

CONSOLIDATED ELECTRIC LIGHT CO. v. McKEESPORT LIGHT CO.

Circuit Court, W. D. Pennsylvania.

October 5, 1889.

1. PATENTS FOR INVENTIONS—ELECTRIC LIGHT CARBONS—EXTENT OF CLAIM.

The claims of letters patent granted May 12, 1885, to the Electro Dynamic Light Company, for improvements in electric lamps, (excluding the third claim, which was not in issue,) are substantially as follows: (1) A conductor of carbon, made of fibrous or textile material, and of an arched form; (2) a conductor of carbon, made of fibrous material, in an hermetically sealed chamber, without regard to form; (3) the combination of a conductor of carbon, made of fibrous or textile material, in an arched form, and the glass chamber, hermetically sealed, and deprived of carbon-consuming gas. *Held*, in view of the state of the art, and the evident necessities of the case, that these claims amounted to the broad claim of the exclusive use, in incandescing lamps, of all carbons made of fibrous or textile materials.

2. SAME.

Such a claim is void for want of novelty, in view of the fact that wood charcoal had previously been used for electric lighting in incandescent lamps.

3. SAME—AMENDMENT TO APPLICATION.

The original application of Sawyer & Man, filed January 9, 1880, for a patent for improvements in incandescing electric lamps, was evidently intended to secure only the arched form of the carbon burner; but in 1885, after Edison's inventions had been published to the world, the purpose of the application was changed to secure the use of all carbons made of fibrous material. *Held*, that such a change was not justifiable, and the claim based thereon is void.

4. SAME—INVENTION.

Held, further, from the evidence in the case, that Sawyer & Man did not invent a successful lamp, and did not discover the principle on which such a lamp could be made; but that the true principle for constructing such a lamp was described in the patents of Edison applied for in April, 1879, and November 4, 1879, and numbered 227, 229, and 223, 898, as exhibited in the filamental or thread-like conductors or burners, inclosed in a more perfect vacuum than had ever before been used.

In Equity. Bill for infringement of patent.

Edmund Wetmore, Thomas B. Kerr, Amos Broadnax, and John Dalzell, for complainant.

R. N. Dyer, B. F. Thurston, G. P. Lowry, W. R. Griffin, and Magnus Pflaum, for respondent.

BRADLEY, Justice. This is a bill for the alleged infringement of a patent, filed December 8, 1887, and the patent alleged to be infringed is dated May 12, 1885, and is for improvements in electric lamps. It was granted upon the application of William E. Sawyer and Albon Man, of New York, to their assignees, the Electro Dynamic Light Company, and by mesne assignments was transferred to the complainant, whose title commenced in October, 1882, before the patent was issued. The application for the patent was filed January 9, 1880, and the issue was delayed by various proceedings in the patent-office, including an interference with an application of Thomas A. Edison, which had been filed

CONSOLIDATED ELECTRIC LIGHT CO. v. McKEESPORT LIGHT CO.

a month earlier, to-wit, December 11, 1879. Various defenses were set up in the answer, such as anticipation by prior inventors, vagueness of description, want of novelty and utility, undue change of specification after filing, surreptitious claim of an invention made by Edison, etc. It is conceded that the defense of the suit is conducted by the Edison Electric Light Company, a corporation of New York, which sells the lamps complained of as infringements of the patent, and is interested as assignee in

the patents, for electric lights formerly owned by the Edison Electric Light Company, and in the question of interference between Edison and the complainants. In the specification of the patent sued on, called "Sawyer and Man Patent," the invention is described as relating to that class of electric lamps employing an incandescent conductor, inclosed in a transparent, hermetically sealed vessel or chamber, from which oxygen is excluded, and constituting an improvement upon the apparatus shown in a previous patent granted to the same parties (Sawyer and Man) June 18, 1878, and numbered 205, 44. It is further stated in the specification that the invention relates more especially to the incandescent conductor, its substance, its form, and its combination with the other elements composing the lamp; and that the improvement consists, first, of the combination in a lamp chamber, composed wholly of glass, as described in the said, former patent, of an incandescent conductor of carbon, made from a vegetable fibrous material, in contradistinction to a similar conductor made from mineral or gas carbon, and also in the form of such conductor, combined in lighting circuit within the exhausted chamber of the lamp. The construction of the lamp is then described; reference being made to the drawings for illustration. The lamp as described and shown in the drawings is a glass cylinder, with rounded top, cemented at the bottom to a glass disk or plate, ground to fit closely to the cylinder, and the whole bottom inclosed in a cup filled with wax or suitable cement, to prevent, as far as possible, the access of atmospheric air. Two holes are made in the bottom of the lamp for the passage of the wires which convey the electric current into and out of the lamp. The carbon conductor within the glass cylinder is connected by its extremities to these two wires, respectively, in a mode specified in another patent of Sawyer and Man, dated December 10, 1878, and numbered 210, 809, so as to constitute a part of the circuit; and having a low conductivity, and presenting a certain amount of resistance to the current of electricity, it becomes incandescent and highly luminous. If the carbon in this condition were exposed to atmospheric air, that is, to oxygen, it would be consumed by combustion. Hence another part of the combination necessary to the result consists in filling the lamp with nitrogen gas, or other gas, which prevents combustion, to the exclusion of atmospheric air. The mode of doing this is pointed out in the patent No. 205,144, before referred to. It is further stated, in the specifications; that in the practice of the invention the applicants had made use of carbonized paper, and also wood carbon; also that they had used conductors of different shapes, such as V-shaped, and with rectangular corners, but preferred the arch-shaped, as shown in the drawings. It is added that a description of the mode of making the illuminating carbon conductors described, "and making the subject-matter of this improvement," was unnecessary as they could be made, by any one skilled in the art, by the ordinary well-known methods in practice. The specification then states the proposed practical advantages of the arched form of the conductor, by its per-

CONSOLIDATED ELECTRIC LIGHT CO. v. McKEESPORT LIGHT CO.

mitting the carbon to expand and contract, and casting less shadow, and the advantage of making the wall of the lamp

wholly of glass, by its preventing oxidation, leakage, etc., and states particularly the advantages resulting from the manufacture of the carbon from vegetable fibrous or textile material, instead of mineral or gas carbon. "Among them," it says, "may be mentioned the convenience afforded for cutting and making the conductor in the desired form and size, the purity and equality of the carbon obtained, its susceptibility to tempering, both as to hardness and resistance, and its toughness and durability." "We have used," it is added, "such burners, inclosed in hermetically sealed, transparent chambers, in a vacuum, in nitrogen gas, and in hydrogen gas, but we have obtained the best results in a vacuum, or an attenuated atmosphere of nitrogen gas; the great *desideratum* being to exclude oxygen or other gases, capable of combining with carbon at high temperatures, from the incandescing chamber, as is well understood." The patent has four claims

"(1) An incandescing conductor for an electric lamp, of carbonized fibrous or textile material, and of an arch or horseshoe shape, substantially as hereinbefore set forth. (2) The combination, substantially as hereinbefore set forth, of an electric circuit and an incandescing conductor of carbonized fibrous material, included in and forming part of said circuit, and a hermetically sealed chamber, in which the conductor is inclosed. (3) The incandescing conductor for an electric lamp, formed of carbonized paper, substantially as described. (4) An incandescing electric lamp, consisting of the following elements, in combination: *First*, an illuminating chamber, made wholly of glass, hermetically sealed, and out of which all carbon-consuming gas has been exhausted or driven; *second*, an electric circuit conductor passing through the glass wall of said chamber, and hermetically sealed therein, as described; *third*, an illuminating conductor in said circuit, and forming part thereof, within said chamber, consisting of carbon made from fibrous or textile material, having the form of an arch or loop, substantially as described, for the purpose specified."

The great question in this suit is whether the patent sued on is valid, so far as it involves a general claim for the use, in electric lamps, of incandescing; carbon conductors, made of fibrous or textile substances. If it is, the complainant must prevail; if it is, not, the bill must be dismissed. The claims of the patent (excluding the third claim, which the defendant does not use, and which is not involved in the case) may be summarized as follows: (1) A conductor of carbon, made of fibrous or textile material, and of an arched form; (2) a conductor of carbon, made of fibrous material, in an hermetically sealed chamber, without regard to form; (3) The combination of a conductor of carbon, made of fibrous or textile material, in an arched form, and the glass chamber, hermetically sealed, and deprived of carbon-consuming gas. The claim of the combination last named may be dismissed from consideration as a separate claim; because a glass chamber, hermetically sealed, for holding the light, has always been used, and must necessarily be used, in all incandescing carbon electric lamps. It was used by King in 1845, by Greener and Staite in 1846, by Roberts in 1852, by Konn in 1872, by Kosloff in 1875, and by others. Unless

CONSOLIDATED ELECTRIC LIGHT CO. v. McKEESPORT LIGHT CO.

the patent is valid for the conductor of carbon, made of fibrous or textile material, in an arched form, it cannot be made valid by combining such conductor with a glass chamber,

hermetically sealed. We are equally of opinion that the giving of an arched form to the conductor was not new, and could not give to the claim any validity which it would not have as a broad claim of the conductor itself, made of carbon produced from a fibrous material. The arched or bent shape in incandescent conductors was applied in 1848 by Staite to an iridium conductor, in 1858 by Gardiner and Blossom to a platinum conductor, and in 1872 by Konn to a carbon conductor. In the last case the conductor was inclosed (as it had to be) in a glass lamp or case filled with nitrogen or other gas incapable of supporting combustion. The carbon, it is true, is presented in a V-shaped form; but in a similar patent, applied for a few weeks afterwards, claiming the same apparatus for the production of heat, the patentee very properly says: "It is evident that stems of other shapes may be used." If the U or V shaped form had not been given to carbons made in fibrous material, for incandescent light, before Sawyer and Man adopted that form, it was merely an application by them of an old device to a new and analogous use. But the carbons used by Konn included charcoal, as well as other carbons. He mentions graphite as preferable, but he claims the use of carbon generally. As before stated, therefore, the patent must be construed as making the broad claim to the use, in electric incandescing lamps, of all carbons made of fibrous or textile substances.

Is the patent valid for such a broad claim? The defendant contends that it is not—*first*, because no such invention was set forth in the original application, but was introduced for the first time more than four years after it was filed, and after the same material had been used by Edison, and claimed by him in an application for a patent; *secondly*, because Edison, and not Sawyer and Man, was really the original and first inventor of an incandescent conductor made of fibrous or textile material for an electric lamp; *thirdly*, because, if Edison was not the first inventor, the thing claimed as an invention was old, and neither of the parties was entitled to a patent for it. The whole vegetable kingdom is composed of fibrous material, and all carbon or charcoal made therefrom comes within the scope of the complainant's claim. Silk is fibrous or textile, and carbon made from silk thread is therefore within the claim. Mineral coal, and the carbon produced in gas-retorts, are not included. Can it possibly be said, when we look at the history of the art of electric lighting, that carbon made from fibrous or textile material was never used for that purpose until Sawyer and Man used it in 1878? We think not. We do not propose to describe in detail the various English patents of prior date which have been adduced in evidence. The word "charcoal," as well as "carbon," is constantly used to define the material from which the conductors were made; and that word, in the English language, *prima facie* refers to carbon or coal made of wood. We cannot yield our assent to the ingenious theory of the complainant's counsel, and some of their witnesses, that the word has come to have an artificial or technical meaning, in this particular art, signifying gas or mineral

CONSOLIDATED ELECTRIC LIGHT CO. v. McKEESPORT LIGHT CO.

carbon. We think that carbon made from wood or other vegetable material is generally intended. In King's patent of 1845 he Says:

“The nature of the invention consists in the application of continuous metallic and carbon conductors, intensely heated by the passage of a current of electricity to the purpose of illumination.” “When carbon is used, it becomes necessary, on account of the affinity this substance has for oxygen at high temperature, to exclude from it air and moisture. To accomplish this in the most perfect manner, it should be inclosed in a Torricellian vacuum.”

He does not confine himself to any particular kind of carbon. It is true, he does afterwards say: “That form of carbon found on the interior of coal-gas retorts which have long been used, is well suited for this purpose;” but his claim is general, for “the application of metallic and carbon conductors, intensely heated,” etc., and the use of wood carbon would have infringed the patent. Greener and Staite, in their patent of 1846, in describing how they prepared the carbon for the incandescing stems in their lamps, say:

“We take a quantity of lamp-black, or of charcoal reduced to powder, or of coke reduced also to powder, which has been purified,” etc. “The carbon thus highly purified we next bring into a state of great dryness, and then convert it into solid prisms, or into cylinders, both solid and hollow,” etc.

The charcoal here referred to is clearly wood charcoal. Roberts, in his patent of 1852, says:

“Another part of my invention consists of a mode of obtaining electric light by passing a current of electricity through a thin piece of graphite, coke, or charcoal, or other infusible body, being a conductor of electricity, whilst it is inclosed in a vacuum, or space not containing any oxygen or other matter, which can cause the combustion or destruction of it, when brought into an incandescent state by the action of the current of electricity.”

This certainly refers to wood charcoal. We have already alluded to Konn’s patent of 1872, in which he claims carbon stems generally, arranged as specified in the patent, for giving incandescent light. We may add that, in the earliest experiments of Sir Humphrey Davy and others on the effects of the electric current in producing light in various substances, charcoal was one of the most frequent articles used for that purpose. Long prior to 1878 it was a well-known fact in science and the arts that the transmission of the electric current through a pencil of charcoal, interposed in a metallic circuit, would produce intense light; and that when this charcoal was guarded from contact with oxygen, in a vacuum or otherwise, it would not be consumed. This is fully verified, not only in scientific writings, but by the statements found in several of the patents referred to. The great *desideratum* was to construct an apparatus and to discover a process which would make the light economical and convenient of use for ordinary domestic purposes. We are clearly of opinion, therefore, that neither Sawyer and Man nor Edison can maintain any just claim to the exclusive use of charcoal generally, in any form, as an incandescing conductor in an electric lamp. This view of the subject is sufficient to decide the present

CONSOLIDATED ELECTRIC LIGHT CO. v. McKEESPORT LIGHT CO.

case against the complainants. But there are other considerations which go to corroborate the conclusion to which we have come, which, however, we shall only cursorily examine.

It is very clear to us that, in the original application for the patent sued on, the applicants had no such object in view as that of claiming all carbon made from fibrous and textile substances as a conductor for an incandescing electric lamp nothing on which to base any such claim is disclosed in the original application. We have carefully compared it with the amended application, on which the patent was issued, and are fully satisfied that, after Edison's inventions on this subject had been published to the world, there was an entire change of base on the part of Sawyer and Man, and that the application was amended to give it an entirely different direction and purpose from what it had in its original form. It is true that the last claim of the original was for "an illuminating arc, made of carbonized fibrous or textile material." But this claim had special reference to the arched form of the conductor, rather than to the material of which it was composed. And this claim is the only expression in the application which even suggests any exclusive right to all vegetable carbons, or any invention or discovery in relation thereto. No advantage in the use of said carbon is anywhere alleged. The whole scope and purpose of the application related to the arched form of the conductor. A subsidiary purpose was to claim carbon made from paper or pasteboard. They say distinctly: "Our improvement consists in the employment of an incandescent arc of carbon in the circuit as the light-giving medium,"—"carbon" generally, not any particular carbon. By an adroit amendment made in 1885 they say: "Our improvement relates more especially to the incandescing conductor, its substance, its form, and its combination with the other elements composing the lamp." The purpose of this amendment is obvious, and needs no comment. After explaining the drawings, the original application goes on to say:

"Our improved burner or incandescent arc consists of an arch-shaped or semi-cylindrical piece of carbon, A, mounted in its clamps or supports in the usual well-known ways. We have tried carbonized paper covered with powdered plumbago, wood carbon, or charcoal, and ordinary gas carbon. We have also used such arcs or burners of various shapes, such as pieces with their lower ends secured to their respective supports, and with their upper ends united, so as to form an inverted V-shaped burner. We have also used arcs of varying contour, that is, with rectangular bends, instead of curvilinear ones, but prefer the arch-shaped, as the shadow cast by such a burner is less than that produced by other forms of burners. We have used such burners in close transparent chambers, in a vacuum, in nitrogen gas, and in hydrogen gas, but have attained the best results in a vacuum or attenuated atmosphere of nitrogen; the great *desideratum* being to exclude oxygen from the combustion chamber, as is well understood. The operation of our improved apparatus will readily be understood from the foregoing description."

Then come the claims, as follows:

"*First*, incandescing arcs for electric lights, made of carbon, substantially as hereinbefore set forth; *second*, incandescing arcs of carbon, in combination with the circuit of an electric

CONSOLIDATED ELECTRIC LIGHT CO. v. McKEESPORT LIGHT CO.

light; *third*, the combination, substantially as hereinbefore set forth, of the Circuit of an electric light, an incandescing arc of carbonized paper, included in the circuit, and a close transparent chamber

in which the arc is inclosed; *fourth*, an incandescing arc, made of carbonized fibrous or textile material.”

This is the whole of the original application, except the formal introduction. The arc is everything. The changes are rung on the arc. The fact is that Sawyer and Man were unconscious that the arc was not new, and supposed that they could get a patent for it; but, as their eyes were opened, they changed about, and amended their application, and made the material of the conductor the great object,—carbon made from fibrous or textile material. Compare the original with the amended application, as first stated in this opinion, and this purpose most obviously appears. The carbons mentioned in the original application are merely mentioned by the way, to show that the arched form would apply to all kinds of carbon. “We have tried carbonized paper, covered with powdered plumbago, wood carbon, and ordinary gas carbon.” This is changed in the amended application to the words: “In the practice of our invention, we have made use of carbonized paper, and also wood carbon.” The object of this change is manifest. In other parts of the amended specification the importance of vegetable carbon, as distinguished from gas carbon, is dwelt upon. Thus they say in a former paragraph:

“Our improvement consists, first, of the combination in a lamp chamber composed wholly of glass, and described in patent No. 205,144 of an incandescing conductor of carbon, made from a vegetable fibrous material, in contradistinction to a similar conductor made from mineral or gas carbon, and also in the form of such conductors, so made from such vegetable carbon, and combined in the lighting circuit within the exhausted chamber of the lamp.”

The fact that the whole object of the application was changed is evinced by the correspondence of the parties. In a letter from William B. Baldwin, one of the attorneys of the applicants for the patent, to his clients, the Electro Dynamic Light Company, (who then owned the interest in the invention,) dated January 8, 1880, he says:

“I have this day prepared an application for patent of arched form of an incandescent carbon electric lamp, made by Wm. E. Sawyer and Albon Man, as joint inventors, containing a request for the issuing of such patent to your company, etc. I will not make any alteration in the claims or specification of said patent, enlarging its scope beyond its intended purpose of covering the arched or angular form of the carbon used for incandescent electric lights.”

In a letter from Albon Man, one of the applicants for the patent, to a Mr. Cheever, dated December 12, 1880, he says:

“I have received your two notes of 11th inst., inclosing letter from the patent-office, advising Messrs. Baldwin, Hopkins, and Payton of substitution of Mr. Broadnax as attorney in carbon arch matter.”

CONSOLIDATED ELECTRIC LIGHT CO. v. McKEESPORT LIGHT CO.

This had relation to the application in question; Baldwin, Hopkins & Payton being the solicitors in the case, and Mr. Broadnax being substituted in their place. "Carbon arch matter" are words that could hardly be more suggestive. As before stated, Edison had filed an application for a patent in December, 1879, about a month prior to the application in question; and in September, 1880, an interference was declared between

the two applications. The controversy raised on this interference related principally to carbon made from paper, which Edison claimed in his application. The case was not finally decided until the beginning of 1885. Mr. Broadnax was examined as a witness in this suit, and testified as follows:

“After the decision of the commissioner of patents of the interference, awarding priority of invention to Sawyer and Man, I resumed the prosecution of the application, insisting upon our right to the claims that had been once rejected by the examiner, among which was one for the U-shaped or loop-carbon illuminant. My attention was then called for the first time by the examiner to the British patent of Konn, in which is shown an arch-shaped carbon illuminant, and which, as I thought, anticipated broadly the claim for the U-shaped or arch-shaped carbon illuminant; and then, in the discussion of the case with the examiner, my attention was called to the patentability of the fibrous carbon illuminant, as such, on account of the properties such carbon possessed, which made it available for electric lighting above all other carbons.”

Being asked when this was, he said it followed soon after the decision of the commissioner of patents upon the question of priority, or as soon as he could, in the ordinary course, get the case before the primary examiner again. His best recollection was that it occurred in February, 1885. This testimony of Mr. Broadnax, which is undoubtedly to be relied on, in connection with the letter just quoted, shows that the idea of claiming carbons made from fibrous and textile materials was an after-thought, and was no part of the purpose of the original application. The amendments relating to this new and broad claim were made afterwards, in February and March, 1885. We are of opinion that the changes made in the application in this regard were not justifiable, and that the claim in question cannot be sustained.

There are other aspects of the case, to which we might refer, which operate strongly against the claim of the complainants. We are not at all satisfied that Sawyer and Man ever made, and reduced to practical operation, any such invention as is set forth and claimed in the patent in suit. Their principal experiments were made in 1878, and perhaps the beginning of 1879. The evidence as to what they accomplished in the construction of electric lamps is so contradictory and suspicious that we can with difficulty give credence to the conclusions sought to be drawn from it. We are not satisfied that they ever produced an electric lamp with a burner of carbon made from fibrous material, or any material, which was a success. During the year referred to, 1878, and the beginning of 1879, they applied for and obtained ten different patents (besides an English patent) on the subject of electric lamps; but not one of them contains a suggestion or a hint of any such invention as is claimed in the patent in suit, which was not applied for until 1880. They all relate to lamps with straight pencil burners, generally of carbon, but without any preference given to one kind of carbon over another. The application for the patent in suit

CONSOLIDATED ELECTRIC LIGHT CO. v. McKEESPORT LIGHT CO.

was not, made until January, 1880 nearly or quite a year after all their experiments had ceased, and after the inventions of Edison had been published to the

world. One cannot read the patents before applied for by Sawyer and Man, with all their detail of apparatus and process for constructing and managing the straight stem conductors, without distinction of carbons,—apparatus and processes, many of which would be needless in the lamp now claimed,—without indulging some degree of astonishment at the pains and ingenuity gratuitously expended or wasted, if it was true that, all the time, they had in their possession a secret invention which would take the place of those complicated contrivances. The explanations made by the complainants for the delay in applying for the patent in suit fail to satisfy our minds that Sawyer and Man, or their assignees for them, have not sought to obtain a patent to which they were not legitimately entitled. But suppose it to be true, as the supposed inventors and some of the other witnesses testify, that they did in 1878 construct some lamps with burners of carbon made of fibrous material, and of an arched shape, which continued to give light for days or weeks or months, still, were they a successful invention? Would any one purchase or touch them now? Did they not lack an essential ingredient which was necessary to their adoption and use? Did they go any further in principle, if they did in degree, than did other lamps which had been constructed before? It seems to us that they were following a wrong principle,—the principle of small resistance in an incandescing conductor, and a strong current of electricity; and that the great discovery in the art was that of adopting high resistance in the conductor, with a small illuminating surface, and a corresponding diminution in the strength of the current. This was accomplished by Edison in his filamental, thread-like conductors, rendered practicable by the perfection of the vacuum in the globe of the lamp. He abandoned the old method of making the globe in separate pieces, cemented together, and adopted a globe of one entire piece of glass, into which he introduced small platinum conductors, fastened by fusion of the glass around them; thus being able to procure and maintain, perhaps, the most perfect vacuum known in the arts. In such a vacuum the slender filaments of carbon, attenuated to the last degree of fineness, may be maintained in a state of incandescence, without deterioration, for an indefinite time, and with a small expenditure of electric force. This was really the grand discovery in the art of electric lighting, without which it could not have become a practical art for the purposes of general use in houses and cities. It is unimportant to trace the various steps by which this great discovery was arrived at. It is well indicated and shown in Edison's patent applied for in April, 1879, and issued May 4, 1880, No. 227,229, and is more fully described in that which he applied for November 4, 1879, and issued January 27, 1880, No. 223,898. An extract from the latter will serve to explain the principles of this invention. Edison there says:

“Heretofore 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

CONSOLIDATED ELECTRIC LIGHT CO. v. McKEESPORT LIGHT CO.

replaced by gases that do not combine chemically with carbon. The vessel holding the burner has been composed of glass, cemented

to a metallic base. The connection between the leading wires and the carbon has been obtained by clamping the carbon to the metal. 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 100 to 500 ohms resistance to the passage of the current, and that it is absolutely stable at very high temperatures; that if the thread be coiled as a spiral, and carbonized, or if any fibrous vegetable substance which will leave a carbon residue after heating in a closed chamber be so coiled, it offers as much as 2, 000 ohms resistance, without presenting a radiating surface greater than three-sixteenths of an inch; that, if such fibrous material be rubbed with a plastic composed of lamp-black and tar, its resistance may be made high or low, according to the amount of lampblack placed upon it; that carbon filaments may be made by a combination of tar and lamp-black, the latter being previously ignited in a closed crucible for several hours, and afterwards moistened and kneaded until it assumes the consistency of thick putty. Small pieces of this material may be rolled out in the form of wire as small as seven one-thousandths of an inch in diameter, and over a foot in length, and the same may be coated with a non-conducting, non-carbonizing substance, and wound on a bobbin, or as a spiral, and the tar carbonized in a closed chamber by subjecting it to high heat, the spiral after carbonization retaining its form. All these forms are fragile, and cannot be clamped to the leading wires with sufficient force to insure good contact and prevent heating. I have discovered that if platinum wires are used, and the plastic lamp-black and tar material be moulded around it, in the act of carbonization, there is an intimate union by combination and by pressure between the carbon and platina, and nearly perfect contact is obtained without the necessity of clamps; hence the burner and the leading wires are connected to the carbon, ready to be placed in the vacuum bulb. When fibrous material is used, the plastic lamp-black and there are used to secure it to a platina before carbonizing. By using the carbon wire of such high resistance, I am enabled

CONSOLIDATED ELECTRIC LIGHT CO. v. McKEESPORT LIGHT CO.

to use fine platinum wires for leading wires, as they will have a small resistance compared with the burners, and hence will not heat and crack the sealed vacuum bulb. Platina can only be used, as its expansion is nearly the same as that of glass. * * * I have carbonized and used cotton and linen thread, wood splints, papers coiled in various ways; also lamp-black, plumbago, and Carbon in various forms mixed with tar, and kneaded so that the same may be rolled out into wires of various lengths and diameters. Each wire, however, is to be uniform in size throughout.”

The first claim of this patent is for 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. The

second claim is the combination of such filaments with the receiver, made entirely of glass. Of course, the form of the filament in the receiver or globe may be varied at pleasure. It may be in the shape of a coil, or of a horseshoe, or it may be wound on a bobbin. All these forms are old. The principal and great thing described is the attenuated filament, and its inclosure in a perfect vacuum. There may be a preference of materials from which the filament is made. Practice will evolve all these collateral advantages. We think we are not mistaken in saying that, but for this discovery, electric lighting would never have become a fact. We have supposed it to be the discovery of Edison, because he has a patent for it. This may not be the case. It may be the discovery of some other person; but, whoever discovered it, it is undoubtedly the great discovery in the art of practical lighting by electricity. We have given a more detailed account of it, in order to illustrate what we mean, when we raise the question whether the claimed inventions of Sawyer and Man were ever successful. They may have made a lamp that would burn; but was it a success, or was it a failure? Did it ever go into use? What was the object of all the experiments made by them and others? Was it not to make an electric lamp that could be successfully used by the public, and have a commercial value? Did they succeed in making such a lamp, or in finding out the principle on which it could be made? We do not so read the evidence. The bill must be dismissed.