

THE RISE AND PROGRESS OF PRINTING

BY

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## THE RISE AND PROGRESS OF PRINTING

### I. Introduction

1. Definition: Printing is the art of taking an impression from an inked form, plate, block or stone.

2. Branches: There are several distinct branches of this important art, and each branch is, practically, a separate art, distinct from its rivals in its theory, its processes, and its applications. These methods are:

(a) Steel-plate and Copper-plate Printing, in which the subject is printed from an etching or engraving below the surface of a plate of steel or copper.

(b) Lithography, in which the subject is printed from a transferred engraving on the surface of a prepared stone.

(c) Xylography, in which the subject is printed from a design engraved on a block of wood in high relief.

(d) Typography, in which the subject is printed from a combination of movable metal types cast in high relief.

The arts of lithography and copper-plate are useful and beautiful methods of printing, but they do not make books and newspapers. The necessity which compels the making of a new engraving for every new subject restricts them almost exclusively to the field of art and ornament. If no other method of printing were known, encyclopedias and newspapers would be impossibilities.

"The art preservative of all arts" is not the art of lithography nor of copper-plate. This distinction rightfully belongs to

typography only.

The theory upon which this method is based is that of the independence of each character, and of the mutual dependence of all its characters. Every character is a separate and movable type, so made that it can be arranged with others in an endless variety of combinations. All other methods of printing require, at the outset, the engraving on one piece of wood or metal of all the letters or parts of a design, which, when once combined, cannot be separated; they can be applied only to the object for which they were first made. Typography is most successful when applied to the letters of the alphabet. It fails totally when applied to maps or to any kind of printed work requiring irregularly varying lines. It is only partially successful in the representation of combined ornaments and the characters of music. Its true field is in the representation of words and thoughts, and here it is supreme. The feature which gives to typography its precedence in usefulness over all other branches of the graphic arts is not so much its superior adaptation to impression or its superior facility for combining letters. Its merit is in the mobility of its types and their construction for combination.

## II. Discussion

1. History: The art of printing is of comparatively modern origin, only about 500 years having elapsed since the first book was issued from the press; yet we have proofs that the principles upon which it has ultimately developed existed among the ancient Assyrian nations. Entire and undecayed bricks of the famed city and tower of Babylon have been found stamped with various symbolic fig-

ures and hieroglyphic characters. In this, however, as in every similar relic of antiquity, the object which stamped the figure was in one block or piece, and therefore could be employed only for one distinct subject. This, though a kind of printing, was totally useless for the propagation of literature, both on account of its expensiveness and tediousness.

The Chinese are the only existing people who still pursue this rude mode of printing by stamping paper with blocks of wood. The work which they intend to be printed is, in the first place, carefully written upon sheets of thin, transparent paper; each of these sheets is glued, with the face downwards, upon a thin tablet of hard wood; and the engraver, then, with proper instruments, cuts away the wood in all parts on which nothing is traced, thus leaving the transcribed characters in relief and ready for printing. In this way, as many tablets are necessary as there are written pages. No press is used; but when the ink is laid on, and the paper carefully placed above it, a brush is passed over with the proper degree of pressure. A similar kind of printing by blocks for the production of playing-cards and rude pictures of scriptural subjects was in use in Europe toward the end of the 14th century.

But in all this there was little merit. The great discovery was that of forming every letter or character of the alphabet separately, so as to be capable of rearrangement, and forming a succession of pages of work, thereby avoiding the interminable labor of cutting new blocks of type for every page.

(a) The True Inventor. The credit of discovering this simple yet marvelous art is contested by the Dutch in favor of Lawrence

Coster, of Haarlem, between 1420 and 1426, and by the Germans, on behalf of Johann Gansfleissch, of Mentz, of the Gutenberg family, about 1438. It is the belief of some authorities that the discovery was made almost simultaneously, but the stronger argument seems to be in favor of Coster. It is said that as he was walking in the woods contiguous to the city, which was the general custom of the richer citizens and men of leisure, in the afternoon and on holidays, he began to cut letters on the bark of the beech; with these letters he enstamped marks upon paper in a contrary direction, in the manner of a seal, until at length he formed a few lines for his own amusement and for the use of the children of his brother-in-law. This succeeding so well, he attempted greater things, and, being a man of genius and reflection, he invented, with the aid of his brother- or son-in-law, Thomal Pietrison, a thicker and more adhesive ink, as the common ink was too thin and made blotted marks. With this ink he was able to print blocks and figures, to which he added letters. In the beginning he printed on one side only. Spiegal enser Behondenisse is thought to be one of the first books printed after the invention of the art, because the leaves are pasted together that the naked sides might not be offensive to the eyes. The new art attracted numerous customers, and thus did the profit arising from it increase his love for it and his diligence in the exercise of it.

The necessity for employing workmen to assist in prosecuting the art led to the divulgence of the secret. Among these men, it is supposed, was John Gutenberg Sr., who assisted at the press under oath. After learning the art of casting the types, setting t

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them, and other processes belonging to the art, he thought himself sufficiently instructed and watched his opportunity for escape. As he could not find a better, he packed up the types and other articles on Christmas eve, while the family was engaged in celebrating the festival, and stole away with them. He first fled to Amsterdam, thence to Cologne, until he could establish himself at Mentz, as a secure place, where he might open shop and reap the fruits of his knavery. At Mentz he communicated the secret to his nephew, John Gutenberg, an ingenious artist of Strasburg. It is in evidence that the latter, in connection with two partners, spent a considerable amount of money in some private experiments. These appear to have occupied several years, from 1436 to 1439, when a legal contest arose as to the rights of one of the partners whose zealous activities had caused his death. Gutenberg continued at Strasburg till 1444, when, his means being exhausted, he rejoined his uncle at Mentz. Here he renewed his experiments and, needing money, procured an introduction to John Fust, a capitalist and money-lender, who seemed to have been struck with the importance of the work and advanced a considerable amount in the furtherance of the enterprise. Two years were occupied in making the types and necessary machinery, when the work of printing the Bible was begun.

(b) Spread of the Art. It was of course impossible to conceal the knowledge of an art so useful to man, and within ten years after the publication of the Bible presses were established in several German cities, in Rome and other parts of Italy, and soon thereafter in France and England?

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1. Introduction into England. Previous to 1471 printing had reached Rome, Venice, Florence, Milan, Paris, Teurs, and other continental cities, and about the same year or a few years later, 1476 or '77, Caxton introduced the art into England by setting up a press within the precincts of Westminster Abbey.

When the art had spread throughout the country, when education became more common and men began to read about the questions and events of the day, it began to be seen by the authorities and rulers that a mighty power for good or evil had arisen in the land. Then it was deemed necessary to regulate the press. In 1530, censorship was established in England. It ushered in a period of lamentable decadence in the quantity and quality of the printing done. Printers were cruelly punished, especially during the existence of the unconstitutional Star-chamber. Oppressed, abused, and often imprisoned, printers lost all enterprise and all social position. For many years there were no good printers at all. Then began a period of revival, greatly aided by the improvements of type-founding in the middle of the 18th century. Censorship was abandoned in 1694.

2. Introduction into Scotland. It is believed that printing was introduced into Scotland in 1507, and as early as 1508 several small publications were issued. Up to 1600 the average workmanship of the Scottish printers was about as bad in quality as that of their later successors has been distinguished for its beauty, excellence, and accuracy.

3. Introduction into America. Printing was first introduced into America at Mexico, by the Viceroy Mendoza, in 1536. The first

book printed was Escala Espiritual de San Fuan Climaco, of which no copy is known to exist. In 1638 permanent provision was made for a college at Cambridge, and the first printing press, in what is now the United States, was established at the same place. Thus early was established the school and the press, which have stood in close relationship with American art and industry. The press erected at Cambridge, in 1638, and which went into operation in the beginning of the following year, was brought from England by Rev. Mr. Glover, who had engaged in England a printer, named Daye, to conduct it for him. Mr. Glover died on the passage over, but the press was set up by Daye, at Cambridge, where, in January, 1639, he printed the "Freeman's Oath," which was the first issue of the Colonial press.

(a) The First American Book. In 1640, "The Psalms, newly turned into metre," which had just been translated from the Hebrew, with close fidelity to the original, by Rev. Mr. Weld and Rev. John Eliot, was printed by Daye, at Cambridge, and was the first production of the American press in book form. It was called the "Bay Psalm Book."

(b) The First American Newspaper. Richard Pierce commenced printing about 1684 and is chiefly entitled to notice as the printer of the first newspaper sheet ever published in the New World. It was started in Boston, in 1690.

About two hundred newspapers were published in the United States in the year 1801, of which seventeen were issued daily, seven three times a week, thirty twice a week, and one hundred forty-six, weekly. There must also have been at the same time as many as sixty offices engaged in

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miscellaneous printing. In 1810, three hundred fifty-nine newspapers were published in the United States --an increase of two hundred forty in nine years.

From this time on the amount of printed literature rapidly increased, and to-day in England and the United States the art of printing has attained to extraordinary proficiency.

(c) Improvement of the Press. One line along which great improvement has been made is that of the press.

1. Franklin Hand Press. Turn, for a moment, to the old Franklin hand press. It was constructed almost entirely of wood, though iron was subsequently used in many of its parts. On the clumsy frame the great statesman has left the mark of his inky fingers.

2. Earl Stanhope's Invention. In the early part of the 19th century Earl Stanhope invented a press made entirely of iron, the frame being cast in a single piece. The power was applied by a combination toggle joint and lever.

3. Columbian Press. The Columbian press was invented by a Philadelphian in 1817. The power was applied by a compound lever.

4. Washington Press. In 1829 the Washington press, by Samuel Rust, was invented, and many improvements were introduced in inking; later a self-inking device was invented.

5. First Power Press. The first power press produced in America was that of Daniel Treadwell, of Boston, in 1822.

6. First Rotary Press. The first attempt to make a rotary press was that of Frederick Konig, in 1814. In this the type moved horizontally, and it could give 1800 impressions per hour.

7. First Type-Revolving Press. The first great step toward

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facilitating the rapid and cheap production of the modern newspaper was made by Col. Robert Hoe, of New York, about 1840, when the first of the type revolving presses was built.

8. Applegate Machine. About the same time a type-revolving press on materially different lines, the Applegate machine, was brought into practical use into England. This machine was first employed by the London Times, in 1848. In this machine the type-holding cylinder revolved on a vertical axis, and the machine could print about 12,000 single sheets on one side in an hour.

9. Modern "Perfecting" Press. So gradually the modern "perfecting" press, so-called because both sides of the paper are printed in passing through the press, was introduced. In the largest size, the octuple machine, this press prints, folds and counts 96,000 completed eight-page papers per hour, or 48,000 sixteen-page papers, the size of the page being that of the ordinary daily newspaper.

(d) The Type-setting Machine. Many are the improvements connected with the art of printing that have taken place within the last century, but, in the way of labor-saving devices, nothing surpasses the type-setting machine. This problem of mechanically composing type has occupied the attention of inventors since early in the 19th century, the first recorded attempt being that of Benjamin Forster, in London, in 1815.

1. The First Patent. The first patent for the type-setting machine was granted to Dr. Wm. Church, of Boston, Mass., as early as 1822 and since that time over one hundred twenty machines have been introduced.

2. Alden Machine. The Alden machine was first heard of in 1857. Over \$800,000 has been expended in its development, and it is still in the hands of the inventors.

3. Empire Machine. In 1875, Green and Burr brought out the Empire machine, and it has been used with considerable success. One machine, operated by two men, will turn out about as much solid matter in a day as could be set by seven or eight ordinarily good compositors. This machine is found in American and European offices to-day.

4. Thorne Machine. The first radical change in the system of mechanically composing individual types was made by Joseph Thorne, who, in 1880, constructed a combined distributing and composing machine, which permitted distribution and composition to proceed synchronously. This was an important advancement in the art, the compactness of the machine being another point in its favor. This machine met immediate success and went into use in a large number of printing-offices. In 1898 the company was succeeded by the Unity Company and the entire machine remodeled and brought out as the Simplex One-man Type-setter. The output is from three to four thousand ems per hour, with one operator.

Innumerable other inventions for the furtherance of the art have been made, among prominent inventors there being the names of McMillan, Typobar, Converse, Paige, Scudder, Lanston, Brott, Dow, Cox, Calendoli, Fowler and Rogers.

5. The Linotype. But the name of Ottmar Mergenthaler stands foremost, for to him belongs the honor of being the original inventor of slug- or line-casting machines. The linotype was the

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culmination of seven years of fruitless struggling to produce a machine to displace hand composition by various means. In 1883, abandoning all attempts to produce a machine on the lines previously prosecuted, Mergenthaler conceived the idea of assembling a line of dies or female matrices and casting into them molten metal to form a complete slug or line of type. Two machines were built and the idea proven entirely practicable. In these machines the letters were stamped on the edges of upright bars, each bar containing the letters of the entire alphabet, the operation of the key-board acting to set up stops which allowed these bars to descend to the proper distance, when a cast was taken from the aligned matrices. The wedge justifier, over the invention of which litigation afterward developed, was incorporated in the second machine built, in 1885. The impossibility of making corrections as soon as discovered led to the conception of the independent matrix machine, which was next built in 1885, and this marked the advent of the linotype as a new factor in the printing world. Over two hundred machines of the new pattern were constructed, sixty of which were sent to England, leading newspapers in both countries installing them.

In 1890 Mr. Mergenthaler made a vast improvement over the previous style. With the exception of its square, massive base, weighted justification levers, and other minor details, it resembles the present form of linotype. Mr. Mergenthaler continued to make improvements on the machine until the time of his death, in 1899.

The linotype has developed step by step as experience directed, and improvements are still going on. The latest linotype permits

any size of type from agate to pica to be composed in any length of line from five to thirty ems pica. Fifteen different languages are now set on the linotype in as many different countries. The linotype has revolutionized composing-room methods, and more than eight thousand of these machines are in use to-day in all parts of the civilized world.

(e) The World's Greatest Print-Shop. Let us examine, briefly, the greatest print-shop in the world, namely, the Government Printing Office at Washington, and comprehend, if we may, something of the marvelous growth of this important art. In 1861 there were three hundred employees and \$500,000 covered expenses. To-day there are four thousand employees and over \$5,000,000 is required annually to meet its requirements. Some idea of the growth of this institution is shown by the fact that when the first government printing-office was established 60,000 square feet of floor space was sufficient, whereas at present 377,200 square feet is none too much to give all branches of work ample quarters.

There is always a million and a half pounds of type in stock, and yet this is not considered sufficient, for at least two hundred fifty tons are always tied up in live standing matter on the galleys. The annual pay-roll of this establishment approaches three and one half-million dollars. The proof paper alone consumed in the composing-room costs \$25,000 a year. Over 40,000 pounds of printing ink are used in twelve months, and ten tons of roller composition are necessary to keep the presses in good order. The paper bill, of course, is the largest supply item, and amounts to over \$800,000 a year, which means a daily average of about fifteen

tons of paper and cardboard. Last year 1,648,214 bound volumes figured as a formidable part of the output.

The first building acquired by the Government in 1861 was a four-story structure, then considered large, and in 1896 Congress provided for a new seven-story annex, 27x169 feet, and last year the printing plant proper was moved into a new seven-story, fire-proof building, which has a frontage of 408 feet on one street, 175 feet on another, and 278 feet on the alley. The new building cost two and one-half million dollars. It is as absolutely fire-proof as modern science can devise, and is equipped with a power plant which operates 500 electric motors.

Owing to the immense weight to be carried by the walls and floors, the maximum strains were provided for, and the foundations of interior columns and walls are pyramids of concrete extending to bed-rock. The new building rises to the height of one hundred twenty-five feet. Six hundred tons of steel were used in the framework and nearly 7,840,000 bricks were required to enclose the walls. The floors are so constructed as to carry a load of three hundred pounds to the square foot. Every machine operated in the building has its own motor, the electricity being carried in the floors. Between the floor and the ceiling spaces are conduits for this purpose, the floors themselves being built of solid brick arches and hollow tiles. All the window- and door-frames are of iron, as are also the base-boards, so that with the exception of the floors themselves, which are of hard maple laid in asphalt, there is absolutely no wood about the building. The walls of the building are devoted, whenever possible, to window space, there being nine

hundred windows in the structure. The plumbing, heating and ventilating systems are of the most modern character, and fifteen elevators for passengers and freight are to be found in various parts of the building.

The character of the work done in the Government printing-office covers almost every conceivable phase of typographical art. It ranges from the printing on sheepskin of a single copy of an important treaty to the issuing of some report contained in a score or more of large volumes. As an indication of what can be done in this magnificent plant operated by its thousands of employees, I mention the fact that in 1899 the president of the United States sent to the Government printing-office, accompanied by a short message, the report of the Naval Court of Inquiry upon the destruction of the Maine. When printed that report contained two hundred ninety-eight pages of text, 15x7 inches, twenty-four full-page engravings, and a four-color lithograph. It was not until 3:00 o'clock in the afternoon that the shop got the originals of the illustrations and it was after six o'clock that night when the manuscript reached the foreman's hands. Before Congress assembled the next morning a complete copy of this bulky volume, bound in pamphlet form, was upon every desk in the Senate and House, containing, as it did, the illustrations, lithograph, and text as perfect as if a job printer had been given a month in which to do it. That is to say, a thousand copies of a book of more than three hundred pages were manufactured in sixteen hours from the time the manuscript reached the foreman's composing room.

### III. Conclusion

Thus we see that an art which was once strictly forbidden by the Government, stands, in this twentieth century, foremost among the great inventions of the world. Close the printing establishments the world over for a single day and what would be the result? Wipe out of existence any one of the great inventions that the world has ever known, and what would be missed more than that of printing? Should all literature cease to be issued from the press, an inestimable check would be laid upon the educational advancement of mankind. The school and the press go hand in hand, each dependent upon the other, and consequently time, brains and money should be equally expended in seeking their perfection.