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STORIES of New Jersey

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FIVE HUNDRED YEARS OF PRINTING

The huge automatic presses that rumble in printing plants all over the country are turning out many thousand words this year about a clumsy little wooden press built and painstakingly operated by Johann Gutenberg five centuries ago. The world is celebrating the 500th anniversary of the invention of that little wooden press, the foundation of the great structure of the printed word.

Four other printing anniversaries are also being celebrated: the 400th anniversary of the first printing in the New World; the 300th of the first known book produced in the American colonies; the 250th of the first paper mill in what is now the United States; and the 150th of the death of Benjamin Franklin, whose name is connected with the early days of not only American printing but also printing in New Jersey.

In a three-block-long building a printer presses a button. A low hum and a growl answer him, and tons of steel, brass and lead begin to revolve. Faster and faster the huge rollers turn; the hum changes to a whine and then a roar as the long web of paper is pulled over the spinning cylinders. The paper moves five miles an hour--then ten--fifteen--and even twenty. Rollers hiss as they cover the type and engravings with glistening red, blue, yellow and black ink. The freshly printed paper dries as it rushes over glowing burners. At the end of the block-long machine emerge finished magazines, printed, folded, cut and counted, ready to be shipped away to cities and towns and mail boxes all over the country.

The ancestor of these complicated modern machines is Johann Gutenberg's shaky wooden press that printed one sheet at a time. Gutenberg, in turn, owed his invention to thousands of unknown men in Africa, Asia and eastern Europe who developed writing and the alphabet.

To print means "to press a mark, a figure or an illustration upon another substance." The ancient king who pressed his seal on a piece of wax was a printer. Seals and dies had been known in many countries for thousands of years before Gutenberg, but the Chinese were the first to print books. Scholars have found one Chinese book printed from page-size wooden blocks in 868 A.D., and it is thought that the Chinese used individual letters of type as early as the eleventh century. Gutenberg and his contemporaries, however, were familiar only with the use of wooden blocks with figures engraved on them for imprinting designs on clothing materials and playing cards.

For centuries before Gutenberg books and learning had played little part in the lives of Europeans. The destructive wars and social disorder that followed the fall of the western Roman empire in the fifth century brought commerce

virtually to a standstill, and the ancient art of writing was kept alive only by monks who copied by hand the writings of the ancient philosophers and historians at the rate of 25 pages a day. By the eleventh or twelfth century trade revived and schools and universities reappeared. Soon books were being copied in large numbers by private publishers as well as in the monasteries.

Against this background Gutenberg invented the printing press and movable type: and production of paper, which replaced the extremely costly parchment, made possible less expensive books in greater number.

Printing came first to the Americas not in Boston or Philadelphia or New York but in Mexico City, where by 1540 religious books were being turned out for the use of the Catholic church in teaching Christianity to the natives. Before printing presses appeared in the English cities of Liverpool, Leeds and Birmingham, they were already operating in Massachusetts, Maryland and Pennsylvania. On the press in Massachusetts, the first in British America, a broadside called *The Freeman's Oath* was printed in 1639. The following year the Bay Psalm Book appeared, the first American publication of which copies exist.

Toward the end of the seventeenth century colonial governors were ordered to see "that noe person keep any press for printing, nor that any book, pamphlet or other matters whatsoever bee printed without your especial leave & license first obtained." Governing officials had the right of censorship, but government printing was the printers' main source of income. The government's need for printing is considered the chief factor in the establishment of printing shops in the colonies.

The first trial for violations of a colonial press law came in Pennsylvania in 1692. William Bradford, one of America's earliest printers and member of a famous printing family, published an anonymous pamphlet supporting the minority sect in an internal quarrel among the Quakers. For issuing a publication without a license he was arrested but never convicted.

New Jersey's first press belonged to Bradford, who shifted his plant to Perth Amboy temporarily to print an issue of currency in 1723 and at the same time printed a set of New Jersey laws. Benjamin Franklin came to New Jersey to print money, too. In 1727 he built a copper-plate press, "the first that had been seen in the country," and set it up in Burlington for Samuel Keimer, who had just obtained a government printing contract. Keimer had called Franklin to assist him on the job because only Franklin could supply the necessary type and engravings. Like Bradford, Franklin and Keimer also printed an issue of Jersey laws.

The first permanent press in New Jersey was set up in 1754 at Woodbridge by James Parker, a former New York printer. The first of his many government printing jobs was *The Votes and Proceedings of the General Assembly of the Province of New Jersey*, but his most significant work, perhaps, was the *New American Magazine*, a 40-page monthly that offered a varied diet of essays, stories, verse, history and current events. Brought out in 1758, it lasted only 27 issues, though it was the only publication of its kind in the colonies.

Samuel Smith's history of New Jersey, the first book printed in the colony, also came from Parker's press. At a branch shop in Burlington, where the author lived, Parker spent six months turning out 600 copies of the 570-page work. He also aspired to be a newspaper publisher, but the Stamp Tax on printed matter made success doubtful. Parker felt so strongly about the impending tax that in 1758 he permitted William Goddard, later a prominent editor, to use the Woodbridge press to print a violent attack on the Act. The papers were taken secretly to New York, where the newsboys hawked them on the streets. Called "The Constitutional Courant, containing matters interesting to Liberty--but no wise repugnant to Loyalty," the paper stated that it had been published "by An-

drew Marvel, at the Sign of the Bribe refused, of Constitution Hill, North-America."

Parker's death in 1770 left an opening for a printer in New Jersey, and Isaac Collins of Philadelphia set up business in Burlington that year. Shortly afterward he became printer to the government. With the backing of the legislature Collins established in December 1777 the *Jersey Gazette*, the first regular newspaper in New Jersey. The paper was printed at Trenton from 1778 until it was discontinued in 1786 for lack of patronage. Collins also printed editions of the New Testament and the Bible and a compilation of the State laws from 1776 to 1783.

In 1779, as opposition to the British-controlled newspapers of New York, Sheppard Kollock, a Continental Army lieutenant, began publishing the *New-Jersey Journal* at Chatham. To this obscure village, out of reach of the British troops, the Revolutionary Army sent paper and, when no paper was to be had, remnants of old army tent cloth to be made into paper.

Kollock and a partner began the *Political Intelligencer* at New Brunswick in 1783, but two years later Kollock became sole owner and moved his paper to Elizabethtown, where he published it as the *New-Jersey Journal* until 1818. The *Elizabeth Daily Journal*, one of the oldest newspapers in the country and the oldest in the State, is its direct descendant. Among the important books Kollock printed in Elizabethtown was one of the earliest editions of Weems' *Life of Washington*, in which the famous cherry tree first appeared.

Another New Jersey printer was Philip Freneau, "Poet of the Revolution." Freneau set up a press at his home at Mount Pleasant and published a small weekly paper called the *Jersey Chronicle* in 1795-6. He also printed a collection of his poems. (See Bulletin No.3, Series 1939-40.)

The value of New Jersey printing kept pace with and even grew faster than that of the rest of the country during the nineteenth century and up to the present. In 1931 the industry reached its peak production of 53 million dollars. Though now the printing business accounts for less than 2 percent of the annual total production value of the State's industry, it amounts to more than 44 million dollars.

The big period of increase in the country, but especially in New Jersey, came after 1850. While the value of printing for the United States multiplied about 26 times between 1860 and 1914, the New Jersey product jumped 36 times in value. Increased population was a factor in this growth, but technical developments were also important. New Jersey printers quickly adopted the new inventions.

The last United States census of manufactures in 1937 listed 589 plants in New Jersey that produce at least $5,000 worth of printing annually. They employ 8,500 wage earners and pay them annually more than 13 million dollars.

PAPER AND INK

In these days when newspaper plants turn out huge editions of 64-page newspapers in several hours, it is difficult to realize the problems that confronted the colonial printer. Now a paper dealer can deliver practically any quantity of paper in almost any color or size. Even small dealers stock ink by the ton. And type is cast in complete lines by a machine that operates almost as easily as a typewriter, or in individual pieces by machines that produce thousands of letters every hour.

But in colonial times type, ink, paper and a press were all made by hand, slowly and laboriously. Almost all the newspapers then carried appeals for linen rags, for it was only from this material that paper could be made. To make paper the linen was soaked in water and beaten to a pulp which was poured

into wooden frames the size of the desired sheet. The bottoms of the frames were made of strands of criss-crossed wire like a coarse screen. The layer of pulp was pressed until most of the water was forced out and it had formed a damp sheet, which was taken carefully from the frame and placed between felt pads. Many of these sheets and pads, one on top of the other, were placed in a powerful press that squeezed out all the water and made the sheets very thin and fairly strong. They were then hung like wash to dry.

The quality of the paper depended on the skill of the papermaker. If the pulp were poured into the frames unevenly, the sheet would be too thin in some spots and too thick in others. Because they were so fragile it was an achievement to handle sheets 15 by 25 inches. Books and newspapers were smaller, and good printing was difficult with the uneven paper texture. The modern paper machine, using a pulp made of wood, old paper, rags or even potato peelings, turns out a continuous sheet of paper more than five feet wide and thousands of feet long. The modern printer with sheets of perfectly uniform paper large enough to hold 64 pages can print a book of 256 pages in four printings. Bradford or Franklin would have had to print the 256-page book in 32 printings.

All the good paper was imported from Europe at first, but gradually mills were built here and slowly the quality of their product improved. By 1810 there were 185 mills operating in the United States, producing paper that was comparable to the imported variety.

The lampblack, linseed oil and resin for ink were more plentiful than linen for paper, but the process was delicate and unpleasant. Lamp black is soot such as a burning match deposits. Mixed with varnish, which is composed of linseed oil and resin, it forms black, sticky printer's ink. Linseed oil, extracted by crushing and pounding flax seed, is strained, filtered and boiled until thick. As it boils, powdered resin is added. According to old records the bubbling oil smelled so unpleasant that people never lived near ink mills. The oil had another inconvenient habit--it often exploded, and some ink makers boiled the oil outdoors.

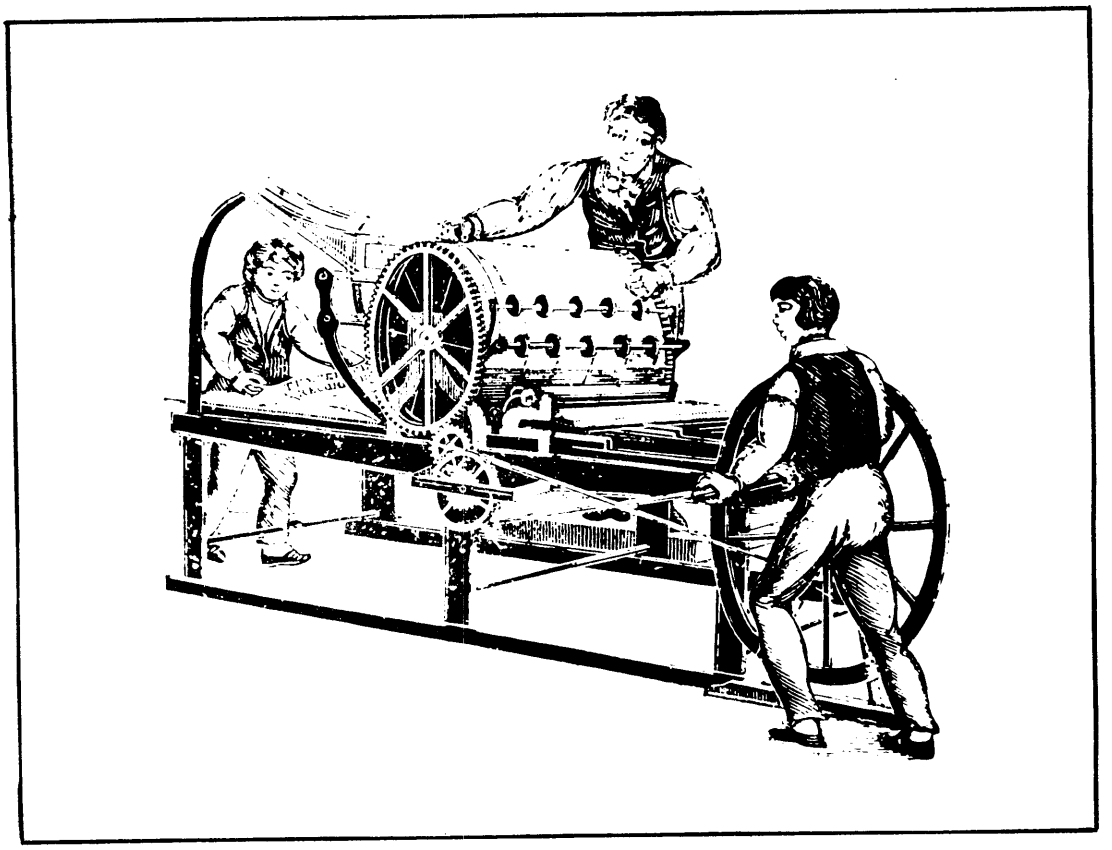
Printers bought varnish and lampblack separately and mixed them together on a mixing block. The wrong amount of resin or too much or too little boiling resulted either in ink that would not dry or ink that would not spread evenly.

THE PRINTING PRESS

Gutenberg's press consisted of a wooden screw that pressed a sheet of paper against a form of freshly inked type. After each sheet was printed, the screw had to be loosened, the paper removed and the type re-inked. With the relatively weak wooden screw the paper could not always be pressed against all the type evenly, and sometimes parts of the printed matter could scarcely be read. To offset this printers used to dampen the paper to make it more pliable.

A greater defect was the immovability of the bed of type, which made it necessary for the printer to lift the type out of the press to ink it. About 1620, however, Willem Janszoon Blaeu of Amsterdam, Holland, designed a press on which the stone type bed could be shifted to one side after a sheet had been printed. Blaeu also substituted an iron screw for the wooden one and by this improvement was able to print much more evenly because he could put more pressure on the paper.

Using a screw to press the paper against the type was not discarded for many years, but eventually presses were perfected that used a simple, powerful lever instead. The lever quickly and easily brought the type and paper together in a single movement and just as quickly drew them apart for removing the sheet and re-inking the type.



An early flat bed press. The printer is clamping the paper to the cylinder by hand. Later presses had automatic fingers that gripped the paper as the cylinder turned.

Inking the type held back the development of rapid printing. Despite improvements, the printing presses of 1800 were little, if any, faster than those that Blaeu had built in 1620. Between each impression the type still had to be inked by hand with leather pads or ink balls.

William Nicholson was the first to hit upon a speedier method of printing. His invention was the cylinder press, so called because of the heavy cylinder which grasps the paper and rolls it over the type. Since the cylinder could press paper against the type much more quickly than the old-fashioned screw, Nicholson's machine was potentially faster--but only faster if some quick method of inking the type were devised. In 1790 he conceived the idea of making a roller to spread the ink over the type, but he could never find a workable material for it. He tried making rollers of layers of cloth covered by pliable sheep pelt like the sheepskin-covered wool ink pads. A roller made this way, however, was too irregular to equal the smooth hand-inked job.

In 1813 a man named Foster (or Forster) watched potters painting their products. Their dabbers were covered with a rubbery substance made of glue and molasses. Foster used the mixture to make better ink balls, but someone else combined Nicholson's and Foster's inventions for speedier printing. In 1814 an historic edition of the London *Times* was printed--the first ever run on a cylinder press. The press used many of Nicholson's ideas in its construction; the ink was spread by wooden rollers covered with a mixture of glue and molasses.

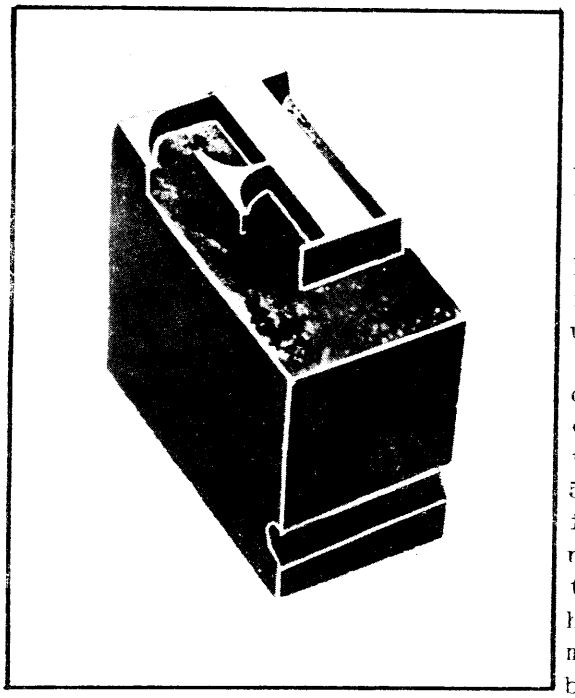
The pace of printing was stepped up, limited only by the speed with which men could fasten sheets of paper to the cylinders. D. Napier, a London machin-

ist, contributed the next major development: a set of automatic steel fingers that gripped the paper as the cylinder turned. Swiftly moving belts piled the finished sheets in stacks.

This type of cylinder or flat bed press is still used for most of the good printing. Had the printing of books been the only consideration, development might have stopped. But newspapers needed a still faster press, one that could print both sides of the sheet and many pages in one operation. In 1851 at the Crystal Palace Exhibition in London a small press was exhibited that printed from a continuous roll or "web" of paper. The idea was used by William Bullock, who built a large newspaper press in 1865. From this "web" press there developed the modern newspaper press that can print, fold and count more than 60,000 newspapers per hour, each containing 64 pages.

A practical method of putting type on a cylinder had to be invented before the block-long mammoths of today could begin their building-shaking production. On some of the early cylinder presses wedge-shaped type was set directly on the cylinder, but that was awkward and slow. Then came the invention of a molding machine which permitted the stereotyping of semicircular plates. The type is set in a huge flat form and an impression taken with damp papier-maché. This is dried, bent into a semicircle and placed in the molding machine. Lead is poured in and a curved replica of the original is formed. The curved plates are bolted to the press cylinder, ready to stamp their message on the speeding web of paper.

TYPE AND TYPESETTING



A piece of foundry type.

Type and typesetting developed as slowly as the printing press. Until the seventeenth century printers made their own type, engraving dies by hand, punching the matrices or metal molds and casting the individual letters out of lead. Then type making became a separate craft. Some of the early type designers such as Caslon, Baskerville, Elzevir and others made letters so beautiful and legible that their styles are still used today.

There were too few printshops in the colonies to support a foundry, and printers imported type at great expense. By the time of the Revolution, however, there were 50 printshops here. Shortly before this, in 1769, the Connecticut Assembly had recognized the need for a foundry by granting £100 to Abel Buell, a silversmith, provided that he build one. Buell, who had been experimenting with type, never built his plant, but six years later a firm in Germantown, Pennsylvania, was turning out quantities of type.

Type is kept in a wooden drawer, divided into little boxes for the individual letters, numbers, punctuation marks and symbols such as $&*. Printers will set type by hand, but only for small jobs and special editions of books. The typesetter spells out each word by picking up the individual letters and placing them in a typeholder called a stick. To write the word "the" in type,

for example, the typesetter first picks up the "t", then the "h" and finally the "e". This takes a tremendous amount of time, but time was cheap until the middle of the nineteenth century, and the whole printing process was slow.

Lack of type was another problem. To set a 100,000-word book would take about 500,000 letters, which is much more than even printers today have in one size. The book would have to be set in sections, printed and the type put back in the case before the next portion could be set.

When a press was developed capable of printing a complete newspaper edition in a few hours, the typesetters had to work at an exhausting pace. More and more typesetters were employed to make up in numbers what hand setting lacked in speed, but still there was a lag. A machine was needed.

Successful machines were invented to set the type, but there was still the problem of getting the type back into the machine quickly so that it could be used again. Among the men seeking the solution to that problem was young Ottmar Mergenthaler, a watchmaker and machinist, who was hired by a group of promoters to perfect a typesetting machine in which they were interested.

In his first workable machine the operator used a keyboard like a typewriter's to punch out papier-maché matrices or molds. The molds were cut and spaced evenly in full lines, and lead was poured into them by hand. This was slow, however, and the inventor, after several experiments, finally hit upon his now famous machine. Brass matrices of individual letters are stored in a magazine from which they drop one by one as the keys on a keyboard are pressed. When a line is completed, the matrices automatically move over to the melting pot, which is full of molten lead, and the line of type is cast in one piece. The matrices are then brought to the top of the magazine by an automatic arm and dropped into their proper places. This distribution is made possible by the notches, like those in a door key, at one end of each matrix.

This machine was demonstrated in the composing room of the New York *Tribune* on July 3, 1886. Whitelaw Reid, publisher of the paper, christened it the Linotype because it cast a line of type at a time. In 1893 the Newark *Daily Advertiser* installed a machine. Not only did the Linotype set the type with speed and distribute the matrices automatically, but it cast fresh type for each job and so made better-looking printing.

OTHER PRINTING PROCESSES

Most printing is done with raised type from which the ink is transferred to the paper. This is called the relief method. There are, however, two other major systems of printing, each with many variations. For *intaglio* printing ink is applied in almost liquid form to letters cut into a flat surface, and the paper is forced into these depressions to absorb the ink. Used on web or rotary presses, it is called *rotogravure*.

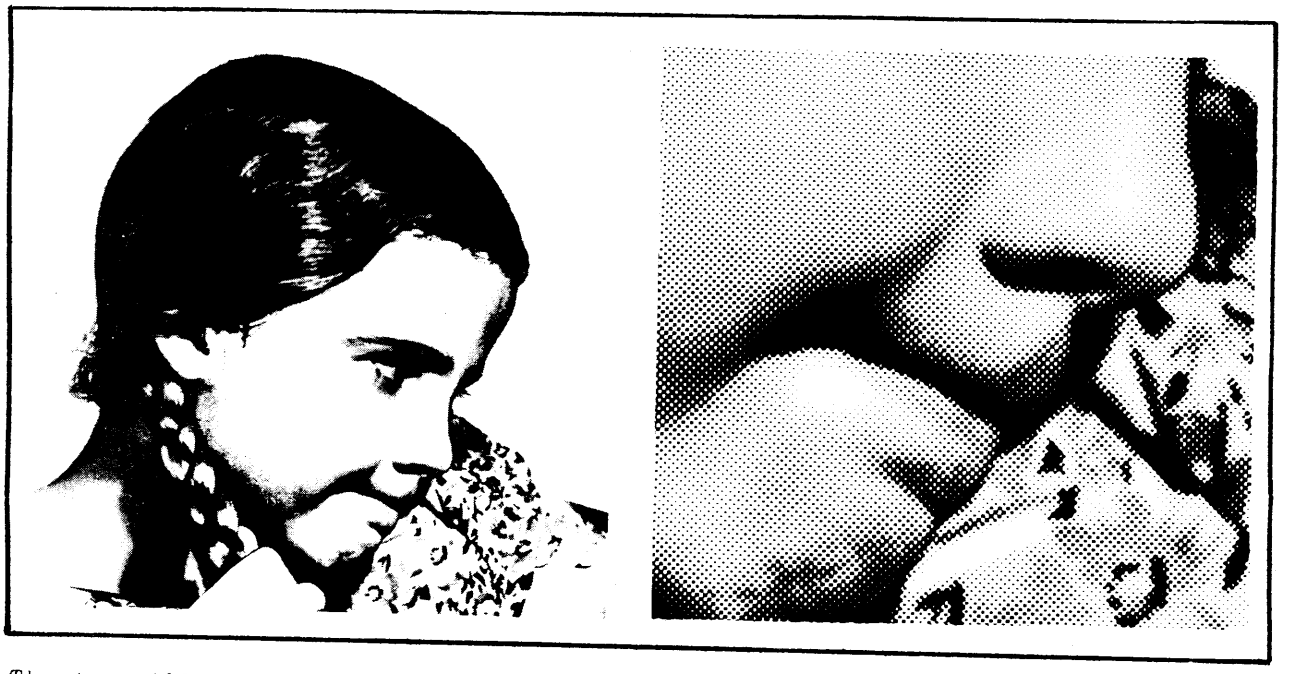
The relatively inexpensive *planograph* or offset method is halfway between the relief and the intaglio processes. The plates are perfectly smooth, and by a chemical process the letters hold the ink while the rest of the plate repels the ink. Material already printed can be photographically transferred to planograph plates, thus eliminating typesetting. This bulletin was printed by the planograph method.

ILLUSTRATIONS

Woodcuts became increasingly elaborate as they began to be used to illustrate books. In the last half of the fifteenth century engravings on metal were substituted for woodcuts. On metal much truer pictures could be reproduced. By putting a series of thin lines close together various shades of gray

were obtained. The closer the lines, the darker the shading.

But in 1839 Louis Daguerre invented the daguerreotype, and printers were faced with the problem of reproducing a photograph. A method had to be discovered that would translate all the delicate shades of a photograph into solid black and pure white. A plan was evolved to break the picture into little black dots by rephotographing it through a screen. The black parts of the picture photographed as dots that filled the holes in the screen; the gray parts made smaller dots; and the white portions made no dots at all. Because this method reproduced not only black and white but also the in-between tones, it was called half-tone engraving



The two illustrations above are half-tones. The picture at the right is an enlargement of the nose, mouth and chin of the girl. The enlarged dots that give the effect of shading are clearly visible.

The plates for pictures, called "cuts," work like type. In relief cuts, the part that is to be black is raised; the part that is to be black is indented in intaglio cuts; and on planograph plates the black portion is chemically treated to pick up the ink.