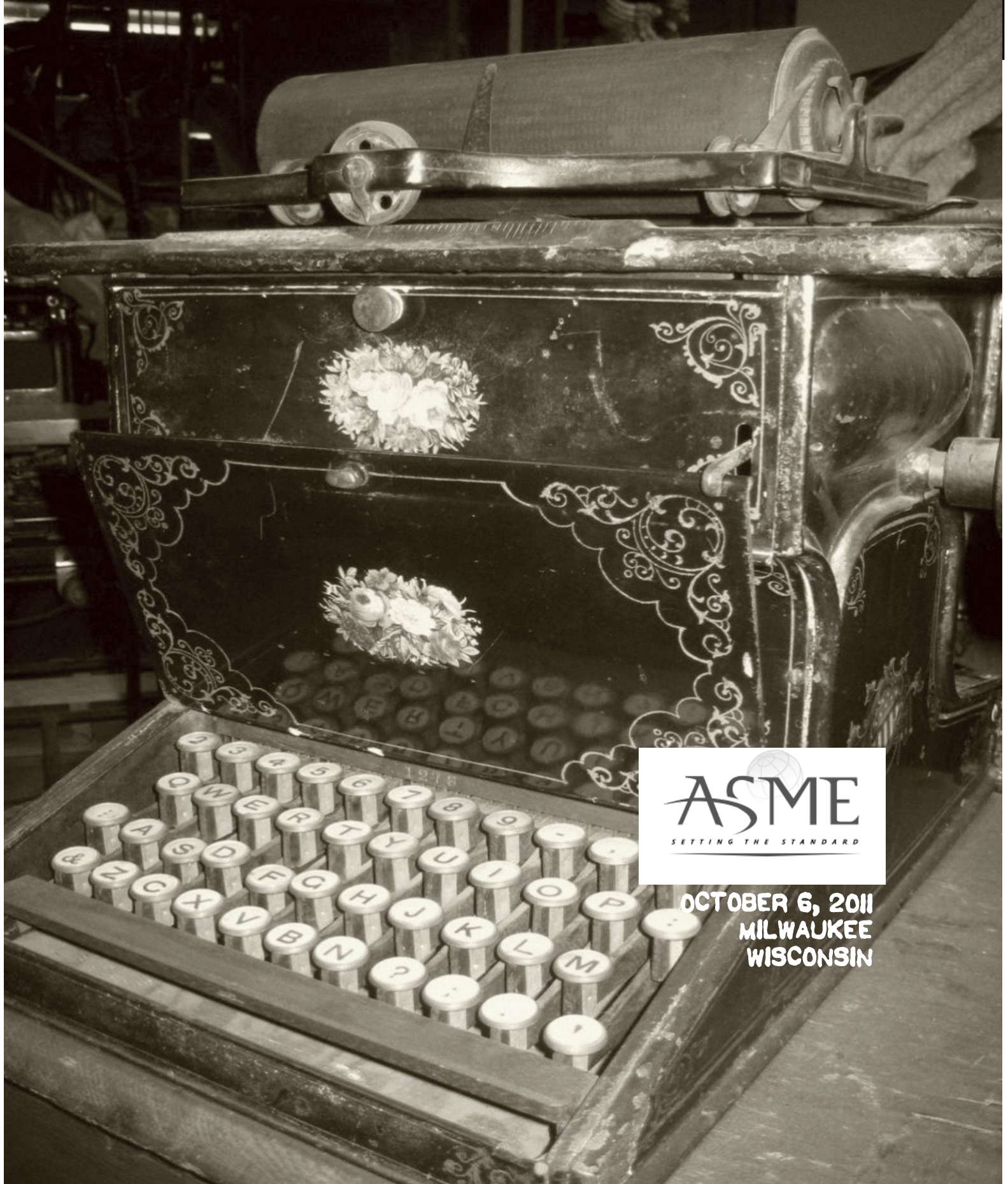


**SHOLES & GLIDDEN 'TYPE WRITER'
A HISTORIC MECHANICAL ENGINEERING LANDMARK**



**OCTOBER 6, 2011
MILWAUKEE
WISCONSIN**

CHRISTOPHER LATHAM SHOLES

Born February 14, 1819
Died February 17, 1890
Resting place Forest Home Cemetery, Milwaukee, Wisconsin
Known as "The Father of the Typewriter"



C. Latham Sholes

Born in Mooresburg, Pennsylvania in 1819, Christopher Latham Sholes worked as an apprentice to a printer in nearby Danville as a youth. He moved to Green Bay, Wisconsin when he was eighteen where he initially worked for his brothers who were publishers of the *Wisconsin Democrat*. Within a year he was promoted to edit the *Madison Enquirer*. In 1840, Sholes established the *Southport* (eventually renamed, 'Kenosha') *Telegraph*, which he published for many years. He eventually became associated with various Milwaukee newspapers, such as the *News*, and the *Sentinel*.

In addition to working as a publisher, Sholes played a key role in early Wisconsin politics. He helped to organize the 'Free Soil' and Republican parties in Wisconsin and served several terms in the state senate and assembly. Perhaps his most memorable legislative accomplishment was leading the successful campaign to outlaw the death penalty in Wisconsin in 1853. During the Civil War, Sholes also served for a time as Milwaukee postmaster, and was later port collector and commissioner of public works.

A practical and active inventor, Sholes developed several devices in the course of his newspaper career, including a newspaper addressing machine (ca 1840-1850s), and a paging or numbering device (1864), before becoming involved in the development of the typewriter which interested him for the remainder of his life. He, with the assistance of others, developed the first commercially successful typewriter.

Cover Photograph:

The cover features the Sholes & Glidden 'Type Writer' that is being designated by ASME as a Historic Mechanical Engineering Landmark. The photograph was taken as the typewriter was being removed from storage and prior to being cleaned. Of the five similar machines in the Milwaukee Public Museum's extensive collection, this appears to be the first manufactured.

Catalog notation: H34385/24284 Sholes & Glidden typewriter, marked #1276, 4 bank, 44 glass top keys, all capitals, black enamel iron frame, Japanned dustcovers ornately decayed and with stencil designating E. Remington & Son as maker. Mounted to treadle sewing (style) machine stand. Made circa 1873, this typewriter is part of the extensive Carl Dietz Collection at the Milwaukee Public Museum.

HISTORY OF THE DEVELOPMENT OF THE TYPEWRITER

Charles F. Kleinsteuber's machine shop on State Street in Milwaukee must have been an interesting place in the mid-1860s. In addition to providing machining and foundry services, the shop served as an informal incubator for would-be inventors. Carlos Glidden was working on designs for a steam-driven rotary plow and a mechanical spade. Christopher Latham Sholes had developed a newspaper addressing machine and a page numbering device.

It is reported that in 1867 Glidden, while observing Sholes's work on perfecting his page numbering device, encouraged him to develop a mechanical writing machine. With the aid of Glidden, machinist and clock-builder Mathias Schwabach and fellow inventor Samuel Soulé, Sholes produced a functioning machine by the fall of that year.



The machine shop of Charles F. Kleinsteuber, as it appeared in 1867. Photograph courtesy of the Milwaukee Public Museum

Sholes and various associates toiled for nearly seven more years before his design of the world's first practical typewriter was introduced for mass production in 1874. The innovations and refinements that occurred during this seven year period are what distinguished the Sholes & Glidden typewriter from that of the numerous other innovators who had previously attempted to create a mechanical typing machine. With extensive testing and numerous refinements, they converted a crudely built model into a device that typed reasonably well. With the assistance of process engineers at Remington, the resulting machine was reliable, rugged and able to be manufactured in large numbers.

James Densmore, a former newspaper associate of Sholes, provided financing to assist in moving the development into manufacture. Of equal importance, Densmore continuously prodded Sholes to test and tweak the design in order to improve functionality, reliability and ease of use – essentially moving the typewriter from a rough model to a marketable, mass-produced product.

Historian Richard N. Current, formerly a member of the history faculty at Lawrence College in Appleton, Wisconsin, provided the most extensive record of the development work during this time.^{1,2} He relied on extensive correspondence between Densmore and Sholes and others involved in the development. According to these accounts, Densmore agreed to provide financing in exchange for an ownership share, prior to actually seeing the device. By the time he saw the typewriter in March 1868, there were two versions: the original relied on long wires to connect the type bars and key levers, and a refinement developed by Samuel Soulé involved a simplified arrangement for striking the keys onto paper. In the summer of that year, Densmore attempted to manufacture the refined machines in Chicago. After making fifteen typewriters and observing them in use – some of which were used in a school for telegraphers in Chicago, he concluded that the design was not yet suitable for the market.

Current reports that this prompted Sholes, for the first time, to look into the record of what previous inventors had done. He came to the conclusion that all had failed because they had not satisfied one or more of the “fundamental ideals” that he and Densmore considered “essential to success.” These ideals were that, “the machine must be simple and not liable to get out of order,” that “it must work easily and be susceptible of being worked rapidly,” and that “it be made with reasonable cheapness.” Additionally, Densmore insisted that a successful typewriter be capable of writing on paper of ordinary thickness – as opposed to the early designs by Sholes that only printed satisfactorily on paper that was tissue-thin.

To satisfy this last requirement, Sholes abandoned the flat platen design and devised a revolving cylindrical platen to serve as the paper carrier. Sholes employed the cylinder in a novel way to avoid infringing on an existing patent. The cylinder rotated to space the letters, and indexed along its axis to change the lines. While this permitted thick paper to be used, the page was limited to the width of the cylinder – roughly three inches.

In September, 1869, Sholes declared that he had perfected all the necessary principles, writing to Densmore on the machine, “I am satisfied the machine is now done.”

Densmore continued to press for improvements, much to the annoyance of Sholes. However, Sholes continued to work on refinements. He next adopted a refined keyboard, devised by Schwalbach, which involved four rows of metal key levers and buttons set in ascending banks. At the urging of a customer who tried this design, a space bar was added underneath the four rows.

In the summer of 1871, Densmore manufactured in Milwaukee a sufficient number of typewriters to “supply the present demand, pay up the debts and have one or two over to sell.” In addition to durability issues, the type bars wouldn’t stay in line. Sholes, Glidden, Schwalbach and Densmore’s stepson, Walter J. Barron, worked together to resolve this problem. The design was using short, stiff wires, which directly connected the key levers and type bars and pulled at an angle. Glidden initially suggested a system of intermediate levers. Despite Sholes’s disapproval, Densmore pressed on with this approach – which ultimately failed. Barron meanwhile suggested an alternative method which reduced the angle. Sholes and Schwalbach redesigned the machine using that approach, which while not perfect, improved type alignment.

That year, Sholes also tackled an issue for another customer. D. N. Craig, of the Automatic Telegraph Company, told him that his typewriter would be much more useful if it could accommodate a continuous roll of paper. To meet this request, Sholes redesigned the cylindrical platen to move

¹ Current, Richard N. *The Typewriter and the Men Who Made It.* Champaign: University of Illinois Press. (1954) ISBN 0911160884 and;

² Current, Richard N. “*The Original Typewriter Enterprise 1867–1873,*” *Wisconsin Magazine of History* Madison: State Historical Society of Wisconsin. (June 1949).

lengthwise to space the typed letters, and to rotate to index to the next line. Since letters were typed on the underside of the cylinder, Sholes also hinged the mechanism so that it could be swung up to allow the typist to review typed print. While that was a significant improvement, it infringed on a patent that had recently been issued to Charles A. Washburn of San Francisco, requiring the payment of a license fee to Washburn.

Finally, to reduce the nuisance of type-bar collisions, which were frequent, Sholes and Densmore worked out a non-alphabetical arrangement for the keys, resulting in the QWERTY layout that became and remains the standard for keyboards everywhere.

With these improvements in hand, Densmore began his third attempt to manufacture typewriters for sale. He rented a former wheelwright's mill between the Milwaukee River and the Rock River Canal. With Schwalbach's assistance, he equipped the shop, using water power from the canal. The machines were produced individually, which allowed him to continue to incorporate changes in design as the manufacturing process progressed.



Picture of a Milwaukee-built Sholes & Glidden "Type Writer" Courtesy of the Buffalo Museum.

OUTSOURCING TYPEWRITER MANUFACTURING

While Schwalbach and his workmen were turning out typewriters in their improvised factory, Densmore calculated that the machines were costing more to build than they could be sold for. For advice, he turned to his friend and former business associate, George Washington Newton Yost who was then managing a farm implement factory at Corry, Pennsylvania.³ Yost visited him in Milwaukee to observe his operations and suggested that he contact E. Remington & Sons. Remington manufactured guns, farm implements, and sewing machines, in Ilion, New York. Yost made the introductions and arranged for himself and Densmore to visit their factory in Ilion.

On March 1, 1873, Densmore signed a contract under which Remington agreed to have their lead mechanics, William Jenne and Jefferson Clough, rework the machine and to produce a minimum of a thousand machines. Under the contract, Densmore agreed to pay them \$10,000 for manufacturing the typewriters, plus agreeing to pay a royalty for the services of Remington's lead mechanics. Jenne and Clough prepared the design for mass production, encasing the production version in metal instead of wood, and somewhat reducing the size. In principle, the final Sholes and Glidden typewriters were the same in form and function as the last Milwaukee-built machines.⁴ However, the refinements of Jenne and Clough were significant and often understated, in advancing the design of the machine.⁵

³ This was at least the second time Densmore had contacted Yost to obtain his advice – the first having occurred approximately four years earlier when Yost viewed a much earlier model in New York.

⁴ Ibid. Under the contract, Remington agreed to produce as many as 24,000 typewriters, at its discretion -

SIGNIFICANCE OF THE SHOLES & GLIDDEN TYPE WRITER

The typewriter that is the subject of this designation is particularly noteworthy in that it represents the first commercially successful typewriter to be manufactured in quantity for sale to the public. It was also the first typewriter that enabled operators to write significantly faster than a person could write by hand.

The Sholes and Glidden typewriter set off a revolution in the conduct of commerce and business, as well as in communications. The ability of a skilled operator to type uniform, easily read text at high speed, and to also employ the use of carbon paper to make multiple copies, created significant increases in efficiency and economy in the workplace.

One measure of the significance of the Sholes & Glidden 'Type Writer' was the competition it attracted. Several other makes of typewriters were developed and marketed by 1885, including the Hall, the Caligraph, the Crandall, and the Hammond. While each looked different from the Sholes & Glidden/Remington, they were all clearly inspired by the Sholes machine, leading to patent litigation. *The Stenographer*, a professional magazine, counted no fewer than forty-seven makes of typewriters on the market by 1891. By that time, it is reported that all sizable offices had at least one resident typist. By 1910, there were at least eighty-nine typewriter manufacturers,⁶ many influenced in part by the Sholes & Glidden design, albeit with numerous improvements.

By the early 1900s, clerical typing pools and stenographers became universally employed in all modern offices, and typing courses began to be offered in secondary schools. As the price came down, many families also purchased a typewriter for home correspondence and student use. By the mid-1900s, the typewriter had become commonplace throughout modern society.

It is clear that millions of typewriters were manufactured over the years by United States manufacturing firms such as Remington, Underwood, Smith Corona Corp., Royal, Oliver, International Business Machines, etc.⁷

The use of the typewriter was also an important tool for writers. Mark Twain claimed in his autobiography that he was the first important writer to present a publisher with a typewritten manuscript, for *The Adventures of Tom Sawyer* (1876).⁸ While he may have been the first, the typewriter eventually became a standard tool for most writers, poets, and reporters, as well as anyone that wrote for his or her profession.

Densmore had to borrow the funds for advance payment; Remington did not acquire the patent rights.

⁵ Private correspondence with Dr. Peter M. Weil, Interim Chair, Department of Anthropology and Associate Professor, University of Delaware Newark, DE

⁶ Monaco, Cynthia, *The Difficult Birth of the Typewriter*, American Heritage of Invention and Technology," Spring/Summer 1988, Vol. 4, Number 1, pg 20.

⁷ It is reported that Underwood alone produced over 5 million typewriters by 1939.

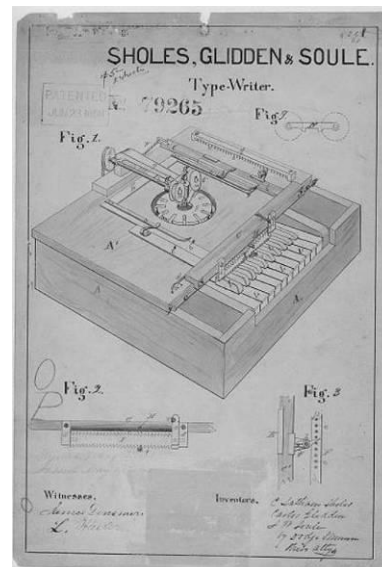
⁸ Typewriter collector and historian Darryl Rehr challenged this claim, stating that Twain's memory was faulty and that the first novel submitted in typed form was *Life on the Mississippi* (1883).

TECHNICAL DEVELOPMENT

As patented in June and July, 1868, the claims of Sholes, Glidden, and Soulé were: (1) a circular annular disc, with radial grooves and slots to receive and guide the typebars so that they struck the center, (2) radial typebars to correspond with this disc, (3) a ratchet to move the paper-carriage by the breadth of a tooth when a key was struck, (4) a hinged clamp to hold the paper firmly on its carriage.^{9,10}

Sholes employed an inked ribbon in his typewriter, relying upon technology first developed by Dr. S. V. Francis in 1857. The advantages were significant, since such a ribbon is virtually dry under a light touch, yet readily transferred its ink under the sharp stroke of a typebar on the Sholes machine.^{11,12}

While it has been stated that, “there is hardly a single feature of the [Sholes typewriter] which cannot be found in the work of some earlier inventor,”¹³ the configuration and combination of its mechanical features provided the first commercially successful mechanical device with keys that, when pressed, cause ink to be printed on a medium, usually paper.



In their original 1868 typewriter design, paper was placed horizontally on the top of the machine, held in place by a movable square frame to provide line and letter spacing. Above the paper and centered on the device, an arm held an inked ribbon which crossed over a small metal plate. Depressing a key caused a typebar to rise from underneath the paper, pressing the paper upwards against the ribbon and thus printing an inked character. This method of imprinting required use of very thin, nonstandard paper, such as tissue paper.¹⁴ Two variants were produced with alternative methods of actuating the typebars: one in which the keys and typebars were connected by a series of wires and one in which the keys directly "kicked" the typebars upward.¹⁵

The arm and frame components were replaced with a cylindrical platen in 1869. Unlike modern typewriters, the revised machine entered letters around the cylinder, with axial rotation providing letter spacing and horizontal shifting providing line spacing. Paper was clipped directly to the cylinder, which limited its length and width to the dimensions of the apparatus.¹⁶

The platen was again redesigned in early 1872 to allow the use of paper of any length. The redesigned platen also introduced the modern spacing functionality (horizontal movement and axial rotation providing letter and line spacing, respectively). The cylindrical platen became “an indispensable part

⁹ Densmore arranged to patent two versions of the Sholes typewriter. The first patent was actually for a later design that involved a simplified arrangement for striking the keys onto paper, as developed by Samuel Soulé and is shown above. The July patent was for the previous design, which involved long wires to connect the type bars and key levers.

¹⁰ Iles, George, *Leading American Inventors*, Henry Holt and Company, New York, NY, 1912, pg. 324.

¹¹ Ibid, pg. 326.

¹² S. V. Francis of New York developed a typewriter with an inked ribbon in 1857, but it was not a commercial success.

¹³ Gould, Rupert T. *The Story of the Typewriter*. London: Office Control and Management, 1948, pg. 28.

¹⁴ Iles 1912, op. cit p. 324.

¹⁵ Current, Richard N. “*The Typewriter and the Men Who Made It.*” Champaign: University of Illinois Press. (1954) ISBN 0911160884.

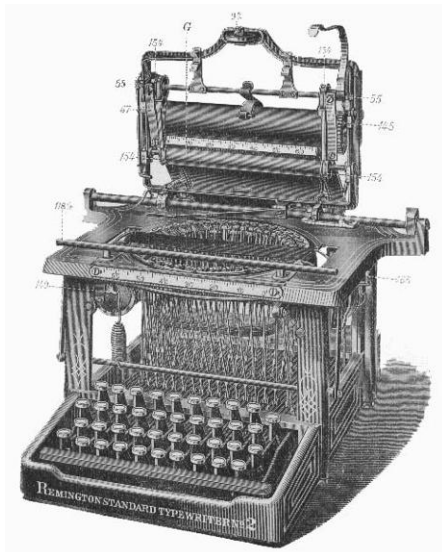
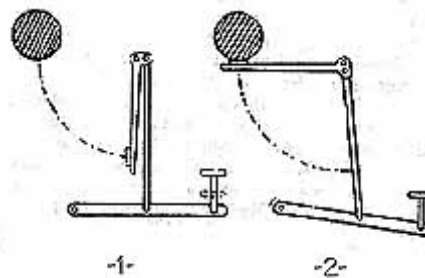
¹⁶ Current, Richard N. “*The Original Typewriter Enterprise 1867–1873.*” *Wisconsin Magazine of History* Madison: State Historical Society of Wisconsin (June 1949).

of every standard [typewriter].”¹⁷

By the end of 1872, the appearance and function of the Sholes & Glidden typewriter had assumed the form that would become standard in the industry and remain largely unchanged for the next century.

The resulting Sholes and Glidden typewriter incorporated several components adapted from existing devices, such as escapement (a geared mechanism governing carriage movement) adapted from clockwork, keys adapted from telegraph machines and type hammers adapted from the piano.¹⁸ In developing their initial typewriter design, Sholes and Soulé had not investigated printing machines created by other inventors and, consequently, spent a good deal of energy and effort that may have been otherwise avoided.¹⁹

The Sholes & Glidden typewriter was an ‘upstrike’ typewriter. Upstrikes were blind-writers – they printed on the underside of the platen, and operators therefore could not see their work while they were typing. The basic mechanism for striking the typebar onto paper on the Sholes & Glidden Type Writer is illustrated at right, along with an etching of the basic mechanism – in this case from a later model Remington of similar design:



The illustration at the left shows how the hinged carriage (in this case a Remington No. 2) could be swung up so that the operator could check what had been typed.

In later years, ‘Visible’ typewriters were developed, which allowed the typist to view the type as it was placed on the paper.

¹⁷ Iles 1912, op. cit p. 323.

¹⁸ Utterback, James M. *Mastering the Dynamics of Innovation*. Boston: Harvard Business Press. (1999). ISBN 0875847404, pg. 4.

¹⁹ Iles, George *Leading American Inventors*, (1912) New York: Henry Holt & Company, p. 323.

TEXT OF LANDMARK PLAQUE

HISTORIC MECHANICAL ENGINEERING LANDMARK SHOLES & GLIDDEN TYPE WRITER

1873

DESIGNED IN MILWAUKEE, WISCONSIN, BY CHRISTOPHER LATHAM SHOLES, AND DEVELOPED WITH CARLOS GLIDDEN, SAMUEL SOULÉ, AND MATHIAS SCHWALBACH, THIS WAS THE FIRST COMMERCIALY SUCCESSFUL DEVICE THAT RAPIDLY PRINTED ALPHANUMERIC CHARACTERS ON PAPER IN ANY ORDER.

MANUFACTURED BY E. REMINGTON AND SONS, THE TYPE WRITER EMPLOYED A LEVER-ACTION KEY MECHANISM, INKED RIBBON, AND CYLINDRICAL, SHIFTING PLATEN. ITS "QWERTY" KEYBOARD LAYOUT MINIMIZED STICKING KEYS. WITH IT, A SKILLED OPERATOR COULD PRODUCE ORIGINAL DOCUMENTS FASTER THAN POSSIBLE BY HAND.

BY 1900, TYPED DOCUMENTS DOMINATED BUSINESS RECORDS AND CORRESPONDENCE. THE DEMAND FOR TYPISTS ENABLED WOMEN TO ENTER THE BUSINESS WORLD IN UNPRECEDENTED NUMBERS.



THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS 2011

WOMEN AND THE TYPEWRITER²⁰

One historian has commented that, "perhaps one of the greatest or even the greatest achievement of the typewriter is the transformation it wrought in the social order. A strong prejudice existed ... against the employment of women in business. Then the typewriter came, soon to be followed by the girl typist, who blazed the way for other women to enter every department of business life."²¹

This association of women with the typewriter can be traced to the earliest advertising for the machine. Before Remington acquired the design rights, Sholes's daughter was employed to demonstrate the device and to appear in promotional images. It is reported that Remington's marketing included the use of attractive women to demonstrate their typewriter.

It can be argued that the stereotyping that resulted from placing women in these clerical roles had a detrimental effect to the upward mobility of women for decades. Nevertheless, in 1874, less than four percent of clerical workers in the United States were women. By 1900, the number of women clerical employees had increased to approximately seventy five percent.

Before his death, Sholes remarked of the typewriter,

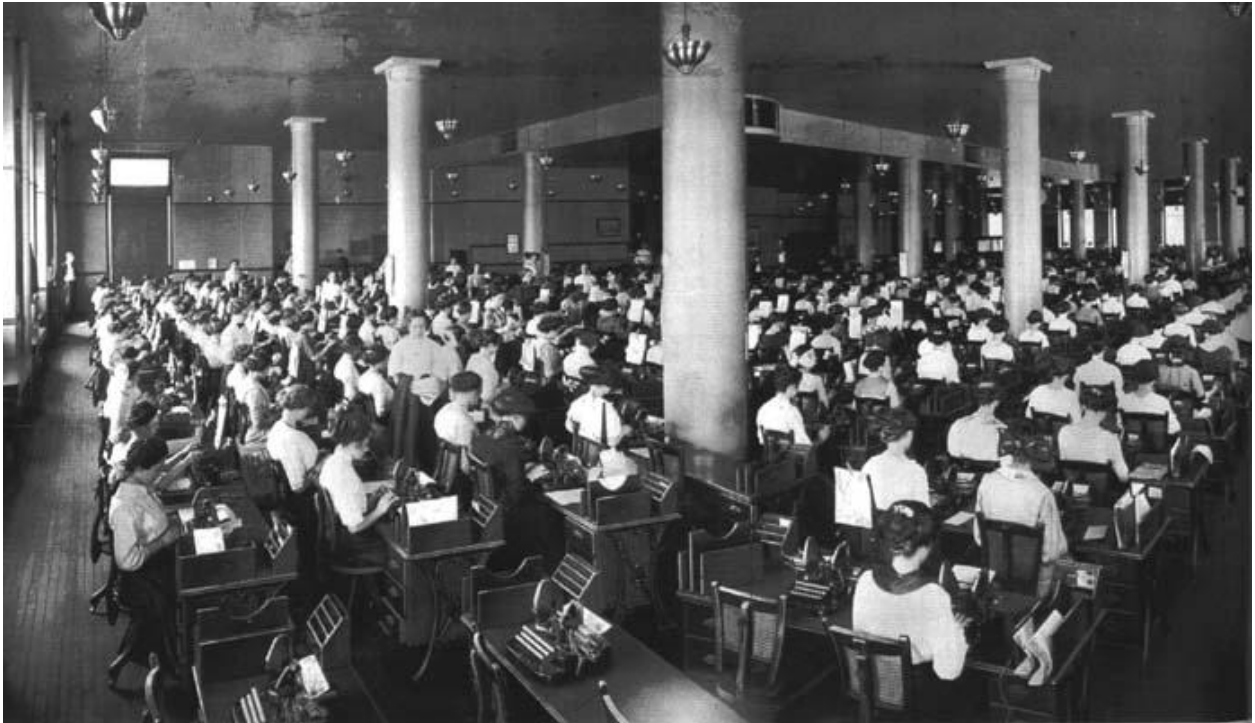


A typist operating a Sholes & Glidden Type Writer, as depicted in an 1872 article in *Scientific American*.

²⁰ Hoke, Donald "The Woman and the Typewriter: A Case Study in Technological Innovation and Social Change," *Business and Economic History* (1979) Milwaukee: Milwaukee Public Museum, Series 2.

²¹ "Honoring the Inventor of the Typewriter," a lecture by Alan C. Reiley, broadcast from Marquette University radio station, Milwaukee, June 6, 1924.

“I do feel that I have done something for the women who have always had to work so hard. This will enable them more easily to earn a living.”



This incredible photograph is of the order entry department at Sears, Roebuck & Co., Chicago, IL, c. 1913. Workers are using Oliver typewriters. (Photograph from Smithsonian Institution, National Museum of American History.)

THE QWERTY KEYBOARD

The Sholes & Glidden typewriter had one entirely original feature – the arrangement of the keys. It has been reported that Sholes arranged the keys in the now familiar QWERTY layout to minimize the possibility of jamming the typebars. The QWERTY layout was commonly adopted by other typewriter manufacturers and as a result much of the world will likely have to live with this letter configuration forever, even on computers and mobile devices.



THE HISTORY AND HERITAGE PROGRAM OF ASME

Since the invention of the wheel, mechanical innovation has critically influenced the development of civilization and industry as well as public welfare, safety and comfort. Through its History and Heritage program, the American Society of Mechanical Engineers (ASME) encourages public understanding of mechanical engineering, fosters the preservation of this heritage and helps engineers become more involved in all aspects of history.

In 1971 ASME formed a History and Heritage Committee composed of mechanical engineers and historians of technology. This Committee is charged with examining, recording and acknowledging mechanical engineering achievements of particular significance. For further information, please visit <http://www.asme.org>

LANDMARK DESIGNATIONS

There are many aspects of ASME's History and Heritage activities, one of which is the landmarks program. Since the History and Heritage Program began, 248 artifacts have been designated throughout the world as historic mechanical engineering landmarks, heritage collections or heritage sites. Each represents a progressive step in the evolution of mechanical engineering and its significance to society in general.

The Landmarks Program illuminates our technological heritage and encourages the preservation of historically important works. It provides an annotated roster for engineers, students, educators, historians and travelers. It also provides reminders of where we have been and where we are going along the divergent paths of discovery.

ASME helps the global engineering community develop solutions to real world challenges. ASME, founded in 1880, is a not-for-profit professional organization that enables collaboration, knowledge sharing and skill development across all engineering disciplines, while promoting the vital role of the engineer in society. ASME codes and standards, publications, conferences, continuing education and professional development programs provide a foundation for advancing technical knowledge and a safer world.

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NOTE: THE TYPEFACE USED TO HIGHLIGHT TEXT IN THIS DOCUMENT IS A REPLICATION OF THE FONT OF THE 1873 SHOLES & GLIDDEN TYPE WRITER, BASED ON A LETTER TYPED BY MARK TWAIN. COURTESY OF RICHARD POLT OF THE CLASSIC TYPEWRITER WEBSITE.