

## William E. Sawyer and the Rise and Fall of America's First Incandescent Electric Light Company, 1878-1881

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### INTRODUCTION

The first serious effort to develop and market an incandescent electric lighting system was attempted by the Electro-Dynamic Light Company during the period 1878-1881. The company experienced great difficulties with William Edward Sawyer the primary inventor of the system they were exploiting, and eventually the company failed. This article traces the birth and death of the Electro-Dynamic Light Company.

William Edward Sawyer, one of the pioneers in the field of incandescent electric lighting, died in New York City at the age of 33, on 15 April 1883 [20]. The Operator and Electrical World, on 19 May 1883, described Sawyer as an erratic genius:

Mr. Sawyer will be remembered as one of the pioneers in the field of electric lighting in America. ... Unfortunately for Mr. Sawyer, his nature combined discordant elements of character; his disposition was governed by traits at once uncongenial and incompatible with each other. ... he possessed undoubted talent as an electrician. But his character was not possessed of that fixedness and stability which command success. His erratic and careless habits were practically at war with his talents, and led him continually into difficulty [3, p. 309].

It was the unpredictable character of Sawyer that caused the difficulties of the various companies with which he was involved during the years 1874-1881. While each company probably would make an interesting story, only the records of the Electro-Dynamic Light Company have survived and make possible an account of its problems.

THE ELECTRO-DYNAMIC LIGHT COMPANY: 1878-1881

Sawyer was born in Brunswick, Maine in 1850. He became a telegraphic reporter for the Boston Post and, in 1873, a journalist with the Washington, D.C., office of the Boston Daily Traveller. In November 1875, Sawyer left Washington and moved to New York City where Spencer D. Schuyler hired him as the electrician for the United States Electric Engine Company.

In July 1877, Hiram Maxim was hired as chief engineer for the United States Electric Engine Company. Upon assuming his position, Maxim discovered an unusual state of affairs in Schuyler's office with regard to the personal habits of Sawyer. Maxim wrote,

He [Schuyler] had in his employ a large, clumsy, and brutal-looking fellow, clean shaven, whom we will call Mr. "D." [Sawyer]; he was said to be an expert electrician and telegraph operator, but he was a great drunkard...I assured him that there was a great deal more nourishment in a pint of milk than in a gallon of brandy, and advised him strongly to try milk. The next day...his brother was sent out two or three times for milk. Mr. D said that the change was a good one and he felt much better for it. Shortly after I learned that the so-called milk was just about half brandy, and that the fellow was still in a half-drunken condition all day. As things went from bad to worse I made up my mind that we had better get rid of him" [8, pp. 121-22].

Maxim waited a few months, and in October 1877 he discharged Sawyer.

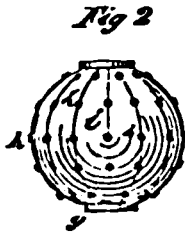
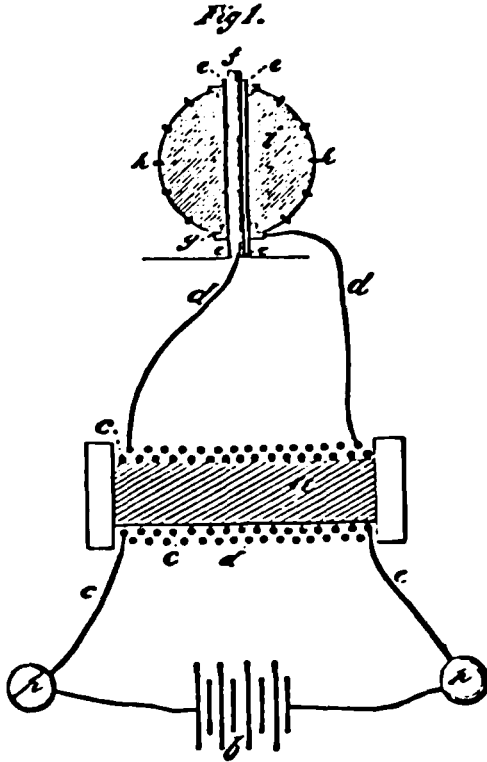
After leaving the United States Electric Company, Sawyer became associated with James Flannagan; and through Flannagan he came to know William H. Church; and Church, in turn, introduced him to Albon Man, a New York lawyer. Man was a director of the River and Rail Electric Light Company and had an interest in electricity. Sawyer and Man met in January 1878, and Sawyer easily convinced him that "he could make an incandescent or permanent lamp...." [5, p. 520]. Man soon agreed to finance further experiments and to personally aid Sawyer in developing a workable incandescent lamp.

During January and February 1878, Sawyer and Man carried out additional experiments, but according to Man's testimony and sketches in 1887, none of them resulted in the "permanent" lamp described by Sawyer. The first was a straight glass tube with metal caps on each end and an incandescent conductor extending from one end of the tube to the other. The next lamp consisted of a Florence flask with an incandescent conductor of a pencil of carbon held between two metal supports as shown in the sketch in Figure 1. The second lamp seemed the most practical, and on 7 March 1878, Sawyer wrote Man that he had obtained the

W. E. SAWYER.  
ELECTRIC LIGHTING APPARATUS.

No. 194,563.

Patented Aug. 28, 1877.



*Witnesses.*  
*Chandler Hall*  
*James S. Smith*

*Inventor.*  
*William Edward Sawyer*

FIGURE 1  
SAWYER ELECTRIC LAMP  
PATENT 194,563  
AUGUST 28, 1877

temporary use of a dynamo electric machine. And when "I tried the full power on the lamp yesterday, and you would have supposed a small sun was shining in the vicinity" [5, p. 3878]. On the same day Sawyer rented a small room at 43 Centre Street to use as a shop for further experiments. Sawyer's selection of this location was a procedure he was to follow in selecting other sites for his workshops and offices during the years 1878-1880, as shown on the map in Figure 2. These locations were selected by Sawyer because they were far away from the offices of his financial supporters. It was not easy for them to visit these premises, and therefore it was difficult for them to ascertain the real progress Sawyer was achieving. They had to rely on what he would tell them; and, to achieve his own purposes, he would frequently report successes when there were actually failures.

The work at Centre Street enabled Sawyer and Man, on 16 March 1878, to file a patent for an "improvement in Electric Lamps" [5, p. 144 (see Figure 7)], which included nitrogen gas in the globe to preserve the carbon conductor. The carbon was located near the top and supported by large zig-zag radiators to remove the carbon from the heat produced in the globe. This lamp is shown in Figure 3. The weakness of the lamp, however, was in the fact that the carbon was held rigidly and was unable to expand and contract; it therefore broke frequently. To overcome this problem, further experiments were carried on at Centre Street during March 1878, focusing on different forms of carbons, in the form of an arch or horseshoe, made from twigs of willow or carbonized paper. These experiments revealed the lack of agreement between Sawyer and Man as to the correct form of carbon. Man preferred the use of carbonized paper carbons, but Sawyer said a much harder carbon would be better.

Despite their work, Man was still unhappy about their results because they did not have a lamp that could become the basis of a company. Man's unhappiness with their joint efforts was expressed by him in 1890:

although I had aided him by suggestions, money and advice up to that time, (he) was in despair about producing a light that would be satisfactory...and said if I would stick with him and help him that the thing could be worked out;...he besought me to stay with him and help him and contrary to my better judgment, I did, and have been sorry for it that I did. [5, pp. 520-21]

Because Man believed their efforts were a commercial failure, no company was formed during April and May of 1878. The situation changed in June, because on 4 June 1878, the United States Electric Lighting Company was formed. It possessed the incandescent lamp patents, but concentrated on installing arc light systems; and Man, afraid of passing up an important opportunity, urged his capitalist friends to help him form an incandescent electric light company. Therefore, on 8 July 1878, the Electro-Dynamic Light Company was organized and incorporated in New York on 11 July 1878, by Albon Man, William E. Sawyer, Hugh McCulloch (a lawyer), Lawrence Meyers, and three bankers: Jacob Hays, William H.

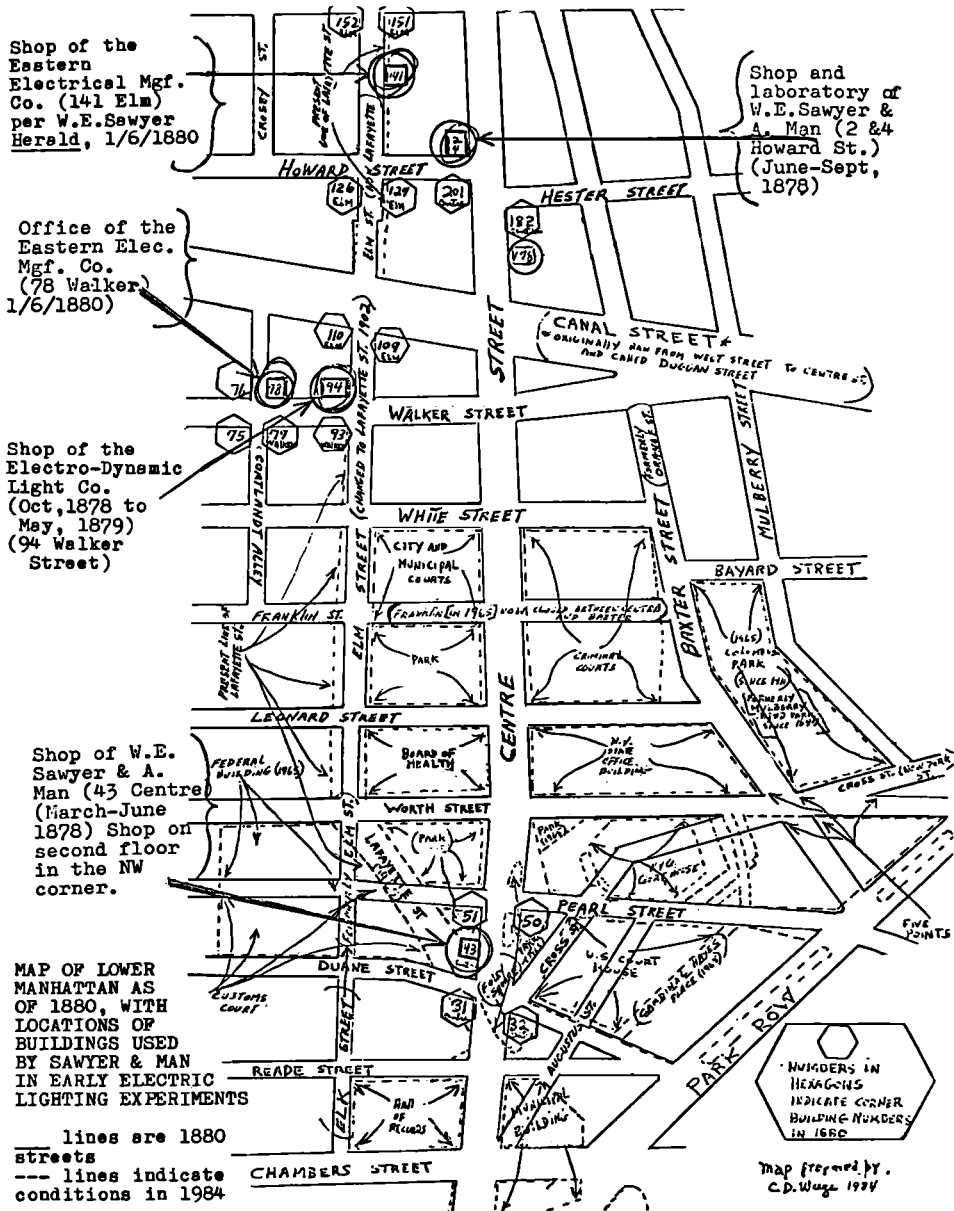
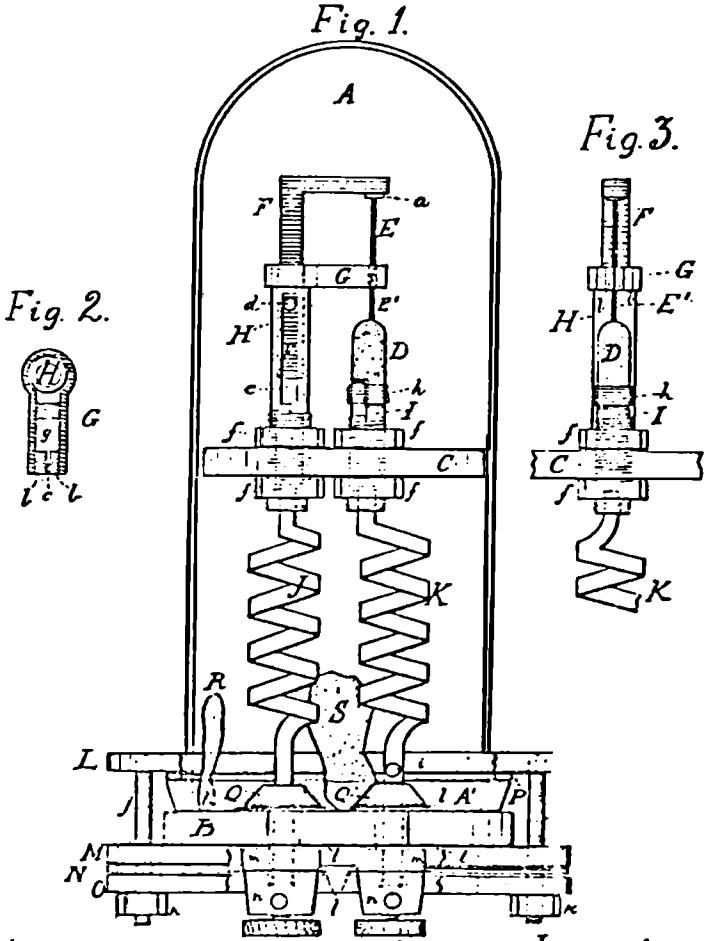


FIGURE 2  
 SAWYER'S OFFICES AND WORKSHOPS

W. E. SAWYER & A. MAN.  
Electric Lamp.

No. 205,144.

Patented June 18, 1878.



Witnesses:  
W. H. Church.  
George H. Priten

Inventors:  
W. E. Sawyer.  
-Albin Man-

FIGURE 3  
SAWYER-MAN LAMP  
PATENT 205,144  
JUNE 18, 1877

Hays, and James P. Kernochan [9, p. 8]. A chart of the meetings of Electro-Dynamic appears in Figure 4.

The first meeting of Electro-Dynamic was held at 3 Nassau Street, in the office of Classon & Hays, on 15 July 1878. At this meeting William Hays was elected president; Albon Man, Vice-President; Jacob Hays, Treasurer; and William Sawyer, Secretary. The company purchased the patents of Sawyer and Man issuing them the whole capital stock of the company and \$290,000 in scrip certificates of the company, payable out of profits. The total price came to \$300,000.

The second meeting of Electro-Dynamic took place on 10 September 1878 at 3 Nassau Street. Man became President and was repaid \$729.74 for money he had spent in the preparation of lamps. Man also said that Davol Mills of Fall River, Massachusetts, proposed placing the lamps of Electro-Dynamic in their cotton mills and also that Electro-Dynamic required a dynamo-electric machine to exhibit the lamps of the company and proposed to employ Professor F. N. Holbrook of Columbia College to serve as chemist for Electro-Dynamic.

The third meeting of Electro-Dynamic was held on 8 October 1878, at 3 Nassau Street. Man announced that final arrangements had been made with William C. Davol to equip the Davol Mills (at Davol's own expense) with the lights of Electro-Dynamic and that they would pay a royalty of \$100 per year for the use of the equipment. (There is no evidence that Davol Mills ever installed the Sawyer-Man Lights.) Man also announced "the present workshop is unsuitable for the exhibition of the light and for experimental purposes" [5, pp. 3281-82]. Man was authorized to rent suitable premises and a new shop was established at 94 Walker Street on 15 October 1878 [5, p. 509]. Sawyer was hired as the electrician for the company, and Edwin L. Meyers of Stevens Institute of Technology was hired as a chemist to replace Professor Holbrook.

A special meeting of Electro-Dynamic was held on 15 October 1878 at 3 Nassau Street. At this meeting Man was authorized to exhibit the electric light at any location he might believe proper to procure patents in foreign countries on inventions owned by the company if the expense could be paid from the sale of company stock.

Two days after this meeting, on 17 October 1878, New York lawyers began talking about the formation of the Edison Electric Light Company by Grosvenor P. Lowery, a leading New York lawyer and friend of Edison. In the formation of the company Lowery had secured the financial backing of a number of capitalists including J. P. Morgan. The capital of this new company was \$3,000,000 in marked contrast to the little more than \$1,000 in cash held by Electro-Dynamic.

Another special meeting of Electro-Dynamic was held on 31 October 1878, at 3 Nassau Street to discuss a letter received from Lowery of the Edison Electric Light Company regarding Electro-Dynamic. McCulloch, Hays, and Man were appointed a committee to confer with Lowery on the subject of the letter. Lowery was to meet with the committee at the Electro-Dynamic shops at 94 Walker Street.

July 15, 1875  
First Meeting  
\$300,000 for  
Patents in script

September 10, 1878  
Second Meeting  
Plans for lights  
at Davol Mills

October 8, 1878  
Third Meeting  
More plans for  
Daval Mills and  
New Shop

October 15, 1878  
Special Meeting -  
Plans for exhibits  
and foreign  
patents

October 31, 1878  
Special Meeting  
Letter from  
Edison Elec. Light  
Co.

November 12, 1878  
Fourth Meeting  
Discussion of  
Lowery Letters

December 12, 1878  
Fifth Meeting  
Bank Balance:  
\$737.19 - Borrowed  
\$500 from Man and  
\$600 from J. Hays

January 14, 1879  
Sixth Meeting  
No business  
transacted

February 18, 1879  
Seventh Meeting  
Sawyer & Man  
authorized to  
exhibit lamps

February 25, 1879  
Special Meeting  
Sawyer-Judd  
Agreement on Dynamo

March 11, 1879  
Eighth Meeting  
No quorum -  
adjourned to  
March 18th

March 18, 1879  
Eighth Meeting  
No quorum -  
adjourned to  
March 20th

March 20, 1879  
Eighth Meeting  
\$2.61 in bank  
Liabilities \$3,536.72  
Sawyer plan to  
reorganize Co.

April 8, 1879  
Ninth Meeting  
\$2.61 in bank  
Liabilities \$3,660.69  
Sawyer announced  
"Feeder" Lamp

April 19, 1879  
Special Meeting  
94 Walker Street  
Shop to be used  
for one month

April 26, 1879  
Special Meeting  
Interference - Keith  
& Maxim. Sawyer  
tells of new plan  
to reorganize Co.

May 13, 1879  
Tenth Meeting  
Sawyer tells of  
Thomas Wallace  
plans for Co.

May 14, 1879  
Special Meeting  
Sawyer abandons  
March 20th plans

May 20, 1879  
Special Meeting  
Thomas Wallace  
to reorganize  
Company

June 10, 1879  
Eleventh Meeting  
License to Wallace  
to build lamps  
at Ansonia

FLOW CHART  
OF MEETINGS  
OF ELECTRO-  
DYNAMIC LIGHT  
COMPANY, JULY 15,  
1878 - June 10, 1879\*

\*From notes taken by  
William E. Sawyer in  
1878-1879.

FIGURE 4  
MEETINGS OF THE ELECTRO-DYNAMIC COMPANY



The fourth meeting of the Electro-Dynamic was held at 94 Walker Street on 12 November 1878. The main topic was a discussion of two letters from Lowery concerning Electro-Dynamic. In the first letter of 2 November 1878, Lowery said he was surprised that Man would suggest a union of interests between Electro-Dynamic and Edison Electric Light Company. In the second, he said Edison did not need the Sawyer-Man patents because he had "produced a perfectly novel invention" [5, p. 3285]. At this meeting the treasurer reported on the financial condition of Electro-Dynamic as follows: receipts from the sale of stock and scrip, \$2,616; total receipts, \$3,236; total expenditures to 12 November 1878, \$2,224.21; balance in bank, \$1,011.79; scrip in treasury, \$26,000 [5, p. 3286].

Four days after this meeting, on 16 November 1878, The Scientific American described an exhibition of the Sawyer-Man light, stating, "the light exhibited was steady and brilliant" [1, p. 304]. The same magazine presented a more extensive account of the Sawyer-Man lamp in their issue of 7 December 1878 [18, pp. 351-54]. An illustration from this article appears in Figure 5.

The fifth meeting of Electro-Dynamic was held at 94 Walker Street on 12 December, 1878. The minutes of this meeting indicate Electro-Dynamic was having difficulties. Man announced that the company did not possess any foreign patents for their equipment because they had been unable to sell any stock to finance such patents. In addition, as of 10 December 1878, the balance in the bank was \$737.19. It was also obvious that the company was having difficulties with Sawyer since Lawrence Meyers was appointed superintendent of the company with full authority to: "supervise and direct the business with a view to pushing forward the construction of lamps and other apparatus necessary for practical work under the patents owned by the company...." [5, p. 3290].

The sixth meeting of Electro-Dynamic was held at 94 Walker Street on 14 January 1879. The minutes of the previous meeting were read and approved, but no business was transacted. The seventh meeting was held at the same location on 18 February 1879, and at this meeting, in an effort to sell lamps, Sawyer and Man were "authorized to furnish lamps to applicants upon such terms as may be agreed upon between them and the applicants" [5, p. 3291].

A special meeting of Electro-Dynamic was held at 3 Nassau Street on 25 February 1879, to discuss an agreement between Sawyer and H. L. Judd. Judd, at his own risk, would build a Sawyer electro-dynamic machine. Judd was given one-quarter interest in the invention and would manufacture the machines exclusively for use by Electro-Dynamic.

The eighth meeting of Electro-Dynamic was held at 3 Nassau Street on 11 March 1879, but no quorum was present so it was adjourned to 18 March 1879. At that time again no quorum was present, and the meeting was adjourned to 20 March 1879. It was held at 3 Nassau Street, and the treasurer's report revealed that the company had only \$2.61 in cash and \$3,536.72 in liabilities, with \$1,850 being due to Man. At this meeting Man announced that he had discharged all the workman employed

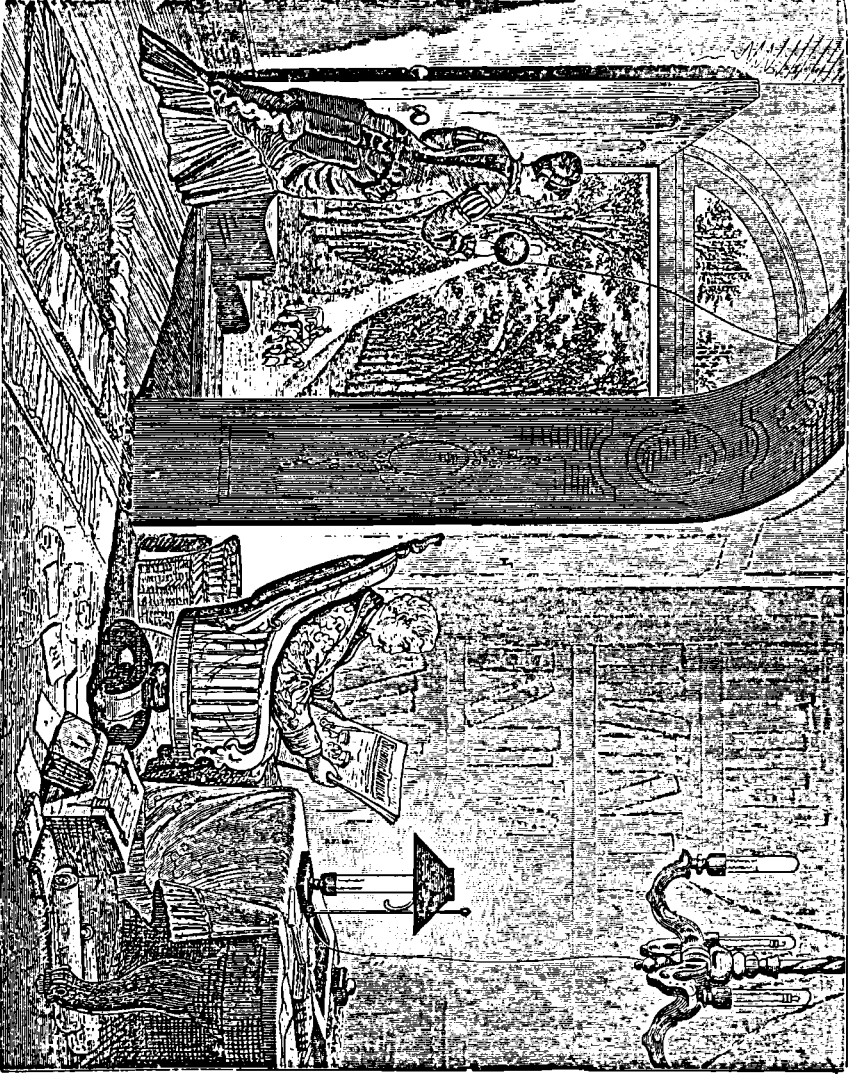


FIGURE 5  
THE SAWYER-MAN ELECTRIC LIGHT  
(SCIENTIFIC AMERICAN, DECEMBER 7, 1878, P. 351)

by the company at 94 Walker Street, but allowed Sawyer to continue working there at his own expense. Man said that while Sawyer believed that the principle upon which their lamps were built was correct and that the new ones they had built would be "permanent and last forever ... and ... never burn out, but remain as they are ..." he did not believe this was true [5, p. 3265]. In reply to Man, Sawyer said that since the officers were unwilling to go on with the business of the company, that he would like permission to have "the free use of the shop and tools of the company until the 20th of April in which to conduct his own experiments at his own expense." Sawyer then stated,

that he should be allowed three month's time in which to pay the debts of the company, and that upon his paying the debts of the company, not to exceed four thousand dollars in amount, all of the members of the board now present, excepting himself, shall turn into the treasury of the company two-thirds of the stock and scrip originally held by them, which shall be used as working capital to secure funds for carrying on the business of the company... [5, p. 3266].

The other members of Electro-Dynamic accepted this proposition with the understanding that except for the stock held by Sawyer, that the remaining stock and scrip retained by the present members of the board should be protected from assessment or debt and that the board members would retain their membership in any new organization.

On 22 March 1879, two days after making the proposal to solve the problems of Electro-Dynamic, Sawyer (without informing the members of Electro-Dynamic) wrote a letter to Edison asking that the two men join forces, saying that he was willing to forget their former disagreements and that his inventions would become the property of the Edison Electric Light Company. Sawyer told Edison he was willing to meet him secretly at the Astor House that evening to talk the proposition over [10]. Edison replied two days later declining to meet him or take him into partnership [6].

The ninth meeting of the Electro-Dynamic was held at 3 Nassau Street on 8 April 1879. At this meeting the treasurer said the bank balance was still \$2.61, the total liabilities were \$3,660.69, and that Man was owed \$1,862.50.

A special meeting of Electro-Dynamic was held at 94 Walker Street on 19 April 1879. At this meeting Man was authorized to continue the use of the premises at 94 Walker Street for a period of one month or more.

Another special meeting was held at 94 Walker Street on 26 April 1879, to discuss with Keith and Maxim an interference case arising from the application of Sawyer and Man for a patent assigned to Electro-Dynamic for manufacturing carbon for electric lights. Man said that Keith had already renounced any claim to the Sawyer-Man invention and that Maxim would probably do the same. Sawyer said he had developed a "Feeder Lamp" where the carbon burner would be continually

fed upward from the lamp base (through a clockwork mechanism) to the point of incandescence as the lamp burned. He also remarked

nothing remains to be done except to manufacture and sell lamps ... and ... recommended that the workshop of the company be closed ... and that an office be hired in which lamps may be...kept on exhibition ... [5, p. 3295].

Sawyer's recommendations were received and entered in the minutes, but nothing was done to implement his suggestions.

At this meeting, Sawyer also offered to pay off the debts of the company on the following basis:

- (1) He would be reimbursed for all the expenses he had incurred for the six weeks ending 29 April 1897, amounting to \$800.
- (2) The company should pay him \$3,500, and he would assign for the \$3,500 in cash \$3,500 of his stock and scrip. This money was to be his salary as electrician for Electro-Dynamic for one year.
- (3) Sawyer would have the privilege of buying back the above \$3,500 of stock and scrip within one year at par and that he would give his services to Electro-Dynamic for the rest of the year without salary.
- (4) A sufficient amount of scrip of Electro-Dynamic would be sold to provide \$22,500 for manufacture and exhibition.
- (5) As the company electrician, Sawyer was "to have exclusive charge and direction for one year of all work connected with the manufacture...and putting up of lamps, and all electrical work..." [4, pp. 3296-97].
- (6) An understanding should be arrived at "respecting the sale of rights, increasing the capital stock of the company, and admission to the company of certain capitalists with whom W. E. Sawyer has been negotiating to carry out his proposition of March 20th" [5, p. 3297].

The board said they would consider his proposal, but no action was taken.

The tenth meeting of Electro-Dynamic was held on 13 May 1879 at the new offices of Jacob Hays, 11 Nassau Street. Man said Sawyer believed he could make an arrangement with Thomas Wallace & Sons, of Ansonia, Connecticut, to build and sell the Electro-Dynamic lamps and to pay Electro-Dynamic a royalty of three dollars per lamp.

A special meeting of Electro-Dynamic was held at 11 Nassau Street on 14 May 1879. At this meeting, Sawyer announced he would not carry out his proposition of 20 March 1879 to reorganize the company. Another

special meeting of Electro-Dynamic was held on 20 May 1879, at 11 Nassau Street to make important changes in Electro-Dynamic. At this meeting, Thomas Wallace was appointed trustee of Electro-Dynamic, and Man resigned but was re-elected as a vice president. Man said Thomas Wallace had presented a promissory note in payment of scrip of Electro-Dynamic and since "it is desired that the affairs of the company be closed up ... I move that the treasurer be authorized to apply this note to the extinguishment of the debts of the company" [5, pp. 3300-01]. Man's motion was approved and the note used to pay off the debts of Electro-Dynamic. Thomas Wallace then said that his company would build the Electro-Dynamic lamps and "use their present machinery for manufacturing and facilities for introducing this lamp as widely and generally as it is possible to do..." [5, p. 3301].

The eleventh and last meeting (for which records exist) of Electro-Dynamic was held at 11 Nassau Street on 10 June 1879. Mr. Dow, attorney for Wallace & Sons presented the draft of a license between Electro-Dynamic and the company that gave "the right to manufacture and sell lamps under the company's patent..." [5, p. 3303]. With this meeting, the exact details of the existence of Electro-Dynamic pass into oblivion.

The further history of Electro-Dynamic is obtained from Man's testimony in the Edison Patent Suit in January 1890. Man said the Electro-Dynamic officials had made the agreement with Wallace & Sons because of the difficulties they experienced with Sawyer's explosive behavior and because Sawyer was "unwilling that anybody else should be placed in charge of the manufacture" of lamps [5, p. 428]. Although Wallace & Sons knew that Sawyer was irresponsible, they also recognized that they needed his help in constructing the first 100 lamps they planned to build. In July 1879, Sawyer and Edwin Meyers moved to Ansonia to help assemble lamps. According to Man, however, Sawyer soon caused trouble:

Mr. Sawyer's conduct was so bad after going to Ansonia that the Wallaces would have nothing to do with him by the reason of his drunkenness and immorality. They finally came to an open quarrel and Mr. Sawyer returned to New York in September, 1879 [5, p. 428].

Meyers was retained at Ansonia until November 1879, but he became ill and returned to his home in Plattsburg, New York, where he remained until his death from consumption on 26 February 1881 [7, p. 72].

## THE EASTERN ELECTRIC MANUFACTURING COMPANY

After returning to New York City, Sawyer initiated a scheme to form a rival company to compete with Electro-Dynamic. The financial backing for this scheme came from John J. Anderson, a New Jersey tool manufacturer; Horace Little, a New York banker; Samuel L. Warner, a congressman from Middletown, Connecticut; D. J. Noyes of Long Branch, New Jersey; Joseph Goodrich of Hartford, Connecticut; and Walter

Goodrich of New York. The group gave Sawyer \$10,000 to provide the facilities Sawyer said were needed to construct a new generation of Sawyer lamps. Once again Sawyer followed the same pattern used at Electro-Dynamic and rented a number of buildings. By 21 December 1879, he opened an office at 78 Walker Street, a shop at 141 Elm Street, and his "Exhibitorium" at 226 West 54th Street. Sawyer's plans for a new company, however, were temporarily upset by the activities of Edison.

Early in December 1879, having reached a degree of uniformity in the manufacture of his incandescent lamps that promised commercial results, Edison prepared for a public exhibition of his light during the Christmas holidays. On 21 December 1879, before his exhibition, The New York Herald published a popular account of Edison's work including an entire page of the paper containing numerous illustrations as shown in Figure 6. While this article mentioned other inventors besides Edison (such as Maxim), it did not refer to Sawyer's work. This omission produced a violent reaction by Sawyer. He began drinking heavily and wrote to The New York Herald stating he had developed a "horse-shoe" filament lamp like Edison's a year before. Sawyer said this lamp was a failure, and he had never applied for a patent. He claimed the lamp was still in existence but that he had "placed said abandoned institution in the hands of Mesres. Arnoux & Houchhausen, No. 2 Howard Street, yesterday (Monday) morning at 9 o'clock. So far as I am concerned, the Wizard is welcome to patent it" [12, p. 2].

Sawyer's letter, however, came to the attention of Charles Cheever of New York, a patent speculator. Cheever saw in the lamp described by Sawyer in his letters to the press the opportunity to make a large profit. Within a few days, he opened negotiations with Sawyer and Man to file an application for a patent on their behalf and for him to secure an option for its purchase at the price of \$100,000 in cash [5, p. 892]. Cheever, on 5 January 1880, informed Man that "I have just seen Mr. Church; he says Sawyer has promised to do all in his power to help us along" [5, p. 291]. By this time Sawyer realized that the paper conductors he had experimented with in 1878 were important and that a patent for them was desirable. Therefore a new lamp patent was filed by Sawyer and Man on 9 January 1880. It was a revision of a Sawyer-Man patent held by Electro-Dynamic, with descriptions of paper conductors and hard carbon conductors inserted into the patent.

Despite this new patent, Sawyer became more irrational "capricious and utterly unmanageable, and [would] do and say all sorts of foolish and extravagant things..." [5, p. 1010]. However, the success of the Edison lamp encouraged Sawyer's new financial backers to form a company to exploit Sawyer's lamps, and, as a result, the Eastern Electric Manufacturing Company (EEMC) with a capital of \$2,000,000 was formed in Connecticut on 17 January 1880 [21].

EEMC commenced operations in February 1880 but was hampered by Sawyer's obsession with attacking Edison in the newspapers. However, within a few months Sawyer would create more problems for the company. In March 1880, according to the Newark Daily Advertiser, Sawyer was living with his wife and children at 261 West 42nd Street. However, his excessive drinking gave him an "impulsive and violent temper ... (and he

# EDISON'S LIGHT.

The Great Inventor's Triumph in Electric Illumination.

## A SCRAP OF PAPER.

It Made a Light, Without Use of Glass, Longer Than 60.

## TRANSFORMED IN THE FURNACE.

Complete Details of the Perforated Carbon Lamp.

## FIFTY-FIVE MONTHS OF TOIL.

Key of Its Secret Exposed with Lamp, Burner and Apparatus.

## SUCCESS OF A COTTON THREAD.

The Secret of Its Making, with Study of the "Carbon" Process.

## HISTORY OF ELECTRIC LIGHTING.

The first experiment in the history of electric lighting was made by the Italian physicist Galvani in 1780. He discovered that when a metal rod was connected to a battery and touched a frog's leg, the leg would twitch. This was the first demonstration of bioelectricity. In 1800, the English chemist Volta invented the voltaic pile, the first battery. In 1820, the Danish physicist Oersted discovered that an electric current could create a magnetic field. In 1827, the German physicist Ohm formulated Ohm's law. In 1831, the English physicist Faraday discovered electromagnetic induction. In 1833, the German physicist Ampere formulated Ampere's law. In 1837, the English physicist Joule discovered the law of conservation of energy. In 1842, the English physicist Rankine formulated Rankine's law. In 1847, the English physicist Thomson discovered the electron. In 1850, the English physicist Faraday discovered the law of electromagnetic induction. In 1855, the English physicist Joule discovered the law of conservation of energy. In 1857, the English physicist Rankine formulated Rankine's law. In 1859, the English physicist Thomson discovered the electron. In 1861, the English physicist Faraday discovered the law of electromagnetic induction. In 1863, the English physicist Joule discovered the law of conservation of energy. In 1865, the English physicist Rankine formulated Rankine's law. In 1867, the English physicist Thomson discovered the electron. In 1869, the English physicist Faraday discovered the law of electromagnetic induction. In 1871, the English physicist Joule discovered the law of conservation of energy. In 1873, the English physicist Rankine formulated Rankine's law. In 1875, the English physicist Thomson discovered the electron. In 1877, the English physicist Faraday discovered the law of electromagnetic induction. In 1879, the English physicist Joule discovered the law of conservation of energy. In 1881, the English physicist Rankine formulated Rankine's law. In 1883, the English physicist Thomson discovered the electron. In 1885, the English physicist Faraday discovered the law of electromagnetic induction. In 1887, the English physicist Joule discovered the law of conservation of energy. In 1889, the English physicist Rankine formulated Rankine's law. In 1891, the English physicist Thomson discovered the electron. In 1893, the English physicist Faraday discovered the law of electromagnetic induction. In 1895, the English physicist Joule discovered the law of conservation of energy. In 1897, the English physicist Rankine formulated Rankine's law. In 1899, the English physicist Thomson discovered the electron. In 1901, the English physicist Faraday discovered the law of electromagnetic induction. In 1903, the English physicist Joule discovered the law of conservation of energy. In 1905, the English physicist Rankine formulated Rankine's law. In 1907, the English physicist Thomson discovered the electron. In 1909, the English physicist Faraday discovered the law of electromagnetic induction. In 1911, the English physicist Joule discovered the law of conservation of energy. In 1913, the English physicist Rankine formulated Rankine's law. In 1915, the English physicist Thomson discovered the electron. In 1917, the English physicist Faraday discovered the law of electromagnetic induction. In 1919, the English physicist Joule discovered the law of conservation of energy. In 1921, the English physicist Rankine formulated Rankine's law. In 1923, the English physicist Thomson discovered the electron. In 1925, the English physicist Faraday discovered the law of electromagnetic induction. In 1927, the English physicist Joule discovered the law of conservation of energy. In 1929, the English physicist Rankine formulated Rankine's law. In 1931, the English physicist Thomson discovered the electron. In 1933, the English physicist Faraday discovered the law of electromagnetic induction. In 1935, the English physicist Joule discovered the law of conservation of energy. In 1937, the English physicist Rankine formulated Rankine's law. In 1939, the English physicist Thomson discovered the electron. In 1941, the English physicist Faraday discovered the law of electromagnetic induction. In 1943, the English physicist Joule discovered the law of conservation of energy. In 1945, the English physicist Rankine formulated Rankine's law. In 1947, the English physicist Thomson discovered the electron. In 1949, the English physicist Faraday discovered the law of electromagnetic induction. In 1951, the English physicist Joule discovered the law of conservation of energy. In 1953, the English physicist Rankine formulated Rankine's law. In 1955, the English physicist Thomson discovered the electron. In 1957, the English physicist Faraday discovered the law of electromagnetic induction. In 1959, the English physicist Joule discovered the law of conservation of energy. In 1961, the English physicist Rankine formulated Rankine's law. In 1963, the English physicist Thomson discovered the electron. In 1965, the English physicist Faraday discovered the law of electromagnetic induction. In 1967, the English physicist Joule discovered the law of conservation of energy. In 1969, the English physicist Rankine formulated Rankine's law. In 1971, the English physicist Thomson discovered the electron. In 1973, the English physicist Faraday discovered the law of electromagnetic induction. In 1975, the English physicist Joule discovered the law of conservation of energy. In 1977, the English physicist Rankine formulated Rankine's law. In 1979, the English physicist Thomson discovered the electron. In 1981, the English physicist Faraday discovered the law of electromagnetic induction. In 1983, the English physicist Joule discovered the law of conservation of energy. In 1985, the English physicist Rankine formulated Rankine's law. In 1987, the English physicist Thomson discovered the electron. In 1989, the English physicist Faraday discovered the law of electromagnetic induction. In 1991, the English physicist Joule discovered the law of conservation of energy. In 1993, the English physicist Rankine formulated Rankine's law. In 1995, the English physicist Thomson discovered the electron. In 1997, the English physicist Faraday discovered the law of electromagnetic induction. In 1999, the English physicist Joule discovered the law of conservation of energy.

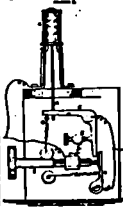
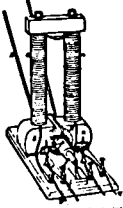
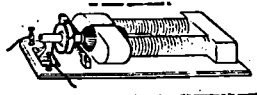
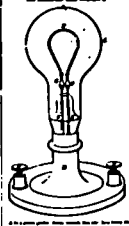
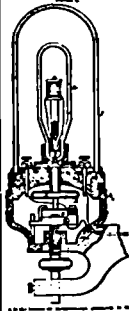
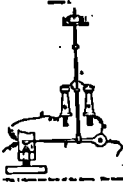


FIGURE 6  
ARTICLE ON EDISON'S ELECTRIC LIGHTING SYSTEM  
(NEW YORK HERALD, DECEMBER 21, 1879)

was )... given to altercations with his wife at unreasonable hours. The landlady objected to these family affairs...and about the middle of last month (March) requested the Sawyers to vacate the premises" [19, p. 2]. Besides these domestic quarrels, Sawyer also argued with another boarder, Dr. Theophilus Steele, over the Edison lamp. These arguments continued until 5 April 1880, when Sawyer (apparently after drinking) shot Steele in front of the Rossmore Hotel at 42nd Street and 7th Avenue [19, p. 2]. Sawyer was arrested, but was released on bail supplied by Horace Little of EEMC.

During the months from April 1880 to April 1881, when he went to trial for the shooting, Sawyer continued to develop new lamps. As a result, two new lamps were patented. Lamp #227,386, patented by Sawyer's father, similar to Sawyer's previous lamps, and #241,430, an incandescent lamp designed to burn in the open air, patented by William Sawyer and Robert Street.

Sawyer finally came to trial in April 1881 and was convicted of shooting Steele on 12 April 1881. The next day EEMC was reorganized with an increased capital of \$3,000,000. A few days earlier, anticipating Sawyer's conviction, Electro-Dynamic sold the rights to the Sawyer lamps to EEMC. On 2 September 1882, EEMC was reorganized into Consolidated Electric Light Company which, in 1885 (after the Sawyer-Man patent covering paper filaments was finally granted) adopted the Edison-type filament and abandoned the Sawyer carbon burner.

In the months between his conviction of shooting Steele in 1881 and the formation of the Consolidated Electric Light Company in September 1881, Sawyer created new problems for EEMC. Although the EEMC officials had provided the money for Sawyer's defense in the Steele trial, Sawyer soon attacked all his benefactors. In The New York Times for 26 March 1882, Sawyer said they had not carried out their agreements with him regarding his lamps and wanted him "to prostitute his reputation as electrical engineer in making exaggerated statements in regard to the inventions owned by the company and which were utterly false" [15, p. 7]. Little, et al., on the other hand, said Sawyer was trying to blackmail them. Sawyer admitted he owed them \$25,000 but said the "damage sustained by him through them aggregates \$100,000..." [15, p. 7]. Four days later Sawyer said the total amount involved in the suit would exceed \$1,700,000 [16, p. 8]. Sawyer's suits, however, never succeeded; and as his health began to fail in 1882, he discontinued his usual attacks against those he believed had wronged him in some manner. Sawyer's health became worse in 1883, and on 15 April 1883, shortly before he was scheduled to be sentenced to prison for shooting Steele, he suddenly died. After his death, his widow announced, on 16 April 1883, that she would soon patent twenty inventions that he had left behind [4, p. 1]. As a result, on 16 July 1883, the Sawyer-Man Electric Company was formed to exploit these patents. In 1884, the Thompson-Houston Electric Company gained control of Consolidated Electric Company and in 1886, these two companies purchased control of the Sawyer-Man Company. In 1887, Thompson-Houston sold all its stock in the Sawyer-Man to Consolidated, and in 1888, it sold its control in Consolidated to Westinghouse Electric



Company [2, p. 83]. With this step, the names of Electro-Dynamic, Sawyer, and Man disappeared from the electric lamp scene.

## CONCLUSION

It is possible that the companies discussed in this article might have become successful except for the personal behavior of William Edward Sawyer. Sawyer's drinking and uncontrolled personal behavior continually offered problems for the people associated with these companies. It appears that the bankers and lawyers involved were unfamiliar with the complexities of developing a commercially useful incandescent lamp. They naively assumed that such a lamp could be easily constructed and sold. The intricate and complex elements of a complete electric lighting system were a mystery to them, and they relied almost completely on Sawyer. Their failure to deal adequately with Sawyer was one of the main causes of the demise of Electro-Dynamic. Many other companies also collapsed during the early years of the development of electric lighting, and one must wonder whether or not similar conditions existed in these companies. Research into this aspect of business history certainly seems a necessity.

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5. "Edison Filament Patent Suit" (A collection of suits over the Edison Filament Patent in the Edison National Historic Site, West Orange, New Jersey.) Two suits are used in this article: Edison Electric Light Company vs. the United States Electric Light Company; Consolidated Electric Light Company vs. The McKeesport Light Company.
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14. "Mr. Edison Challenged by Mr. Sawyer," New York Herald, 13 August 1880, p. 3.
15. "Mr. Sawyer on the Warpath," New York Times, 26 March 1882, p. 7.
16. "Mr. Sawyer vs. Eastern Electric Manufacturing Company," New York Times, 30 March 1882, p. 8.
17. "Sawyer System Exhibition," New York Times, 17 March 1880, p. 2.
18. "Sawyer Man Lamp," Scientific American, 7 December 1878, pp. 351-54.
19. "Sawyer Shoots Steele," The Newark Daily Advertiser, 6 April 1880, p. 2. See also, "Sawyer's Shot," New York Herald, 8 May 1880, p. 8.
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## MANAGEMENT AND LABOR RELATIONS