

OFFICE COPYING & PRINTING PROCESSES

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This excerpt is part of Chapter 16 from the book

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

A companion book to the

ENCYCLOPEDIA OF PRINTING, PHOTOGRAPHIC AND PHOTOMECHANICAL PROCESSES

by

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MAIN OFFICE COPYING & PRINTING PROCESSES, 1780-2000

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	1780	1790	1800	1810	1820	1830	1840	1850	1860	1870	1880	1890	1900	1910	1920	1930	1940	1950	1960	1970	1980	1990	2000	
Glutinous ink																								
Hectograph																								
Carbon paper																								
Reflectography																								
Aniline process																								
Blueprint																								
Ferro-gallic																								
Papyrography																								
Edison pen																								
Typewriter stencil																								
Trypograph																								
Cyclostyle																								
Neostyle																								
Autocopyist																								
Photostat																								
Spirit duplicating																								
Electrostatic-zinc																								
Diffusion transfer																								
Thermography																								
Xerography																								
Laser printing																								
Color copier																								
Inkjet																								
Main period of use:																								
Period of lesser use:																								

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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 *part of* Chapter 16 from the book **GUIDE TO THE IDENTIFICATION OF PRINTS AND PHOTOGRAPHS, Featuring a Chronological History of Reproduction Technologies** to be published in 2011. CAPITALIZED terms in this chronology refer to entries in the author’s **ENCYCLOPEDIA OF PRINTING, PHOTOGRAPHIC AND PHOTOMECHANICAL PROCESSES**. Please contact the author (director@photoconservation.com) or his web site www.photoconservation.com) for information on the availability of these books and upcoming courses on the history and identification of reproduction technologies..

#	YEAR	COMMENTS
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 this is considered the ancestor of the modern typewriter.
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,’ aka. ‘screw copying–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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#	YEAR	COMMENTS
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. Well-known US brand names were DEXIGRAPH, LINAGRAPH, Rectigraph, Retocee (diaz system) and Ruthurstat. Aluna, Rectophot, Lumoprint, Ultrakop and many others popular in Germany and other European countries. 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. FERROPRUSSATE. 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.....	1844.....	The Copiste électro-chimique is introduced by the Maison Beau in Paris. Said to be affordable and likely to replace the old copy press.
1.18.....	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.
1.19.....	1850s–1950s.....	Watt's glutinous ink process (see 1780) becomes popular in the form of the LETTER COPYING BOOK PROCESS (aka. copier letter-book). 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

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#	YEAR	COMMENTS
		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.
1.20.....	1854.....	AUTOGRAPHIC PROCESS. Early application of LITHOGRAPHY. This patented version, involving an autographic press had been purchased by Waterlow & Sons.
1.21.....	1856.....	A British chemist, William Perkin, synthesizes the first aniline dye, mauve. This dye will be used extensively in glutinous ink processes, e.g., LETTER COPYING BOOK PROCESS (1850s–1950s) and HECTOGRAPH.
1.22.....	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.
1.23.....	1868, ca.	As a result of permission granted to Western traders to enter Japan, Japanese tissues (papers) are imported and used as copying papers in letter books. See 1850s–1950s.
1.24.....	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 of the typewriter started the following year.
1.25.....	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.
1.26.....	1875, ca.	The LETTER COPYING BOOK PROCESS becomes a standard office procedure. See 1850s–1950s.
1.27.....	1876.....	BLUEPRINT paper becomes popular in North America. See 1842.
1.28.....	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.
1.29.....	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

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#	YEAR	COMMENTS
		file plate grooving in the form of ink dots from the holes in the stencil. See 1894.
1.30.....	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 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.
1.31.....	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.
1.32.....	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 his MIMEOGRAPH process to Unz in Philadelphia in 1885 who did not exploit it, but sold it to A.B. Dick in 1887. See 1887 MIMEOGRAPH.
1.33.....	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.
1.34.....	1884, ca.....	COPYGRAPH. A type of HECTOGRAPH. See 1805–1950s.
1.35.....	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.
1.36.....	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.
1.37.....	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.
1.38.....	1888, ca.....	A new HOME COPYING PROCESS involves tracing a photo with autographic ink, which is then transferred to a zinc plate.
1.39.....	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

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		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.
1.40.....	1891.....	AUTOCOPYIST (1877) 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 (ca. 1895) and Autocopiste noir, aka. Black Autocopyist.
1.41.....	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.
1.42.....	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).
1.43.....	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.
1.44.....	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.
1.45.....	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).
1.46.....	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.
1.47.....	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, seemingly marketed at first as the ‘Neostyle’ or ‘Nero.’
1.48.....	1899.....	A.B. Dick of Chicago also obtains a licence to make and sell rotary STENCIL duplicating machines based on Lowe’s patent.
1.49.....	1901.....	A.D. Klaber moves to England to create the Neostyle Manufacturing Company in 1900 and the following year markets the Rotary Neostyle and the Roneo Water-bath copier, the first mechanized departure from the screw copying-press.
1.50.....	1901.....	Roneo is trademarked by A.D. Klaber, coining the word from the “Ro” of Rotary and the “Neo” of NEOSTYLE. See 1907.
1.51.....	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.

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1.52.....	1903.....	A.D. Klaber loses the rights to the trademark Neostyle and renames his product Roneo, which he had trademarked in 1901. See above.
1.53.....	1907.....	Roneo Limited, with A.D. Klaber as managing director is formed to take over the business of the Neostyle Manufacturing Company.
1.54.....	1909–1990?	PHOTOSTAT. A camera that uses SILVER HALIDE photographic 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 W PAPER, which offered black text on white background. Other brands included Rectigraph.
1.55.....	1913.....	MANUL process. Aka. Ullmann process, or LITHO REFLECTOGRAPHY. A variation of the PLAYERTYPE (1896) which uses dichromated gelatin to make FACSIMILE reproductions of bound books without taking them apart. See 1927 TYPON.
1.56.....	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.
1.57.....	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.
1.58.....	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.
1.59.....	1927.....	TYPON process. A Swiss variation of the PLAYERTYPE (1896) that used silver gelatin materials to make facsimile reproductions of bound books without taking them apart. Many books such as lexicons, law books, etc. were printed by this method. See 1913 MANUL.
1.60.....	1927–1940s?.....	REPLIKA. A modified OFFSET LITHOGRAPHY process for the reproduction of books.
1.61.....	1932–1960s?.....	Dermaprint. An A.B. Dick PHOTO-STENCIL dichromated gelatin process that worked from a positive photographic copy to a mimeograph stencil surface.
1.62.....	1938.....	XEROGRAPHY is invented. Not commercialized before 1948 and not popular before 1960.
1.63.....	1940s	OZAPHANE. Developed by the Ozaphane Corporation of America. A diazo light sensitive compound <i>in the film</i> substance, a cellulose acetate base much thinner than regular film used for MICROCOPY work. As the process is a direct print method the results are called direct copies, that is a negative from negative or positive from positive. The light sensitive compounds are dyestuffs in the colloidal state, therefore the image is virtually grainless and so the resolving power of the material is very high, a property of first importance for

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		material used in microcopy (MICROFILM) work. Development calls for exposure to ammonia vapour for about a minute.
1.64.....	1940s-1950s	As output devices early computers use adaptations of three typewriter-based serial impact printing terminals: IBM Model B typewriter, Teletype, and the Friden Flexowriter (which was built around IBM typewriter mechanics).
1.65.....	1941.....	Airgraph, or “V-Mail,” is developed by the British Post Office and Kodak as a system for microfilming letters to conserve shipping space during World War II. Ilford introduces its Micro Neg microfilm.
1.66.....	1944.....	The IBM Electric Executive Typewriter, the first typewriter with proportional letter spacing, is introduced
1.67.....	1946.....	The ENIAC, considered the first large scale digital computer, is introduced at the University of Pennsylvania. Output was by IBM card punch at 100 cards per minute (80 characters per card). The cards could then be carried to a tabulating machine and printed out off-line.
1.68.....	1946, ca.	GESTEPRINT PROCESS, devised by the Gestetner Co., combines the REFLEX PROCESS of copying, with a PHOTO STENCIL produced with a SILVER BROMIDE emulsion coated on both sides of a Yoshino Japanese tissue. The process, which uses a tanning developer instead of DICHROMATED GELATINE, can be adapted to the reproduction of photographs with a HALF-TONE screen.
1.69.....	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.
1.70.....	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).
1.71.....	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.
1.72.....	1949.....	DIFFUSION TRANSFER REVERSAL (DTR), in the UK, aka. as “chemical transfer”. Agfa’s Copyrapid; Gevaert’s Gevacopy (1950); Kodak VERIFAX (1952–1976); DIAVERSAL; COPYPROOF (1980s?); DT was widespread in various countries by 1960. Other products not specifically intended as copying processes, which used similar technology include PHOTOMECHANICAL TRANSFER, PMT; Kodak Ektaflex (1981); Polaroid, sepia (1948), id., black and white (1950), id., color (1963).
1.73.....	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.
1.74.....	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.

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1.75.....	1950.....	Floppy disk invented at the Imperial University in Tokyo by Doctor Yoshiro Nakamats, the sales license for the disk was granted to IBM.
1.76.....	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.
1.77.....	1950s.....	Criterion, in England, introduces DUOPRINT, a contact document paper with a sensitive silver emulsion on both sides.
1.78.....	1950s.....	INKJET recorders appear. Siemens' Mingograf oscilloscopic recorder is introduced in 1952. Inkjet typewriters will appear in the 1960s.
1.79.....	1950s.....	By the 1950s DIAZO technology is used in large enterprises for office copying.
1.80.....	1950s?.....	KODAK REFLEX COPY PAPER, Type 1075. Could be used in subdued room light.
1.81.....	1952-1976.....	Kodak VERIFAX. Based on a DIFFUSION TRANSFER invention by Yutzky and Yackel in 1947. This GELATIN-DYE-TRANSFER process could produce prints by REFLECTOGRAPHY on plain, uncoated paper stock, with overall brown cast. It used a soft gelatin image that contained developed silver halides and dye, as a printing matrix from which up to a dozen prints could be obtained by physical transfer of the soft gelatin. READYPRINT was a different brand using the same technology with a matrix that produced a unique copy. EKTALITH was a variant with a projection-speed emulsion. See 1896 PLAYERTYPE.
1.82.....	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.
1.83.....	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.
1.84.....	1954-today.....	ELECTROFAX. Direct electrostatic (or DIRECT ELECTROPHOTOGRAPHY) on a support coated with zinc oxide developed with a liquid or dry toner. Essentially a XEROGRAPHIC process except that the image is not formed on a metal drum but on zinc oxide coated paper which becomes the copy.
1.85.....	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.
1.86.....	1955.....	The total dollar volume of the office copy industry in America is now at \$50 million. Ten years later the industry will have grown more than tenfold, steadily climbing toward the \$1 billion mark.
1.87.....	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.
1.88.....	1950s (late).....	COLOR TONERS for ELECTROFAX and Haloid Corp. Xerox (7 colors).
1.89.....	1957.....	First DOT MATRIX PRINTER is marketed by IBM.
1.90.....	1960.....	XEROGRAPHY (TRANSFER ELECTROPHOTOGRAPHY) becomes popular. Invented in 1938 and introduced commercially in 1948.

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#	YEAR	COMMENTS
1.91.....	1960s?	VQC (3M, VARIABLE QUALITY COPIER).
1.92.....	1960s	EICHNER DRYCOPY PROCESS. A variant form of thermographic copying. See 1950 THERMOGRAPHY.
1.93.....	1960	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. A small, light blue flame emblem is imprinted on the back of each sheet to distinguish the coated from the uncoated side. A transparent receptor sheet was available for the production of TRANSPARENCIES that could be used with overhead projectors.
1.94.....	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. See 1965, ca. IMAGIC.
1.95.....	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.
1.96.....	1960s	IMPACT PRINTING becomes the most widely used process in computer-related applications. Dot matrix and daisy wheel printers involve mechanical parts like needles or letters transferring ink by hitting a paper surface.
1.97.....	1963	CARBONLESS. "Action" paper is introduced by 3M. By 1974 there were 16 major producers of carbonless paper worldwide.
1.98.....	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.
1.99.....	1964	Xerox introduced the LDX (Long Distance Xerography) FAX (FACSIMILE) machine.
1.100....	1965	Canon introduces the Canofax 1000 electro-FACSIMILE copying machine.
1.101....	1965	3M ELECTROCOLOR PRINT. Produces permanent prints. Not commercialized.
1.102....	1965, ca.	Imagic, a trade name of Imagic Processes Ltd (UK) for a THERMOGRAPHIC PROCESS in which an exposed material changes the volatile characteristics of a solvent, leaving a latent image which is made visible by the application of a toner powder. See 1960s ADHEROGRAPHY.
1.103....	1968-1976	COLOR-IN-COLOR. First full color copier, by 3M, using a direct electrostatic process combined with dye sublimation (thermal dye transfer). Produced bright images on a velvety or glossy surface. Details suppressed. Five years before another ELECTROSTATIC PROCESS: the Xerox 6500 Color copier.
1.104....	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.
1.105....	1968, ca	THERMOGRAPHIC WASH-OFF FILM. Gevaert-Agfa Transparex film for overhead TRANSPARENCIES and Thermoline Wash-Off Film for reproduction of maps, plans, etc.

OFFICE COPYING & PRINTING PROCESSES

- 1.106....** 1969..... Texas Instruments announces Silent 700™ data terminal, first to use thermal printing technology. See 1965; 1971.
- 1.107....** 1969..... A.B. Dick Company introduces the Model 9600 printer in 1969. They claim this was the world's first commercial inkjet printer. See 1950s.
- 1.108....** 1969..... Gary Starkweather, while working with Xerox, invents the LASER printer.
- 1.109....** 1970..... Canon unveils the NP-1100, Japan's first plain paper copier, circumventing 600 Xerox patents.
- 1.110....** 1970..... Ricoh invents the first digital fax (FACSIMILE) machine.
- 1.111....** 1970s DAISY-WHEEL TYPEWRITERS are becoming popular, but the daisy-wheel itself dates back to 1890 when it was used on the Victor Typewriter.
- 1.112....** 1971..... Agfa-Gevaert introduces the first European xerographic copier.
- 1.113....** 1971..... Texas Instrument introduces the Silent 700 Portable Terminal line. The Model 725's rapid and quiet, non-impact printing results from its innovative solid-state silicon printhead — an integrated circuit matrix of 35 elements which instantly create the desired character on heat-sensitive (thermal) paper. See 1965; 1969.
- 1.114....** 1971..... Alan Shugart at IBM produced the first regular use of an 8 inch floppy diskette drive, primarily for the Displaywriter.
- 1.115....** 1972..... The daisywheel printer is introduced by Diablo Systems. Xerox acquires Diablo the same year.
- 1.116....** 1973..... XEROX 6500 Color Copier is introduced, followed by the 1005 model. They provide bright images with plenty of sharp details.
- 1.117....** 1973..... Panasonic markets the first domestic facsimile machine connected to a telephone line.
- 1.118....** 1973..... Appleton Papers, Inc. introduces THERMAL chart and calculator papers.
- 1.119....** 1973..... Canon releases Japan's first full-color plain paper copier.
- 1.120....** 1973..... The Xerox 1200 is the first ELECTROPHOTOGRAPHIC printer marketed. Photographic images of the characters, mounted on the drum, were illuminated by an array of flash lamps and projected onto the photoconductor drum of a copier engine (then to be toned by a black thermostatic particles, transferred to paper, and fixed by heat). No laser technology was used.
- 1.121....** 1974..... Printronix invents the concept of line matrix printing.
- 1.122....** 1975..... Canon successfully develops the LASER Beam Printer, not marketed in the U.S.
- 1.123....** 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.
- 1.124....** 1975..... Early drop-on-demand inkjet printers using piezo technology include Silonics in 1975 and the more successful Siemens PT-80i in 1977.
- 1.125....** 1976..... The 5.25 inch floppy disk is invented. It will become industry standard two years later.
- 1.126....** 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

OFFICE COPYING & PRINTING PROCESSES

#	YEAR	COMMENTS
		became the industrial standard for microcomputers. This was despite being designed not to produce graphics. Within a year the Grafrax version with graphics had hit the streets. This marked the beginning of DIGITAL PRINTING for the masses.
1.127....	1978.....	The Canon NP-8500, the world's first retention-type copying machine, is unveiled.
1.128....	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.
1.129....	1979.....	Canon launches the LBP-10 LASER beam printer.
1.130....	1980.....	Canon unveils its Telefax B-601, Japan's first FACSIMILE machine.
1.131....	1980s?.....	COPYPROOF. (1949 DIFFUSION TRANSFER). Mostly for graphic arts application.
1.132....	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.
1.133....	1980.....	RISOGRAPHY. A modern version of the STENCIL process developed by RISO Kagaku in Japan. The Risograph is a high-speed duplicator (also called printer-duplicator, digital stencil duplicator and copy 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 1986 Riso launches the Risograph Digital 007 duplicator, introduced in America in July 1987. They introduced their first 600 dpi machine in November 1997. See 1950 Roneo Electronic Stencil Cutting Machine.
1.134....	1980s.....	LASER PRINTERS. Essentially, XEROGRAPHY where the image is produced by a computer and a laser beam. Also used in combination with FAX (FACSIMILE) MACHINES and office copiers. Can be used to produce TRANSPARENCIES.
1.135....	1980s.....	LED (light emitting diode) and LIQUID CRYSTAL PRINTERS. Less expensive alternative to LASER PRINTERS.
1.136....	1982.....	Oita Canon Inc. is established in Japan. The PC-10 and PC-20, the world's first personal copying machines with replaceable cartridges, are introduced.
1.137....	1982.....	Canon introduces a color inkjet printer.
1.138....	1982.....	Sony develops the Mavigraph, a color still video printer (dye sublimation), to work with the Mavica, an <i>analog</i> still video camera introduced in August 1981. The first digital cameras for the consumer-level market that worked with a home computer via a serial cable were the Apple QuickTake 100 camera (February, 1994), the Kodak DC40 camera (March, 1995), the Casio QV-11 (with LCD monitor, late 1995), and Sony's Cyber-Shot Digital Still Camera (1996).
1.139....	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.
1.140....	1982.....	In May, IBM introduces the double-sided 5.25 inch 320K floppy disk drives.

OFFICE COPYING & PRINTING PROCESSES

#	YEAR	COMMENTS
1.141....	1984.....	INKJET. THERMAL INKJET is first introduced by Hewlett–Packard (Thinkjet, 96 dpi) 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.
1.142....	1984.....	Canon introduces LBP-8/CX, the world’s smallest and lightest laser beam printer. See Hewlett–Packard Laserjet below.
1.143....	1984.....	Hewlett–Packard introduces its first Laserjet. The first desktop LASER printer.
1.144....	1984.....	Canon introduces the first digital laser copying machine system, the NP–9030..
1.145....	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.
1.146....	1985.....	CD–ROM, the 650MB computer data version of the 1983 music CD is introduced. See 1979 OPTICAL DISK.
1.147....	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.
1.148....	1985.....	Canon introduces the BJ–80 Bubble jet printer, the result of eight years of research. Also called a THERMAL INKJET technology.
1.149....	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.
1.150....	1986.....	The Canon CLC1 digital 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.
1.151....	1987.....	Color LASER copier. First introduced by Canon: the digital CLC1. 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.
1.152....	1987.....	Hewlett–Packard introduces its first color INKJET printer, the Paintjet.
1.153....	1987.....	Canon introduces the Board Copier A–1, an electronic blackboard that can print on plain paper.
1.154....	1988.....	Canon introduces the Color Bubble Jet Copier A1.
1.155....	1988.....	Hewlett–Packard introduces the DeskJet printer, the company’s first mass-market inkjet printer.
1.156....	1988.....	Kodak introduces the world’s fastest color copier of its day, the Kodak Coloredge Copier–Duplicator.

OFFICE COPYING & PRINTING PROCESSES

#	YEAR	COMMENTS
1.157....	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.
1.158....	1989.....	QMS introduces the first desktop color LASER printer, with a retail price of \$25,000.
1.159....	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.
1.160....	1990.....	In December, Sharp introduces the world’s first full-color facsimile machine, the JX-5000.
1.161....	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.
1.162....	1991.....	New copiers from Kodak offer innovative digital features, such as the ability to customize copies of original documents.
1.163....	1992.....	Kodak launches a writeable CD which its first customer, MCI, used for producing telephone bills for corporate accounts.
1.164....	1992.....	Kodak introduces the Photo CD.
1.165....	1992.....	Canon introduces the CLC 550, the world’s first copying machine with anti-forgery technology. Such technologies, e.g., banknote detection systems, may prevent a copier from copying banknotes which are recognized by the software that controls the copier or printer. Other technologies have been used by Xerox and most manufacturers of color printers and copiers to prevent counterfeiting money or documents. Many color printers and copiers will print their serial numbers in yellow ink that is only visible under a magnifying glass under a blue light.
1.166....	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.
1.167....	1993.....	Minolta–QMS introduces its first desktop color LASER printer.
1.168....	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.
1.169....	1994.....	Seiko Epson Corporation introduces 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., use THERMAL INKJET technology.
1.170....	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

OFFICE COPYING & PRINTING PROCESSES

#	YEAR	COMMENTS
		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.
1.171....	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 half-tone dots into four quadrants and randomizes the half-tone pattern formed by the laser as it sweeps the page.
1.172....	1994.....	Canon introduces the world's first automatic-duplexing color laser copying machine, the CLC 800.
1.173....	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.
1.174....	1995.....	Canon introduces the CLC1000, a high-speed, full-color copying machine with four linked photosensitive drums.
1.175....	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.
1.176....	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.
1.177....	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 FAX (FACSIMILE) machine with color facsimile functions is introduced.
1.178....	2005.....	Ricoh introduces the Aficio G500 and G700 Gelsprinters based on their geljet color printing technology first introduced in 2003 in the IPSiO G Gel Jet printer series. These fast plain paper printers are to compete against color laser printers.

OFFICE COPYING PROCESSES

COLOR GUIDE INDEX

(not complete)

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

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 DUSTAT; 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; 1960 DUAL SPECTRUM PROCESS*; 1965 3M ELECTROCOLOR PRINT.

OFFICE COPYING & PRINTING PROCESSES

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); 1960 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.

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