Statement of the Case.

The objection that the Atlantic and Pacific Railroad Company, as grantee from the United States, of a part of the tract in question, was a necessary party defendant, has not been pressed in argument, and we only notice it to say that, under the provisions of the fifth section of this act, the private rights of third parties are not affected by any proceeding or decree under said act.

The decree of the court below is

Affirmed.

THE INCANDESCENT LAMP PATENT.[1]

APPEAL FROM THE CIRCUIT COURT OF THE UNITED STATES FOR THE WESTERN DISTRICT OF PENNSYLVANIA.

No. 10. Argued October 29, 30, 1894. — Decided November 11, 1895.

With the exception of the third claim, viz., for "the incandescing conductor for an electric lamp, formed of carbonized paper, substantially as described," the claims in the letters patent No. 317,076, issued May 12, 1885, to the Electro-Dynamic Light Company, assignee of Sawyer and Man, for an electric light, are too indefinite to be the subject of a valid monopoly.

This was a bill in equity, filed by the consolidated Electric Light Company against the McKeesport Light Company, to recover damages for the infringement of letters patent No. 317,076, issued May 12, 1885, to the Electro-Dynamic Light Company, assignee of Sawyer and Man, for an electric light. The defendants justified under certain patents to Thomas A. Edison, particularly No. 223,898, issued January 27, 1880; denied the novelty and utility of the complainants' patent, and averred that the same had been fraudulently and illegally procured. The real defendant was the Edison Electric Light Company, and the case involved a contest between what are known as the Sawyer and Man and the Edison systems of electric lighting.

[1] This is the title of this case in the opinion of the court; but its docket title is, "The Consolidated Electric Light Company, Appellant, *v.* The McKeesport Light Company."

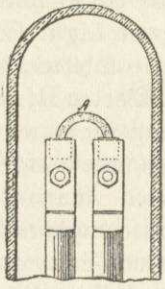
Statement of the Case.

In their application, Sawyer and Man stated that their invention related to "that class of electric lamps employing an incandescent conductor enclosed in a transparent, hermetically-sealed vessel or chamber, from which oxygen is excluded, and . . . more especially to the incandescing conductor, its substance, its form, and its combination with the other elements composing the lamp. Its object is to secure a cheap and effective apparatus; and our improvement consists, first, of the combination, in a lamp chamber, composed wholly of glass, as described in patent No. 205,144," upon which this patent was declared to be an improvement, "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 conductor so made from such vegetable carbon, and combined in the lighting circuit with the exhausted chamber of the lamp."

The following drawings exhibit the substance of the invention:

Figure 2.

Figure 3.



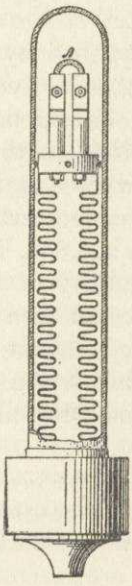
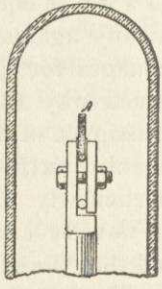


Figure 4.



Statement of the Case.

The specification further stated that:

"In the practice of our invention we have made use of carbonized paper, and also wood carbon. We have also used such conductors or burners of various shapes, such as pieces with their lower ends secured to their respective supports, and having their upper ends united so as to form an inverted V-shaped burner. We have also used conductors of varying contours — that is, with rectangular bends instead of curvilinear ones; but we prefer the arch shape."

"No especial description of making the illuminating carbon conductors, described in this specification and making the subject-matter of this improvement, is thought necessary, as any of the ordinary methods of forming the material to be carbonized to the desired shape and size, and carbonizing it while confined in retorts in powdered carbon, substantially according to the methods in practice before the date of this improvement, may be adopted in the practice thereof by any one skilled in the arts appertaining to the making of carbons for electric lighting or for other use in the arts."

"An important practical advantage which is secured by the arch form of incandescing carbon is that it permits the carbon to expand and contract under the varying temperatures to which it is subjected when the electric current is turned on or off without altering the position of its fixed terminals. Thus the necessity for a special mechanical device to compensate for the expansion and contraction which has heretofore been necessary is entirely dispensed with, and thus the lamp is materially simplified in its construction. Another advantage of the arch form is that the shadow cast by such burners is less than that produced by other forms of burners when fitted with the necessary devices to support them."

"Another important advantage resulting from our construction of the lamp results from the fact that the wall forming the chamber of the lamp through which the electrodes pass to the interior of the lamp is made wholly of glass, by which all danger of oxidation, leakage, or short circuiting is avoided."

"The advantages resulting from the manufacture of the carbon from vegetable fibrous or textile material instead of

mineral or gas carbon are many. Among them 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 such burners in closed or 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 claims were as follows:

"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."

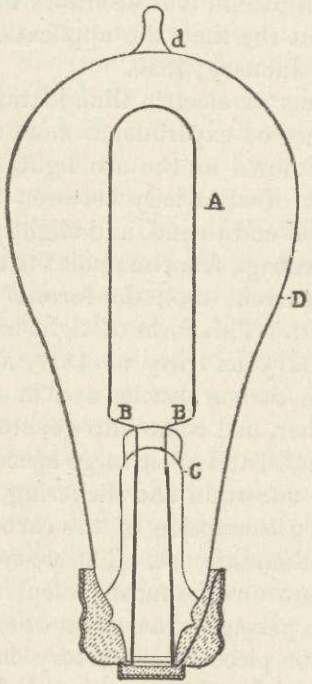
"2. The combination, substantially as hereinbefore set forth, of an electric circuit and an incandescing conductor of carbonized fibrous material, included in and forming part of said circuit, and a transparent hermetically sealed chamber in which the conductor is enclosed."

"3. The incandescing conductor for an electric lamp, formed of carbonized paper, substantially as described."

"4. An incandescing electric lamp consists 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 a fibrous or textile material, having the form of an arch or loop, substantially as described, for the purpose specified."

The commercial Edison lamp used by the appellee, and which is illustrated below, is composed of a burner, A, made of carbonized bamboo of a peculiar quality discovered by Mr. Edison to be highly useful for the purpose, and having a length of about six inches, a diameter of about five one thou-

sandths of an inch, and an electrical resistance of upwards of 100 ohms. This filament of carbon is bent into the form of a loop, and its ends are secured by good electrical and mechanical connections to two fine platinum wires BB. These wires pass through a glass stem, C, the glass being melted and fused upon the platinum wires. A glass globe, D, is fused to the glass stem C. This glass globe has originally attached to it, at the point *d*, a glass tube, by means of which a connection is made with highly organized and refined exhausting apparatus, which produces in the globe a high vacuum, whereupon the glass tube is melted off by a flame, and the globe is closed by the fusion of the glass at the point *d*.



Upon a hearing in the Circuit Court before Mr. Justice Bradley upon pleadings and proofs, the court held the patent to be invalid, and dismissed the bill. 40 Fed. Rep. 21. Thereupon complainant appealed to this court.

Mr. Edmund Wetmore and *Mr. Leonard E. Curtis*, (with whom were *Mr. John W. Houston* and *Mr. Thomas B. Kerr* on the brief,) for appellant.

Mr. Frederick P. Fish, (with whom was *Mr. Richard N. Dyer*, on the brief,) for appellee.

Mr. Justice Brown, after stating the case as above reported, delivered the opinion of the court.

In order to obtain a complete understanding of the scope of the Sawyer and Man patent, it is desirable to consider briefly the state of the art at the time the application was originally made, which was in January, 1880.

Two general forms of electric illumination had for many years been the subject of experiments more or less successful, one of which was known as the arc light, produced by the passage of a current of electricity between the points of two carbon pencils, placed end to end, and slightly separated from each other. In its passage from one point to the other through the air, the electric current took the form of an arc, and gave the name to the light. This form of light had been produced by Sir Humphry Davy as early as 1810, and by successive improvements in the carbon pencils and in their relative adjustment to each other, had come into general use as a means of lighting streets, halls, and other large spaces; but by reason of its intensity, the uncertain and flickering character of the light, and the rapid consumption of the carbon pencils, it was wholly unfitted for domestic use. The *second* form of illumination is what is known as the incandescent system, and consists generally in the passage of a current of electricity through a continuous strip or piece of refractory material, which is a conductor of electricity, but a poor conductor — in other words, a conductor offering a considerable resistance to the flow of the current through it. It was discovered early in this century that various substances might be heated to a white heat by passing a sufficiently strong current of electricity

through them. The production of a light in this way does not in any manner depend upon the consumption or wearing away of the conductor, as it does in the arc light. A *third* system was a combination of the two others, but it never seems to have come into general use, and is unimportant in giving a history of the art.

For many years prior to 1880, experiments had been made by a large number of persons, in various countries, with a view to the production of an incandescent light which could be made available for domestic purposes, and could compete with gas in the matter of expense. Owing partly to a failure to find a proper material, which should burn but not consume, partly to the difficulty of obtaining a perfect vacuum in the globe in which the light was suspended, and partly to a misapprehension of the true principle of incandescent lighting, these experiments had not been attended with success; although it had been demonstrated as early as 1845 that, whatever material was used, the conductor must be enclosed in an air-tight bulb, to prevent it from being consumed by the oxygen in the atmosphere. The chief difficulty was that the carbon burners were subject to a rapid disintegration or evaporation, which electricians assumed was due to the disrupting action of the electric current, and, hence, the conclusion was reached that carbon contained in itself the elements of its own destruction, and was not a suitable material for the burner of an incandescent lamp.

It is admitted that the lamp described in the Sawyer and Man patent is no longer in use, and was never a commercial success; that it does not embody the principle of high resistance with a small illuminating surface; that it does not have the filament burner of the modern incandescent lamp; that the lamp chamber is defective, and that the lamp manufactured by the complainant and put upon the market is substantially the Edison lamp; but it is said that, in the conductor used by Edison, (a particular part of the stem of the bamboo lying directly beneath the silicious cuticle, the peculiar fitness for which purpose was undoubtedly discovered by him,) he made use of a fibrous or textile material, covered by the patent to

Sawyer and Man, and is, therefore, an infringer. It was admitted, however, that the third claim — for a conductor of carbonized paper — was not infringed.

The two main defences to this patent are (1) that it is defective upon its face, in attempting to monopolize the use of all fibrous and textile materials for the purpose of electric illumination; and (2) that Sawyer and Man were not in fact the first to discover that these were better adapted than mineral carbons to such purposes.

Is the complainant entitled to a monopoly of all fibrous and textile materials for incandescent conductors? If the patentees had discovered in fibrous and textile substances a quality common to them all, or to them generally, as distinguishing them from other materials, such as minerals, etc., and such quality or characteristic adapted them peculiarly to incandescent conductors, such claim might not be too broad. If, for instance, minerals or porcelains had always been used for a particular purpose, and a person should take out a patent for a similar article of wood, and woods generally were adapted to that purpose, the claim might not be too broad, though defendant used wood of a different kind from that of the patentee. But if woods generally were not adapted to the purpose, and yet the patentee had discovered a wood possessing certain qualities, which gave it a peculiar fitness for such purpose, it would not constitute an infringement for another to discover and use a different kind of wood, which was found to contain similar or superior qualities. The present case is an apt illustration of this principle. Sawyer and Man supposed they had discovered in carbonized paper the best material for an incandescent conductor. Instead of confining themselves to carbonized paper, as they might properly have done, and in fact did in their third claim, they made a broad claim for every fibrous or textile material, when in fact an examination of over six thousand vegetable growths showed that none of them possessed the peculiar qualities that fitted them for that purpose. Was everybody then precluded by this broad claim from making further investigation? We think not.

The injustice of so holding is manifest in view of the ex-

periments made, and continued for several months, by Mr. Edison and his assistants, among the different species of vegetable growth, for the purpose of ascertaining the one best adapted to an incandescent conductor. Of these he found suitable for his purpose only about three species of bamboo, one species of cane from the Valley of the Amazon, impossible to be procured in quantities on account of the climate, and one or two species of fibres from the agave family. Of the special bamboo, the walls of which have a thickness of about three-eighths of an inch, he used only about twenty-thousandths of an inch in thickness. In this portion of the bamboo the fibres are more nearly parallel, the cell walls are apparently smallest, and the pithy matter between the fibres is at its minimum. It seems that carbon filaments cannot be made of wood — that is, exogenous vegetable growth — because the fibres are not parallel and the longitudinal fibres are intercepted by radial fibres. The cells composing the fibres are all so large that the resulting carbon is very porous and friable. Lamps made of this material proved of no commercial value. After trying as many as thirty or forty different woods of exogenous growth, he gave them up as hopeless. But finally, while experimenting with a bamboo strip which formed the edge of a palmleaf fan, cut into filaments, he obtained surprising results. After microscopic examination of the material, he despatched a man to Japan to make arrangements for securing the bamboo in quantities. It seems that the characteristic of the bamboo which makes it particularly suitable is, that the fibres run more nearly parallel than in other species of wood. Owing to this, it can be cut up into filaments having parallel fibres, running throughout their length, and producing a homogeneous carbon. There is no generic quality, however, in vegetable fibres, because they are fibrous, which adapts them to the purpose. Indeed, the fibres are rather a disadvantage. If the bamboo grew solid without fibres, but had its peculiar cellular formation, it would be a perfect material, and incandescent lamps would last at least six times as long as at present. All vegetable fibrous growths do not have a suitable cellular structure. In

some the cells are so large that they are valueless for that purpose. No exogenous, and very few endogenous, growths are suitable. The messenger whom he despatched to different parts of Japan and China sent him about forty different kinds of bamboo, in such quantities as to enable him to make a number of lamps, and from a test of these different species he ascertained which was best for the purpose. From this it appears very clearly that there is no such quality common to fibrous and textile substances generally as makes them suitable for an incandescent conductor, and that the bamboo which was finally pitched upon, and is now generally used, was not selected because it was of vegetable growth, but because it contained certain peculiarities in its fibrous structure which distinguished it from every other fibrous substance. The question really is whether the imperfectly successful experiments of Sawyer and Man, with carbonized paper and wood carbon, conceding all that is claimed for them, authorize them to put under tribute the results of the brilliant discoveries made by others.

It is required by Rev. Stat. § 4888 that the application shall contain a written description of the device "and of the manner and process of making, constructing, compounding, and using it in such full, clear, concise, and exact terms as to enable any person, skilled in the art or science to which it appertains or with which it is most nearly connected, to make, construct, compound, and use the same." The object of this is to apprise the public of what the patentee claims as his own, the courts of what they are called upon to construe, and competing manufacturers and dealers of exactly what they are bound to avoid. *Grant* v. *Raymond*, 6 Pet. 218, 247. If the description be so vague and uncertain that no one can tell, except by independent experiments, how to construct the patented device, the patent is void.

It was said by Mr. Chief Justice Taney in *Wood* v. *Underhill*, 5 How. 1, 5, with respect to a patented compound for the purpose of making brick or tile, which did not give the relative proportions of the different ingredients: "But when the specification of a new composition of matter gives only

the names of the substances which are to be mixed together, without stating any relative proportion, undoubtedly it would be the duty of the court to declare the patent void. And the same rule would prevail where it was apparent that the proportions were stated ambiguously and vaguely. For in such cases it would be evident, on the face of the specification, that no one could use the invention without first ascertaining, by experiment, the exact proportion of the different ingredients required to produce the result intended to be obtained . . . And if, from the nature and character of the ingredients to be used, they are not susceptible of such exact description, the inventor is not entitled to a patent."

So in *Tyler* v. *Boston*, 7 Wall. 327, 330, wherein the plaintiff professed to have discovered a combination of fusel oil with the mineral and earthy oils, constituting a burning fluid, the patentee stated that the exact quantity of fusel oil, which is necessary to produce the most desirable compound, must be determined by experiment. And the court observed: "Where a patent is claimed for such a discovery it should state the component parts of the new manufacture claimed with clearness and precision, and not leave a person attempting to use the discovery to find it out 'by experiment.'" See also *Béné* v. *Jeantet*, 129 U. S. 683; *Howard* v. *Detroit Stove Works*, 150 U. S. 164, 167; *Schneider* v. *Lovell*, 10 Fed. Rep. 666; *Welling* v. *Crane*, 14 Fed. Rep. 571.

Applying this principle to the patent under consideration, how would it be possible for a person to know what fibrous or textile material was adapted to the purpose of an incandescent conductor, except by the most careful and painstaking experimentation? If, as before observed, there were some general quality, running through the whole fibrous and textile kingdom, which distinguished it from every other, and gave it a peculiar fitness for the particular purpose, the man who discovered such quality might justly be entitled to a patent; but that is not the case here. An examination of materials of this class carried on for months revealed nothing that seemed to be adapted to the purpose; and even the carbonized paper and wood carbons specified in the patent,

experiments with which first suggested their incorporation therein, were found to be so inferior to the bamboo, afterwards discovered by Edison, that the complainant was forced to abandon its patent in that particular, and take up with the material discovered by its rival. Under these circumstances, to hold that one, who had discovered that a certain fibrous or textile material answered the required purpose, should obtain the right to exclude everybody from the whole domain of fibrous and textile materials, and thereby shut out any further efforts to discover a better specimen of that class than the patentee had employed, would be an unwarranted extension of his monopoly, and operate rather to discourage than to promote invention. If Sawyer and Man had discovered that a certain carbonized paper would answer the purpose, their claim to all carbonized paper would, perhaps, not be extravagant; but the fact that paper happens to belong to the fibrous kingdom did not invest them with sovereignty over this entire kingdom, and thereby practically limit other experimenters to the domain of minerals.

In fact, such a construction of this patent as would exclude competitors from making use of any fibrous or textile material would probably defeat itself, since, if the patent were infringed by the use of any such material, it would be anticipated by proof of the prior use of any such material. In this connection it would appear, not only that wood charcoal had been constantly used since the days of Sir Humphry Davy for arc lighting, but that in the English patent to Greener and Staite of 1846, for an incandescent light, "charcoal, reduced to a state of powder," was one of the materials employed. So also, in the English patent of 1841 to De Moleyns, "a finely pulverized boxwood charcoal or plumbago" was used for an incandescent electric lamp. Indeed, in the experiments of Sir Humphry Davy, early in the century, pieces of well-burned charcoal were heated to a vivid whiteness by the electric current, and other experiments were made which evidently contemplated the use of charcoal heated to the point of incandescence. Mr. Broadnax, the attorney who prepared the application, it seems, was also of opinion that a broad claim for

vegetable carbons could not be sustained because charcoal had been used before in incandescent lighting. There is undoubtedly a good deal of testimony tending to show that, for the past fifty or sixty years, the word "charcoal" has been used in the art, not only to designate carbonized wood, but mineral or hard carbons, such as were commonly employed for the carbon pencils of arc lamps. But we think it quite evident that, in the patents and experiments above referred to, it was used in its ordinary sense of charcoal obtained from wood. The very fact of the use of such word to designate mineral carbons indicates that such carbons were believed to possess peculiar properties required for illumination, which before that had been supposed to belong to wood charcoal.

We have not found it necessary in this connection to consider the amendments that were made to the original specification, upon which so much stress was laid in the opinion of the court below, since we are all agreed that the claims of this patent, with the exception of the third, are too indefinite to be the subject of a valid monopoly.

As these suggestions are of themselves sufficient to dispose of the case adversely to the complainant, a consideration of the question of priority of invention, or rather of the extent and results of the Sawyer and Man experiments, which was so fully argued upon both sides, and passed upon by the court below, becomes unnecessary.

For the reasons above stated the decree of the Circuit Court is

Affirmed.

RICHARDS *v.* CHASE ELEVATOR COMPANY.

PETITION FOR A REHEARING.

No. 319 of October term, 1894. Received June 3, 1895 — Denied November 11, 1895.

The court, on application to file a petition for rehearing, adheres to its opinion, reported in 158 U. S. 299, that letters patent No. 308,095, issued November 18, 1884, to Edward S. Richards for a grain transferring ap-