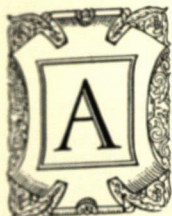


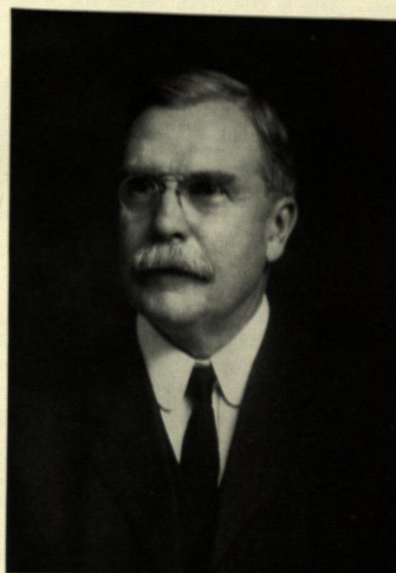
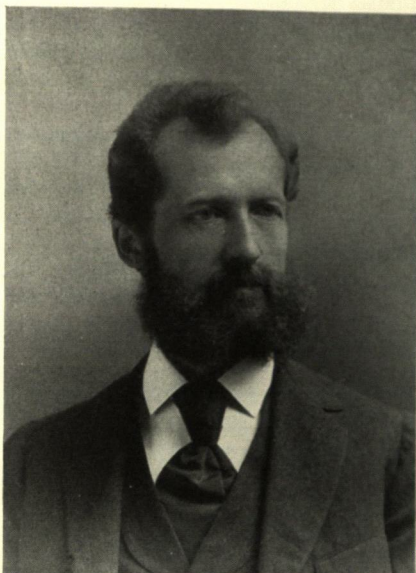
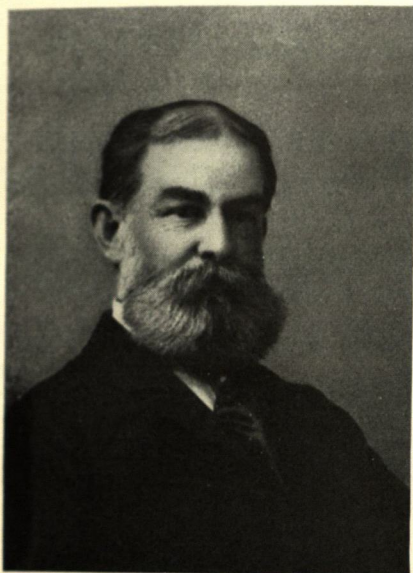
Origin and Development of the Linotype Machine

PART I.—BY HENRY LEWIS BULLEN



AMONG inventions none has a history more curious than that of the linotype machine. When the machine first became commercially practicable in 1891 it was a combination of the inventiveness of several minds, among which that of Mergenthaler was by no means the most effective. In this review an attempt is made to award the credit due to each of the various men who were concerned, consciously or unconsciously, in this important invention, and thereby

after Sholes had successfully passed it through the experimental stages. On Densmore's first visit to Clephane, the latter undertook to test every machine Sholes might make, and agreed to pay \$150 for each machine delivered. These experimental machines were made by hand. There were six of them constructed at different periods, and put to use in his business by Clephane, but, while each was an improvement on its predecessor, all revealed serious defects. Sholes came to think Clephane was too exacting, while Densmore persisted in the belief that to satisfy Clephane was to satisfy the world. So

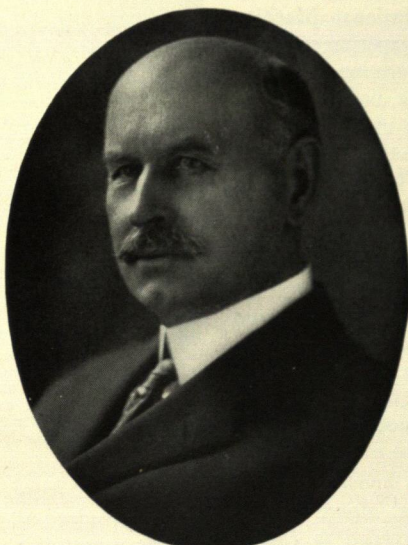


The Men Who Made the Mergenthaler Linotype Machine Possible

James Ogilvie Clephane, a lawyer who carried on the business of law reporting. To him primarily the world owes the linotype machine. He was born in Washington, D. C., February 21, 1842. Ottmar Mergenthaler, born in a village in Wurttemberg, Germany, May 10, 1854. He was a watchmaker, learning his trade in Bietigheim, Wurttemberg. In 1872 he came to America, and entered the employ of his uncle, A. Hahl, who then had a machine shop in Washington, which he later on removed to Baltimore. Linn Boyd Benton is the present director of the general manufacturing department of the American Type Founders Company. He was born in Little Falls, New York, May 13, 1844. He is now in his eightieth year, but still active. Originally a printer, his experience in typesetting began in 1873, since which time he has revolutionized the art of punch and matrix making. No portrait of J. W. Schuckers is available to us.

broaden the field for historians who may hereafter venture upon more detailed narratives of the various steps of this great event in the history of printing.

The world owes the linotype machine primarily to the progressiveness and persistency of James Ogilvie Clephane, a court stenographer and later a practicing lawyer in Washington, D. C., in which city he was born on February 21, 1842. Oppressed by the tediousness of producing manuscript copies of the notes of himself and his employees for the law courts and the printers, Clephane became interested as early as 1866 in an invention of a typewriting machine, which proved to be impracticable. However, his interest in mechanical writing induced a visit to him in 1867 by James Densmore, the partner of Christopher Latham Sholes, inventor of the first practicable typewriter, which was launched to fame and fortune in 1873 as the Remington typewriter, in which year its manufacture was begun by E. Remington & Sons at Ilion, New York,



Philip Tell Dodge, who became president and general manager of the Mergenthaler Linotype Company in 1891, and is still president. His son, Norman Dodge, is now general manager, having succeeded his father. The elder Dodge was born in Fond du Lac, Wisconsin, July, 1851. He is a graduate of George Washington University. By profession he was a patent attorney, in which capacity he became interested in Mergenthaler's invention. He is also president of the International Paper Company.

it proved to be, and in 1872 nothing remained to Sholes and Densmore but to find a manufacturer who would finance the machine as well as make it. When the Remingtons undertook the manufacture, the first seven Remingtons were sold to and used by Clephane. How few inventors have been fortunate enough to find a business man who would try out their inventions and pay for the machines subjected to the trials! Yet this spirit of invincible coöperation, which had prevented a crisis in the affairs of the inventor of the typewriter, was to be more amazingly displayed in connection with the invention of the Mergenthaler Linotype Machine. Clephane was offered by Densmore a large share of his interest in the Sholes' invention for a comparatively small sum, before it passed into the hands of the Remingtons. But Clephane was not a capitalist, his income being derived solely from his law reporting business, and he was compelled to decline the offer. Densmore, needing money, disposed of the larger part of his

interest to other persons, yet from the small interest he was able to retain he eventually received in dividends as much as \$150,000 a year, while from the same amount of stock his family now enjoys a much larger income.

Clephane's objective from the beginning was to produce a machine which would mechanically produce copy that would

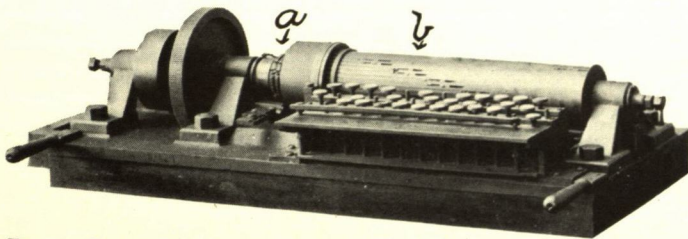


FIG. 1.—The apparatus called the rotary impression machine, out of which the linotype machine was developed after an evolutionary period of twelve years—1879 to 1891. This was the first invention of Ottmar Mergenthaler, in his effort to carry out the ideas of Charles T. Moore and James O. Clephane, who required an apparatus to indent stereotypic matrices, as shown in Fig. 2. At *a* are three wheels, each carrying complete alphabets cut in relief in steel, one wheel each for capitals, lower-case and italic. When the apparatus was put in motion by belted power, the letters on the wheels were controlled by the finger keys, while the lever at the right brought either the capital, lower-case or italic wheel into work, as desired. The short lines *b* on cylinder are the ends of a series of rods, each controlling one character on the wheels. A rod was actuated by pressing the required key, whereupon the rod raised the required character above the periphery of the remaining characters on a wheel and held the letter in position until it was pressed into a narrow strip of matrix paper, at which instant the wheels automatically ceased to revolve until the indentation was made. More than one style of this apparatus was made, our picture showing the latest model. In the first 1879 model Mergenthaler used piano keys to control the letters, and thus made the apparatus unnecessarily cumbersome.

eliminate the cost of type composition. He first tried to interest Phelps, the inventor of the telegraph printing machine, but Phelps declined the attempt. Charles T. Moore, an inventor of a telegraph printing machine never put to use, persuaded Clephane that he could invent the machine he was in quest of. The idea was to print law reports by means of a keyboard on lithographic transfer paper in long, narrow strips, using characters similar to printers' types, and then transfer the original to lithographic stones for printing as many copies as might be desired. The printing characters were engraved on wheels, one for roman, another for italic. The first of these machines was built for Clephane by A. Hahl & Co., of Baltimore, while another machine, also designed by Moore, for arranging the printed strips into lines and pages, was completed by a machinist named Maltby in Washington. This was in 1877, at which time a company had been organized to handle the process and machines—the National Machine Printing Company, capital \$28,000. Under experimental conditions the printing was satisfactory. In forming lines and pages of the required measures from the long, narrow printed strips, justification was effected crudely and unevenly in the manner illustrated in Fig. 2. It was when the transfer to stone was attempted that the invention proved to be unreliable. The stone could not be depended upon to take the transfer complete, or to reproduce it clearly when it did "take." In the building of this machine Clephane first came into contact with Ottmar Mergenthaler, who was then a foreman in the machine shop of his uncle, A. Hahl. Also, in this adventure Clephane and Moore first learned of the difficulties in the way of justifying lines to regular widths. Two printing machines were made. Both were sold to a New York company formed to operate them under license, and a not inconsiderable amount of printing was done on them, but none of it profitably.

But it appears that while working on his invention of the lithographic transfer process, described above, Moore evolved the idea of a stereotypic process, and succeeded in casting in a mold a type-high "slug," with printable type on its surface, the forerunner, in fact, of the present linotype slug. Moore, supported in his experiments by Clephane, patented his "slug" idea, and the Mergenthaler Linotype Company eventually became owner of that patent. Convinced that the stereotypic process was superior to the lithographic process he was using,

Clephane arranged with A. Hahl & Co. to build an apparatus for making the matrices, the result being the Rotary Impression Machine, patented in 1879, a later and improved variation of which is shown in Fig. 1 and described thereunder. A patent was granted to Mergenthaler for this machine, his first invention, which was, however, the property of Clephane. A page of matrices for the stereotypic process is shown in Fig. 2. Such a page was cast in a peculiar kind of mold, having a series of brass bars which separated the lines, so that though several lines were cast at one pouring of metal, each line left the mold a separate slug. This stereotypic process superseded the lithographic process. Mergenthaler's connection with it ceased in 1879. It was improved at various times by other machinists. However, this first Mergenthaler patent afforded him a basis for becoming financially interested in the National Machine Printing Company. He and Hahl were each given three shares of the par value of \$1,000 apiece, shortly after which the owners of the invention established a machine shop of their own in Washington, and Mergenthaler's connection with the evolution of the linotype machine ceased, not to be resumed until about four years later, in 1883. Mergenthaler thought so little of the future of the company that in 1881 he sold his three shares for \$60. Hahl, holding on a year or two longer, sold his three shares for \$900. These shares today represent a value of tens of thousands of dollars.

In 1882 Clephane persuaded L. G. Hine, a wealthy lawyer of Washington, to acquire a controlling interest in the National Machine Printing Company, which was still hopeful of its stereotypic process. A new company, the National Typo-

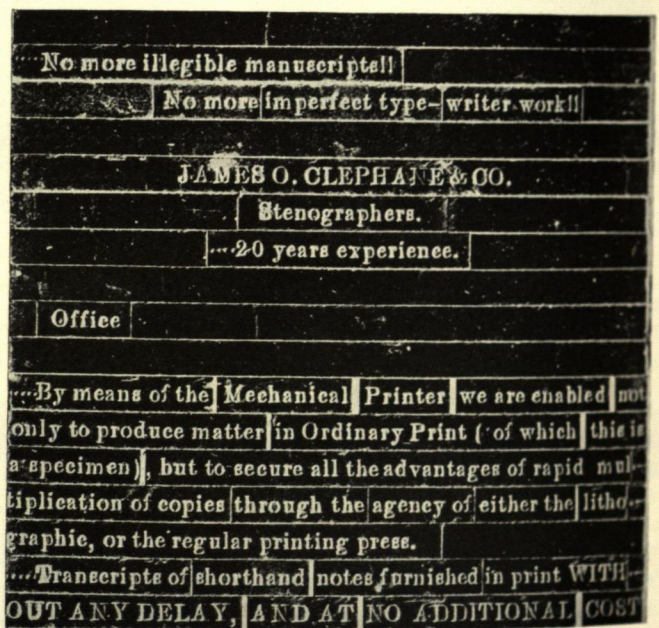


FIG. 2.—Reproduction from a matrix made by the rotary impression machine (Fig. 1), being an advertisement of the so-called mechanical printer. The letters were stamped one at a time into long strips of papier maché, about one pica wide. The strips were cut into line lengths and justified to the width of the page by cutting the strips to permit wider spacing between words, without regard to even spacing. When adjusted into lines, the line matrices were pasted on a tough piece of manila paper. Larger spaces and blank lines were made with blank matrix strips. Charles T. Moore, under whose directions Mergenthaler worked, devised an apparatus which made the justification and assembling of matrix lines much easier and quicker than the picture might lead one to suppose. The result was extremely crude, yet a market was developed for the product and Clephane was encouraged to proceed toward the linotype machine.

graphic Company, was formed, with a capital of \$1,000,000, which acquired all the interests and patents of its predecessors in the quest of a workable machine to eliminate hand composition. Activities in producing machines and apparatus for the stereotypic process were increased, without profit, but probably without loss. Meanwhile, Mergenthaler, who had gone into the machinist business on his own account on January 1, 1883, had been studying Clephane's objective. Out of his studies he evolved his first so-called "band" machine.

It was intended to produce papier maché matrices in single lines to any required measure, the matrices to be assembled as theretofore, as shown in Fig. 2. The radical new features

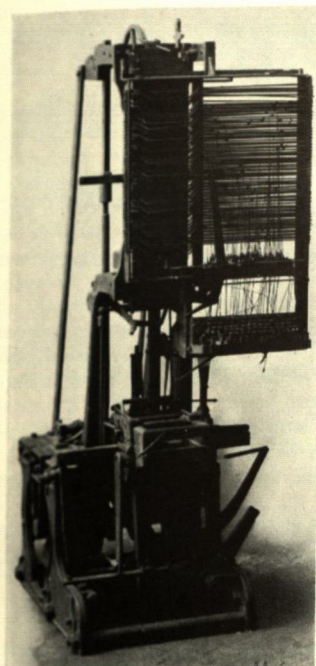


FIG. 3.—Mergenthaler's second "band" machine of 1884, on which the first line-of-type was cast, and in which a casting apparatus was first used, reproduced from a photograph of an incomplete and damaged machine, the last survivor. See description under Fig. 4.

were the abandonment of letter wheels and the substitution of bands or bars of metal, upon the edges of which were engraved in relief in steel all the letters and other characters used in ordinary type composition. At the touch of the corresponding key on the keyboard the bar dropped until the required letter came into alignment with other letters, which formed words and lines. The line of punches was then pressed into a long strip of papier maché, which in turn was assembled on paper and justified as in Fig. 2, after which each page was stereotyped in a hand mold.

During the development of Mergenthaler's first band machine, the means of improving it dawned on the inventor and his associates. One thought was: If a line of punches can be assembled and justified, why not a line of matrices? Another

thought was: If a line of metal matrices can be assembled, justified and controlled, why not make the cast direct from them? With these two thoughts the line-of-type machine was born! I am informed by a friend of Mergenthaler, who worked with him in developing the linotype machine, that it was Hine who suggested that the slugs might be cast in the same machine that aligned the band matrices, after he had been given the opportunity of seeing the process of typesetting in the typefoundry of John Ryan in Baltimore. The first casting apparatus applied in a linotype machine was a part of a hand typesetting machine bought from John Ryan. Mergenthaler is reported by his biographer, Schoenrich, whose biography was revised by the inventor and is in fact an autobiography, to have conceived the idea of "stamping matrices into his type bars and casting type metal into them in the same machine," while on a journey to Washington for the purpose of confessing the commercial impracticability of his first band or type bar machine, well as it worked in the machine shop. The National Typographic Company lost no time in ordering two of the band or type bar machines with band matrices and with a typefounder's casting apparatus attached.

It was in July, 1884, that the first line of type was cast in Mergenthaler's shop in Baltimore on Bank Lane on the "band" machine shown in Fig. 3. Hine and Clephane and their associates believed that they now had a practicable machine. A factory was set up in Baltimore, under the management of Mergenthaler, and preparations were made to begin manufacturing and selling. In this first linotype machine the most radical improvement was the introduction of a wedge justifier. In the first "band" machine Mergenthaler was still justifying in the crude way devised by Moore. In this second "band" machine the letter bands were justified by wedges placed between the words and spreading the lines to equal measures; but the wedge was not Mergenthaler's invention. The patent covering the first wedge justifier was bought by the National Typographic Company from Merritt Gally, well known to

printers as the inventor of the Universal Press, of which the Colt's Armory Press is now the most popular variation. Gally is also the original inventor of the player piano, player organ, and other remarkable and useful inventions. It was in 1872 that Gally was granted a patent for a machine to punch letters into papier maché, from which to make lines of matrices, in which justification of the letters was effected by wedges. Clephane and Hine and their associates believed they had reached their goal with this first line-of-type machine. A public exhibition was given in Washington in February, 1885, attended by President Arthur and many other celebrities. The affair ended with a banquet at which the guest of honor was Ottmar Mergenthaler. The banquet was presided over by Stillson Hutchins,

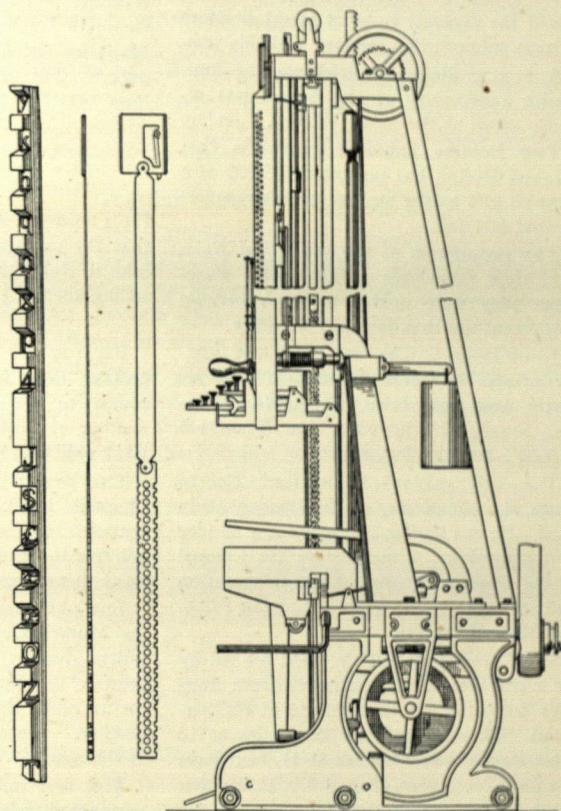


FIG. 4.—Detailed view of Mergenthaler's second "band" machine. At left, a magnified section of the "band" or bar, on one edge of which was punched matrices of all the characters of a font. Second to left, end view of a "band" drawn to same proportion as the machine itself. The bands were wedge shaped, the wedge being reversed on each alternate "band," so that under pressure from above the bands were wedged together tightly in the line of matrices. Third to left, side view of a "band" with notches in rear by which alignment was secured. By striking the corresponding key a band dropped until the desired letter matrix came into alignment with other letters in the line. There was a space key, but no automatic justification. Justification was effected by the operator extending the spacing by adding spaces until the line was full, consequently spacing was uneven. When the line of matrices was complete a mechanism carried it to the mold, where it was cast, after which each matrix band was lifted mechanically above the keyboard. As each "band" carried matrices for every character in the front, enough were required to fill a line as long as the mold would cast, which on this machine was twenty-three picas. In the third "band" machine a single justifying wedge was used for the first time, other details being as in the second or 1884 machine. These machines were complicated and expensive. None of them were put to practical use.

proprietor of the *Washington Post*, himself a stockholder in the National Typographic Company. *To him belongs the honor of coining the all potent word, Linotype, now the property of the Mergenthaler Linotype Company.* But, alas, the way of an invention is hard! The much-lauded machine was merely the promise of the actual linotype of commerce, which did not appear until six long and expensive years had elapsed.

(To be continued)

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