

Linn Boyd Benton, Morris Fuller Benton, and Typemaking at ATF

Linn Boyd and Morris Fuller Benton, father and son, each played crucial parts in the development of modern typefounding in the United States and the world. Both worked at the American Type Founders Company, which as a general policy did not promote or advertise the importance of individual employees. Although Morris “sublimated his talents to the needs of a commercial type foundry,”¹ nevertheless “his scores of remarkably successful designs . . . form the backbone of American type design.” At the same time, “the mechanical wizardry that made the profusion of these types possible in the great mechanical age of typefounding is due in no small measure to the efforts of his illustrious father.”²

As individuals, the Bentons are virtually unknown. Linn Boyd was a gregarious man who, all through life seized opportunities and found ways to produce the results he wanted. His son Morris was reticent, not eager to be noticed or praised, and even proved to be a difficult subject for the *Inland Printer* reporter once sent to interview him.

The Benton name was brought to the United States by an Englishman, Andrew Benton, who settled in Connecticut in 1638. Linn Boyd Benton’s father, Charles Swan Benton, was the youngest in a family of ten children. Charles was born July 12, 1810, in Fryeburg, Maine, to Dr. Joseph Benton and Catherine Britton. Dr. Benton was a physician “of the old school, whose reputation extended for a circuit of a hundred miles.”³ Charles developed a great respect for his father, noting in later years that his scoldings cured more people than did his medicines.

When Charles was fourteen he was sent to Little Falls, New York, where he was apprenticed to his uncle, a tanner. Charles soon gave up the tanner’s trade to attend the nearby Lowville Academy, and then, at the age of 20, began to study law at the office of his oldest brother, Judge

Nathaniel S. Benton, also in Little Falls. Charles was admitted to the bar in 1835 when he was twenty-five years old, but apparently was not destined to pursue a legal career, since, as one hand-written obituary pointed out years later, “he possessed a warm feeling-ed, human friendly for right and truth glowing heart, and a man with one such heart, can as lawyer here not successful be.”

When Charles Benton was twenty-two, he established the *Mohawk Courier & Little Falls Gazette*. In 1834 Josiah A. Noonan became publisher of the paper, with Benton as editor, which brought him prominence and a means for being vocal on political issues.

In 1840 Charles married Emeline Fuller, whose family could trace its ancestry back at least to 1671, when a Thomas Morris bought a large mansion in New Haven, Connecticut. Amos Morris, a descendent of Thomas, served in the Revolutionary War, and was taken captive by the British. In 1783, Eliphalet Fuller married Amos’s daughter Amy, who became Emeline’s grandmother.

Two years after he married, Charles Benton was elected to Congress from the 17th Congressional District of New York State, and was re-elected in 1844. While he was in Congress, Benton voted to aid Samuel Morse in building the first electric telegraph line.

During his term in Washington, D.C., Charles met a congressman named Linn Boyd from Kentucky, who later became Speaker of the House of Representatives. The two became close friends and shared an interest in dueling. Boyd, while teaching Charles the sport, declared: “Never fight a duel; never be afraid to fight a duel—let them know you will fight and you will never have to fight.” On May 13, 1844, Linn Boyd Benton was born and named after Charles’s esteemed friend.

In 1847, Charles Benton was elected Clerk of

the Court of Appeals of New York State and served for two terms. His wife Emeline died during this time, less than five years after Linn Boyd was born. Boyd, as he came to be called, remained an only child and a motherless one for several years until 1853 when his father married Elizabeth Babcock Reynolds of Oswego, N.Y. She and Charles had one son, Charles R. Benton. At least for some of the time, Boyd was brought up by his maternal grandmother. He learned to rely on himself during those years, and became increasingly independent (fig. 1).

In 1855, Boyd moved to Milwaukee, Wisconsin, to join his father who was by then the editor and part owner of the *Milwaukee Daily News*. Boyd, at the age of eleven, learned to set type in the composing room of the paper. Charles Benton's former publisher in Little Falls, Josiah A. Noonan, also moved to Milwaukee during this time, became a partner in a paper mill, opened a paper warehouse, and also established what came to be the Northwestern Type Foundry.

Around 1856, Charles Benton was appointed registrar of the land office in LaCrosse, Wisconsin, by President Franklin Pierce, and held that office until Abraham Lincoln was elected President in 1861. Charles Benton had actually been considered as a candidate for the presidency in the 1860 Democratic convention, but lost the nomination to Stephen Douglas. In 1862 he was a candidate for Congress on the Democratic ticket, and, while he had no hopes of winning the election in the highly Republican sixth district of Wisconsin, he did carry LaCrosse County. After this, Charles took up farming in West Salem, Wisconsin, and later in Galesburg, Illinois, until 1869, when he returned to LaCrosse.

Because his family moved so often, Boyd Benton's education was somewhat unusual. After attending schools in Little Falls and Milwaukee, he was sent to Galesville College in Galesville, Wisconsin, and later studied Latin, Greek, and other advanced subjects for about two years with a private tutor in LaCrosse. Determined not to be taught from books all day, Boyd arranged with his tutor to teach him in the mornings; if they finished their lessons, Boyd could do as he wanted in the afternoons.

Boyd liked to work with the local tombstone maker, learning to design letters and cut them in

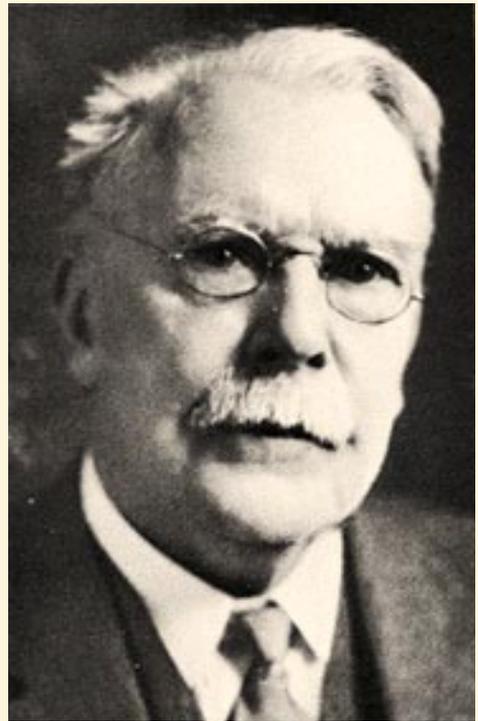


Fig. 1. Linn Boyd Benton in his last formal portrait. Published in the August, 1932, issue of *The Inland Printer*.

stone. Evidently, he was not particularly apt. His mistakes had to be chiseled off, the tombstones smoothed down, and the work started over, all paid for out of Boyd's own money. He later told his granddaughter that he never earned any cash money because he ruined so many tombstones, though he did learn a lot about letters.

When a jeweler settled in LaCrosse, Boyd Benton decided to leave the tombstone business to study jewelry repair. Detail and accuracy became very important to young Boyd as he learned to remake watch parts. His mechanical aptitude became obvious when the jeweler gave him a piece of gold that Boyd fashioned in his spare time into a tiny model steam engine that actually ran. The jeweler was so pleased that he put the steam engine on display in the window of his shop.

After completing his education, Boyd apparently went back to Milwaukee to work again at the *Daily News*. But instead of exploiting Boyd's talents, his employer used him mainly as an errand boy. Another contemporary account has Boyd learning to print in the office of Charles



Fig. 2. Morris Fuller Benton, ca. 1915.

Seymour's *LaCrosse Republican*, and then leaving to work as a bookkeeper for a leather house in the same town.

In any event, Boyd must have had some accounting training because in 1866 he became the bookkeeper for Josiah Noonan's Northwestern Type Foundry in Milwaukee. Soon after, Boyd was promoted to buyer for Noonan's warehouse.

One summer night while out for a walk, Boyd heard the lovely music of banjos and mandolins being played by several young women as they sat on the steps outside one of their homes. Stopping to enjoy the music, he quickly recognized one of the young women as Jessie Elizabeth Donaldson, a friend from his youth whom he had first met in a dancing class but had not seen in years. Following a romantic courtship, Boyd and Jessie were married in Milwaukee in 1871.

Perhaps because he had been an only child for eleven years, Boyd longed to have a large family. Jessie, too, wanted many children. Their plans were altered, however, when Jessie's first child was delivered in a breech birth. Boyd swore never to put her through such an experience

again, and so Morris Fuller Benton, born on November 30, 1872, was to be their only child (fig. 2). He was named after Boyd's maternal grandmother's brother, Morris E. Fuller.

Josiah Noonan went bankrupt in the panic of 1873, enabling Boyd and a partner named Cramer to purchase Noonan's type and electrotype foundry. Years later Boyd lamented that if he had known anything about typefounding at the time, he would have thrown the entire plant into the lake as a measure of economy! Instead, he went on to master that difficult art and change it dramatically with a series of important improvements and inventions.

In 1874 Cramer sold his half-interest in the type foundry to Lieutenant-Commander Frank M. Gove, a man who knew nothing about the foundry business but who would prove to be a most successful and popular salesman for the firm. The new partners changed the name of the firm to Benton, Gove and Company. While Gove handled the business end, Boyd Benton learned everything he could about manufacturing type in a highly competitive market.

Many years later, in 1922, Henry Lewis Bullen, the historian and publicist for the American Type Founders Company, described this period of Boyd's life in an article for *The Inland Printer*:

Before Gove died, Benton had completed his self-instruction in typefounding and found himself on the most intimate terms with decimal fractions and measurements of ten thousandths of an inch. He had and still has a mania for accuracy to the vanishing point, not only knowing, as the books tell us, that a hot breath impinged on a small piece of steel changes its dimensions, but actually taking that solemn fact to heart, grieving that it cannot be overcome. The bane of Benton's career has been the limitations of error which are made necessary by the disposition of all metals to refuse to resist molecular action. What other mortals cheerfully accept as accuracy Benton regards as a calamity.⁴

Benton's first type-related patent was registered in 1882 and described a multiple mold for casting leads and slugs. Benton claimed that this machine, "with one man operating it, could cast more spacing material in a ten-hour day than ten men working the same period could turn out with other methods."⁵ In the same year, Benton began to work on a typesetting machine with automatic justification. He devised a system,

based on his so-called “self-spacing type,” that shortened the time required for justification by reducing the number of character widths in a font of type. Thus, printing type was cast for the first time to pre-determined widths.⁶

Gove died in 1882, and Benton sold a one-third interest to R. V. Waldo, a former wholesale grocer who in time proved to be an ideal partner. Again the firm’s name changed, this time to Benton, Waldo & Co.

Linn Boyd Benton continued to invent and perfect machines for his type foundry. By 1884 the foundry was using the first version of a pantograph machine he invented for engraving steel punches. Benton received a patent for the third version in 1885. He was becoming well known in the printing industry, though his company was not as influential as other foundries. The September 1886 *Inland Printer* reported that Benton was “an intelligent, entertaining, unostentatious gentleman, a mechanical genius of whom [Milwaukee] has every right to feel proud; . . . one such man is of more value to the community than all of the brainless dudes to be found throughout the length and breadth of the country.”⁷

Though Benton spent much of his time developing his business, he still made time for outside interests. He had a fine baritone voice and sang in a number of Milwaukee church choirs. Boyd and Jessie also belonged to a singing society in Milwaukee, and performed in a number of Gilbert and Sullivan productions, as well as other light operas. An interest in music was also cultivated in young Morris. He sang as a choirboy, studied the violin, and later, like his mother, learned to play the mandolin.

As Boyd had learned to set type at age eleven with the help of his father, so Morris Fuller Benton spent time in his youth working at his own printing press in the family’s home on Wells Street in Milwaukee. When he was eleven, Morris designed and printed admittance tickets for children’s music classes, tickets for neighborhood shows, receipts for work he did for his father, and booklets of riddles. He also printed a parody of “Twinkle, Twinkle Little Star” and named it *To an Electric Light*.

Morris was not a strong boy and suffered through a variety of childhood ailments, including scarlet fever. As a result of Morris’s poor health, his doctor recommended that he be

moved away from Lake Michigan. So the family moved to the west of Milwaukee to Wauwatosa, and Morris again set up a workshop for his printing and photography.

The relocation took its toll on the social life that Boyd and Jessie had enjoyed so much in Milwaukee. The city was several hours by horse and buggy, and the last train left Milwaukee too early in the evening for the Bentons to attend the theater. Calling upon the same inventiveness that he brought to his business, Boyd quickly found a solution to the dilemma. Boyd’s granddaughter Caroline recalled: “My grandfather and two or three buddies decided to buy a train from the Milwaukee railroad.”⁸ Running an engine and one car, the young entrepreneurs could take their friends to Milwaukee to see all the shows and other evening activities that interested them, and leave the city just before midnight. The enterprise was so successful that they bought a second car, and then a third. At the end of the year the railroad bought back the train.

In September 1892, at the age of twenty, Morris left Milwaukee for Cornell University in Ithaca, N.Y. He was older than most of his fellow students because of the school time lost to childhood illnesses. Morris did not intend to follow his father into the typefounding business and, when he first matriculated at Cornell, was still open-minded about his career. Only later did he decide to study mechanical engineering, perhaps because he realized he had a knack for it.

One thesis requirement was to work for part of a semester at a machine shop. Morris’s assignment was to choose a piece of machinery in the shop, draw blueprints of it, and then build a model. While at Cornell he also designed a cannon, built a model of it out of brass, and, for years afterwards, fired it every fourth of July.

Morris’s best grades were in mechanical drawing, but he had trouble with the language requirement. Caroline remembers her father recalling his struggle with French: “He kept going in to take the test in French. He’d bone up on it and he’d go in—he only had to have a reading knowledge, I think . . . And finally, senior year, he had his thesis all written (and he had a little trouble on that—the professor lost the thesis, and had to give him a grade off the top of his head)—but finally, the French professor said, ‘I’ve seen too much of you. You bone up once



Fig. 3. Mary Ethel Bottum Benton and her two daughters Elizabeth (left) and Caroline, ca. 1910.

more and come in and we'll see what we can do.' So he went in and took it once more and [the professor] gave him a passing grade." Morris graduated in June 1896, having taken prizes in freehand drawing, mechanical drawing, and machine shop work.

* * *

In 1892, just as Morris was entering Cornell, twenty-three American type foundries—including the Benton, Waldo firm—merged to form the American Type Founders Company, or ATF as it soon came to be called. For the first few chaotic months after the merger, the elder Bentons remained in Milwaukee, but it soon became evident that Boyd's genius and experience were required in New York where the new company had decided to situate its offices. Boyd moved his foundry to New York in 1894, but left Waldo in Milwaukee to handle a sales office. He also held onto his house on Wells Street. Morris was in charge of renting out the Wells Street house and spent a few summer vacations away from Cornell, looking after the family property. When the

time came several years later to sell the house, Morris handled most of the arrangements.

A few months after Morris graduated from Cornell, he became his father's assistant at ATF. He designed machines and began to learn about typefaces. On September 1, 1897, after a three-year engagement, Morris Benton married Ethel Bottum, the daughter of Boyd's patent attorney.

The young couple took up residence in a small, somewhat dingy apartment on Staten Island, ten blocks away from the senior Bentons. Each morning, Morris and his father would meet and take the ferry to New York City. The foundry was at that time on the southernmost tip of Manhattan. Ethel was alone all day, and when her first daughter, Elizabeth Boyd, was born the following year, she became terribly lonesome. Caroline explained, "She didn't know anybody, not a soul, on Staten Island." Shortly after the baby's birth, the young family moved in with Boyd and Jessie, who had recently bought a large Victorian house at 19 Central Avenue in Thompkinsville, Staten Island. Another daughter, Caroline, was born in 1902 (fig. 3). The two families lived together on Staten Island for nine years.

After ATF moved to Communipaw Avenue in Jersey City, N.J., in 1903, Boyd and Morris decided to leave Staten Island and move closer to the company. They eventually chose Plainfield, N.J., for its schools and because it was famous for its clean artesian well water. In 1906 Boyd rented a home for the whole family, a large Victorian house at 131 Crescent Avenue. About two years later he bought a house with three and a half acres of lawn and gardens at 107 Crescent Avenue (fig. 4). Boyd had always wanted a large family, and both he and Jessie were pleased with the three-generation arrangement (fig. 5).

Morris's interest in hobbies was as keen as ever. He took color photographs and developed them in his own darkroom on the third floor of the new house. The darkroom contained a work table and a lathe, as well as equipment for experimenting with stereotypes. Morris also amused himself with target shooting, though he did not care for hunting. He had inherited a collection of some fourteen guns from his father-in-law, and he belonged to a local gun club. He kept his guns, target records, and ammunition locked in his darkroom. Morris kept the guns oiled and



Fig. 4. The Benton's house in Plainfield, N.J., at 107 Crescent Ave., ca. 1915. Photograph by Morris Fuller Benton.

cleaned, and later taught his daughters how to shoot at tin cans. The children had toy pantographs and Morris once electrified a mechanical train for them, before electric trains were readily available.

Music was an important feature of family life in the Benton household, and both of Morris's daughters were encouraged to study the piano. Very much like his father, who expected perfection from mechanical parts, Morris often retuned the piano after the regular piano tuner had left the house. Caroline recalled that "he had the theory that every individual piano had certain tonal areas which needed to be balanced with extra care in the tuning."

He owned an Edison phonograph and, later, a Victrola, and loved to listen to Enrico Caruso and most classical music, except Brahms. He also owned an Aeolian Orchestrelle, a pump organ with stops that Benton would manipulate to get the tone he wanted, while the paper roll took care of the notes. His daughter Elizabeth remembered: "He used to play Tannhauser, and my little bed upstairs would rock!"

Morris was a patient man, and explained things carefully to his daughters. He drew diagrams on the paper tablecloth after dinner to illustrate points he was making and, when the table was set with good linen, would use the salt and pepper shakers to represent in simple terms some complex piece of machinery.

Both Morris and Ethel loved the outdoors. He



Fig. 5. Linn Boyd Benton wrote this letter in the outline of a dog to his six-year-old granddaughter Caroline on 26 July 1908.

was an avid figure-skater, and took the family to the Adirondacks for vacations, where they would hike with map and compass. Caroline described one of her father's foolproof methods for finding their way back: "He would take red tags and hang them on the trees, and then coming back, he'd collect the tags again." Daughter Elizabeth recalled that he took slides of the family vacations and later would give slide shows back in Plainfield.

Boyd was more sociable than his son. His grandchildren described him as a "big, powerful character." He would often orate at the dinner table, especially about politics. He was what people then called a "single taxer" who did not support the 1913 income tax law, saying, "That's terrible! It's socialism." He would often slap the table to make a point, startling his wife in the process.

Morris channelled his own considerable drive and ambition into careful and conscientious work. Prior to coming to New Jersey, Morris had helped his father to further develop the punch-and-matrix-engraving machines, in addition to his work on other typefounding equipment. Throughout his career, Morris's lack of preten-

sion won him considerable respect in the company, even if accounts of his achievements did not reach far beyond Jersey City. According to Caroline, he was never adequately compensated for his many contributions to ATF.

Caroline remembered the two Bentons consulting over some of the later inventions. “[They] would talk things over sometimes, [but] not at the [dinner] table. Grandpa would say, ‘Oh, Morris, before you go upstairs, I’d like to ask you something.’ And they would go into a huddle together and discuss [it]. . . . After my grandfather died I [asked] my father about working on one of the recent machines grandpa had perfected, and I said, ‘Did you work on that too?’ And he said, ‘Oh, yes.’ And then I said ‘Well, you had a mechanical engineering degree, did you work on the others?’ And he said, ‘I think I worked on practically all of them.’”

Morris Fuller Benton had become ATF’s chief type designer in 1900. Painstakingly researching each new typeface idea, Morris studied the market to determine what sort of face was needed. Richard Marder, whose grandfather John Marder was one of the original founders of ATF, remembered seeing Benton in the company’s renowned typographic library on Saturdays, which then were half workdays for employees. “I used to spend a lot of my time on Saturdays in the library. . . . [Benton’s] inspiration came from that library. That’s one of the reasons it was created.”⁹

About the time that Morris Benton’s great Century Schoolbook typeface was making its debut, he endured a personal tragedy that made him even more reticent. On March 17, 1920, his wife Ethel died suddenly of an infection after an operation. She was only forty-two years old, and her death was a shock to the family. Shortly after Ethel’s death, Morris shared some thoughts with Caroline. “[He said that] life divided itself up into compartments, and they didn’t necessarily follow through, they cut off, . . . He just felt that one [had] ended, and he was very, I wouldn’t say that he was philosophical, but he did accept the fact that the facts were the facts. He had to make a new life.”

In 1923, Morris married Katrina Ten Eck Wheeler, his second cousin on his father’s side of the family. She was thirty-one at the time, twenty years younger than Morris. They moved out of the big white house in Plainfield to an

apartment about half a block away and remained there for seven years.

In the mid-1920s Morris’s health suffered again with the onset of serious stomach ulcers, “which probably [were caused by] coping with Grandpa,” Caroline explained, “because Grandpa wasn’t as sweet and lovable as he had been when he was younger.” The added pressures at work also took their toll. “If things didn’t go right at the foundry, then he [Morris] was the one that had to straighten them out,” Caroline explained, and there were times when he was so tired, he would just have bread and milk for supper.

To other observers, Boyd’s advancing age only found him more affable. In 1922, when Boyd was seventy-eight years old, Henry Lewis Bullen wrote, “Mr. Benton outdoes his youthful years in humor and geniality. An observant man, he has accumulated a great fund of genial anecdotes.” Bullen also noted that Boyd Benton retained “as ardent an interest . . . in every detail of typefounding as ever he had when confronting its most difficult problems in earlier years. He [permitted] nothing to interfere with a most punctual attention to his duties, though these [were] largely self-imposed.”¹⁰ His character, according to Bullen, was beyond reproach. In 1923 the *American Printer* described Boyd Benton as “one of those men, quietly doing their day’s work, who have had a tremendous influence on the American printing industry.”¹¹

Boyd loved working—his friends were at ATF and his social life revolved around the company. He did not have the same interest in hobbies, sports, and the outdoors that his son had, so he put off thoughts of retirement, even though his eyesight became worse and worse. In 1930, when he was eighty-six years old, he received a patent “for an important improvement in the larger printing types used in newspaper headings.”¹²

On September 9 of the same year, Jessie Benton died at the age of eighty-four. Boyd missed her greatly. Caroline remembered: “He would stand at the dining room table and bring his fist down, saying, ‘Damnable! I’ve lost my little doll!’”

After his mother died, Morris and Katrina moved back to the big white house with Boyd. The two men continued to go to work together every day. Caroline recalled, “Papa said, [Boyd]

would come into the foundry and all hell would break loose—everything had to be just so. . . . That's the trouble when you work 'til you're 88, you know, somebody has to help you. And you know who did it." But Caroline stressed that Morris remained "very patient with his father, and very sweet."

Linn Boyd Benton retired from his position as manager of ATF's general manufacturing department on July 1, 1932. He died suddenly on July 15 of a cerebral hemorrhage.

The minutes of the ATF directors' meeting for October 14, 1932 included the following statement:

RESOLVED: That the Directors of the American Typefounders Company place upon record their sorrow and deep sense of loss to themselves personally and to the Company in the death of LINN BOYD BENTON, who has been a member of the Board of Directors since its first organization in 1892, a period of forty years.

Devoting his great natural genius of invention exclusively for the advantage of this Company from the time, forty years ago, he became a Director of the Company, and Manager of its General Manufacturing Department, Mr. Benton's inventions revolutionized the typefounding art and craft, and placed the Company in a position of leadership, to the great advantage of the Company and the printing industry which it serves. These benefits have been, from the beginning, of incalculable value. These benefits will continue as long as the indispensable art of typography survives.

Those engaged in the arts of typography throughout the world have acknowledged Mr. Benton's genius, and the resulting benefits. This Company has benefitted by his prestige. No other man connected with the Company has served it more valuably than our late departed friend.

As a Man Mr. Benton endeared himself to us by his modesty, his delightful humor, and his probity in all matters, intellectual and material. He was ever faithful to his conscience and also to this Company and the Board of Directors, who were conscious of the honor of being associated with so great and fine a Man.

The Directors respectfully present this appreciation of the Man and his character and genius to his Family in profound sympathy with their grief.¹³

Other lengthy obituaries appeared in the *Plainfield Courier-News*, the *American Printer*,

and *The Inland Printer*, which printed the following testament: "In recognition of the benefits showered upon the industry through the genius of this great figure, some of whose achievements are here recorded, the seat of honor, as it were, in this issue is given over to his most recent portrait. Turn to the frontispiece . . . , study the kindly, intelligent features, recognize that he worked to benefit you—even after years of practical blindness—until past eighty-eight, and remember him as one of the truly great in the industry's march of progress. —The Editor."¹⁴

Morris Benton remained at ATF for another five years after his father's death, but it was a difficult period for the company. Already in the 1920s, profits had begun to decline, and the 1930s brought a brush with bankruptcy. Caroline attributed some of ATF's problems to a lack of planning—management seemed unwilling to groom successors for the company's ageing executives. "Everyone was getting old," she said, "and I think that was the trouble. . . . It was very short-sighted not to take in younger men and train them, and they didn't. They were satisfied with getting their profits."

In 1937, at the age of sixty-five, Morris Benton retired from the American Type Founders Company. He apparently maintained few contacts with the firm, because in an August 8, 1937, letter to Ben Lewis, he stated, "I have definitely retired from business and am no longer connected with the A.T.F."

In 1939, after Jessie and Linn Boyd Benton had been dead for several years, Morris and Katrina bought a house on Long Hill Road in Millington, N.J., about six miles from Plainfield, and sold the "White Elephant." Their new house included a large landscaped area on a slope and a lovely view on three sides. Morris loved the Long Hill Road house since, according to his daughter Caroline, it was the one home he could truly call his own. Though advised by his doctor that his recurrent ulcers required treatment and possibly surgery, Morris nevertheless resisted exposing himself to the same risk that had taken his first wife.

Morris enjoyed the remaining nine years of his life, spending summer vacations at a cottage on Beaver Lake, N.J. Like his father, he offered political advice, cautioning daughter Caroline to

pattern is right, then the more accurate and precise the machine, the more perfect the reproduction of the designer's art."¹⁶

Preliminary Research

Before Morris Benton began to draw a new typeface, he studied the historic exemplars in ATF's extensive typographical library. Even when he was designing a completely modern face, Benton first conducted extensive research. He believed that gathering thorough background information for a new face was an essential part of the designer's job. Benton studied original typefounders' specimen sheets, as well as books—including incunabula—printed in a wide variety of typefaces. Many of these resources were located in ATF's splendid library and museum.

The Drawings

Morris Benton and his colleagues began with pencil drawings, which would then be inked-in for evaluation. These would be used to get a sense of what the letters would look like.

An original drawing could be of any size, but preferably was 96-point or larger. Some faces began life as just one word: Balloon Light and Extrabold, for example, both originated from the word CHAMPION.

Every year ATF received hundreds of proposed type faces from enthusiastic letterers. The original drawings they provided could seldom be used as working drawings because independent designers rarely realized the complexities of the type manufacturing process. Most designs had to be redrawn to conform to technical limitations and peculiar word combinations. For example, Bertram Goodhue's drawings for Cheltenham were not directly translated into patterns for cutting matrices upon reception by ATF's design department. Morris Benton first had to adapt them to the appropriate specifications for typecasting.

Some designers were prepared to make the slight design changes that were needed to compensate for the different sizes of a face. D. B. Updike, for example, wrote that "a design for a type alphabet that may be entirely successful for the size for which it is drawn, cannot be successfully applied to all other sizes of the same series. Each size is a law unto itself, and is often bettered by modifications in the original design made by the

feeling and taste of the designer."¹⁷

The concept can be illustrated easily by reducing 48-point type, for example, to nine or ten points. The serifs will start to disappear, the counters may begin to close up, and consequently the letters will lose their appeal. Though type designers understood the concept of optical scaling, a 1947 article in *The Inland Printer* stated, "The belief is widespread that a type face originates by some designer submitting the drawing of an alphabet to the founder who . . . then proceeds to photograph it to the various sizes to make up a series."¹⁸ This was far from the case. The original drawings were simply the starting point for the design department.

The Delineating Apparatus

The next step in type production was to get the characters to an appropriate size for making patterns. Each drawing for a typeface was placed in a special delineating machine invented by Linn Boyd Benton where an enlarged outline was made—so large, in fact, that all errors could be easily seen and corrected.

The delineating machine was a refined pantograph with a microscope attachment, enabling the operator to enlarge or reduce a single character very accurately. Benton's patent application for the machine was at first rejected by the United States Patent Office on the grounds that it described a mechanical impossibility! But after a demonstration on an ATF delineating machine that had been in operation for several months, the patent was promptly granted.

The face of the microscope attached to the delineator held two single filaments of silk, crossed in the center of the focal point. Directly beneath the focal point, a small bed or plate held the character, clamped in place. The larger bed of the machine held a sheet of paper under the pantograph's tracing point, which for enlarging operations held a small pencil. The cross-hairs of the microscope were focused on the outline of the character being traced. Then the operator, looking through the microscope, followed the outline of the design by moving the pencil holder and, in so doing, traced an enlarged outline of the character.

The bed of the holder on which the original character was clamped could be swiveled to any angle, "thereby changing the style of the letter to



Fig. 6. Microphotograph of the Lord's Prayer cast on the end of an 8-point piece of type. The matrix was cut so that the text would be right-reading. This exhibition of the precision of Benton's matrix engraving machine was used for advertising purposes. (Photo credit, Sheila Donnelly).

vote for Wilkie, not Roosevelt, in the 1944 presidential election. He was, claimed an October 14 letter to her that year, "firmly and completely convinced that another four years of FDR [would] be the finish of the U.S." A few years after the election he wrote, "The doctor says there is nothing the matter with me; but the multitude of complications of the present times gets my goat easier than it would twenty years ago."

Morris Benton died of an embolism after a brief illness on June 30, 1948, in All Souls Hospital in Morristown, N.J., at the age of seventy-five. He had smoked heavily and, said Caroline, "if he hadn't had an ulcer he probably would have had lung cancer."

Brief obituaries of Morris Benton appeared in *The New York Times* and *The Inland Printer* and, in each case, dwelled for a precious sentence or two on his father's importance to the type-founding industry.

The two Bentons, in separate and equally important ways, revived a moribund industry. Morris's outstanding program of type design helped the American Type Founders Co. define new markets for itself in the advertising commu-

nity, making its loss of body type sales to the Linotype and Monotype machines less painful. Linn Boyd, for his part, raised the standards of typemaking to levels that made ATF type admired throughout the world. Though the company itself is no longer in business, much of its Benton-designed or modified machinery was saved from the scrap heap and still carries on its precision duties.

* * *

How Type Was Made at ATF

In December 1909, the *American Machinist* magazine published an article by W. J. Kaup on the American Type Founders Company, noting that the making of type "is an art where the little things, measured in fractions of a thousandth of an inch, are the big things as exemplified by [ATF], whose system makes each small step a refinement link in the whole chain of microscopic accuracy."¹⁵ This accuracy was what both Linn Boyd and Morris Fuller Benton demanded of themselves and others. Father and son were perfectly suited to this type of work, and the results they achieved were phenomenal.

One of ATF's advertising devices, used as early as 1922, was a piece of type on which was cast the entire Lord's Prayer: sixty-six words, made up of 271 characters, including punctuation. On an eight-point version of the Lord's Prayer, the lower case letters were .0044" in height; the matrix was cut by a tool measuring .0005" in diameter and its area was constrained to a six-point square, that is, a square measuring 1/144th of an inch on each side. Amazingly, the words are entirely legible under a microscope (fig. 6). ATF also cast and distributed another version of the Lord's Prayer on a 4-point body.

The microscopic detail of this advertising piece was made possible by Linn Boyd Benton's greatest invention: the matrix-engraving machine. But an accurate matrix engraver would be of little use if the design of the type was not also precise. And type design was Morris Benton's job—he oversaw the design department at ATF with a zeal and passion for quality that equaled his father's. As independent type designer Frederic W. Goudy said, "The machine itself may be hard and uncompromising, but its product is entirely within the control of the pattern—if the

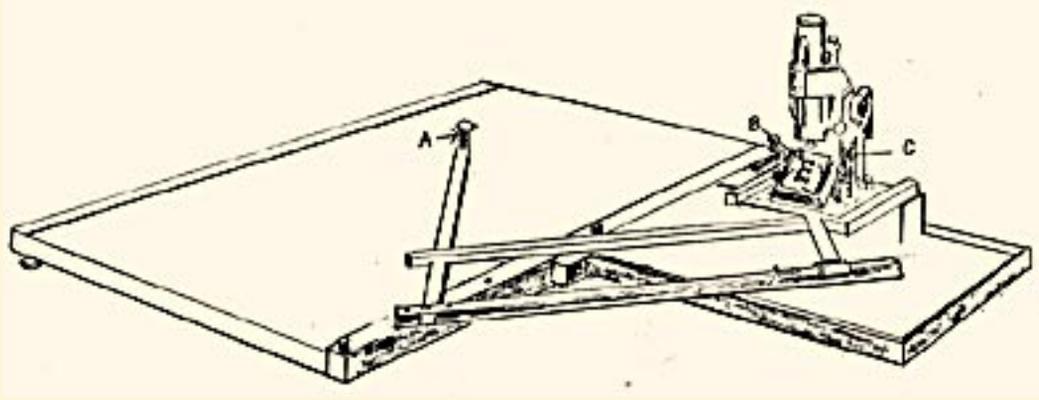


Fig. 7. The delineating machine. A, tracing point; B, fingers for clamping the pattern character; C, bed plate showing angle possibilities. Note that the character shown is clamped at an angle, enabling the operator to produce a condensed version of the original. (Redrawn from an illustration in the *American Machinist*, 16 December 1909.)

wide, narrow, back slope or italic, both the italic and back slope being produced through the combination of angles,” explained Kaup in the *American Machinist* (fig. 7).

In his 1906 essay “The Making of Type,” Linn Boyd Benton noted that, “with the aid of the delineating machine, the operator, besides being able to produce an accurately enlarged outline pencil tracing of a design, is also enabled, by various adjustments, to change the form of the pencil tracing in such a manner that it becomes proportionately more condensed or extended, and even italicized or back-sloped.”¹⁹

The resulting enlarged outline drawing was normally made about ten inches high, and the designer now evaluated it. Judging an enlarged letter and visualizing it in a text size required considerable skill. Inevitably the drawings of an independent letter designer not thoroughly trained and experienced in typemaking always had to be adjusted by a trained specialist. “Believe me, it isn’t easy,” Richard Marder explained.

The enlarged outline drawings were modified to meet the limits of the standard lining and point systems, and from there went back to the delineating machine. This time, however, the microscope attachment was removed, and a small pencil arm was attached to trace a small-scale outline of the letter by moving the long arm pencil over the large outline. The operator reduced the design to a practical size, say, 36-

point or less. This reduced outline was inked in, giving it the appearance of a sharp impression from a piece of type. A solid letter so made lent itself more readily to further evaluation. If the reduced image was not satisfactory, the ten-inch outline drawing was again altered, and the process was repeated until the letter was approved.

Thus the delineator was used both to enlarge and reduce characters. If the original drawings came in very large, the process was simply reversed, first reducing the image and inking it in, and then making the appropriate ten-inch outline drawings. The focal length of the delineator’s magnifier could be changed to meet the requirements of the changes in the size of the letter.

Design Considerations

The three-dimensional nature of type imposed limitations on its design. Hairlines and serifs had to be well supported to prevent breakage. Counters had to be deep enough, especially in the smaller sizes, to prevent being filled up with ink and paper dust during printing. In short, designers had to consider a number of mechanical factors in designing practical, useable type.

Working Drawings

Before final drawings were released by the design department, they were worked and reworked many times. The delineating machine enabled a

designer to reduce the original ten-inch outline drawings to various sizes and study them without the expense of actually casting the type. Thus adjustments could easily be made at the drawing stage for different type sizes.

The approved traced outline of a character was used to make its actual working drawing. If the designer wanted a vertical line to be perfectly straight, for example, he would use a straight edge on the working drawing. Each such drawing was marked with measurements that would be helpful during later processes.

The Pattern

Once the ten-inch working drawings were approved, the next step was to create a pattern plate for each character. These were made either in wax and then electrotyped, or directly in metal, depending on whether a punch or a matrix was required. Another Linn Boyd Benton pantograph machine was used to make the patterns (fig. 8). Henry Lewis Bullen called one early version "Benton's Wax Plate Machine."

If a punch was required, the pantograph machine was fitted with a glass or brass plate coated with wax. The operator used a "follower" to trace the ten-inch outline drawing, while the cutting tool engraved a smaller outline of this character entirely through the wax. The character was reduced in this process to about a third of the working drawing's size, or about 3½" high.

A thin layer of copper was electrically deposited on the plate, which was then backed up with metal, trimmed, and finished. The result was now called the "pattern"; it had a raised outline image, and was ready to be used on Benton's punch cutting machine.

Pattern plates to be used for matrix engraving were of lead or zinc into which the characters were incised. Later, copper electro wax shells (backed with lead) were done by outside contract. During the war materials shortage years of 1941–46, Gorton-engraved brass plates were used; after 1948 photoengraved zinc plates were used. When the ATF plant in Elizabeth, New Jersey, closed in 1993, many hundreds of such patterns were scattered helter-skelter over tables and cabinets.

Matrices of all the regular type sizes could be cut from these pattern plates. As Linn Boyd Benton explained in "The Making of Type," the pat-

tern determined the shape of the letter, but its size and any design variations from the pattern were determined later by means of adjustments on the engraving machine.

Engraving a Matrix

While still in Milwaukee, Benton had invented a pantographic machine to cut punches from which matrices would be struck and used to cast the "self-spacing types" sold by Benton, Waldo & Co. The matrix engraver was an adaptation of the punch-cutting machine and was developed in the early 1900s when ATF decided that engraving directly into a matrix blank was more practical than either cutting a punch or cutting a model from which new matrices could be grown electrolytically.

The matrix engraver consisted of two housings between which a long pendulum swung (fig. 9). The pendulum was suspended, as described in the *American Machinist*, in a compound yoke by means of gimbal screws which gave it a toggle-joint effect. The free end of this pendulum could be moved all around a pattern, which was placed on the bed of the machine, directly in front of the operator. Matrices could be cut for different point sizes of a given type design simply by adjusting the reproduction ratio between the pattern and the cutting tool.

The nickel brass matrix blank was fixed in a jig and inserted into the cutting platform of the engraver; there it was held fast by a thumbscrew above the operator's head. This blank or "planchet" became the matrix after the cutting protocol was completed. Minute cutters, spinning in ball-bearing races within the "quill" assembly, cut the character step by step.

The quill, or the head which housed the cutting tool, was perhaps the most highly developed part of the engraving machine. "The steel is specially selected and machined and then laid away for three or four months for seasoning or adjustment of the various strains inherent in all steels," the *American Machinist* explained. Only after such time was it fitted into its guides. The allowable tolerance in the construction of this head was within 0.0002".

There were three kinds of cutting tools, each used in turn to engrave the matrix: the first or roughing cutter (also used to cut the counter areas of a character); the medium tool; and, third,

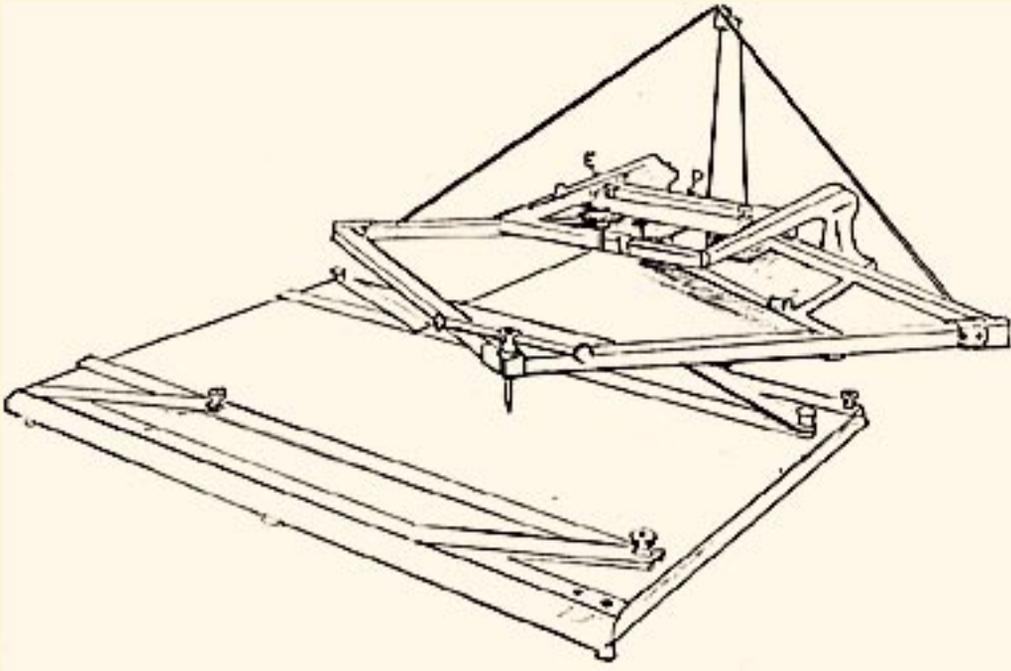


Fig. 8. The wax-plate delineator. D, tracing point inverted; E, frame for holding plate. (Redrawn from an illustration in the American Machinist, 16 December 1909.)

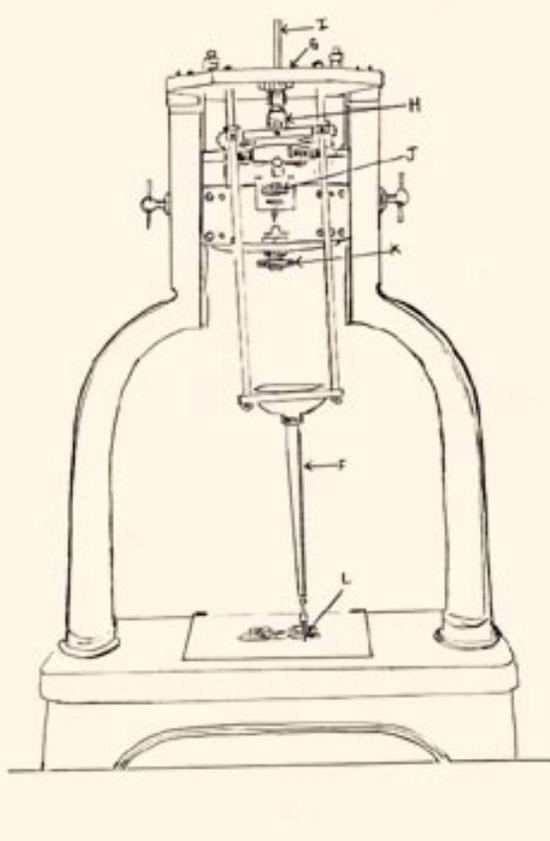


Fig. 9. The matrix engraving machine. E, pendulum; G, yoke; H, quill; I, flexible shaft drive; J, matrix; K, micrometer adjustment; L, follower. (Redrawn from an illustration in the American Machinist, 16 December 1909.)

the finishing tool. When Theodore Low DeVenne described Benton's earlier punch-cutting machine, he was especially impressed with the precision of the cutting tools: "The cutting tools are exceedingly minute, but they are made with the nicest accuracy, and are rotated at high speed by steam power."²⁰

Once in place, the cutting tool was driven by a flexible shaft spinning at a speed of 8,000 to 10,000 revolutions per minute. The dimension of the facet of the cutting edge of each tool varied from 0.001" to 0.080" in width (depending on the amount of metal to be removed). The largest was used to rough out the major portion of the design, while the smallest was used for finishing.

A follower was inserted in the taper-end collet of the pendulum, and used by the operator to trace around the edges of the pattern. There were large followers which fit into a ball-end shank, and smaller, finisher-followers with tapered shanks to fit the collet. The *American Machinist* described the precision required to cut an accurate matrix: "a light spring in tension against the end of the pin holds the follower always in position. The size of the follower is in direct ratio with the size of the tool, as for example, the pendulum arm with a ratio of 10 to 1, using a tool with a 0.008-inch face, would require a follower ten times as large, or 0.080-inch diameter."

The operator guided the follower along the inside edges of the pattern, while simultaneously the cutting tool above cut the outline of the character on the matrix. The matrix moved in unison (but at a proportionately reduced scale) with the follower and was pushed against the fixed tool in the cutting head assembly. The work moved, not the cutting tool, which rotated at high speed in place, perpendicular to the matrix blank. A rough character was made first, and the surplus metal removed. After an adjustment, another circuit of the pattern was made, refining the incision and removing more metal. The operator also guided the follower/cutting tool over the inner area of the pattern between the character's outlines. Different tools were used for many successive cuts, and finally a finishing tool was used to make the last precision cuts.

The operator periodically examined the cutting tools through a microscope, since the accu-

racy of the matrix depended to a large extent on the accuracy of the cutting tools. So perfectly ordered was the procedure that only if a tool was damaged was the resulting matrix faulty. In those cases where a tool edge was broken or damaged, necessitating its removal in the middle of the operation, it was essential that some means of grinding or renewing the edge be available to the operator, to ensure that the tool remained within proper tolerances.

Typically when faced with challenges of this kind, Linn Boyd Benton invented a special machine. In this case, he designed a device to grind the cutting tools automatically and with extraordinary accuracy when a gauge on the machine was properly set. Any desired width of tool face could thus be obtained.

The cutting tools, after being re-ground, were inspected under a microscope. "Across the center of the face or lens of the microscope, is arranged a fine scale reading in 0.0005 of an inch," the *American Machinist* explained. This is about half the thickness of a cigarette paper. A cutting tool looks like a heavy nail under this microscope, and so the cutting tools could easily be gauged by eye—the 0.080" tool covered 160 lines on the scale, and the 0.001" tool covered two lines.

The Benton engraving machine was hailed by type foundries around the world as a miracle of accuracy. Though Benton had leased out some of his early machines while still in Milwaukee, he later had to reacquire them as part of his hiring agreement with ATF. In the early 1900s, many companies copied its design for themselves. The Stempel foundry in Frankfurt, Germany, had one, and most American composing machine manufacturers used modified versions of it.

Cutting Slips

At ATF, engraving instructions, or "cutting slips" were written out for each size of a typeface (fig. 10). These slips guided the engraving machine operator in choosing the proper followers, cutting tools, and precision steel adjustment standards.

Apparently Benton used such cutting slips from the very beginning. An 1888 advertisement for Benton's punch-cutting machine reads, "The operator is provided with a card on which is printed a series of numbers, corresponding with numbers stamped on the followers, opposite



Fig. 10. The ATF cutting slip for 6-point Bernhard Gothic Light. (Photo taken by author at ATF, November 1984).

which are a series of figures identical with figures on the micrometer. This card indicates to the operator the order in which the different followers should be used, and the number to which the micrometer is to be set for each succeeding change of follower.”²¹

Adjusting the Machine

While the Benton matrix engraver could accurately reproduce the image on the pattern plate in any type size, it was also capable of altering that image, deviating from exactly proportional reproductions, when the operator so adjusted the machine. Henry Lewis Bullen explained in 1907 that it was capable of “infinitesimal gradations in all directions.” Thus, Benton’s matrix engraver could be adjusted to compensate for the optical variables that occur when letter sizes change.

Dr. James Eckman, an avid historian of American type foundries, confirmed that such adjustments were made at ATF. “In the matrix-engraving department of the American Type Founders Company,” he wrote, “I have seen, on the walls, great charts of trigonometric projections of curves for use in correcting aberrations produced by magnification of letter forms from a beginning prototype of one size of a letter. I think there is, therefore, no doubt that both Bentons accepted and employed magnification

to obtain different sizes of a given design.”²²

Beatrice Warde, in an article on machine-cut typefaces published in the *Dolphin* No. 2, mentioned Benton’s device in a footnote: “[T]here exists an ingenious mechanism by which a certain amount of repropportioning can be done by adjusting the machine. Opinions differ as to the wisdom (from the designer’s point of view) of using the adjustment.”²³

D. B. Updike was among those who were apprehensive of such machine adjustments. “In point of fact,” he wrote in *Printing Types*, “the first types produced by punch-cutting machines did seem to show a certain rigidity from the point of view of design. That there has been an improvement of late in type cut by machine is undeniable, and yet there has been practically no change in its mechanism. This improvement, I learn, has come to pass through a more sympathetic and subtle manipulation of the machine itself, and by modifications of rules by the eye of the workman who operates it.”²⁴ Updike concluded that the trained eye must remain the primary judge of good design, and that machine alterations must be made by operators with a sense of good design.

Morris Benton used cutting slips to make certain that ATF’s engraving machine operators precisely and consistently adjusted the machine for every point size. The operators were not permit-

ted to deviate from the cutting slip specifications when preparing replacement blanks, thereby ensuring continuity and uniformity. The reproduction tolerance for replacement work was ± 0.0002 ". Consulting the cutting slips, the operators made the optical changes for the different point sizes based on previously determined calculations.

"These adjustments are all established for each size of each face on the cutting slips," Richard Marder explained. Precision steel standards were used to adjust the machine to produce either narrower than normal or wider than normal matrices from the same pattern plate. Linn Boyd Benton himself wrote: "The adjustments are such that the operator is enabled to engrave the letter proportionately more extended or condensed, and lighter or heavier in face, than the pattern. All these variations are necessary for the production of a properly graded modern series containing the usual sizes. In fact, on account of the laws of optics, which cannot be gone into here, only one size of a series is cut in absolutely exact proportion to the patterns."²⁵

For example, only the 36-point size of the typeface News Gothic was cut exactly proportional to the pattern plate. Going down in size, the face was actually extended in width but not in height. Above 36-point, the letters were condensed relative to the standard. On the other hand, Richard Marder recalled that ATF's American Caslon, cut in sizes from 6- to 48-point, was not adjusted at all from size to size. Each size, then, was photographically proportional to the pattern plate.

In the 1940s, the great contemporary type designer Hermann Zapf was designing type for the Stempel foundry while it still used a Benton matrix engraver. He explained that the normal practice at Stempel was to produce three sets of patterns for each typeface. Adjustments on the machine itself were only used to widen characters in the very smallest point sizes.

Fitting, or Justification

"The adjusting of the matrix to the mould is technically called fitting," Linn Boyd Benton explained, "and requires great skill. If type is cast from unfitted matrices, be the letters ever so cleverly designed and perfectly cut, when assem-

bled in the printed page they will present a very ragged appearance. Some letters will appear slanting backwards, some be above the line, others below; some will perforate the paper, while others will not print at all; the distances between the letters will everywhere be unequal, and some will print on but one edge. Indeed, a single letter may have half of these faults, but when the matrices are properly fitted, the printed page presents a smooth and even appearance."²⁶

So the unfinished matrix went to a fitter, who made final adjustments on yet another Benton invention, the matrix fitting machine. According to Richard Marder, "the matrix as delivered from the Benton engraving machine required very precise trimming in order to place the engraved letter cavity exactly central to the to-be-cast body and absolutely straight and on the proper baseline."²⁷

The fitter had to know where the baseline of the type fell in relation to its set of matrices, a position not always apparent when dealing with characters such as o or c. If all the letters were placed exactly on the type's true baseline, they would appear to be bouncing up and down on it, because letter combinations and shapes give rise to optical illusions. Deviations have to be made to trick the eye into believing that all the letters in a font of type sit on a common baseline. These irregularities cannot be systematized, but vary with each new alphabet design, and, to an extent, with every size of a given design.

The left and right edges of the matrix determined the "set" of the letter, or, how much space would appear around that letter when it was placed beside another character in the font. As new designs were readied for production, proofs were made for each letter in combination with every other letter, and the results would be studied for legibility and beauty. Certain letters, such as H, O, o, and m, because of their shapes and proportions, were used as standards and printed beside each character in the font to judge the set.

Casting

ATF's type was cast from a mixture of tin, antimony, lead, and a small amount of copper. The mixture was proportioned so that, according to Linn Boyd Benton, "the expansion of the antimony will practically counteract the shrinkage of other ingredients." In actuality, antimony

does not expand but rather acts as a retardant in the shrinking process of the alloy. The proportion of the mixture was even varied according to the size and style of the type and the purposes for which it would be used.

The casting machine was a marvel of engineering. Invented in 1888 by Henry Barth, president of the Cincinnati Type Foundry, the Barth automatic type caster not only cast the type, but broke off the jets, ploughed grooves to form the feet, cut four trimmed edges on each type character at the mold/matrix interface, and delivered them in lines ready for inspection. Soon after the formation of the American Type Founders Company, Barth was made a director with his son Henry O. Barth as assistant. After the senior Barth's death in 1905, Linn Boyd Benton made several improvements to the machine and received patents for them.

Each Barth machine at ATF was set up to cast a single body size. The matrices for a font of, say, 12-point Cheltenham, were held firmly and accurately in turn against the Barth machine's adjustable mold, which allowed each character's set width to be properly fixed. After every cast, the matrix was pulled away from the mold and the type sent on its way to a series of finishing operations.

Benton described the casting sequence thusly:

The melted type metal is forced by a pump into the mould and the matrix, and when solidified, the type is ejected from the mould and moved between knives which trim all four sides. The type is delivered side by side on a specially grooved piece of wood, three feet long, called a "stick," on which they are removed from the machine for inspection. Type is cast at the rate of from one to two hundred and forty per minute, according to the size, the speed being limited only by the time it takes metal to solidify. To accelerate this, a stream of cold water is forced through passages surrounding the mould, and a jet of cold air is blown against the outside.²⁸

An inspector then examined the type under a magnifying glass, and discarded any flawed type. The perfect type was sent to the "fonting" room, where it was weighed, counted, and packaged for sale.

* * *

The story of the Bentons given here is far from

complete. Morris Fuller Benton spent his entire working life at ATF, while his father devoted some forty years of his own career to the same company. Their influence on the type-making industry was far-reaching and of a significance still not truly appreciated.

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