

OFFICE COPYING & PRINTING PROCESSES

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Chapter 16 excerpt from the book

GUIDE TO THE IDENTIFICATION OF PRINTS AND PHOTOGRAPHS Featuring a Chronological History of Reproduction Technologies

A companion book to the

ENCYCLOPEDIA OF PRINTING, PHOTOGRAPHIC AND PHOTOMECHANICAL PROCESSES

by

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Processes invented to reproduce documents used in business offices. We also include other significant inventions, like typewriters, printers, etc. **Bold** dates refer to important advances or inventions.

This excerpt is Chapter 16 from the book **GUIDE TO THE IDENTIFICATION OF PRINTS AND PHOTOGRAPHS, Featuring a Chronological History of Reproduction Technologies** to be published in 2003. CAPITALIZED terms in this chronology refer to entries in the author's **ENCYCLOPEDIA OF PRINTING, PHOTOGRAPHIC AND PHOTOMECHANICAL PROCESSES**, to be updated in 2003. Please contact the author (staff2@photoconservation.com; www.photoconservation.com) for information on the availability of these books and upcoming courses on the history and identification of reproduction technologies.

| # | YEAR | COMMENTS |
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| 1.1 |2500 BC, ca. | From the scribes of Babylon and Egypt, to the copy clerks of the Victorian era, documents are copied by hand with wedges, quills and pens on clay, papyrus, parchment, or paper as time progressed. |
| 1.2 |7th cent. AD | The quill is first used in the copying of manuscripts in monasteries. It won't be replaced by another device, the steel pen, until the 19th century. See 1803. |
| 1.3 |16th cent. AD | Masters of the 16th century produce "cartoons" that are now highly valued by collectors. This was the recognized method of copying an original drawing on paper by pin-pricking it and then dusting it over with a muslin bag containing charcoal or graphite powder to provide the outline copy on which the final work was executed. T.A. Edison made reference to this kind of transfer in his patents. |
| 1.4 |1655 | Samuel Hartlib in London uses a glutinous ink that can produce a dozen copies when moist sheets of paper are pressed onto it. The process was not used commercially. See 1780. |
| 1.5 |1714 | Henry Mills' "artificial machine or method for impressing letters as in writing." is granted an English Patent in 1714. The four page patent contains no details but "artificial writing" has been used to describe hand-set typography. |
| 1.6 | 1780 | James Watt patents and markets the first popular letter-copying process. Letters written with glutinous ink are pressed against water-dampened tissue-paper with screw press. The writing appeared in reverse but the thin tissue could be read from the other side. See 1655. |
| 1.7 | 1790s | Multiple writing machines which use two or more pens or quills are invented. A well-known user of this invention was Thomas Jefferson, third president of the United States of America. These machines were used mostly by businessmen –not office copy clerks. |
| 1.8 |1803 | The first steel pens are hand-made by Wise of London but they are not a commercial success until between 1820 and 1840 when Joseph Gillott and others in Birmingham begin manufacturing them from steel sheets using machinery. See 7th century AD and 1850s. |

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| 1.9..... | 1805–1950s | Writing with glutinous and later (after 1855) aniline ink (often methyl blue) transferable to a gelatin pad from which several copies could be made, usually of a purple color. Popular after the 1850s and 1870s and quite common in schools and for home use after ca. 1900. Known as ANILINE PROCESS; CHROMOGRAPH; COPYGRAPH (1884, ca.); GELATIN METHOD; graph; HECTOGRAPH (late 1870s); indirect method; POLYGRAPH (1884, ca.) |
| 1.10..... | 1806..... | Ralph Wedgwood's manifold stylographic writer is patented in England. The original apparatus was designed as a means of helping blind people to write but a few years later it was adapted to produce copies of private or business letters. A metal stylus was used to write on thin paper under which there was a double-sided <i>carbon paper</i> . Wedgwood called it <i>carbonic</i> or <i>carbonated paper</i> . Although popular, this process was not adopted by commercial businesses which preferred their outgoing letters to be written in ink. Some sources indicate that carbon paper was first used in France. |
| 1.11..... | 1818, ca..... | TRANSFER LITHOGRAPHY is described by J. Alois Senefelder. Normal writing with a suitable ink on paper can be transferred to a stone which can provide right way around printed text. |
| 1.12..... | 1823..... | Cyrus P. Sakin, of Concord, Massachusetts, USA is one of the earliest manufacturers of carbon papers for office use. |
| 1.13..... | 1839..... | BREYERTYPE. Brought into practical use much later as PLAYERTYPE (1896) and MANUL PROCESS (1913), followed by the TYPON PROCESS (1927). These belong to categories known as REFLECTOGRAPHY, REFLEX COPYING PROCESS and REFLEXION COPYING PROCESS. Two U.S. brand names were DEXIGRAPH and LINAGRAPH. See 1896 PLAYERTYPE, for description. |
| 1.14..... | 1839..... | The first viable photographic process, the DAGUERREOTYPE, is made public. Other processes, e.g., SALT PRINT, BLUEPRINT, CALOTYPE, have been used from time-to-time to make copies of office documents. |
| 1.15..... | 1841–1890s..... | ANASTATIC PROCESS OF LITHOGRAPHY. Invented in Germany and introduced in England in 1844. Used for FACSIMILE reproductions. A print soaked in dilute nitric acid is applied firmly onto a sheet of zinc, allowing the acid to etch the metal where the ink of the print does not prevent it. After more etching, the plate is ready to be inked up with a roller and provide many impressions. |
| 1.16..... | 1842..... | Herschel's BLUEPRINT PROCESS, aka. FERROPRUSSIATE. Little used in North America until ca. 1876. This uses the sensitivity of ferric salts reduced by the action of light to a ferrous state, resulting in the precipitation of Prussian blue (ferric-ferrocyanide) by the action of potassium ferricyanide. This process provides white lines on a blue background. When this process is used to produce pictorial photographs from negatives, it is called CYANOTYPE. |
| 1.17..... | 1850s..... | The quill is being replaced by the steel pen, now manufactured on a large scale. The transition will be complete by the turn of the century. See 1803. |
| 1.18..... | 1850s–1950s..... | Watt's glutinous ink process (see 1780) becomes popular in the form of the LETTER COPYING BOOK PROCESS. The book consisted of tissues, up to a thousand, serially numbered and bound in a leather-spined volume with index. Copy was made by dampening the tissue in situ with water from a brush or cotton cloth soaked in water and placed flat on top of the tissue. Sheets of oiled paper were used to insulate the wet tissue from adjacent dry tissues in the book. After insertion of a freshly written and dried original, the whole book was closed and placed for half a minute in a screw press. See 1875. |

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| 1.19..... | 1854..... | AUTOGRAPHIC PROCESS. Early application of LITHOGRAPHY. This patented version, involving an autographic press had been purchased by Waterlow & Sons. |
| 1.20..... | 1856..... | A British chemist, William Perkin, synthesizes the first aniline dye, mauvine. This dye will be used extensively in glutinous ink processes, e.g., LETTER COPYING BOOK PROCESS (1850s–1950s) and HECTOGRAPH. |
| 1.21..... | 1864..... | ANILINE PROCESS of William Willis. A DICHROMATED paper was exposed under a positive and subjected to the fumes of aniline, by which means aniline colors were formed. For twenty years the process was used mostly in Europe for the reproduction of tracings with little competition other than that of the BLUEPRINT (1876) and PELLET (1877) processes. Edward Anthony purchased the aniline process rights for America but failed to make it work successfully for more than a few months in 1868. |
| 1.22..... | 1868, ca. | As a result of permission granted to Western traders to enter Japan, Japanese papers are imported and used as copying papers in letter books. See 1850s–1950s. |
| 1.23..... | 1872..... | First demonstration of a practical typewriter for commercial use, the Sholes and Glidden typewriter, in the New York office of E. Remington and Sons, Gunsmiths and Sewing Machine manufacturers. Lebbeus Rogers took the opportunity to show that his carbon papers could be used with this new invention. Commercial production started the following year. |
| 1.24..... | 1874–1890s | PAPYROGRAPHY, by Eugenio de Zuccato in London. A special type of ink (a solution of caustic soda) is used to write upon a specially prepared paper. The sheet is then soaked in water, and the ink corrodes the fabric of the wet paper, leaving open lines in place of the writing. The sheet is then used as a STENCIL. This is the first recorded use of the word “stencil” associated with the reproduction of handwriting. Used in Britain and in the USA during the 1870s and 1880s. Disappeared in the 1890s. |
| 1.25..... | 1875, ca. | The LETTER COPYING BOOK PROCESS becomes a standard office procedure. See 1850s–1950s. |
| 1.26..... | 1876..... | BLUEPRINT paper becomes popular in North America. See 1842. |
| 1.27..... | 1876–1890s | EDISON ELECTRIC PEN. This produces a STENCIL made by the aid of a style containing a fine needle which is moved up and down by a small motor at the top of the pen. This creates a series of minute holes that produce a stencil which can be used to provide more than 500 copies. Copies were “spidery,” recognizably dotted and were generally poor representations of handwriting. Edison referred to this process as Autographic Printing. It never proved popular in Europe nor in Britain but was used in the USA until the 1890s. |
| 1.28..... | 1877..... | TRYPOGRAPH, or FILE PLATE PROCESS. Patented by Eugenio de Zuccato and commercialized from early 1880s. Similar to the CYCLOSTYLE wheel pen (1881), except that the paper was stretched over a metal plate that had a multitude of sharp corrugations, which pierced the paper as a stylus was moved over them. Styli were made fine, medium and broad and files correspondingly coarse or fine but copies obtained from these STENCILS, made with a fluid ink, were spidery. With a magnifying glass it is possible to see the pattern of the file plate grooving in the form of ink dots from the holes in the stencil. See 1894. |
| 1.29..... | 1878..... | COLLOGRAPHY. Invented in England by A. Pumphrey. A film of gelatin on glass was dichromate–sensitized and dried. Writing or drawing was done on |

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| | | a suitable paper with solutions of iron salts, nutgalls, or similar substances. This tanned the gelatin surface, to which the design was next transferred. By keeping the gelatin pad moist and applying an ink roller, the lines would take the greasy ink, but the white parts would repel it. Paper was then brought into contact with the pad, and an impression taken by rubbing or squeegeeing. See 1891 AUTOCOPYIST. |
| 1.30..... | 1870s, late | The HECTOGRAPH becomes popular. See 1805–1950s. The name is derived from the Greek, hekaton, meaning a hundred but the process was never capable of making that many impressions from one image on a gelatin pad. In Germany, the process was known originally as Schapirograph. |
| 1.31..... | 1880..... | The TRYPOGRAPH duplicating apparatus (1877) but not the FILE PLATE PROCESS, is patented in America by E. de Zuccato. T.A. Edison obtains a patent in 1880 for a similar method of perforating a sheet of paper by placing it on a bed of needle points, or on a grooved metal plate, and writing on it with a blunt metal stylus. Edison sold this process to Unz in Philadelphia in 1885 who did not exploit it, but sold it to A.B. Dick in 1887. See 1887 MIMEOGRAPH. |
| 1.32..... | 1881–1888, ca.... | CYCLOSTYLE wheel pen invented by David Gestetner. First patented in England, it is made available in America in 1884. A thin paper coated with paraffin wax on one side, is stretched over a smooth metal plate. The writing instrument holds a small wheel having a serrated edge, perforating the paper with minute, cut lines, creating a STENCIL. It was a do-it-yourself type of printing sometimes called AUTOGRAPHIC PRINTING. This process, a major breakthrough, was also used for MUSIC duplication. See 1888 Neostyle. |
| 1.33..... | 1884, ca | COPYGRAPH. A type of HECTOGRAPH. See 1805–1950s. |
| 1.34..... | 1884, ca | POLYGRAPH. Writing with aniline ink transferable to a gelatin pad from which several copies could be made. Also known as ANILINE PROCESS; CHROMOGRAPH; GELATIN METHOD; graph, HECTOGRAPH (late 1870s); INDIRECT METHOD. See 1805–1950s. |
| 1.35..... | 1887..... | MIMEOGRAPH (STENCIL). File plate process invented by Zuccato (1877) and T.A. Edison (1880) and marketed by A.B. Dick Company of Chicago. Used to duplicate both handwritten and eventually typewritten texts. See 1888. |
| 1.36..... | 1888..... | John Brodrick is granted a US patent for the first successful STENCIL material suitable for a typewriter; a handmade Japanese tissue of a very porous structure, the Yoshino, was the basis for this stencil. This was the tissue that Gestetner imported from Japan once he started the manufacture of typewriting stencils. The Yoshino paper was replaced in the 1930s by a machine-made paper. For a long time, stencils were coated with wax but the modern material used nitrocellulose, plasticized with oils to make them pressure-sensitive. |
| 1.37..... | 1888, ca. | A new home copying process involves tracing a photo with autographic ink, which is then transferred to a zinc plate. |
| 1.38..... | 1888–1950s | NEOSTYLE wheel pen. American name given to David Gestetner's British Neo-Cyclostyle (sometimes called diaphragm duplicators). STENCIL process for handwriting that replaced CYCLOSTYLE (1881) with a superior wheel pen that allowed more comfortable writing. Thousands of copies could be made in one hour using an "indestructible" paper stencil. By 1889 the Pennsylvania Cyclostyle Co. was boasting that it had 60,000 customers among American firms and institutions. Still used in some parts of the world in the 1970s. See 1881–1888, ca. cyclostyle. |

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| 1.39..... | 1891..... | AUTOCOPYIST (1886?) becomes popular in the USA. An improved version of COLLOGRAPHY (1878) which made use of a matrix made of parchment stretched over a bed-plate. The printing was made by means of an ordinary letter-copying press. By 1891, the French designed "Autocopiste" was becoming popular in the U.S.A. Other variations included the PHOTO-AUTOCOPYIST and Autocopiste noir, aka. Black Autocopyist. |
| 1.40..... | 1893..... | David Gestetner and Albert Blake Dick (aka. A.B. Dick) enter into various reciprocal business agreements concerning the manufacture and sale of STENCIL duplicating equipment in Great Britain and America. |
| 1.41..... | 1893-1910, ca. .. | Introduction of the Gestetner Automatic Cyclostyle, patented in 1891 and manufactured until ca. 1910. This device was a major contribution to the progress of STENCIL duplicating although it did not replace the Neostyle (1888). |
| 1.42..... | 1894, ca. | The FILE PLATE PROCESS (see 1877 TRYPOGRAPH) reached the Far East ca. 1894, from the USA and quickly became popular as Chinese and Japanese typewriters, with as many as 3,000 type-characters, are difficult to use. The process was still used to some extent in the 1970s. |
| 1.43..... | 1895..... | The word "duplicator" comes into use, for the first time in an advertisement in <i>Knowledge</i> dated Dec. 2, 1895, by the Ellams Duplicating Company. |
| 1.44..... | 1896..... | An American, Henry W. Lowe, of Omaha, patents a rotary STENCIL machine (single drum) which will be licenced to A.B. Dick (Rotary mimeograph) and A.D. Klaber (Rotary neostyle, 1899). |
| 1.45..... | 1896-1950s | PLAYERTYPE. A REFLEX COPYING PROCESS, also referred to as REFLECTOGRAPHY, in which a silver gelatin paper is placed face down on the printed matter, pressed into contact and exposed through the back of the silver paper. The light passing through the paper is reflected back from the white surface of the letter, plan, or drawing, whereas the dark lines of the latter hardly reflect any light at all. On development, a negative copy is obtained. See 1839 BREYERTYPE. |
| 1.46..... | 1899..... | Rotary STENCIL machines based on Lowe's patent are manufactured and sold in America by A.D. Klaber under the name of Rotary Neostyles. |
| 1.47..... | 1899..... | A.B. Dick of Chicago also obtains a licence to make and sell rotary STENCIL duplicating machines based on Lowe's patent. |
| 1.48..... | 1901..... | A.D. Klaber moves to England to create the Neostyle Manufacturing Company in 1900 and the following year markets the Rotary Neostyle. |
| 1.49..... | 1901..... | Roneo is trademarked by A.D. Klaber, coining the word from the "Ro" of Rotary and the "Neo" of NEOSTYLE. See 1907. |
| 1.50..... | 1903, ca.-1950 .. | The first twin-cylinder duplicating machine based on the Gestetner patents is called the Gestetner Rotary Cyclostyle. The No. 3 model, following two prototypes, was manufactured until 1950. |
| 1.51..... | 1903..... | A.D. Klaber loses the rights to the trademark Neostyle and renames his product Roneo, which he had trademarked in 1901. See above. |
| 1.52..... | 1907..... | Roneo Limited, with A.D. Klaber as managing director is formed to take over the business of the Neostyle Manufacturing Company. |
| 1.53..... | 1909-1990? | PHOTOSTAT. A camera that uses photographic (silver) paper instead of film. Originally, the copy was negative, i.e., white text on black background, unless rephotographed to obtain black text on a white background. In 1953 Eastman Kodak Co. introduced a DIRECT POSITIVE paper, KODAK PHOTOSTAT POSITIVE |

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| | | W PAPER, which offered black text on white background. Other brands included Rectigraph. |
| 1.54..... | 1913..... | MANUL process. Aka. Ullmann process, or LITHO REFLECTOGRAPHY. A variation of the PLAYERTYPE (1896) that uses dichromated gelatin to make FACSIMILE reproductions of bound books without taking them apart. See 1924 TYPON. |
| 1.55..... | 1921, ca. | Blueprint typewriter ribbon, introduced in England. Gave a rich orange color (inactinic) on a paper preferably translucent. This in turn could produce copies on BLUEPRINT paper. |
| 1.56..... | 1923..... | SPIRIT DUPLICATING, introduced by Wilhelm Ritzerfeld, founder of the Ormig Company, in Germany. The master copy was a negative made by typing or writing on a sheet of nonabsorbent paper backed with a carbon containing dye. Copies were made by moistening the sheets of paper with the volatile fluid and bringing them into direct contact, under pressure, with the negative impression of the master copy. The master sheet was clamped on a rotary drum. With each rotation of the drum the moisture on the copy sheet dissolved a very small fraction or layer of the dye on the master copy. This produced positive results —usually of purple color— on the copy sheet. |
| 1.57..... | 1923..... | DIAZOTYPE. First process to seriously compete with the BLUEPRINT, which it replaced by the 1950s for the REPRODUCTION OF MAPS, PLANS, ETC. Also known as WHITEPRINT; AMMONIA PRINT; B&W; GAS-PRINT; 3M DRY DIAZO. By the 1950s the diazo technology was used in large enterprises for office copying. |
| 1.58..... | 1927..... | TYPON process. A variation of the PLAYERTYPE (1896) that used silver gelatin materials to make facsimile reproductions of bound books without taking them apart. See 1913 MANUL. |
| 1.59..... | 1927–1940s?..... | REPLIKA. A modified OFFSET LITHOGRAPHY process for the reproduction of books. |
| 1.60..... | 1938..... | XEROGRAPHY is invented. Not commercialized before 1948 and not popular before 1960. |
| 1.61..... | 1941..... | Airgraph, or “V-Mail,” is developed by Kodak as a system for microfilming letters to conserve shipping space during World War II. |
| 1.62..... | 1947..... | KODAGRAPH AUTOPOSITIVE PAPER. A SILVER PROCESS that gave a direct positive image with a single development operation. Widely used as a REPRODUCTION PROCESS FOR MAPS, PLANS, ETC. —for the final print and as an intermediate. The paper could be handled in bright room light and could be used in the same equipment as that used for DIAZO or BLUEPRINT papers, provided a yellow filter was employed. |
| 1.63..... | 1948..... | KODAGRAPH AUTOPOSITIVE FILM. A SILVER PROCESS, with the emulsion coated on a translucent film support that permitted erasures and additions in ink or pencil to the photographic image or on the support side. Because of its transparency, the film allowed considerably faster travel on DIAZO and BLUE-PRINT exposing equipment than did KODAGRAPH AUTOPOSITIVE PAPER (1947). |
| 1.64..... | 1948..... | XEROGRAPHY commercially introduced. Its basic principle was invented in 1938 and became popular after 1960. One source says that the first Xerox copier was tested during 1949 and was marketed one year later. |
| 1.65..... | 1949..... | DIFFUSION TRANSFER. Agfa’s Copyrapid; Gevaert’s Gevacopy (1950); Kodak VERIFAX (1952–1976); COPYPROOF (1980s?); DT was widespread in various countries by 1960. Other products not specifically intended as copying pro- |

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| | | cesses, which used similar technology include PHOTOMECHANICAL TRANSFER, PMT; Kodak Ektaflex (1981); Polaroid, sepia (1948), id., black and white (1950), id., color (1963). |
| 1.66..... | 1949–50..... | KODAGRAPH REPRO–NEGATIVE PAPER. A low–speed negative material (SILVER PROCESS) that could be used in drawing–reproduction equipment in well–lighted rooms. |
| 1.67..... | 1950..... | THERMOGRAPHY. The process uses heat–sensitive paper, exposed to infrared radiation by the REFLEX method. The process was not suitable for many dye images that did not reflect infrared radiations (see 1896 PLAYERTYPE). The basic principle was discovered in 1939 but was not put on the market before 1950 by 3M Company under the name 3M THERMO–FAX. |
| 1.68..... | 1950..... | INKJET recorders appear. Inkjet typewriters will appear in the 1960s. |
| 1.69..... | 1950..... | Floppy disk invented at the Imperial University in Tokyo by Doctor Yoshiro Nakamats, the sales license for the disk was granted to IBM. |
| 1.70..... | 1950..... | DUOSTAT is introduced by Kodak Ltd. (U.K.) Apparently not available in US. A SILVER PROCESS. A type of STABILIZATION process involving a porous plate, on which the exposed paper was placed, and the application of a developer and stabilizing solutions by means of a viscose sponge. Subsequently, stabilization processing was reduced to a single operation by the use of a single–solution developer–stabilizer. |
| 1.71..... | 1950s..... | Criterion, in England, introduces DUOPRINT, a contact document paper with a sensitive silver emulsion on both sides. |
| 1.72..... | 1950s..... | By the 1950s DIAZO technology is used in large enterprises for office copying. |
| 1.73..... | 1950s?..... | KODAK REFLEX COPY PAPER, Type 1075. Could be used in subdued room light. |
| 1.74..... | 1952–1976..... | Kodak VERIFAX. Based on a DIFFUSION TRANSFER invention by Yutzy and Yackel in 1947. Could produce prints by REFLECTOGRAPHY on plain, uncoated paper stock, with overall brown cast. READYPRINT was a different brand using the same technology. See 1896 PLAYERTYPE. |
| 1.75..... | 1953..... | CARBONLESS PAPER Transfer, chemical type, produced by Appleton Coated Paper for NCR. This often produced a purple image. Mostly used for multiple–copy business forms. |
| 1.76..... | 1953–1990s?..... | KODAK PHOTOSTAT POSITIVE W PAPER and KODAGRAPH PROJECTION POSITIVE PAPER are introduced for limited use, primarily for copying waybills for railway and steamship companies. See 1909 PHOTOSTAT. |
| 1.77..... | 1954–today..... | ELECTROFAX. Direct electrostatic on a support coated with zinc oxide developed with a liquid or dry toner. |
| 1.78..... | 1955–1990s..... | STABILIZATION PROCESS. A SILVER PROCESS first shown in the DUOSTAT (1948, ca) but not popular before significant improvements were made. See 1956 RETROFLEX. |
| 1.79..... | 1956..... | RETROFLEX. SILVER PROCESS. Announced by Kodak Pathé, used stabilization processing and produced a positive in room light without plumbing and washing equipment. The copy was placed under the translucent support of the Retroflex paper and exposed through the back of the original document. The definition was not as good as that obtained in emulsion–to–emulsion contact, but was satisfactory. |
| 1.80..... | 1950s (late)..... | COLOR TONERS for ELECTROFAX and Haloid Corp. Xerox (7 colors). |
| 1.81..... | 1957..... | First dot matrix printer is marketed by IBM. |

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| 1.82..... | 1958 | ELECTROLYTIC PROCESS for 3M Filmac line of microfilm reader–printers. |
| 1.83..... | 1960..... | XEROGRAPHY (ELECTROPHOTOGRAPHY) becomes popular. Invented in 1938 and introduced commercially in 1948. |
| 1.84..... | 1960s?..... | VQC (3M, VARIABLE QUALITY COPIER). |
| 1.85..... | 1960s | EICHNER DRYCOPY PROCESS. A variant form of thermographic copying. See 1950 THERMOGRAPHY. |
| 1.86..... | 1960s | DUAL SPECTRUM PROCESS. A dry process in which the energy coming from the visible part of the electromagnetic spectrum forms a latent image, which is made visible by the invisible radiant energy of the infrared region of the spectrum. Marketed by 3M. |
| 1.87..... | 1960s | ADHEROGRAPHY. A duplicating process developed by 3M. Images were formed by the adherence of powder to a tacky latent image created by the effect of infrared heat. This provided a master from which 200 to 250 copies could be made. The powder image of the resulting print was fused to the paper by heat. |
| 1.88..... | 1960s | Continuous INKJET printing with a steady stream of ink remains the prevalent inkjet technology. An improved version of this process will be introduced by Iris in 1987. |
| 1.89..... | 1960s | IMPACT PRINTING becomes the most widely used process in computer–related applications. |
| 1.90..... | 1963..... | CARBONLESS. “Action” paper is introduced by 3M. By 1974 there were 16 major producers of carbonless paper worldwide. |
| 1.91..... | 1964..... | THERMALLY PROCESSED SILVER. (TPS) film, commonly referred to as “dry silver,” was first commercialized by 3M Company in the mid 1960s with the introduction of microfilm reader–printers. TPS films and papers are now common in many areas once limited to wet electrostatic and silver halide technologies. |
| 1.92..... | 1965 | 3M ELECTROCOLOR PRINT. Produces permanent prints. Not commercialized. |
| 1.93..... | 1968..... | COLOR–IN–COLOR. First full color copier, introduced by 3M. A direct electrostatic process coupled with a thermal dye transfer system. Bright images on a velvety or glossy surface. Details suppressed. |
| 1.94..... | 1968 | In the early 1960s Seiko Epson was established to develop crystal chronometers and printing timers for official timekeeping at the 1964 Tokyo Olympics. Based on those technologies, the company introduced the world’s first commercially successful printer mechanism four years later, the EP–101. |
| 1.95..... | 1968, ca | THERMOGRAPHIC WASH–OFF FILM. Gevaert–Agfa Transparex film for overhead TRANSPARENCIES and Thermoline Wash–Off Film for reproduction of maps, plans, etc. |
| 1.96..... | 1969..... | IBM introduces the Selectric typewriter. |
| 1.97..... | 1969 | Gary Starkweather, while working with Xerox invents the LASER printer. |
| 1.98..... | 1970 | Canon unveils the NP–1100, Japan’s first plain paper copier, avoiding 600 Xerox. |
| 1.99..... | 1970s | DAISY–WHEEL TYPEWRITERS are becoming popular, but the daisy–wheel itself dates back to 1890 when it was used on the Victor Typewriter. |
| 1.100.... | 1970s?..... | Imagic. An exposed material changes the volatile characteristics of a solvent. Could be considered a THERMOGRAPHIC PROCESS. |
| 1.101.... | 1971 | Agfa–Gevaert introduces the first European xerographic copier. |

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| 1.102.... | 1971 | Alan Shugart at IBM produced the first regular use of an 8 inch floppy diskette drive, primarily for the Displaywriter. |
| 1.103.... | 1972 | Canon develops the NP-L7, the world's first plain paper copier with the liquid-dry system. |
| 1.104.... | 1973 | XEROX 6500 Color Copier is introduced, followed by the 1005 model. They provide bright images with plenty of sharp details. |
| 1.105.... | 1973 | Canon releases Japan's first full-color plain paper copier. |
| 1.106.... | 1975 | Canon successfully develops the LASER beam printer. |
| 1.107.... | 1975 | IBM introduces the first LASER printer, called the 3800, which was designed for high-speed printing. In 1978 Siemens introduces the ND2 and Xerox introduces the 9700, which will be used for printing-on-demand. These self-contained printing presses are either online to the mainframe or offline, accepting data in print image format on reels of tape or disk packs. Since an entire page of data has to be written to the cylinder before printing, these printers are often called "page-printers." The 9700 was 120 page-per-minute, full-duplex monster selling for about \$350,000. |
| 1.108.... | 1976 | The 5.25 inch floppy disk is invented. It will become industry standard two years later. |
| 1.109.... | 1978 | Epson introduces the TX-80, which becomes the first successful dot matrix printer for personal computers. The MX-80 was introduced in late 1980, quickly became the best selling printer in the United States, and eventually became the industrial standard for microcomputers. This was despite being designed not to produce graphics. Within a year the Graftrax version with graphics had hit the streets. This marked the beginning of DIGITAL PRINTING for the masses. |
| 1.110.... | 1978 | The Canon NP-8500, the world's first retention-type copying machine, is unveiled. |
| 1.111.... | 1978 | The Canon T, a color copier, is introduced. |
| 1.112.... | 1979 | First OPTICAL DISK, i.e. LASER DISK, on the market. A 12 inch VIDEO DISK capable to store 30 minutes of moving pictures. See 1982 OPTICAL DISK. |
| 1.113.... | 1979 | Canon launches the LBP-10 LASER beam printer. |
| 1.114.... | 1980 | Canon unveils its Telefax B-601, Japan's first FACSIMILE machine. |
| 1.115.... | 1980s? | COPYPROOF. (1949 DIFFUSION TRANSFER). Mostly for graphic arts application. |
| 1.116.... | 1980 | Non-impact, THERMAL TRANSFER MEDIA (TTM) technology, invented jointly by Fujicopian and NTT of Japan. Technical license for thermal transfer media is granted to International Imaging Materials, Inc. (USA) and Armor S.A. (France) in June 1983. First used for printing bar codes on labels and tags, this technology will be adapted to produce ribbons for typewriters, t-shirt transfers, FACSIMILE machines, and color printers. Aka. direct thermal transfer (D1T2), thermal transfer, thermal wax transfer, thermal fusion, thermofusion, thermowax, ALPS Micro Dry (1997), thermal transfer media (TTM) and wax thermal technology. See 1986 THERMAL WAX TRANSFER. |
| 1.117.... | 1980 | RISOGRAPHY. A modern version of the STENCIL process developed by RISO Kagaku in Japan. The Risograph is a high-speed duplicator that uses a thermal head to image a master, which is made from polyester resin film bonded to thin, fibrous paper, and wrapped around an ink cylinder. Inside the cylinder, the ink is pressed through the perforations in the master; pick up rollers then guide paper past the cylinder, and ink is transferred onto the page. In |

OFFICE COPYING & PRINTING PROCESSES

| # | YEAR | COMMENTS |
|-----------|-------------|--|
| | | 1986 Riso launches the Risograph Digital 007, introduced in America in July 1987. |
| 1.118.... | 1980s..... | LASER PRINTERS. Essentially, XEROGRAPHY where the image is produced by a computer and a laser beam. Also used in combination with fax machines and office copiers. Can be used to produce TRANSPARENCIES. |
| 1.119.... | 1980s | LED (light emitting diode) and LIQUID CRYSTAL PRINTERS. Less expensive alternative to LASER PRINTERS. |
| 1.120.... | 1982..... | First OPTICAL DISK storage, the music CD, introduced by Sony and Philips in Japan. Introduced in America a year later. See 1985 CD-ROM; 1985 WORM. |
| 1.121.... | 1982..... | In May, IBM introduces the double-sided 5.25 inch 320K floppy disk drives. |
| 1.122.... | 1984..... | INKJET. THERMAL INKJET is first introduced by Hewlett-Packard (Thinkjet) in computer printers. Also used by manufacturers of fax machines and in color printers. Drop-on-demand inkjet printers are used by several manufacturers. They use liquid ink that is stored in a series of cartridges and sprayed onto the paper. This will eventually be used to produce TRANSPARENCIES. |
| 1.123.... | 1984..... | Hewlett-Packard introduces its first Laserjet. The first desktop LASER printer. |
| 1.124.... | 1984..... | Apple Computer introduces the Macintosh, the first popular computer to use exclusively the 3.5 inch floppy created by Sony in 1981. The first significant company to adopt the 3.5 inch floppy for general use was Hewlett-Packard in 1982. |
| 16 | 1.125.... | 1985..... CD-ROM, the 650MB computer data version of the 1983 music CD is introduced. See 1979 OPTICAL DISK. |
| | 1.126.... | 1985..... WORM (Write Once Read Many) optical disk is introduced to archive business data. The first disk was made by Sony: 1 GB on a 8 inch disk. In 1987 the first 5.25 inch WORM disk was developed (650 MB), along with a 12 inch model that became a de facto standard. Capacity was 3.27 GB in 1987, and doubled to 6.54GB in 1990. |
| | 1.127.... | 1985..... Canon introduces the BJ-80 Bubble jet printer, the result of eight years of research. Also called a THERMAL INKJET technology. |
| | 1.128.... | 1986..... THERMAL WAX TRANSFER PRINTING. Based on 1980's non-impact, THERMAL TRANSFER MEDIA (TTM) technology. Color technology used mostly in computer color printers. Heat from a printhead melts the colored wax from the transfer ribbon and fuses it onto coated paper. Colors are transferred in consecutive passes. Commonly used to produce TRANSPARENCIES and corporate presentations until the mid-1990s. |
| | 1.129.... | 1986..... The Canon CLC1 color copying machine is released. The first copier device to integrate a PostScript controller or RIP. This can be used as a short-run printer. |
| | 1.130.... | 1987..... Color LASER copier. First introduced by Canon. A laser beam marks the image on the organic photoconducting cartridge belt in four passes. The belt moves under the toner cartridge, picks up the color, and applies it to the drum — once for each color. Used in office copiers and computer printers. Can be used to produce transparencies. |
| | 1.131.... | 1987..... Hewlett-Packard introduces its first color INKJET printer, the Paintjet. |
| | 1.132.... | 1988..... Kodak introduces the world's fastest color copier of its day, the Kodak Coloredge Copier-Duplicator. |

OFFICE COPYING & PRINTING PROCESSES

| # | YEAR | COMMENTS |
|-----------|------------|---|
| 1.133.... | 1989 | Kodak introduces the Kodak XL 7700 digital continuous tone DYE SUBLIMATION printer, which produces large format THERMAL COLOR PRINTS. Dye–subs are also known as dye diffusion thermal transfer (D2T2), thermal dye sublimation, thermal dye transfer (TDT) and thermal dye diffusion. |
| 1.134.... | 1989 | QMS introduces the first desktop color LASER printer, with a retail price of \$25,000. |
| 1.135.... | 1989 | Xerox introduces the DocuTech 600 dpi LASER printer capable of printing 135 ppm –8100 pages per hour, up to 11x17 inches. It marked the first time a laser printer could compete with OFFSET printing. |
| 1.136.... | 1991 | SOLID INK PRINTING. The Tektronix Phaser III is introduced after six years of research at Tek Labs. Solid crayons of ink are melted in their respective reservoirs, and the melted ink is sprayed onto the page, where it immediately solidifies. High–pressure rollers flatten and fuse the dots of ink to the page. Can be used to produce TRANSPARENCIES. |
| 1.137.... | 1991 | New copiers from Kodak offer innovative digital features, such as the ability to customize copies of original documents. |
| 1.138.... | 1992 | Kodak launches a writeable CD which its first customer, MCI, used for producing telephone bills for corporate accounts. |
| 1.139.... | 1996 | Fuji introduces its PICTROGRAPHY 3000 printer. This is a photographic–like process based on silver–halide materials. The two–step process features a photo–sensitive material called Donor, which is exposed by laser diode scan. A dye image forms in the Donor and is thermally transferred, resulting in the finished print. |
| 1.140.... | 1993 | Minolta–QMS introduces its first desktop color LASER printer. |
| 1.141.... | 1993 | Hewlett–Packard introduces the DeskJet 1200C, the first printer to use pigmented black ink, developed by DuPont. Two years later DuPont announced the development of an aqueous color pigmented ink technology designed for implementation in a wide variety of inkjet architectures including thermal, piezo, air brush, valve jet, and some continuous flow designs. Pigmented inks are usually more lightfast than the commonly used dye–based inks. |
| 1.142.... | 1994 | In 1994, Seiko Epson Corporation introduced its first color INKJET printer, the Epson Stylus Color, which uses a piezo–electric printhead. Most other inkjet printers, e.g., Hewlett–Packard, Canon, etc. |
| 1.143.... | 1994 | Fuji introduces the Thermo–Autochrome system. An “eco–friendly” printer which does not use any ribbon, ink, dye, toner, or chemicals, does not produce any waste and only uses paper and a little electricity. The paper uses an exclusive heat–sensitive microcapsule system with a new diazo compound and coupler technology, held in the three color layers. The first printer to use this new technology is the Fujix Fotojoy NC-1, seen at Photokina in September 1994. This is followed a year later by the Fujix NC-500. |
| 1.144.... | 1994 | Xerox introduces its first desktop color LASER printer, the Xerox 4900, which uses Xerox’s patented quad–dot technology to reach an effective resolution of 1,200 by 300 dpi. Quad–dot technology divides halftone dots into four quadrants and randomizes the halftone pattern formed by the laser as it sweeps the page. |
| 1.145.... | 1995 | INKJET DYE SUBLIMATION TRANSFERS become popular for printing photographs and designs on coffee mugs, mouse pads, polyester t–shirts, and other short–run needs. |

OFFICE COPYING & PRINTING PROCESSES

| # | YEAR | COMMENTS |
|-----------|-------------------|---|
| 1.146.... | 1996 | Hewlett-Packard introduces its first color LASER printer, the HP Color Laserjet. The 4-color 300 dpi single-pass device based on a Konica engine, produced a non-glossy "matte" finish. |
| 1.147.... | 1997-2001, ca. .. | The ALPS MD-1000 printer offers a combination of two printing technologies, THERMAL TRANSFER and THERMAL DYE SUBLIMATION, the former using ribbons which give near photo-realistic quality with excellent light-fastness. Metallic colors can also be used. The only technology of its type that can print solid white pigment. It is no longer used. |
| 1.148.... | 1999 | The Canon BJ F850 full-color BUBBLE JET is released, with photo-quality output without graininess. Also, the Canon CF-H30CL, a personal use FACSIMILE machine with color facsimile functions is introduced. |

COLOR GUIDE INDEX

(not complete)

16

| TEXT OR LINES | BACKGROUND | NOTE |
|-----------------------------|-------------------------------|---|
| black..... | white | See most processes |
| black..... | bluish | See 1954-today ELECTROFAX |
| black..... | brown | See 1952-1976 Kodak VERIFAX |
| blue, methyl (aniline)..... | white | See 1805s-1950s |
| blue | white | See 1920s DIAZOTYPE |
| brown | white (or now brownish) | text may have been black or sepia originally |
| purple..... | white or colored | See 1920s SPIRIT DUPLICATING |
| purple..... | white | See 1953 CARBONLESS PAPER |
| white | black | See 1909 PHOTOSTAT |
| white | blue..... | See 1842 BLUEPRINT |
| yellow | white or yellowish | text may have been black originally |
| various colors..... | white | Various. See 1950s (late) color toners for ELECTROFAX. Haloid Co. (later Xerox) introduced 7 colors; 1968 COLOR-IN-COLOR; 1973 XEROX Color Copier |

OFFICE COPYING PROCESSES

PAPER/SUPPORT TYPE GUIDE

(not complete)

PLAIN, UNCOATED PAPER STOCK. This includes most processes. See below for processes that require(d) specially coated paper stock.

SPECIALLY COATED PAPER STOCK. This includes 1889–today VANDYKE process; 1896 PLAYER-TYPE; 1909–today PHOTOSTAT; 1920s DIAZOTYPE; 1947 KODAGRAPH AUTOPOSITIVE PAPER; 1948 DU-OSTAT; 1949 DIFFUSION TRANSFER; 1949–1950 KODAGRAPH REPRO–NEGATIVE PAPER; 1950 THERMOGRAPHY; 1950s? KODAK REFLEX COPY PAPER; 1953–today KODAK PHOTOSTAT POSITIVE W PAPER and KODAGRAPH PROJECTION POSITIVE PAPER???, 1955–today STABILIZATION PROCESS; 1956 RETROFLEX; 1958 ELECTROLYTIC Filmac; 1960s ELECTROFAX; 1960s? VQC*???, 1964 THERMALLY PROCESSED SILVER (TPS; dry silver) paper; 1960s DUAL SPECTRUM PROCESS*; 1965 3M ELECTROCOLOR PRINT.

TENDENCY OF COPIES TO CURL

(not complete)

LOW. Most processes.

NOTICEABLE. 1947 KODAGRAPH AUTOPOSITIVE PAPER; 1952–1976 Kodak VERIFAX and READYPRINT; 1949 DIFFUSION TRANSFER; 1950 THERMOGRAPHY; 1954–today ELECTROFAX; 1920s DIAZOTYPE (if paper is thin); 1960s DUAL SPECTRUM PROCESS.

PRONOUNCED. 1958 ELECTROLYTIC PROCESS. Also some of the above mentioned processes if used with a thin stock.

SUPPLEMENTARY NOTES.

Soft images, slightly out of focus: May indicate the use of a process that did not use an emulsion–to–emulsion contact in order to provide right way around reading material. Ex.: 1956, RETROFLEX. Soft images may also indicate that the document is a second or third generation copy.

Copies that are “spidery,” recognizably dotted and are generally poor representations of handwriting are probably produced by the Edison electric pen.

Typewritten text reproduced with STENCILS: See 1887 MIMEOGRAPH; 1920s? NEOSTYLE.

16

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Note: dates refer to the introduction of the inventions or products. **Bold** numbers refer to chapter numbers and paragraphs numbers. E.g., **10.7** refers to chapter 10, paragraph no. 7.

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