Intermediaries and Invention: Business Agents and the Edison Electric Pen and Duplicating Press

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In the 1870s America was redefined. During these years following the Civil War, improved modes of communication and transportation drew the nation together and the United States forged a new national identity. American business experienced a similar transformation. Faster methods of producing and exchanging commodities and phenomenal growth in the size of manufacturing institutions enabled American businesses to change their focus from their traditional local markets to national and eventually international markets. This shift in markets held serious implications for the way Americans would invent and market their inventions. Inventors suddenly found it necessary to understand and address the needs of faceless customers from distant markets. As a result, in the 1870s the business agent assumed an important new role in the process of invention. Inventors relied upon growing corps of business agents to gather and interpret customer feedback to ensure the success of their inventions on the new national market.

The development of Thomas A. Edison's electric pen and duplicating press – a curious battery-powered motor-driven system designed to produce multiple copies from a self-prepared stencil – illustrates the rise of the business agent in the history of American business and invention. Edison designed this autographic printing apparatus at the behest of a friend and local businessman. That gentleman, reflecting on the tribulations of writing out all of his business transactions by hand, asked the inventor, "Why in creation, Edison, don't you turn your attention to inventing something that would save this endless waste of time and labor?" [4, p. 33] Recent historiography suggests that Edison's friend was not the only businessman of his generation to wish for a more expeditious means of business communication.

Conditions in American business at that time endowed the electric pen with great potential for marketability. As James Beniger suggests in *The Control Revolution*, explosive growth in the nation's largest industries, beginning with the railroads, created the need for an inexpensive and rapid means of internal

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communications [1]. The new American business manager of the late nineteenth century came to depend upon efficient office equipment for the proper functioning of a company [3, 15]. Despite the apparent need for Edison's duplicating system, his attempts to market this invention led him into unfamiliar commercial waters. The electric pen was one of the first products designed for use by producers outside a traditional local or specialized market. Patents for Edison's previous inventions had been sponsored by or sold to huge technological companies, such as Western Union, with controlling interests in the field. So the intended market was typically well-defined and available feedback was limited to Edison's fellow associates in the laboratory or his corporate sponsors. However, in the case of the electric pen, Edison needed to convince hundreds of offices, ultimately worldwide, of the usefulness of the electric pen to their operations. Edison made this transition guided by the market feedback made available to him and his experimental team by his electric pen agents.

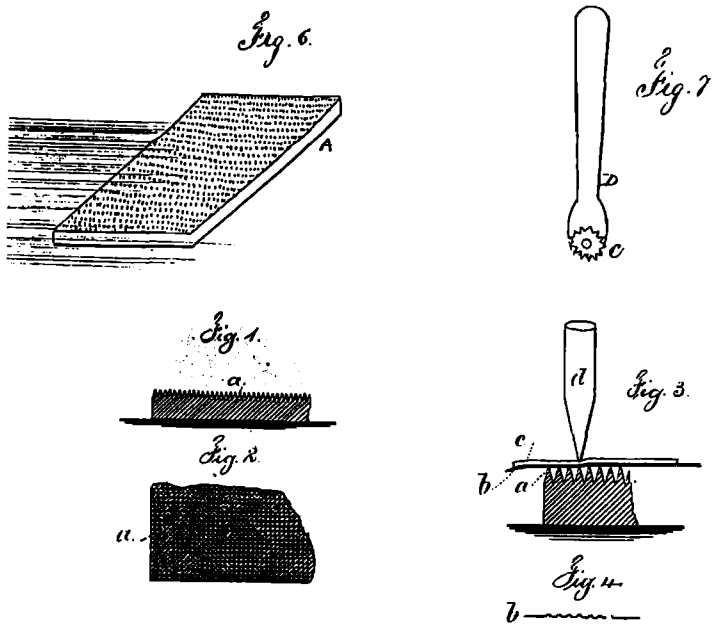
Edison's agents utilized many innovative strategies to market the autographic duplicating system. They offered systems on a five-day day trial basis, advertised in thousands of newspapers and trade journals, and suggested it would add a personal touch to business correspondence. This addressed a common concern among businessmen in the 1870s who lost the close personal contact they enjoyed with their customers before expanding into larger markets. The electric pen agents represented a new phenomenon in Edison's and America's inventive history. In the twentieth century it is assumed that designs for new products intended for a mass market are informed by extensive marketing research based upon consumer feedback. In the 1870s, this was not yet the case. But as the development of the Edison electric pen and duplicating press will demonstrate, the feedback from the apparatus users, filtered through these agents, shaped the technology and its distribution in the late nineteenth century marketplace.

Early Experiments in Autographic Printing

Edison and his small cadre of scientific and technical assistants began their experiments in multiple duplicating in Edison's new independent research laboratory in Newark, New Jersey in the spring of 1875. Because of his fascination with chemistry Edison began his investigation into copying using chemical processes [8, p. 107]. When this approach proved messy and somewhat disappointing, the experimental team investigated non-chemical copying processes. On June 30th, they "struck the idea of making a stencil of the paper by pricking with a pen & then rubbing over with an ink." They cut a 2" x 3" piece of steel that resembled a file with sharp, closely arranged teeth pointing upward. Paper placed atop the file was perforated by writing on it with a stylus (Figure 1). Laboratory notes reveal that this process was also unsatisfactory because "it works but takes too much pressure" to operate [7, doc. 588].

Therefore, at that same session the experimental team resolved to make a pen driven by clock work or engine to prick as it wrote. Having quickly determined that a pen made with clock work was no good, they made one to

Figure 1*



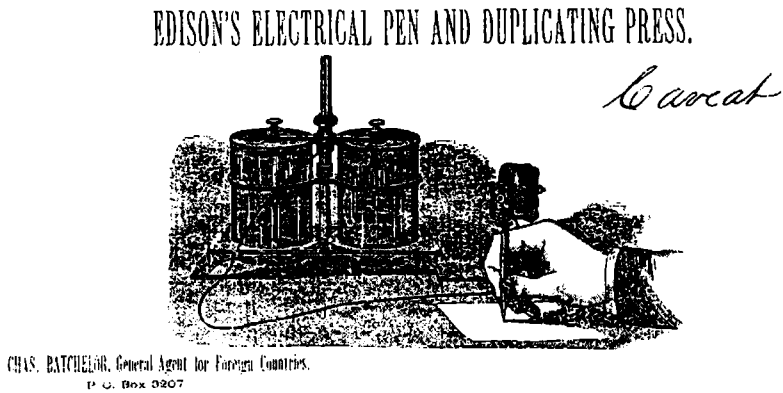
Edison's file plate process for stencil production, caveat 68 submitted 9/27/1875 and U.S. patent no. 224,665.

run by electric engine. The prototype of Edison's electric pen was completed July 20, 1875 [7, doc. 595]. It consisted of a hollow tube encasing a needle fastened to the end of a wire. The wire, powered by an egg-sized electromagnetic engine mounted atop the pen, moved the needle up and down in a perforating motion (Figure 2). As the user wrote his message in the usual manner with this pen, the characters were traced in dotted lines. The rapid motion of the needle punctured the paper as the point of the pen moved to and fro. The motive power used to drive the engine of the pen was derived from a voltaic battery consisting of two containers of caustic chemicals (preferably bichromate of potash and sulfuric acid) with removable lids. Once the pen had produced the stencil, the stencil was clamped over a clean sheet of paper on the wooden bed of an iron, desk-top printing press (Figure 3). A roller, covered with felt or other similar material, and having ink upon its surface, was then rolled over the perforated sheet until all holes were filled with ink, making an impression on the receiving sheet below. This process could then be repeated with the stencil over subsequent receiving sheets [13, no. 180,857].

Edison's experimental team believed in the marketability of their "wonder of electricity" as it was later labeled by Charles Barnard, technical editor of *Scribner's Monthly* [7, doc. 660]. In a letter dated September 13, 1875, Edison included a postscript that read, "There is more money in this than telegraphy.

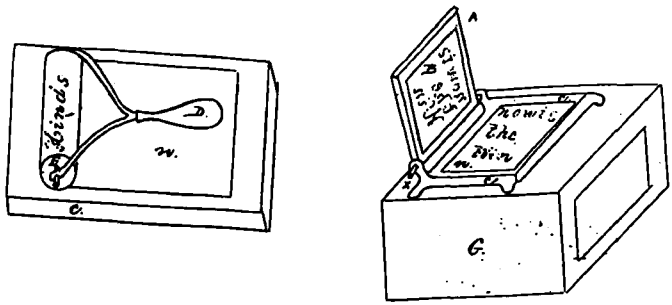
*All figures courtesy of the Edison National Historic Site, West Orange, NJ.

Figure 2



Stationery letterhead illustrating the duplicating process.

Figure 3



Edison's duplicating press as displayed in caveat 68, 9/27/1875.

It is to the Country house [sic] what sewing machines are to the home circle" [7, doc. 624]. Charles Batchelor, one of Edison's foremost experimenters, no doubt perceived the scope of commercial opportunities associated with the invention. He expressed to his brother that "the railroad companies here seem to have a great deal of reduplication & I think we shall supply them all" [7, doc. 625].

The Edison multiple duplicating process provided a cleaner alternative to the messy papyrograph (which used caustic soda and lacquer to produce stencils) and a faster and cheaper alternative to contracting for a traditional printer's services [7, doc. 568]. Thus, on August 31, 1875, the Edison Electric Pen and Duplicating Press Company was formed. The next day the experimental team made plans to exhibit the electric pen at the National Industrial Institute and the New York State Fair, and at week's end they placed an order for one hundred presses and ink rollers to accompany the pens with the manufacturing company of Ezra Gilliland. By late September, production of the instrument was fully underway and Edison's first agent, a Mr. P. Mullarkey, was selling the electric pen in New York City [7, doc. 622].

The Agent-Inspired Evolution of the Electric Pen

Although the electric pen received some encouraging early reviews and there was no doubt a growing need for labor-saving, efficiency-minded office instruments such as the electric pen, Edison soon discovered through communication with his agents that transforming his technically ingenious device into a marketable product would require more than just an exploitable niche and inventive ingenuity. In its earliest form the device was an interesting combination of engineering marvel and office menace. A Danbury newspaper man noted that using the electric pen was like holding "'the business end' of a wasp on a sheet of paper and letting the insect sting holes into the sheet while you move him back and forward" [6, 13:960]. Meanwhile, overturned batteries could result in the quick removal of a layer or two of shellac from the user's desk [7, doc. 568]. As a result, Edison found it necessary to alter his invention according to the needs of its consumers in order to make it commercially viable.

User feedback reached Edison's laboratory via suggestions, praise, and complaints found in the letters of Edison's men on the front lines, the agents. Much the same way salesmen operate today, the Edison electric pen and duplicating press agents of the 1870s established themselves in regional territories and then set out to convince prospective buyers of the usefulness of the product they represented. In the course of demonstrating the electric pen and duplicating press, these agents often received valuable consumer reaction to the duplicating system. Edison's Newark and Menlo Park laboratory notebooks reveal the input he received regularly manifested itself in the adjustments Edison made to his invention.

The earliest feedback came from Edison's first electric pen agent, P. Mullarkey of New York City. Mullarkey seemed to be able to stir up considerable interest, but few sales of the electric pen and duplicating press. He demonstrated the electric pen and duplicating press at offices of the Union Pacific Railroad, the New York City Railroad, the Herring Safe Company, and a variety of other establishments. He reported numerous occasions on which prospective buyers were amazed and delighted to watch his demonstration of the curious new invention, but hesitant to purchase one for their own use. He reported, "the chief objection comes from clerks who do not want to have to use it – others offer such trifling objections as the noise." Mullarkey insisted that "the thing is highly praised everywhere but it will be harder to sell than you anticipate" [6; 13:259, 261-262].

Recognizing the important role of business agents in introducing the electric pen to distant markets, Edison and Batchelor set out to attract energetic gentlemen to represent their product in other regions of the country. To make the opportunity appear more attractive, they inflated reports of Mullarkey's success. In a September letter to Stephen Field of Field's Electrical Construction and Manufacturing Company, Batchelor claimed that the electric pen agent in New York was selling eight units per day when in fact he was selling less than one daily. He further reported that the pen was "much liked by Com merchants, Lawyers, Ins Cos, etc & no difficulty at all is experienced in selling them" [7,

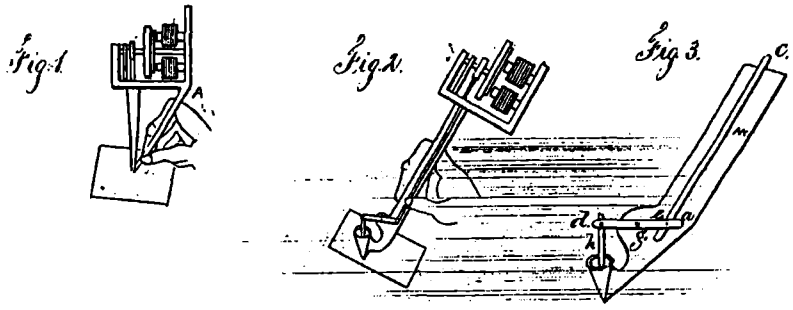
doc. 624]. By early October, these exaggerated sales reports had largely served their intended purpose by enlisting additional agents to distribute the pen.

> The agents we now have are Electrical Construction & M Co San Francisco, Nevada California, Oregon Washn Terr'y, B Columbia. P. Mallarkey NYork City, Chas Mixer Maryland, B F Johnson Philadelphia. W E Blennerhassett Michigan, W E Burton & Son NYork State & New England States & H Clark Brooklyn. – Wood, Jersey City [7, doc. 639].

Thus, Edison began receiving feedback from agents in other regions. In October of 1875, B.F. Johnson of Philadelphia penned a letter to Charles Batchelor asking, "what is the matter with this new pen...I adjust it so the point will project out something more than a 32nd of an inch. Fasten it there tight, but after writing with it a little while it goes way back in the tube again and remains there" [6, 13:277]. His agents clearly expressed that alterations needed to be made to the electric pen and duplicating press if the system was to meet the expectations of its awaiting consumers.

During the next four months, Edison made numerous revisions to the pen, copying press, batteries, and ink, many of which were inspired by the feedback received from his agents. In a draft caveat dated October 3, 1875, Edison outlined modifications that would enable users to hold the electric pen as they would a normal pen, hoping to make his invention easier to use (Figure 4). Earlier versions of the pen required the user to hold the pen in an uncomfortable, perfectly vertical position. When Edison later patented these modifications, he suggested that he made the improvement in his original design so that "such instrument can be used by hand in the same manner as a drawing or writing pen" [13, no. 180,857]. It was hoped that this revision would remove the objection of clerks to its introduction into their offices.

Figure 4



Adjustments designed to promote comfortable handling of the pen, caveat 69, 11/29/1875.

In the same caveat he suggested that the electromagnets in the pen's engine be utilized as a fly wheel, "thus dispensing with the ordinary fly wheel and decreasing the weight of the pen" [7, doc. 638]. In a notebook entry dated February 7, 1876, Charles Batchelor noted a revision that addressed the aforementioned retraction problem.

> We made a great improvement in the pen by giving the cam plenty of side shake and putting a guide above the cam so that it could only move the needle up and down and not at all sideways. The spring is also improved by being made stiffer at the point so that it hardly springs at all between the platina point and the end of spring [7, doc. 720].

On February 8 Edison's laboratory machinists altered the production models that would be sent to Gilliland & Company, the manufacturers of the copying system, to include this latest design change. The desired effect of these proposed revisions was to make the pen more usable and hence, more acceptable on the consumer market.

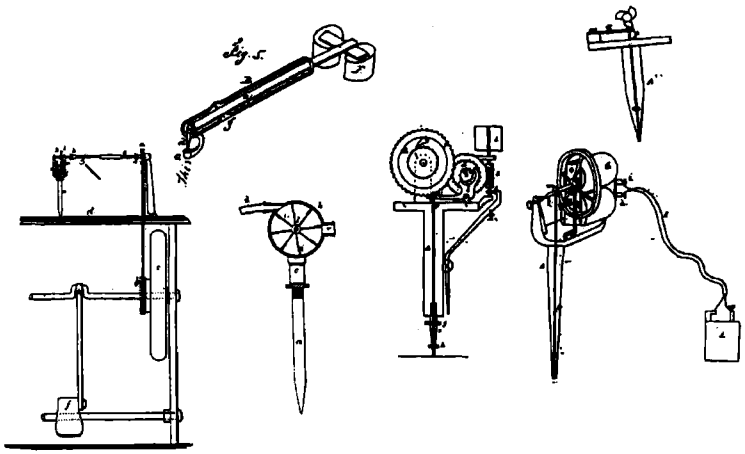
By the end of March, 1876 Edison was seeking agents to sell the electric pen and duplicating process overseas. "The electric pen became an international business when British businessmen John Breckon and Thomas Clare bought the rights to Edison's British patent and established the Electric Writing Company" [10, p. 60]. As their head agent, Frederic Ireland provided valuable market feedback to Edison. In September, 1876, Ireland composed several long letters to Edison describing problems he encountered with the system. He complained that the packaging was poor, the pens were working badly, and the ink was defective. Edison responded at least in part with efforts to devise a better copying ink. "On the 1st day of December 1876 or thereabout Edison compounded the following ingredients to form a new copying ink: Aniline Violet, Alcohol and Gum dextrine" [10, doc. 825].

In October of 1876 Ireland complained to Edison of problems related to the batteries that powered the electric pen. The experimental team must have been surprised by these complaints considering they thought the battery they designed would provide an incentive to purchase the Edison system, as it had been "made in a nice shaped glass bottle & is an ornament on a man's desk" [7, doc. 625]. But Ireland saw the battery as a serious impediment to sales.

> Our sales here have not been so large as I could wish – we have much prejudice and stupidity to overcome. We have found it impossible to get people to recharge their batteries once a week and their general neglect of the pen is something difficult to comprehend [6, 13:983].

Recognizing that the original battery design was problematic for many electric pen users, Edison decided to patent alternative processes to power the pen. A few short months after Ireland's complaints about the batteries, Edison submitted to the patent office designs for air, gas, water, and foot-powered pneumatic pens [13, nos. 205,370 and 203,329] (Figure 5). Although caveats in the fall of 1875 reveal that Edison had invented these designs over a year ago and shelved them in favor of his battery-powered model, it was the feedback filtered through Ireland that convinced Edison to resurrect these designs and submit them to the patent office.

Figure 5



Alternative methods to power the pen.

In May of 1877, Ireland reflected on the changes that had been made to the initial version of the electric pen and duplicating press. "The fact is the British public – with its usual stupidity – did not take kindly to the apparatus as it *was* and it has had to be practically revolutionized" [6, 14:386]. Crucial points in this process of invention were guided by user feedback. In a period of less than three years, the weight of the perforating pen had been cut in half and numerous structural changes had been made to both the original designs for the pen and to the batteries that powered it [4, p. 33; 7, doc. 625]. By addressing the concerns of his agents in the early years of the electric pen, Edison was able to improve its level of acceptance in the market. The occasional orders placed by agents in the fall of 1875 grew steadily so that by the fall of 1878 "upwards of 5000 Electric Pens (had) been sold in the United States and about the same number scattered through all the Commercial Countries of the World" [6, 18:331].

Marketing in a New National Market

During the first two years of its development, Edison responded to a multitude of suggestions made by his agents with adjustments to the invention's original design. By 1877, however, Edison and his experimental team were ready to move on to more exciting projects in the laboratory such as the sextuplex, the telephone, and the phonograph. In a letter to his father from the Menlo Park laboratory dated May 28, 1877, Charles Batchelor explained that "we have now got the 'Electric Pen' fairly out on Royalty and in a very short time I shall have nothing whatever to do for it except receive my share of Royalty" [10, doc. 922]. After this period, neither Edison nor any of his associates at Menlo Park spent any more time altering the design of the perforating pen or perfecting a rotary press for faster duplication. Suggestions for technical revisions to the electric pen design, however, only account for half of the contribution Edison's agents

made toward the success of his copying process. Although he no longer responded to his agents' advice by making design revisions in the laboratory after mid-1877, he continued to follow their marketing advice to reap the highest possible financial return on his invention. He expanded the product's intended audience, sold patents, investigated rival duplicating processes, and revised prices based on their input.

One of the most crucial steps in introducing a product to market is defining an appropriate audience. Early records surrounding the development of the electric pen and duplicating press suggest that, before the assistance of the agents, the Edison experimental team had only successfully targeted half of its eventual users. A prospectus authored by Edison in 1876 to announce the formation of the Edison Electric Pen & Duplicating Press Company demonstrates that he envisioned the pen being used primarily to create documents that would be distributed outside the users' companies. For instance, he suggested that the pen be used to create circulars, price lists, billheads, and pamphlets that would be distributed to customers. His agents, however, also sold the duplicating systems to manufacturing companies that needed the system to duplicate messages for distribution within their own companies. A list of proposed uses produced a few years later had been expanded to include internally distributed documents such as official notices, time tables, cypher books, lists of freight tariffs, and daily produce reports [7, doc. 731]. The agents sold electric pen systems to fraternal organizations, doctors' offices, and many other users unanticipated in Edison's original projections, thus expanding its market beyond the expectations of its inventor.

Perhaps the most insistent market feedback came from George Bliss, General Manager of the Chicago office of the Edison Pen and Press Company. Bliss assumed charge of the electric pen business and many of its agents in America in early 1877. His advice typically addressed price determination and the increasing number of competitors in the field. His suggestions that Edison pursue and sell foreign patents for the electric pen greatly enhanced its opportunities for profitability in markets overseas. Having sold the rights to sell electric pen and duplicating press systems in Great Britain for $10,000, Edison realized the financial potential of foreign patents. However, in his busy isolated world of invention, Edison still depended upon his agents to urge and guide him in the acquisition and sale of patents around the world. Having acquired patents in Austria, Italy, and Belgium by mid-1876 [10, doc. 892], Bliss followed up on patent proceedings in numerous other countries. In 1877 Bliss reported on the progress of patents being sought in Russia and Australia and her colonies, exclaiming "Where won't Edison's goods go?" [6, 14:413] In early 1878 Bliss reported to Edison that his German patent had finally been granted and informed Edison of a prospective buyer for his Spanish patent, suggesting that he not sell it for less than the cost of the German patent [6, 18:259, 286]. The advice Edison received from his agents regarding foreign patents was crucial. It enabled him to gain the utmost profitability from his invention without having to reduce his time for laboratory experimentation to follow the international situation himself.

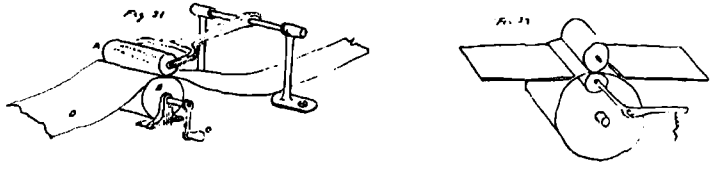
Insight provided by his agents also alerted Edison to the existence of an increasing number of "patent pirates" in the multiple duplicating business. Having been informed on October 26, 1876 by Ireland of the possible infringement of a British pneumatic perforating pen, Edison responded saying,

> Yours of Oct. 9 recd. I saw the article in the Mechanics Magazine describing the pneumatic Pen; you do not often see a clearer case of infringement than that. I do not know what your laws are in England but in this country the parties could be stopped immediately. You will find in the patent the very same thing, turbine or leaf'd wheel within a circular box propelled by water falling from a high to a low level. now our courts would say that substituting air for water is no invention, as it does not require the exercise of inventive faculties. It dont [sic] matter what the other power is that drives the machine...If those people have a peculiar machine for getting air pressure applicable to the pen that does not give them any right to use our pen [10, doc. 803].

Obviously having learned from this experience to beat the competition at their own game, Edison quickly thereafter filed a patent application for old air- and water-powered pneumatic pens of his own design, as they had not yet been patented in the United States [13, no. 205,370].

Facing new competition from the pneumatic pen system during the last quarter of 1876, the manager of the Electric Writing Company of London pushed Edison to develop a high-speed press for more rapid printing. In early 1877 "Edison and Batchelor applied themselves to the problem of a faster press to use with electric pen stencils" [10, p. 202]. The model they invented in late January was equipped with a rotating drum and automatic paper feed and could produce 2,000 copies per hour. Subsequent experiments on Edison's autographic power press devised alternative ways to configure the press and also developed an automatic feed system for the printing process. As word of these experiments reached the agents in the field, agents applauded Edison's efforts and encouraged him to ready the rotary press for the market as soon as possible (Figure 6).

Figure 6



Edison and Batchelor's laboratory designs for a rotary press.

However, as the year progressed Bliss found Edison and Batchelor less and less likely to take the action he recommended. Bliss spent the better part of 1877 and 1878 cajoling Edison to complete his rotary press. In February Bliss

asked for a press suited for rapid work, and for which he could charge a good round price [6, 14:369]. "The Western Electric will send you some more money the latter part of this week. Please use it to fix your German patent and get that rotary press going" [10, doc. 1037]. Bliss' frustration became increasingly obvious in subsequent letters. "You promised that rotary press without fail...How on earth is a man to win in this contest unless you help him? Please do something about these matters right away...We must have that rotary press" [10, doc. 1124]. By the following spring even Bliss' foreign agents were after Edison for the rotary press. From Europe, Colonel George Beetle wrote to Edison asking, "What about the new press? I wish we had one, Our opposition is something to be fought down and that press would be a regular 'Gatlin' gun" [6, 18:296]. But their constant urging was to no avail. After his promising experiments with the rotary press in March of 1877, Batchelor and Edison dropped development and redirected their attention to other inventions.

Edison's agents' advice on the subject of pricing proved to be more fruitful. Bliss challenged changes Edison and Batchelor made in the cost of the electric pen and its ink. In early May, 1877, after assuming leadership of the domestic company, Batchelor penned a letter to Robert Gilliland, father of electric pen manufacturer Ezra Gilliland, mentioning their proposed changes. "We have just brought out a new pen, which will cost only about 1/3 of the cost of the present one, and...in talking over this sometimes Edison and myself have almost come to the conclusion to give away a bottle of this ink with every 'pen'" [10, doc. 900]. Bliss responded in opposition almost immediately. In a letter written only two weeks later Bliss let his opinion be known.

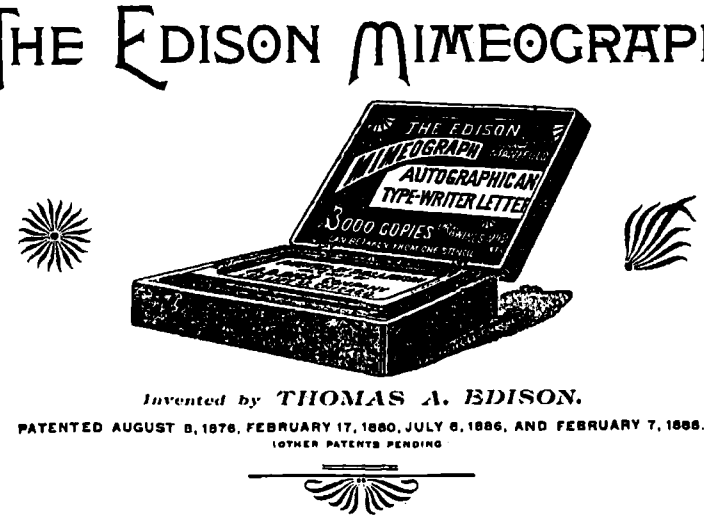
> I am satisfied in my own mind that you are making a great mistake in the price at which the ink is being sold in this country...The men who make the most money are those who put a first class price on their goods & stick to it. The Public once becoming familiar with the goods wont be induced to buy a cheaper article though equally good...We believe large amounts of your ink can be sold at first class prices [10, doc. 912].

Obviously, Edison was persuaded to agree. After Bliss became general manager of Edison's duplicating ink business in the United States, Edison raised the prices on his small and large bottles of ink from $.50 and $1.00 to $1.00 and $3.00, respectively.

A few years later, as competing duplicating systems flooded the market, Bliss changed his stance on quality-based price-setting. On April 16, 1878 Bliss exclaimed, "Here we are again. Another party has turned up with a pneumatic pen and has applied for a patent...It can be made for nothing and sold for less so the parties claim. When will it end?" [6, 18:287] A system offered by the Griest Manufacturing Company sold for five to ten dollars less than the Edison system so Bliss began selling pens at discounts and begging Edison to agree to a lesser royalty so that he could drop the price even further [6, 18:288-290]. Edison was unwilling to accept a reduced royalty on his electric pen and duplicating press, so Bliss advised him to patent a less expensive process for producing stencils.

Edison patented a process he had described in a caveat submitted to the U.S. Patent Office four years earlier whereby stencils could be produced by writing over a file with a stylus. Bliss followed with great interest two competitors' claims to the plate process patent and on April 3, 1987 dashed off a note to Edison reporting that "their time for filing statements is up on the 17th and I hope ere that you will be in the office with your application" [6, 50:416]. Edison followed Bliss's advice to the letter by filing his patent entitled "Method of Preparing Autographic Stencils for Printing" on March 17, 1879 [13, no. 224,665] (Figure 1). This patent was the one Edison later sold to A.B. Dick for incorporation into his mimeograph. A.B. Dick's mimeograph, marketed under the name "Edison mimeograph," was less technical than the Edison electric pen and duplicating press. It involved writing on waxed paper placed atop a file plate with a simple stylus (Figure 7). This process for producing stencils was considerably easier than using the electric pen to produce them. A.B. Dick also perfected the duplicating process with rotary stencil copiers [15, p. 53]. In an April 11, 1887 letter to Edison, Samuel Insull noted that "we have seen the Dick machine and it is *perfect.* It is without a doubt the best duplicating machine in the market and a dealer who wanted to get the agency for *railroads alone* offered to guarantee the sale of ten thousand machines" [11, n.p.]. By 1889 over 20,000 Edison mimeographs had been sold and the product continued to sell for decades thereafter. As the result of following Bliss's advice, Edison earned more in royalties from this patent than from all of his electric pen and duplicating press sales combined.

Figure 7



1889 advertisement for the Edison mimeograph.

Conclusion

Sales of the Edison electric pen and duplicating press dropped precipitously after the introduction of the Edison mimeograph in the late 1880s. Edison had moved on to other inventions and, apparently, office workers preferred the simplified file plate process for stencil production to stencil production using the electric pen. That A.B. Dick, an entrepreneur dedicated to the introduction of labor-saving devices into offices around the world, would ultimately find the greatest success in the duplicating business should perhaps come as no surprise. Committed to the successful sale of the Edison mimeograph, Dick followed market research closely and advertised widely the benefits of his product. Unlike Edison, he was not distracted by the temptation to move on to other inventive activity. In the 1870s, Edison was an inventor first and a businessman second.

Nonetheless, that Edison responded so frequently to the suggestions of his agents and that their suggestions manifested themselves in the design and marketing of the electric pen suggests that the inventive process changed significantly as inventors shifted their attention from local to national markets. The business agent became crucial to the successful development and marketing of goods on an international scale, particularly in the era of consumerism that was to follow.

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