earlier inventors suggested inclosing the carbon burner in a glass globe, from which air and moisture were to be excluded. Their globes were separable to allow of replacement of interior parts. We do not find in the words "suitably sealed," used in the King patent (British, 1845, No. 10,919) to describe a modification of his lamp for use under water, sufficient warrant for the contention that its structure was to be so radically changed as to substitute a light and compact all-glass globe, with irremovable burner, for the cumbrous apparatus with its column of mercury, which he describes in detail. Neither the inclosing chamber of Crookes' nor the Geissler tubes (though being all of glass with wires sealed in, they would not leak) were used by the prior art to protect incandescent burners. By reason, in part, of that mode of construction, with separable chamber, the *vacua* which the earlier experimenters sought to secure could not be maintained. Though subsequent improvements in exhaust pumps might give their apparatus a higher inital vacuum, it would rapidly disappear in the leaking globe. It was against the oxygen or other carbon-consuming gases that all prior inventors sought to protect the burner, and later inventors tried to accomplish the same result by filling the chamber with nitrogen or some other gas which was inert, *i. e.*, did not combine with the carbon. The carbons themselves were also subjected to processes for making them harder and more tenacious, and series of carbons were arranged to be brought into operation successively without opening the chamber. But one and all of these devices failed to secure stability in the carbon. A deterioration, variously described as a "disintegration," a "wearing away," a "kind of evaporation," was soon fatal to the life of the burner. The record abundantly establishes the proposition that, so far from turning to carbon for his burner, which was to have so high a ratio of resistance to radiating surface, one skilled in the art would have been led, by the teachings of that art, to suppose that its instability would prove fatal to its use, irrespective of the size of the burner. Especially is it true that the use of small carbons, in the attenuated or filamentary form, which Edison had indicated in the platinum patent, would not have been thought of. Nor do we find in the suggestions of Lane-Fox, either in his patents (British, Nos. 3988, 4043, 4626, of 1878, and 1122, of 1879) or his other publications, any such appreciation of the cause of the disintegration of carbon, or any such proposed method of preventing it, as would controvert the conclusion that the art was looking elsewhere than to carbon for the burner which should have a future. Certainly

Lane-Fox himself seems to have looked for success rather to his metallic alloys, and his compounds operated in nitrogen or other suitable gas, than to carbon in a perfect vacuum. The literature of the art fully sustains the statement of Mr. Schwendler, quoted in Telegraph Journal in 1879, that "we can scarcely expect that the principle of incandescence will be made use of for practical illumination," unless there be discovered a conductor without the defects of platinum, and "which does not combine at high temperature with oxygen."

In June, 1878, and January, 1879, (United States patents 205,144, 211,262,) Sawyer and Man indicated one of the causes which operated to produce this disintegration of the carbon, viz., that "some oxygen or other element or compound remains in the lamp," the carbon "occluding sufficient air or oxygen to render its consumption a mere question of time," as "the least quantity of oxygen in a sealed lamp is sufficient to combust an indefinite quantity of carbon." This they sought to remedy by heating the carbon pencils, immersed in a hydro-carbon liquid, to an extremely high temperature, thus producing a hard and dense carbon, and one whose specific resistance was lowered by that very process. They also, while the globe was on the pump, and nitrogen flowing in and out of it, heated the "carbon to incandescence, thus driving out all the impurities and occluded gases, which are carried out of the lamp by the current of nitrogen." Believing that the deterioration of the carbon burner was due to the presence of occluded oxygen, which escaped into the sealed chamber and promoted "combustion," they sought to secure stability by substituting for the oxygen they had forced out by heating on the pump an atmosphere of nitrogen. That done they sealed their chamber, which seems to have been a separable one.

Edison had experimented with carbon before he devised the platinum lamp of his French patent. Subsequently to the date of that patent, apparently because that lamp did not seem to promise the success he hoped for, he again turned to carbon. In the course of his investigations he made a discovery as to the causes of "disintegration," of which he availed himself to devise a lamp in which carbon, even in the filamentary form required for a burner, whose ratio of resistance to radiating surface was such as to apply the philosophy pointed out in his French patent, could be maintained for a sufficient length of time to become a commercial success. At the date of the application for the French patent he had apparently reached only the point that "pencils [not filaments] of carbon can also be freed from air in this manner, and be brought to such a temperature that the carbon becomes pasty, and if it is then allowed to cool it is very homogeneous and hard." The knowledge that practical stability could be given to a carbon filament was not gained until October, 1879.

The patent in suit sets forth that theretofore "light by incandescence has been obtained from rods of carbon of one to four ohms resistance, placed in closed vessels, in which the atmospheric air has been replaced by gases that do not combine chemically with the carbon. The vessel holding the burner has been composed of glass cemented to a metallic

base, [or, as the evidence in this case shows, sometimes to a glass base.] The leading wires have always been large, so that their resistance shall be many times less than the burner, and in general the attempts of previous persons have been to reduce the resistance of the carbon rod. The disadvantages of following this practice are that a lamp having but one to four ohms, resistance cannot be worked in great numbers in multiple arc without the employment of main conductors of enormous dimensions; that, owing to the low resistance of the lamp, the leading wires must be of large dimensions and good conductors, and a glass globe cannot be kept tight at the place where the wires pass in and are cemented. Hence the carbon is consumed, because there must be almost a perfect vacuum to render the carbon stable, especially when such carbon is small in mass and high in electrical resistance. The use of a gas in the receiver at the atmospheric pressure, although not attacking the carbon, serves to destroy it in time by 'air washing,' or the attrition produced by the rapid passage of the air over the slightly coherent, highly heated surface of the carbon. I have reversed this practice. I have discovered that even a cotton thread properly carbonized and placed in a sealed glass bulb exhausted to one-millionth of an atmosphere offers from one hundred to five hundred ohms resistance to the passage of the current, and that it is absolutely stable at very high temperatures. [Here follow further statements as to other carbon substances and their manipulation.] By using the carbon wire of such high resistance I am enabled to use fine platinum wires for leading wires, as they will have a small resistance compared to the burner, and hence will not heat or crack the sealed vacuum bulb. [The burner being placed on the glass holder,] a glass bulb (is) blown over the whole, with a leading tube for exhaustion by a mercury pump. This tube, when a high vacuum has been reached, is hermetically sealed. * * * The invention consists of a light-giving body of carbon wire or sheets coiled or arranged in such a manner as to offer great resistance to the passage of the electric current, and at the same time present but a slight surface from which radiation can take place. The invention further consists in placing such burner of great resistance in a nearly perfect vacuum, to prevent oxidation and injury to the conductor by the atmosphere. The current is conducted into the vacuum bulb through platina wires sealed into the glass." Edison's invention was practically made when he ascertained the theretofore unknown fact that carbon would stand high temperature, even when very attenuated, if operated in a high vacuum, without the phenomenon of disintegration. This fact he utilized by the means which he has described,—a lamp having a filamentary carbon burner in a nearly perfect vacuum.

Although all-glass globes, with leading wires passing through the glass and sealed into it, had been used before to preserve the conditions of the interior of a chamber from the effects of leakage at the joints, and although the prior art, including the French patent, indicated that subdivision of the electric light was to be obtained by the use of burners of high resistance and small radiating surface, and although pencils of car-

bon had been tried in imperfect *vacua*, and found wanting, it was invention, in view of the teachings of the art as to the disintegration of carbon under the action of an electric current, to still select that substance as a suitable material from which to construct a burner much more attenuated than had ever been used before, reduced in size to the filamentary form in which economy of construction requires that it must be used in order to avail of the philosophy of high resistance and small radiating surface, and so to combine old elements that the disintegration due to "air washing" should be practically eliminated, and the burner thus become commercially stable. It is true that carbon burners still break down, that the improvements neither of Edison nor of other inventors have made them absolutely stable, and in a sense it may be said that Edison only made them more stable than they were before; that it is a mere matter of degree. But the degree of difference between carbons that lasted one hour and carbons that lasted hundreds of hours seems to have been precisely the difference between failure and success, and the combination which first achieved the result "long desired, sometimes sought and never before attained," is a patentable invention.

It is also true that the combination and manipulation which secured a practically perfect vacuum by heating the burner while the exhaust pump was at work, and subsequently sealing the globe without introducing a foreign gas, is set out by Edison in his French patent as a means of effecting such a change in the condition of platinum as would permit of its being raised to higher temperatures without rupture, cracking, or diminution of weight by volatilization. But the evidence shows that the platinum lamp did not achieve success, and we think there was manifest invention in the substitution of carbon freed from occluded gases, and placed in a nearly perfect vacuum. The change of material involved a reorganization of the lamp. Dispensing with the thermal regulator, which was an essential part of the structure of the French patent, it developed new properties in the lamp by reason of the enormous differences between the resistances and the melting points of the two materials; it utilized the discovery of that cause ("air-washing") of the instability of carbon, which seemed to preclude all hope of its future usefulness as an incandescent illuminant. Finally and principally, by the substitution, there was presented the complete combination of elements, which for the first time in the art produced a practical electric light. We are of the opinion that on principle and under the authorities such a substitution of material is invention. Experts called for the defendant have testified that such change of material involved no invention, because the use, as a substitute for platinum, of carbon of any size, operated in a vacuum, would be obvious to one skilled in the art. To this proposition we cannot assent. Sawyer and Man were skilled in the art, but even after they had learned how to force out the occluded gases, and withdraw them from the lamp chamber, they turned away from the vacuum thus ready to their hands, feeling no doubt that they were following the teachings of the art in seeking stability by the use, not of a vacuum, but of a nitrogen atmosphere. Edison was skilled in

the art, but after he had the nearly perfect vacuum of the French patent, secured against leaking by the all-glass globe of Geissler and Crookes, it was only after months of patient and persistent experiment that he found, in the substitution for his platinum of a filament of carbon, the success he had long sought for, but not till then attained.

The second claim of the patent is broad enough in its phraseology to cover the invention above set forth, at least when the burner is a carbon filament. This last word is not specifically defined in the patent, though it therein appears for the first time in the art. It was a common English word with a meaning sufficiently plain to indicate that the cross section of any article which it was used to qualify must be so small as to be thread-like; and we think a sufficient indication of what that size is would be afforded by an examination of the ordinary threads in common use. An examination of the patent, however, indicates its dimensions with more exactness. It is to be fragile, so small in cross section that, compared with older carbon rods, its use is a "reversal" of former practice. One of the substances suggested in the patent to be used as a burner is to be reduced to .007 of an inch in diameter. Ordinary cotton thread, also suggested in the patent, has varying diameters, the largest in common use being 1-64th of an inch. The patent-office model has a diameter of about 1-66th of an inch. The evidence fails to satisfy us that the prior art furnished any burners less than twice this size. In contradistinction to these earlier burners, Edison calls his burner a "filament." The term is apt, and we do not think he was required to specify, by thousandths of an inch, its precise maximum and minimum. Surely no one could doubt that burners nearly approaching in size the examples of his filament, shown in the patent, would be filaments, nor that burners nearly approaching in size the earlier rod burners would be rods. The defendant's burners are smaller in cross section than the cotton thread of the patent-office model, and indisputably lie wholly on one side of the dividing line between rods and filaments, which, therefore, for the purposes of this suit, need be no more closely defined. The carbons which defendant operates in a high vacuum, in all-glass chambers with platinum wires sealed in, and which by such method are not exposed to air washing, and are thus rendered practically stable, are filamentary in size, and therefore filaments, within the meaning of the second claim, unless that word is to be qualified as defendant suggests. That it is to be so qualified by importing into it a "coiling" of the burner is unwarranted in view of the fact that the patent refers to both coiled and uncoiled threads, and the third claim specifically covers the coiled form. The first claim is the comprehensive one, intended to include—and by its use of the words, "made as described," in fact including—the principal invention, as the draughtsman understood it, to wit, the burner, which was to subdivide the electric light by its ratio of resistance to radiating surface, and also the subsidiary inventions (1) of coiling when desired, either as effecting that ratio or as a protection against flickering; (2) of securing the burner to the wires; and (3) of providing a place for its operation, to wit, the ex-

hausted all-glass globe, which would insure practical stability. To cover each of these inventions a separate specific claim is made, and the second claim seems clearly intended to cover the combination of parts which secures the stability of the burner, irrespective of the fact whether it is coiled or uncoiled, is clamped to the leading wires or secured by the plastic combination of the fourth claim, is made out of one or other of the varieties of carbon mentioned in the patent, or even out of some other known variety not mentioned therein, irrespective also of the fact whether its resistance is higher or lower, except so far as its filamental character and its designed function would determine the measure of that resistance.

This conclusion seems plainly indicated by the peculiar phraseology of the claim. It is for "the combination of carbon filaments with a receiver made entirely of glass, etc., and from which the air is exhausted, for the purposes set forth;" that is, for the purpose of preventing the disintegration of the burner resulting from air washing. All the experts and all the counsel agree that the words "carbon filaments" should read "a carbon filament," because the combination of the patent contemplated only the incandescence of a single filament in each lamp. This is quite correct, but the words thus altered found their place in the claim through no mere clerical error. Inapt though they may be to describe the individual concrete combinations which were to be protected against infringement, they are illuminative of the effort of the draughtsman to secure his exhausted all-glass receivers in combination with carbon filaments of all kinds, and he used the plural, omitting the phrases "of high resistance" and "made as described," used in the first claim, in order to make sure that he should not, as to this second claim, be confined by construction to any one variety of filament. For this reason the further limitations, which defendant seeks to read into this claim, viz., that the filament must be one of high specific resistance, or of at least 100 ohms resistance, cannot be accepted.

The second claim may be thus paraphrased: The combination of carbon, filamentary or thread-like in size, and properly carbonized, used as an illuminant in an incandescent electric lamp with a receiver made entirely of glass, and from which receiver the air is exhausted to such an extent that disintegration of the carbon due to the air-washing action of surrounding gases or to any other cause is so far reduced as to leave the carbon practically stable. Defendant's lamps are plainly infringements of the second claim as thus construed.

Defendant further contends that the patent is invalid because it does not so describe the lamp as to enable a person, skilled in the art at the date of the patent, to make a practically useful structure. The evidence of the witness Howell seems to us a conclusive answer to this contention. He made, as he testifies, according to the directions of the patent, and using only processes known to the art before its date, incandescent lamps such as the patent describes, which lasted 600 hours. Defendant criticizes this evidence, because the witness subjected the filaments made by him to the action of the electric current during the process of exhaustion.

But the patent repeatedly directs that the vacuum shall be high, and nearly perfect. Sawyer and Man had, prior to the date of the patent, shown that there were occluded in the carbon itself, and in the various internal parts of lamp chambers, gases and impurities which are set free by the passage of the current. Manifestly, if they were not removed before sealing, the nearly perfect vacuum would soon disappear. Edison's French patent also details a process for forcing them out of platinum and removing them while exhausting is going on. A person who was sufficiently skilled in the art to know of these earlier publications, and was carefully solicitous to conform to the directions of the patent, would naturally have resorted, as Howell did, to this method to secure a vacuum free, so far as might be, from the intrusion of such occluded gases. It is contended, however, that this process of "electric heating on the pumps" in effect produces a carbonization of the filament; that it is now used as a part of the process of carbonization; and that, because the patent simply directs that the filament be "properly carbonized," because electrical heating is now used with the understood object of supplementing the work of the carbonizing furnace, because Edison has always thus heated his filaments, and because such additional carbonization is necessary to make a practical lamp under his patent,—therefore he has either purposely suppressed an essential element of his process, or has failed to give the full, clear, and exact description of it which the statute calls for. To this proposition we cannot assent. It is immaterial that the philosophy of electrical heating on the pumps is better understood to-day than it was in 1879, so long as the requirements of the patent would not be complied with by one skilled in the art unless he did in fact so heat the filaments. Whether he heated to carbonize, or to secure a nearly perfect vacuum, the result would be the same,—an operative lamp produced by following the directions of the patent with the ordinary skill of the art, and that is all the patentee was required to show.

The other defenses interposed by defendant may be more briefly noticed. The patent in suit was issued January 27, 1880. A patent for the same invention was issued in Canada, November 17, 1879, (No. 10,654,) the term of which, expressed on its face, was five years; but the Canadian statute gave to the owner of the patent the right to an extension at his option, on the payment of a required fee, for the further period of 10 years. On May 4, 1883, the owner paid the fee required, and on October 30, 1883, obtained certificate of extension. In *Bate Refrigerating Co.* v. *Hammond*, 129 U. S. 164, 9 Sup. Ct. Rep. 225, it was held that, so far as the term of a Canadian statute operated to curtail the term of the United States patent under section 4887, Rev. St. U. S., it should be regarded as a continuous term for the entire period. It appears, however, that on March 5, 1880, a patent for the same invention was granted in Sweden, the grantee of which subsequently failed to prove, as required by the law of that country, that the invention was "being constantly practiced within the kingdon." Thereupon, on March 5, 1883, the Swedish patent right was lost and forfeited. Defendant

contends that in consequence the Canadian patent expired on the same day, March 5, 1883, or, if it continued till the expiration of the first five years expressed on its face, viz., November 17, 1884, it could not, by the payment of fees or the certificate of the Canadian commissioner of patents, be extended for the additional 10 years. For that reason defendant contends that the case at bar is distinguishable from *Bate Refrigerating Co.* v. *Hammond*, and that the patent in suit expired with the Canadian patent, either on March 5, 1883, or on November 17, 1884, prior to the beginning of this action. The Canadian statute provides as follows:

"An inventor shall not be entitled to a patent for his invention if a patent therefor in any other country shall have been in existence in such country more than twelve months prior to the application for such patent in Canada; and if during such twelve months any person shall have commenced to manufacture in Canada the article for which such patent is afterwards obtained, such person shall continue to have the right to manufacture and sell such article notwithstanding such patent; and under any circumstances, when a foreign patent exists, the Canadian patent shall expire at the earliest date at which any foreign patent for the same invention expires."

The soundness of the defendant's contention depends on the meaning, under Canadian law, of the phrase "where a foreign patent exists," as used in this statute. If that phrase is confined to foreign patents which exist before the relevant Canadian patent is issued, the loss and forfeiture of the Swedish patent right in no way affected the Canadian patent to Edison. The meaning of this phrase has not been declared by the Canadian courts, but a careful examination of the evidence given by the Canadian lawyers who have testified as to its practical construction by the Canadian government, and have given their professional opinions as to its meaning in Canadian law, satisfies us that it is there used as covering only foreign patents which exist before the issue of the relevant Canadian patent. We are of opinion, therefore, that neither directly (*Pohl* v. *Brewing Co.*, 134 U. S. 381, 10 Sup. Ct. Rep. 577) nor indirectly, through the Canadian patent, is the patent in suit affected by what happened to the Swedish patent.

The failure to limit the patent in suit on its face to a shorter term than 17 years, so as to expire at the same time with the prior foreign patent having the shortest term, does not affect its validity. *Bate Refrigerating Co.* v. *Hammond*, 129 U. S. 151, 9 Sup. Ct. Rep. 225. Nor do we think that validity is in any way affected by the attempted certificate of correction. The patent, as originally issued, being in every respect a regularly executed document, and the statute providing for no subsequent alteration thereof by the patent office, (except in cases of reissue, which this is not,) the action of the commissioner in indorsing it with an attempted "correction" was without jurisdiction, and wholly void. And in the absence of any provision of law contemplating the surrender of an original patent by the grantee or holder, except for reissue, we cannot find, in the request to have such unauthorized correction made, any reason for holding that the patent was by that act surrendered.

It is further urged by the defendant that the suit abated on December 31, 1886, by reason of the dissolution of the complainant consequent upon its merger, at the date named, in the corporation "Edison Electric Light Company." Except for the statute of the state of New York, permitting consolidation, the original companies could not have thus merged themselves into a new corporation. The state, which thus provided for the consolidation of the creatures of its own creation, undoubtedly had the power to regulate the manner of that consolidation and the extent to which the functions inherent in their former life should be thereby suspended or destroyed. Among these functions was the conducting of suits, actions, and proceedings in courts of justice. The right to appear as a party litigant was one which the corporation or artificial person obtained by the act of the state which created it, and it certainly has never been contended that because that creation was under state law such artificial person could not be a party litigant in federal courts. When the state undertook to regulate the matter of consolidation, and the extent to which it should terminate the life of the artificial persons it had created by destroying their functions, it expressly provided (Laws N. Y. 1884, c. 367, § 6) that—

"No suit, action, or proceeding then pending before any court or tribunal, in which any corporation that may be so consolidated is a party, or in which any such stockholder is a party, shall be deemed to have abated or been discontinued by reason of any such consolidation; but the same may be prosecuted to final judgment in the same manner as if the said corporations had not entered into the said agreement of consolidation; or the said new corporation may be substituted," etc.

The state, by this act, expressly avoided interfering with the continued exercise of the artificial person's functions as a litigant in cases when such functions were already in use. Therefore, being properly a party litigant in the suit before consolidation, it would remain so afterwards, not because the state statute is operative to regulate the practice and procedure of federal courts in equity suits, but because, so far as the litigant life of the artificial person (properly a party to the suit when brought) is concerned, there has been no change, the only power which could destroy it having scrupulously refrained from doing so. As by the consolidation all the property and rights of the old company were transferred to and vested in the new, (Consolidated Act, *supra*, § 5,) and the new company succeeded to all the obligations and liabilities of the old one, the fruits of any recovery belong to the new company, and the provisions of an adverse judgment can be enforced only against it. The survival for purposes of pending suits is therefore merely nominal, but that is no anomaly; provisions of law allowing personal representatives to continue suits in the name of the original party after his death are common.

Nor do we find any bar to the maintenance of this suit in the provisions of section 4898, Rev. St. U. S., that "every patent or interest therein shall be assignable in law by an instrument in writing." Whether the bare legal title to the patent in suit passes with all beneficial interest

in the patent by the consolidation to the new company, or whether some instrument in writing must still be executed to make such transfer complete, (the life of the old company continuing sufficiently to consummate the devolution which the consolidation act provided for,—see *Edison Electric Light Co.* v. *New Haven Electric Co.*, 35 Fed. Rep. 236,) the new company would have the right to continue, under the name of the old one, pending litigation to enforce rights which are in fact its own, with the same force and effect as if it were itself complainant. We do not find in the various contracts introduced in evidence sufficient warrant for holding that the complainant was "without such interest in the subject of the controversy as to enable it to maintain the bill in its own name without joining other parties," nor do the facts make out such a case that injunction should be refused on any theory of laches or equitable estoppel by reason of undue delay in bringing suit, or acquiescence in known infringements.

The decree of the circuit court is therefore affirmed, with costs.

ASHTON VALVE CO. *v.* COALE MUFFLER & SAFETY VALVE CO. *et al.*

(*Circuit Court of Appeals, Fourth Circuit.* October 11, 1892.)

No. 18.

1. PATENTS FOR INVENTIONS—ANTICIPATION—SAFETY VALVES.
   Claim 1 of letters patent No. 200,119, issued February 12, 1878, to Henry G. Ashton, for an improvement in safety valves, consisting substantially of an ordinary spring valve with a pop-valve chamber added, in combination with a valve seat, an inclosed spring chamber, and an inclosed discharge chamber, is void because of anticipation by the English patent of 1872, No. 891, to Giles. 50 Fed. Rep. 100, affirmed.
2. SAME—EXTENT OF CLAIM.
   In his specifications Ashton states that his combination is very important "in all cases where the steam is prevented in any way from escaping freely from the hood or casing, as is often the case." In another place he states that he provides holes or vents in the spring chamber for the escape of such steam as may enter it, but these vents are not mentioned in the claims, which cover merely the above combination, "arranged to operate as described." *Held*, that the patent did not cover the use of the vent holes. 50 Fed. Rep. 100, affirmed.
3. SAME—ANTICIPATION—SENIOR AND JUNIOR PATENTS—EVIDENCE.
   Letters patent No. 299,503, issued June 3, 1884, to Ashton, for a combination of a muffling chamber, surrounding a safety valve, with a pipe communicating from the spring chamber to the outside air, was anticipated by patent 297,066, issued April 15, 1884, to Coale, which covers practically the same features, complainant having failed to show by a preponderance of the evidence that Ashton was in fact the first inventor. 50 Fed. Rep. 100, affirmed.

Appeal from the Circuit Court of the United States for the District of Maryland.

In Equity. Suit by the Ashton Valve Company against the Coale Muffler & Safety Valve Company and others for infringement of patents. In the circuit court the bill was dismissed. 50 Fed. Rep. 100. Complainant appeals. Affirmed.