

The Organization of Corporate Patent Management in US Companies: A Case Study of the Thomson-Houston Electric Company

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This paper aims to describe the process of internalization of patent control into the modern industrial enterprise, and to clarify the organization of the patent department of the Thomson-Houston Electric Company. Up until 1888 the patent application and related procedures of the company were individually taken on by Elihu Thomson, for almost of all of the patents of the company were created by him. However, after 1888, the company merged with many competitors to become a big company having many inventors and inventions. Around 1891, the patent department was headed and supervised by patent attorneys as counsel was organized. This course is so different from that of Japan.

Key Words: Elihu Thomson; Alfred D. Chandler, Jr.; patent department; internalization

1. Introduction

Up until now, I have studied the organization and evolution of corporate patent management in Japanese companies. Shibaura Engineering Works, a predecessor of Toshiba, is the earliest case of organized patent management; in 1912 Shibaura appointed a person who was to be in charge of patent affairs. After this organization, patent applications were conducted as corporate procedures, with patent rights belonging to the company; and Shibaura Works formed patent department in 1921.¹⁾ The second case is Tokyo Electric Company, which is another prede-

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1) Shigehiro Nishimura, "The Introduction of Foreign Technology and the Role of Patent Department: Setup and Development of Patent Department at Shibaura Works," *The Kokumin-Keizai Zasshi*, Vol. 186, No. 4, October, 2002, pp. 1-18 (in Japanese).

cessor of Toshiba. Tokyo Electric appointed a person to take charge of patent applications in around 1917, and organized a patent department in 1921.²⁾ Both companies had ties with General Electric Company and introduced foreign technologies from the United States. The formation of patent departments in both companies was the result of revised patent management contracts of 1919 between International General Electric Company, which was a wholly owned subsidiary of GE, and both companies.³⁾ Therefore, the organization and development of patent management in Japanese electrical companies was substantially affected by US company's' international patent strategy and control.

In order to understand the corporate patent management substantially, it is necessary for us to compare the Japanese cases with other countries' patent management. For international comparative studies on patent management, this paper deals with the case of the US company, Thomson-Houston Electric Company. The purpose of this paper is to clarify the substance of corporate patent management and its organization in the period of evolution of modern enterprises, and to clarify how and why modern enterprises integrated functions of patent control with production, engineering, and marketing by analyzing Thomson-Houston case.

Through this paper, I also propose a perspective for comprehending the patent control in relation to the growth of firms and management. Many studies conducted on patents and corporate patenting have been accumulated so far. In the field of economics and economic history, many scholars use macro data such as the number of patents and technological data thereof as an indicator of R&D, or as an agent of innovations.⁴⁾ Also in the field of business administration, there are many studies which make use of patent data to analyze corporate innovative performances.⁵⁾ However, almost no light has been shed on patent management, essential functions which take advantage of patent system and make a profit. Even if someone discusses patent management, usually he or she deals with patent applications, which is just one of many elements of patent management. Patent management embraces such things as application, safekeeping, seeking redress for patent

2) Shigehiro Nishimura, "Technological Development and Patent Management at Tokyo Electric before World War I," *Keizai-Ronso*, Vol. 170, No. 4, October, 2002, pp. 52-71 (in Japanese).

3) Shigehiro Nishimura, "General Electric's International Patent Management before World War II: The 'Proxy Application' Contract and the Organizational Capability of Tokyo Electric," *Japanese Research in Business History*, Vol. 21, 2004, pp. 101-125.

4) Jacob Schmookler, *Invention and Economic Growth*, Harvard University Press, 1966; K. Pavitt, "Patent Statistics as Indicators of Innovative Activities: Possibilities and Problems," *Scientometrics*, Vol. 7, No. 1-2, January 1985.

5) Ove Granstrand, *The Economics and Management of Intellectual Property: Towards Intellectual Capitalism*, Edward Elger, 1999.

infringements and guarding against infringements, enforcement of rights, patent agreements and licensing agreements, and so on. It is fruitful not only for our understandings of corporate growth but also for our recognition of capitalism to analyze the process of formation and evolutions of methods and organizations which combine patents and profit.

Alfred D. Chandler, Jr. provided our recognition with a framework that analyzes the growth and development of big business along with the development of modern capitalism. Chandler proposed an idea of the modern business enterprise by describing the formation and managerial structure of American companies from the second half of the 19th century to the early days of the 20th century.⁶⁾ The modern enterprises consist of many distinct operating units, and managed by salaried executives who were organized by hierarchy, and play a key economical role in combining and coordinating mass-production and mass-distribution. Chandler's theory is essentially devoted to analyzing the internalization and integration of purchasing, manufacturing, and distributing functions into modern enterprise; the functions of patent management are scarcely given efficient attention. Actually the great portion of industrial firms which compete with each other in national and global markets, have their patent strategies, and organizations dealt with patent affairs. Indeed, we can see many scenes in which many firms compete for market shares surrounding essential patents. Therefore, it is fascinating that patent management be incorporated into Chandler's modern enterprise to get more reasonable analytical frameworks.

Thomson-Houston Electric Company was one of the typical modern industrial enterprises. The literature on Thomson-Houston by W. Bernard Carlson is outstanding.⁷⁾ Carlson described the history of Thomson-Houston through activities of Elihu Thomson, one of the founders, by using the Elihu Thomson Papers of the American Philosophical Society and the Hammond File of General Electric Company. Based on Carlson's book, this paper also uses the Hammond File and the US patent data, which was independently collected.⁸⁾

This paper proceeds as follows. First, the growth of Thomson-Houston is surveyed, focusing on the role of patents in the early period of electrical industries. Second, patenting strategy and methods of control of patents which Elihu Thomson

6) Alfred D. Chandler, Jr., *The Visible Hand: The Managerial Revolution in American Business*, Harvard University Press, 1977.

7) W. Bernard Carlson, *Innovation as a Social Process: Elihu Thomson and the Rise of General Electric, 1870-1900*, Cambridge University Press, 1991.

8) Hammond File is now accessible at Schenectady Museum & Archives.

practiced are identified by his inventive activities and patenting activities. In this section, it will be made clear that patent control of Thomson-Houston was implemented as an individual process until about 1888. Finally, it is clarified that patent control was internally instituted after 1888 in Thomson-Houston.

2. Growth of Thomson-Houston Electric Company

2-1. Modern industrial enterprise and patents

Though Thomson-Houston was one of the typical firms taking advantage of the patent system, the relationship between the emergence of modern industrial enterprises and the patent system should be surveyed before explaining individual cases. The modern industrial enterprises, which internalized the multiunit and were controlled by salaried executives, had not existed in the United States before the 1840s. Provided by such conditions as market expansion, development of the railroad and telegraph networks as infrastructures, and technological progress which materialized new goods and new methods of production, modern enterprises were formed in the late of 19th century; they became a dominant institution in the United States until the middle of the 20th century.⁹⁾ Particularly, in an era of the first combination movement from the 1880s to 1900s, a number of modern industrial enterprises had emerged in the fields of petroleum, steel, electrical equipment, chemicals, machines and automobiles.¹⁰⁾

The time of emergence of modern enterprise was also a time when the number of patent applications and registrations had begun to increase in the United States historically. **Fig. 1** shows the long-term trends of the progress of patents, from 1801 to before World War II. The increase of patent applications and registrations had begun from the middle of the 19th century; the first strides appearing from about 1860 to 1880. During this term, the number of patent applications increased up to about 20,000 per year and registrations increased to about 12,000. This is the time when such machine industries as harvesters, looms, sewing machines, and machine tools were developed. It is easy for us to image that, in those fields, modern industrial firms, which produced and handled innovative goods, had taken advantage of the patent system for exclusive use of their technologies and securing competitive advantages.

The second upswing period of patenting is from about 1880 to 1900; the

9) Chandler, Jr., *op. cit.*, pp. 3-4.

10) *Ibid.*, pp. 315-339.

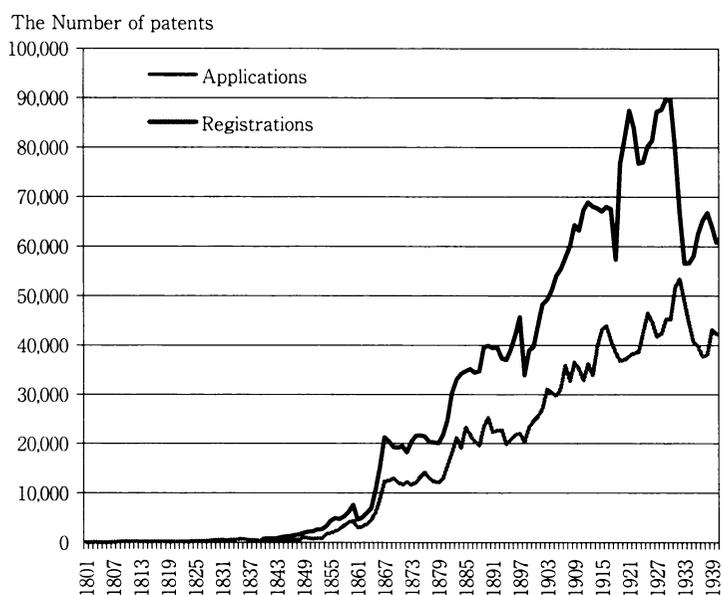


Fig. 1 Trend of US Patents

number of patent applications increased to about 40,000 per year, and the number of registrations increased to about 20,000 per year. This second period corresponds with the time when the first combination movement was developed and leading American big businesses was born. What kind of relationship is there between expansive growth of firms by merger and acquisition, organization of modern industrial enterprise, and the increase of patenting? Focusing on the second upswing period of patenting from 1880 to 1900, this paper clarifies the relations among growth of Thomson-Houston and the patent system from a point of view of management.¹¹⁾

2-2. Corporate growth and patents

2-2-1. American Electric Company

Thomson-Houston Electric Company stemmed from the American Electric Company formed in June of 1880 located in New Britain, Connecticut. This firm aimed to industrialize the arc lighting system which was developed by Elihu Thomson and Edwin J. Houston who were in Philadelphia at that time. Frederick H. Churchill, a lawyer in New Britain, had a great interest in the future of the electrical business, and formed the American Electric Company with share capital

11) The trend of patenting in the United States shows an upswing period in the 20th century; until First World War and 1920s. The evolution of corporate patent management in those periods should be analyzed respectively.

of \$87,500 and 57 local underwriters.¹²⁾

The charter of American Electric did not contain a patent related clause, but mainly provided that the aim of the company was “to manufacture, own, use, buy, sell and lease, electric generators, machines, lamps, apparatus, and other appliances for the production, development, regulation & utilization of electricity for electric light, electric transmission of power, electro-telegraphic, electro-metal-lurgic, and other useful purpose to which electricity is or may be applied,” and so on.¹³⁾ Churchill had taken steps that, beginning with organizing a company engaging in electrical business, made a company contract with Thomson and Houston to utilize their patents. In order to secure their patent rights, American Electric promptly increased their share capital to \$125,000 and assigned newly issued shares to Thomson and Houston. In addition, the company paid them \$6,000 in exchange for their patents.¹⁴⁾

Thomson contracted with American Electric on July 9th of 1880 to work as an electrician for two years at an annual salary of \$2,500. In article 5 of this contract, it was provided that American Electric “shall forthwith after its organization proceed with all reasonable diligence to develop and manufacture the improvements protected by the said Letter Patent of the said Houston and Thomson and those which they or either of them shall hereafter assign to the Company, and to put the machines, lamps, and other articles covered by said patents into public use and to extend their manufacturer and sale by diligent and continuous attention, effort and expenditure in all reasonable and advisable ways.” Further, article 6 provided that “in case of failure on the part of said Company to comply with the terms of this agreement and also in case the Company shall not proceed with reasonable diligence in the manufacture and sale of the articles covered by the said patents of the said Houston and Thomson such of the patents of the said Houston and Thomson or either of them as are then owned by the Company shall in like manner, if the said Houston and Thomson so elect, revert to the patentees”¹⁵⁾ These arrangements were what is called a reasonable diligence clause. This contract shows Thomson intended to industrialize his inventions through operations of American Electric.

Though Thomson engaged in technological development and engineering as an

12) Carlson, *op. cit.*, pp. 148-157; Harold C. Passer, *The Electrical Manufacturers 1875-1900: A Study in Competition, Entrepreneurship, Technical Change, and Economic Growth*, Harvard University Press, 1953, pp. 21-24.

13) Hammond File, J-877-883.

14) Carlson, *op. cit.*, p. 154; Passer, *op. cit.*, p. 24.

15) From E. Thomson to Hammond, July 25, 1925, Hammond File, J-174-175.

electrician of the company, Churchill who was the organizer of the company and business committed suicide in December 1880.¹⁶⁾ What is worse, it became clear that the management of the company was eager to obtain short-term profit, and that they hardly had efficient interest and capability to grow the American Electric as an electrical company through technological development and progress in a long term vision. In particular, New Britain's capitalists consisted mainly of hardware manufacturers who could not recognize the importance of organizing efficient marketing forces to deal with a novel central station system for lighting.¹⁷⁾ Thomson tried to withdraw his patents which were assigned to the company by invoking the reasonable diligence clause, but he failed. As his inventions would not have been industrialized in American Electric, Thomson did not revise his contract with the company and resigned in July 1882.¹⁸⁾

Thereafter Thomson looked for any capitalist who could buy up American Electric, and have interest in industrializing his inventions. Eventually, a syndicate of Lynn, Massachusetts, made an offer to buy out and purchased American Electric in October 1882. The syndicate renovated the management; they elected Henry A. Pevear as president and Charles A. Coffin as vice-president. Thomson contracted with Pevear in November 1882 for his service for five years as electrician of the new company at an annual salary of \$3,000. The new company received certification of charter in April 1883, and changed the name to Thomson-Houston Electric Company.¹⁹⁾

2-2-2. Thomson-Houston Electric Company

Though the president of Thomson-Houston was Pevear, Coffin, vice president and treasurer, was the substantial executive officer. Having previously managed a shoes manufacturing company, Coffin was attracted strongly by the promising future of electric lighting, and managed the newly organized electrical company actively. The distinguishing feature of Coffin's management was, among others, the strategy to sell and install a central station system for electric lighting, which could not be realized at American Electric.²⁰⁾ Coffin could predict that the central station system market would be able to be expanded rapidly by decreasing lighting cost, because, unlike the isolated system such as for factory lighting, a central station system can widely disperse the fixed costs of steam engines, dynamos, and a

16) Carlson, *op. cit.*, p. 172.

17) *Ibid.*, pp. 184-185.

18) *Ibid.*, p. 189.

19) *Ibid.*, pp. 192-193.

20) *Ibid.*, pp. 210-211.

distributing system, over a number of subscribers.²¹⁾ At first, Thomson-Houston sold and installed central station systems by using American Electric and Illuminating Company as an agency, however, Thomson-Houston gradually organized its own marketing forces and began to sell and install directly. In 1885, Thomson-Houston set up their first district sales office, and moreover the Lynn syndicate organized Thomson-Houston International Company to sell and install abroad. The international company expanded their business in South America and Europe.²²⁾

Coffin arranged an organizational structure suitable for the strategy of manufacturing and selling central station system. Organization was largely divided into four functional departments which were led by strong personalities such as Coffin, Thomson and Edwin W. Rice, Jr.; the four departments were designing, manufacturing and engineering, marketing and financing. **Fig. 2** shows the organizational chart of Thomson-Houston Electric Company. Coffin, vice president of the company, was in charge of marketing and financing and worked at the Boston office. Thomson, who was in charge of designing and inventions, did developing work in the model room attached to Lynn Factory. Manufacturing and engineering at Lynn were taken charge of by Rice, Jr., who had been an assistant to Thomson from the time when he was employed by American Electric. It is possible to regard the organizational structure of Thomson-Houston, which was governed by three prominent personalities, as formal departments, but also as a “coalition of groups”.²³⁾ At any rate, it could be said that Thomson-Houston was organized as a modern industrial enterprise that integrated such multi-functions as technological development, manufacturing, engineering, selling and financing into one business corporation.

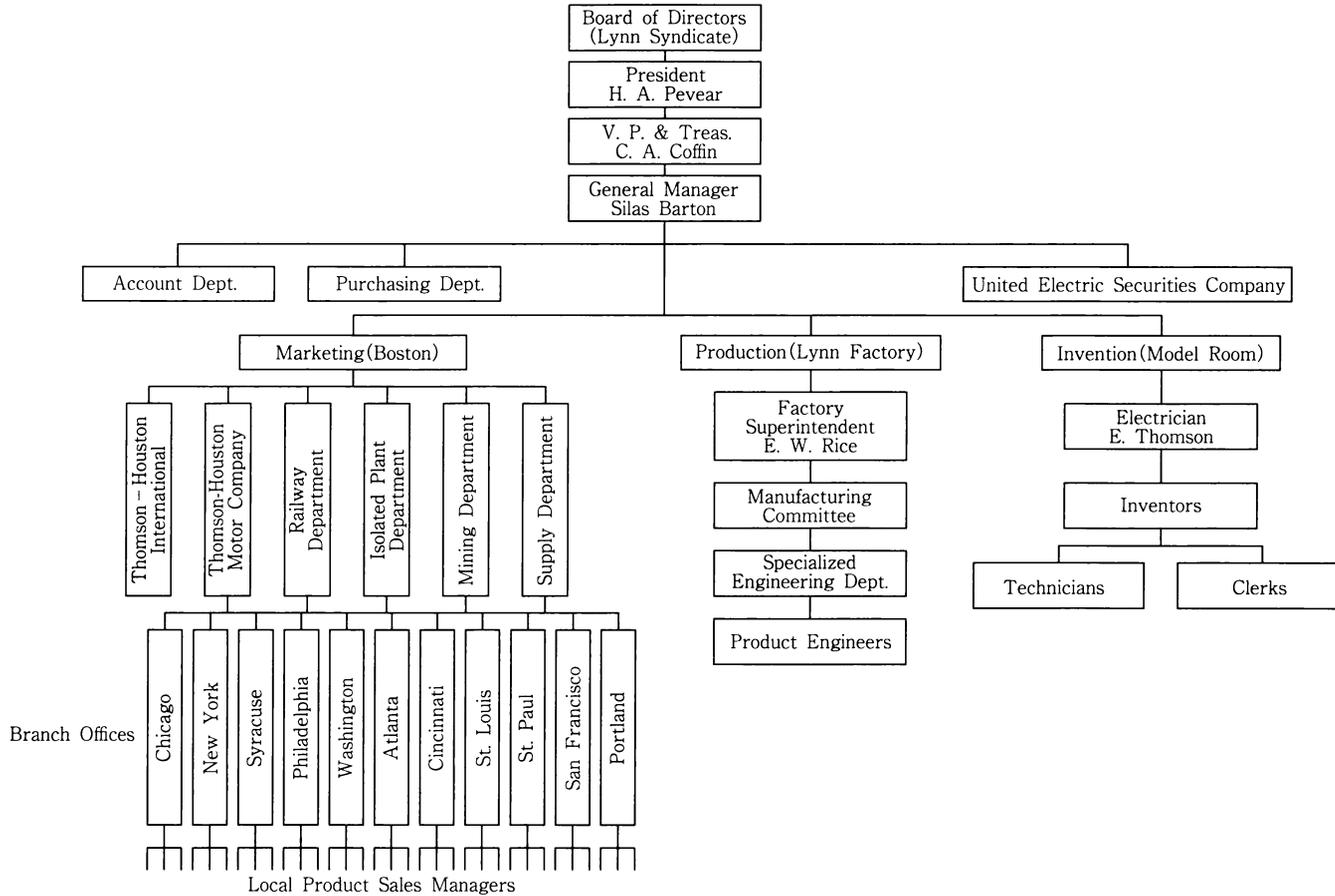
Coffin had to cope with complicated patent problems on the road to growth of Thomson-Houston, because in the early days of electrical industries there were a number of patents that covered new technologies which were invented and tried to be industrialized by many firms. Therefore, the situation was that “numerous patents on which were owned by many different concerns. No manufacturer could build an apparatus without danger of patent infringement.”²⁴⁾ For companies like

21) *Ibid.*, pp. 207, 211-212.

22) *Ibid.*, pp. 223-224; Shigehiro Nishimura, “Foreign Business and Patent Management before World War I: A Case Study of the General Electric Company,” *Kansai University Review of Business and Commerce*, No. 11, March 2009, pp. 77-97.

23) Carlson, *op. cit.*, pp. 218-219.

24) Frederick P. Fish, “Pre-eminently Successful as Organizer and Executive,” September 1926, Hammond File, J-712.



Original Source: Annual Reports of Thomson-Houston Electric Company, 1888-91; various documents in Hammond File, GE, Schenectady.
 Source: Carlson, *Innovations as a Social Process: Elihu Thomson and the Rise of General Electric, 1870-1900*, 1991, p. 220, Fig. 5.5.

Fig. 2 Organization of Thomson-Houston, 1883-1892

Thomson-Houston, it was crucial that their products not infringe patents and industrial property rights of others, when they installed some arc lighting system to public service corporations, because when a product could infringe some patents of others, the concerns which purchased the products and provide lighting service to their customers by using such a product could be the target of law suits. That is to say, customers of Thomson-Houston could hesitate to purchase the Thomson-Houston system due to risks of legal responsibility to rightful patentees, unless the products were guaranteed for no infringement.

The method taken by Coffin to dissolve such complicated conditions of patents and to promote the marketing of the technologically completed Thomson-Houston system was to acquire his competitors with essential patents which they held. Thomson-Houston purchased rivals from 1888 to 1891 and spent about \$4 million.²⁵⁾ During this period, Thomson-Houston purchased and merged with Brush Electric Company, of which Thomson-Houston purchased the majority of share capital in October 1889, Fort Wayne Electric Company, which was purchased in April 1889, Schuyler Electric Company, purchased in January 1889, Excelsior Electric Company, and Indianapolis Jenney Electric Company. Those companies had engaged in an arc lighting system. In the field of electric traction, Thomson-Houston merged with Van Depoele Electric Manufacturing Company, which was purchased in 1888, and Bentley-Knight Electric Railway in 1889.²⁶⁾ Moreover, Coffin sued some competitors for infringement of Thomson patents covering automatic current regulators for arc dynamos, with the aid of Frederick P. Fish, general counsel of Thomson-Houston.²⁷⁾ The suit against Brush Electric, which went ahead of Thomson-Houston in the arc lighting business, proved successful in weakening the market position of Brush Electric, and gave Thomson-Houston a chance to purchase its competitor. Many companies which lost patent cases left the market; the dominances of Thomson-Houston became extremely strong.²⁸⁾

Table 1 shows the growth of Thomson-Houston from 1883 to 1892. The figures as of 1883 were that employees were 45; share capital was \$125,000; and sales

25) Coffin's purchasing strategy peaked when Thomson-Houston merged with Edison General Electric Company to become General Electric Company. Hammond File, J-727.

26) Carlson, *op. cit.*, p. 216.

27) Fish was a partner of a Boston law firm Fish and Neave. Fish was a famous patent lawyer who committed to some patent problems such as incandescent light of Thomas Edison and telephone patents of Graham Bell. From 1885, Fish was general counsel of Thomson-Houston. Jay P. Pederson, *International Directory of Company History*, Vol. 54, 2003, p. 109; John E. Nathan, presented by Albert E. Fey, *Fish & Neave: Leaders in the Law of Idea*, The Newcomen Society of the United States, 1997, pp. 13-19.

28) Not only merged with rivals, Thomson-Houston also purchased essential patents. Carlson, *op. cit.*, p. 216; Passer, *op. cit.*, pp. 52-56.

Table 1 Growth of Thomson-Houston

	Employees*	Capital Stock	Sales	Profit	Local lighting companies using T-H system*
1883	45	\$ 125,000	\$ 426,987.97	\$ 93,696.74	5
1884	145	125,000	700,470.47	96,187.10	31
1885	160	125,000	983,986.85	106,687.50	59
1886	335	125,000	1,405,041.74	123,006.05	100
1887	571	500,000	2,335,594.80	313,596.67	171
1888	888	1,000,000	4,435,982.23	660,828.82	303
1889	1,225	7,500,000	8,222,789.12	1,309,175.19	419
1890	2,328	10,500,000	10,617,661.67	4,337,117.79	587
1891	2,422	10,500,000	10,304,580.17	1,524,414.25	755
1892	3,492	n.a.	n.a.	n.a.	873

Note: *on January 1.

Source: Compiled based on Passer, *The Electrical Manufacturers 1875-1900*, 1953, p. 30, Table 1.

amounted to about \$430,000. By 1891, Thomson-Houston had enlarged its scale; employees jumped to 2,422, which is 600 times as large as the number in 1883; share capital increased to about \$10 million, 84 times that in 1883; and sales were up to about \$10 million, 24 times that in 1883. The fact that every figure of employees, share capital and sales soared by around 1888, tells us that the rapid growth of Thomson-Houston was the result of Coffin's merger and acquisition strategies.

3. Patent Control by Elihu Thomson

3-1. Inventions and patents

In this section, Thomson's activities on invention and patenting are focused on. Though Thomson was in charge of technological development in the company, he simultaneously implemented some operations such as patent applications for securing the fruits from inventive activities and patent control. Hereafter, the evolution of patent management of Thomson-Houston will be clarified by describing individual activities of Elihu Thomson.

Fig. 3 shows the trend of patents which covered Thomson's inventions issued by the US Patent Office from 1879 to 1892. There were few patents up until 1882 when Thomson was an electrician for American Electric, however, since 1883 the number of patents expanded while he was an electrician for Thomson-Houston. In particular, patents issued increased after 1889, the number peaked in 1891; 50

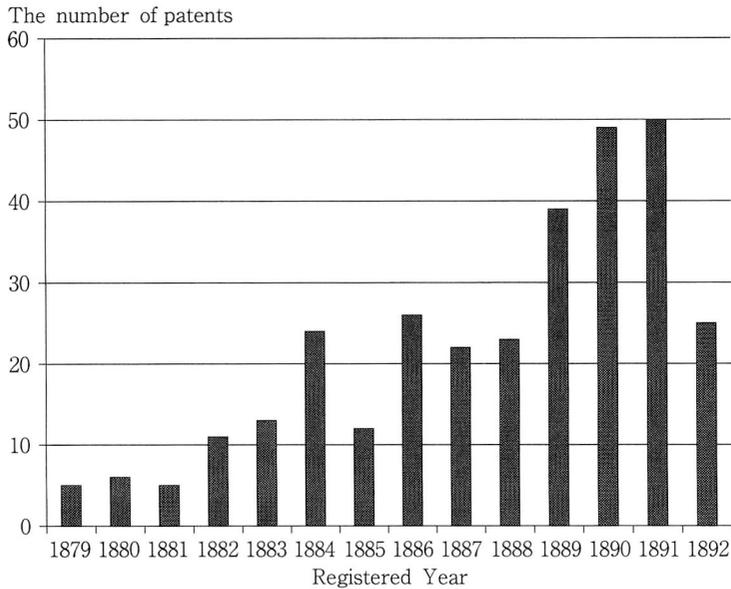


Fig. 3 Patents of Elihu Thomson

patents.²⁹⁾

During his American Electric era, Thomson practiced inventive activities at a private workroom that he called the “model room” on the second floor of the New Britain factory. The name “model room” was derived from the fact that in this room Thomson implemented developing work and made models for patent applications of the results.³⁰⁾ Thomson hired Rice, Jr., to assist his inventive work in the model room.³¹⁾ One of his subjects was to invent and develop an original efficient arc lighting system that could evade the arc lighting patents of Brush Electric, which had been powerful at that time.³²⁾ Thomson successfully invented the automatic current regulator in the model room, the device being one of the most essential elements in Thomson’s arc lighting system. It was difficult to fix the current of an electric circuit connected with multiple arc lamps, because as the number of lighting bulbs changed, the voltage of the circuit also changed. This device was essential to fixing the electric current and to provide people using the light with stable lighting. In relation to arc lighting system, Thomson invented a dynamo suit

29) When based on years of application, the number peaked at 1890 and it was 51 patents. The number of those patents means the patent applications which registered later.

30) Carlson, *op. cit.*, p. 157.

31) *Ibid.*, pp. 158-159.

32) *Ibid.*, p. 163.

arc system originally. The patent covering the arc dynamo was registered in January 13 1890; and the patent of the automatic current regulator was registered in March 1, 1891.³³⁾

When he was an electrician for Thomson-Houston, Thomson continued his inventive works in the same manner. A model room was set up in the Lynn factory as well as in the New Britain factory; the supply room and office for him and his assistants were attached to the model room.³⁴⁾ The subjects of technological development that Thomson tackled were of course set up by himself in some cases, however he usually coped with subjects that were taken by Coffin who led the marketing department and by Rice who supervised the manufacturing and engineering department.³⁵⁾ In his Thomson-Houston era, the magnetic blow-out (patent issued in 1883), the grounded secondary (in 1885), the repulsion motor (in 1887), a device for starting alternating-current motors in fans and ceiling fans (in 1890), and an electric meter, which was known as the Thomson wattmeter, were notable inventions. For the transformer, which was produced in 1885, though, Thomson applied for a patent for it immediately, the patent was eventually issued in 1902, after a series of interferences by competitors.³⁶⁾ Each patent resulted from his endeavor to make the Thomson-Houston's arc lighting system safer and more reliable.

Engaging in development work, Thomson paid adequate attention on broad patent information involving competitors' patents. In addition to reading electrical journals which were published in the United States, Britain and France periodically, Thomson read the *Official Gazette* issued by the US Patent Office. The patent library was instituted in the rear of Thomson's private office on the second floor of the office building. In the patent room, a complete bound set of all electrical related patents descriptions ever issued by the US Patent Office and a complete set of the *Official Gazette* since 1876 were furnished. Also the patents of Thomson-Houston Company were kept in three volumes.³⁷⁾ Patent information is not only technological information, but also is legal information. It is presumed that, taking advantage of patent information provided by the *Official Gazette* in his development process, Thomson practiced invention work taking into account future patent applications and enforcement in order to secure a strong patent position, which

33) Hammond File, J-189-190.

34) Carlson, *op. cit.*, pp. 234-236.

35) *Ibid.*, pp. 236-238.

36) Hammond File, J-189-190.

37) *The Electrical Engineer*, June 29, 1892, Hammond File, J-700-701.

Table 2 Assignee of Elihu Thomson's Patents
Registered in 1879-1992

	Not assigned	American Electric	Thomson-Houston	Thomson Electric Welding	Other	Total
1879	3				2	5
1880	4	2				6
1881	1	3			1	5
1882	3	8				11
1883		8	5			13
1884	2		22			24
1885	7		5			12
1886	18		8			26
1887	16		6			22
1888	17		1	5		23
1889	32		4	3		39
1890	28		12	9		49
1891	17		20	13		50
1892	6		17	2		25
Total	154	21	100	32	3	310

Source: US Patents.

would give Thomson-Houston advantages over competitors.

3-2. Patent applications

Though in present days employee inventions are generally assigned to companies by which the employees are hired by an employment contract, how was the ownership of inventions settled by corporate engineers in the era of Thomson? **Table 2** shows the concerns to which Thomson's invention patents were assigned to. The figures of this table are based on the year the patents were applied for. We can see that the patents were not assigned to others, which means patents issued to Thomson individually, increased from about 1885 to 1889. The patents that were assigned to Thomson-Houston increased from 1890; the patents registered in the individual name remained at the same time. From 1888, some patents registered in the name of Thomson Electric Welding Company, which was organized in 1888 to industrialize transformers for electrical welding that were invented by Thomson in 1885.³⁸⁾ Like this, Thomson's patents were registered not only in some company names such as Thomson-Houston, but also a substantial number of patents in his

38) John W. Hammond, *Men and Volts: The Story of General Electric*, J. P. Lippincott Company, 1941, p. 92.

name.

This pattern of assignment was caused by his contract concluded in November 1882. The contracts between Thomson and Lynn Syndicate did not cover all of the inventions he would invent but some of them. An electric dynamo, a kind of transformer, a system of power transmission, and an underground wire system, for example, were not included in the contract, so Thomson could be free to develop and sell them despite any determination by the company.³⁹⁾ The contract with this feature was concluded by Thomson in order to avoid restraints by the company and to secure his autonomy in part in developing and selling. It is presumed that, according to this thought, Thomson registered in his name some patents which he considered should be maintained, and he assigned others which were included in the contract in such company names as Thomson-Houston and Thomson Electric Welding. These things tell us that patent applications by Thomson were an individual process, as well as an inventing process, rather than a managerial process.

Though the inventive work of Thomson-Houston was led by the strong personality of Thomson, the patent control was also led by Thomson's personality. He considered various strategies for patent application. For example, he deliberated about whether he should apply for the principle behind invention or for specific configuration, whether he should apply for a broad patent covering the whole system or for each elemental part, whether he should file an application aggressively or should do so defensively.⁴⁰⁾ There were substantial problems to be considered on how to file patent application, since they had to cope with severe patent conflict at that time. Surveying the trend of applications and the patent portfolio of his competitors through journals and the *Official Gazette*, Thomson frequently consulted with Coffin, who was supervising marketing affairs, Henry C. Townsend, who was a patent attorney, and Fish, the general counsel of the company.⁴¹⁾

So, it needs to be clarified how the patent application process was conducted in Thomson-Houston. There are many patents in the early days issued to Elihu Thomson that were not signed by patent attorneys. That is because those patents were prepared by Thomson himself, namely the draft of the specifications were made by him, and the patents were applied for.⁴²⁾ In 1889, Townsend was hired as counsel for Elihu Thomson and Thomson-Houston, and this contract seemed to

39) Carlson, *op. cit.*, p. 193.

40) *Ibid.*, pp. 240-241.

41) *Ibid.*, p. 241.

42) Some drafts of specification seemed to be prepared by John W. Gibboney, his secretary. The practices that Thomson prepared specification draft continued after Thomson-Houston changed its name to General Electric by merger with Edison General Electric. Hammond File, L-6618.

continue until 1889.⁴³⁾ Among Thomson's patents, the patents signed by Townsend as patent attorney increased after 1882; after 1889 Townsend signed Thomson's patents continuously. On the other hand, the patents signed by Townsend & MacArthur started appearing since 1887. This means that the patent applications were processed by a law firm. Townsend was not hired as an in-house patent attorney, but contracted with Thomson and the company as a patent agent. Therefore, the form of organization of patent management was that the company made arrangements with patent attorneys or law firms, and utilized such resources outside to process patent applications.

3-3. Licensing and Enforcement

Elihu Thomson not only filed patent applications for his inventions, but also committed to make use of registered patent rights. Since the execution of patent rights or enforcement had a close relationship with the policy and strategy of the company Thomson-Houston, Thomson's commitment was through decision making by the actual chief executive officer, Coffin.

First, one of Thomson's practices in relation to enforcement of patent right was to cope with the interferences. This process is to decide the first inventor of the invention when multiple inventors file similar applications; it is a unique process in the United States which has adopted the first-to-invent system.⁴⁴⁾ Thomson prepared statements and testimony needed for interference proceedings, however, in the late 1880s, Thomson only responded to a limited number of matters of importance because he failed many applications.⁴⁵⁾

The second practice was to tackle infringement cases. As described previously, Thomson-Houston took related manufacturers to court all at once in January 1887, alleging that they infringed Thomson's patent covering an automatic current regulator for an arc lighting system. While Thomson-Houston won those lawsuits and purchased Brush Electric Company eventually, Thomson engaged in "locating evidence, giving testimony, and building special models of both his regulator and those of his competitors" for the cases.⁴⁶⁾ Though Thomson wanted to spend his time and effort in inventing and developing work as an electrical engineer, he had to spare more time and energy to respond to infringement cases.

43) Hammond File, L-6618-9.

44) Donald S. Chisum, Translated by Toshiko Takenaka, Supervised by Nobuo Monya, *Elements of United States Patent Law, Second Edition*, Yushodo Press Co., Ltd., 2000, pp. 274-279.

45) Carlson, *op. cit.*, pp. 242-243.

46) *Ibid.*, p. 243.

Thirdly, Thomson evaluated patents that others invented. Growing their business, Thomson-Houston was based not only on patents and technology which were developed by in-house engineers like Thomson and Rice, but also on patents and technology which were purchased from outside inventors, independent engineers, and consultant engineers. Purchasing those patents and technology was aimed at supplementing Thomson-Houston's patent portfolio and technology, and to prevent others from securing that technology from the point of views of defense. From 1884, Thomson evaluated some patents for storage batteries, motors, and incandescent lamps all of which the marketing department was interested in.⁴⁷⁾ Thomson thought "as electrician of the Company and one of its directors, that any purchase or arrangement for assignments of patents and inventions should include my judgments upon those inventions."⁴⁸⁾ From his way of thinking, it is presumed that Thomson regarded himself as the central figure in the development of Thomson-Houston, that he intended to control all of the technology of the company, and that the functions of the company were controlled and managed by strong personalities.

Fourth, Thomson provided Coffin and other managers with advice on technological and licensing matters as patent related practice. When Thomson-Houston tried to enter the incandescent lamp market in 1844, Thomson gave advice on the strength of Edison's patents to the managers.⁴⁹⁾ Also in 1887 when the company arranged a patent sharing agreement with Westinghouse in order to avoid the risk of infringement, Thomson helped to conclude it. In this contract, Thomson-Houston granted a license to sell the Thomson-Houston arc lighting equipment, and in return Westinghouse provided Thomson-Houston with the license to make and sell an arc lighting distribution system. Although this agreement ended within two years because the Westinghouse patent was judged invalid, Thomson-Houston began to develop patents which gave its mind over competitions with Westinghouse.⁵⁰⁾

As mentioned above, the managerial proceedings of patent applications, enforcement, and licensing in Thomson-Houston were mainly implemented by Thomson as an individual process. The form in which a personality rules a function of patent control and manages a company, however, was changed by enlargement of Thomson-Houston through merger and acquisition of competitors and purchasing assets starting in 1888.

47) *Ibid.*, p. 243-244.

48) *Ibid.*, p. 244.

49) *Ibid.*, p. 245.

50) *Ibid.*, p. 257.

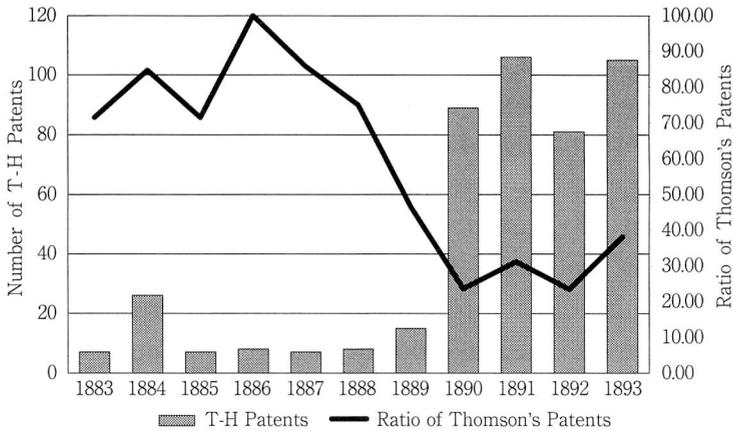


Fig. 4 Patents of T-H and ratio of Thomson's patents

4. Institutionalization of patent control

4-1. Expansion of development facilities

In the description above, the inventions and patents of Elihu Thomson were observed. It is up until 1888, when Thomson-Houston began buying competitors, that we can account for the strategy and structure of the company through describing the individual activities of Elihu Thomson. From that time on, individual processes by Thomson on invention and patent control were swiftly institutionalized, de-individuated, and substituted by social process.

Fig. 4 shows the trend of the number of patents registered in the name of Thomson-Houston. Though the patent registrations in the company name were less than 20 by 1890, the number jumped up to 80 to 100 a year after 1889. Because the columns in this chart indicate the number of patents measured based on registration year, the change appears from 1890; however when the number is re-totalized based on filing year, the change appears around 1889. On the other hand, the proportion of Thomson's inventions in the patents registered in the name of Thomson-Houston decreased dramatically. The ratio of Thomson's inventions among the company's patent was about 80% until 1888; the ratio fell down to 30% from 1890. Namely, the expansion of the patent portfolio of Thomson-Houston was mainly caused by the patents of inventors other than Thomson.

Fig. 5 shows the number of inventors concerned with Thomson-Houston's patents. Being aware that this figure is based on the year of patent applications, the criterion is different from some charts above. From this chart, it is apparent that the number of inventors concerned with the company's patents was 4 at most

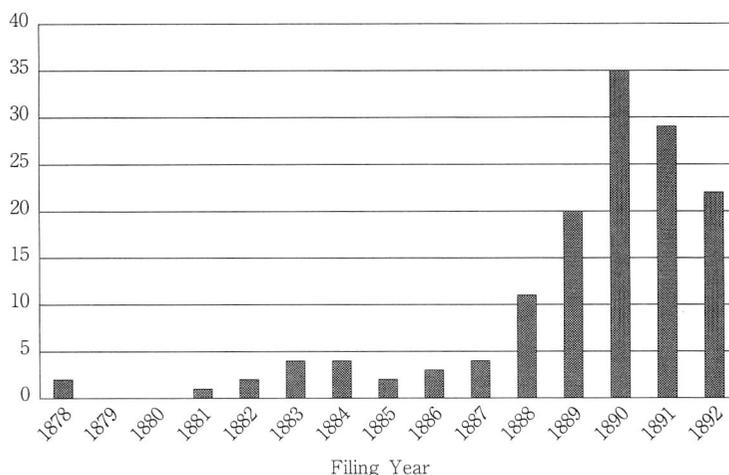


Fig. 5 The number of Inventors

before 1887; the inventors increased rapidly after 1888 and was 35 in 1890.

One of the reasons of the increase of inventors is that the marketing group led by Coffin began purchasing outside patents starting in 1888. While in 1888 and 1889 it seemed that Thomson hardly recognized the purchasing of outside patents, fearing that his initiatives on invention in the company could be desecrated,⁵¹⁾ however, despite Thomson's will, management promoted purchasing patents starting in 1890.

The second reason for the increase is that some inventors that belonged to competitors were transferred to Thomson-Houston by acquisition of rivals from 1888. **Table 3** shows the number of patents of main inventors in the company based on filing year. Among them, Charles J. Van Depoele in the model room had applied for patents in the name of Thomson-Houston after 1887 continuously; he joined to the company as a technical employee through a merger in 1888 with Van Depoele Electric Manufacturing Company, which he organized.⁵²⁾ Both Herman Lemp and Marle J. Wightman had filed applications continuously after 1888; they were engineers of Schuyler Electric Company that was purchased by Thomson Houston in 1889.⁵³⁾ In this way, patent growth was caused by an increase of inventors acquired by merger of competitors.

Furthermore, some engineers who had belonged to Thomson-Houston since

51) *Ibid.*, p. 266.

52) Passer, *op. cit.*, pp. 233-234.

53) Before their transfers to Thomson-Houston, they assigned their patents to Schuyler Electric; and the patents were registered in the company's name.

Table 3 Patent Application of inventors of Thomson-Houston
Filing Year

	1878	1879	1880	1881	1882	1883	1884	1885	1886	1887	1888	1889	1890	1891	1892	
Thomson, Elihu	1			2	1	16	32	5	12	20	10	21	36	26	17	
Houston, Edwin J.	1				2	2	1									
Rice, Edwin W., Jr.						1	6		1		2	3	5	6	2	
.....																
(model room)																
Van Depoele, Charles J.										1	4	2	4	10		
Lemp, Hermann											5	9	15	14	2	
Wightman, Marle J.											3	4	2			
Alton, George H.											1	3	2	1		
Harthan, Charles E.													2	1		
Curtiss, George F.														1		
.....																
(manufacturing and engineering department)																
Blackwell, Francis O.												1	17	5	3	1
Baker, Isaac F.													5	3		
Wakefield, William O.													1	2		
Rohrer, Albert L.													1	1	1	3
Ekström, Axel														2	2	1
Fiske, Jonathan P. B.															5	2
Reist, Henry G.															1	
.....																
(patent department)																
Bentley, Edward M.															1	

Source: US Patents.

early on began to make inventions and file patent applications. For example, Francis O. Blackwell, who was an engineer of the manufacturing and engineering department, Isaac F. Baker, who was a mechanical superintendent of that department, William O. Wakefield of the drafting department, and Albert L. Rohrer who was an Assistant to Rice, Jr. also began to make inventions and apply for patents around 1888 or 1889.⁵⁴⁾

Through the acquisition of patents, increase of inventors by merger, and activation of invention in the internal developing department and engineering department in this way, Thomson-Houston held a number of patents to be applied for, controlled and managed. Though it was feasible that patent control and the patent procedures of the company were governed by Thomson's personality by 1888, the expansion of inventions and patents pushed to the limit the dependency on indi-

54) The title of each person was referred to the organizational chart that Carlson made. Carlson, *op. cit.*, p. 230.

vidual process to control and manage patents.

4-2. Organization of patent department

It was H. C. Townsend and Townsend & MacArthur that filed the patent applications of Thomson-Houston Company before 1887. Townsend graduated from Harvard College in 1871 and started his carrier with an assistant examiner in the US Patent Office at Washington, D. C.⁵⁵⁾ As mentioned above, it seemed that Townsend was hired by Thomson and Thomson-Houston as counsel.

After 1888, the patents whose attorney was Bentley & Knight appeared, added to the patents whose attorney was Townsend. It is said that the first patent department of Thomson-Houston was organized by Bentley & Knight.⁵⁶⁾ Edward M. Bentley, who was an examiner in the electrical section in the US Patent Office from the beginning, began to manufacture equipment for an electric street railway with Walter H. Knight, who was an inventor; they organized the Bentley-Knight Electric Railway Company in 1884.⁵⁷⁾ Bentley-Knight was purchased by Thomson-Houston in 1889, and Bentley and Knight were transferred to Thomson-Houston. In the company Bentley was the head of the patent department and Knight was a design engineer.⁵⁸⁾ Though Knight was in charge of the railway engineering department in Lynn, he sometimes was in the patent department in Boston.⁵⁹⁾

In 1891, the Thomson-Houston's patents signed by Bentley & Blodgett appeared besides the patents signed by Townsend and Bentley & Knight; almost all patents were signed by Bentley & Blodgett except in some cases after 1892.⁶⁰⁾ George R. Blodgett also was an examiner in the US Patent Office as a first carrier. Being an examiner after graduating from Yale University in 1884, he was admitted to the Bar in New York, and then he moved to Boston and became a member of the law firm, Bentley & Blodgett. The firm acted as the counsel for Thomson-Houston, later General Electric Company which was an amalgamation of Thomson-Houston and Edison General Electric.⁶¹⁾ After the establishment of GE, the patent department moved from Boston to Schenectady in March of 1894. At that time, Bentley broke

55) *Third Report of the Secretary of the Class of 1871 of Harvard College*, June 1877, p. 27.

56) "I find evidence of the fact that they were acting as attorneys for the Company as early as May of 1888 and as late as April, 1891." From Macdonald to Hammond, September 25, 1934, Hammond File, L-6618-6619,

57) Passer, *op. cit.*, p. 225.

58) *Ibid.*, p. 228; Hammond File, J-140.

59) *The Electrical Engineer*, June 29, 1892, Hammond File, J-700-701.

60) The firm was changed from Bentley & Knight to Bentley & Blodgett in 1891. Hammond File, L-6618.

61) General Joshua L. Chamberlain, ed., *Universities and their Sons: History, influence and characteristics of American Universities*, 1900, p. 232.

off his connection to the patent department and remained at Boston, and Blodgett moved to the new headquarters and became head of the patent department.⁶²⁾

Most of the patents registered in the name of Thomson-Houston were conducted by attorneys and law firms who were counsels of the company, like H. C. Townsend, Bentley & Knight, Bentley & Blodgett, and G. R. Blodgett. Patents invented by Lemp and Wightman, who were first engineers of Schuyler Electric Company, as well as the patents of Blackwell, Baker, Wakefield, and Rohrer were also applied for by the company's counsel that had taken charge of the patent department. However, not all of the patents of Thomson-Houston Company were managed by the department. All patents invented by Van Depoele were signed and conducted by Frankland Jannus, who perhaps was an independent patent attorney. Therefore, it can be seen that the patent department of Thomson-Houston did not cover all of the patents invented in the company, and there remained inventors that took the initiative to apply for and manage their own patents at that time.

Elihu Thomson gradually lost his motivation for invention and patent control because his work of enforcement related to his patents increased heavily, and because his position as chief engineer of the company was threatened by inventors incrementally added by merger with competitors promoted by Coffin. The management assigned some work such as routine product improvement to the engineering department, and they moved the operations which had been managed by Thomson so far to the patent department that was established for handling patent affairs.⁶³⁾ However, the organization of patent management was not formed in which companies hire in-house patent attorneys. Though Thomson-Houston organized their own patent department, the head of the department was patent attorneys or law firms which formed counsel contracts with the company. They supervised patent affairs, conducted patent applications and procedures of interferences and enforcement cases. Namely, the company at that time did not completely internalize all of the functions of patent management, but utilized external resources such as counsel and a supervisor in patent control and management. Nevertheless, the patent control practices that were implemented individually by Thomson were changed to practices that performed by an organization, or to a managerial form of patent controls.

62) *Ibid.*, p. 232; Hammond File, J-6618.

63) Carlson, *op. cit.*, p. 266. He pointed out the management "established a legal department in 1891 for handling patent matters". It perhaps indicates the patent department taken charge of by Bentley & Knight or Bentley & Blodgett. Anyway, it could be said that the patent department of Thomson-Houston was organized in around 1891.

5. Conclusion

Thomson-Houston Electric Company was a modern industrial enterprise that integrated such multifunction as engineering and manufacturing of an arc lighting system, marketing it, developing it, and financing it. In the electrical industry, patents are essential for manufacturers to grow their business. Having a close relationship between business and patent control, companies have integrated the functions of patent application, enforcement, and licensing from the beginning. On the other hand, a process of patent control was also conducted by Elihu Thomson, who was a chief electrical engineer, as an individual. As a result of mergers with a number of competitors promoted by Coffin, technology development and invention expanded quickly. Due to this expansion, the practice of patent management changed from an individual process and became institutionalized; professionals began to take charge of patent control.

From the point of view of organization, the patent department of Thomson-Houston had the form in which outside professionals like patent attorneys or law firms contracted to be counsel for the company, took charge of the department and supervised patent affairs. Though the patent department was part of the company organization, it was not managed by in-house professionals, but rather managed by utilizing external resources. It was a little later that American companies formed sophisticated and well organized patent departments.

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