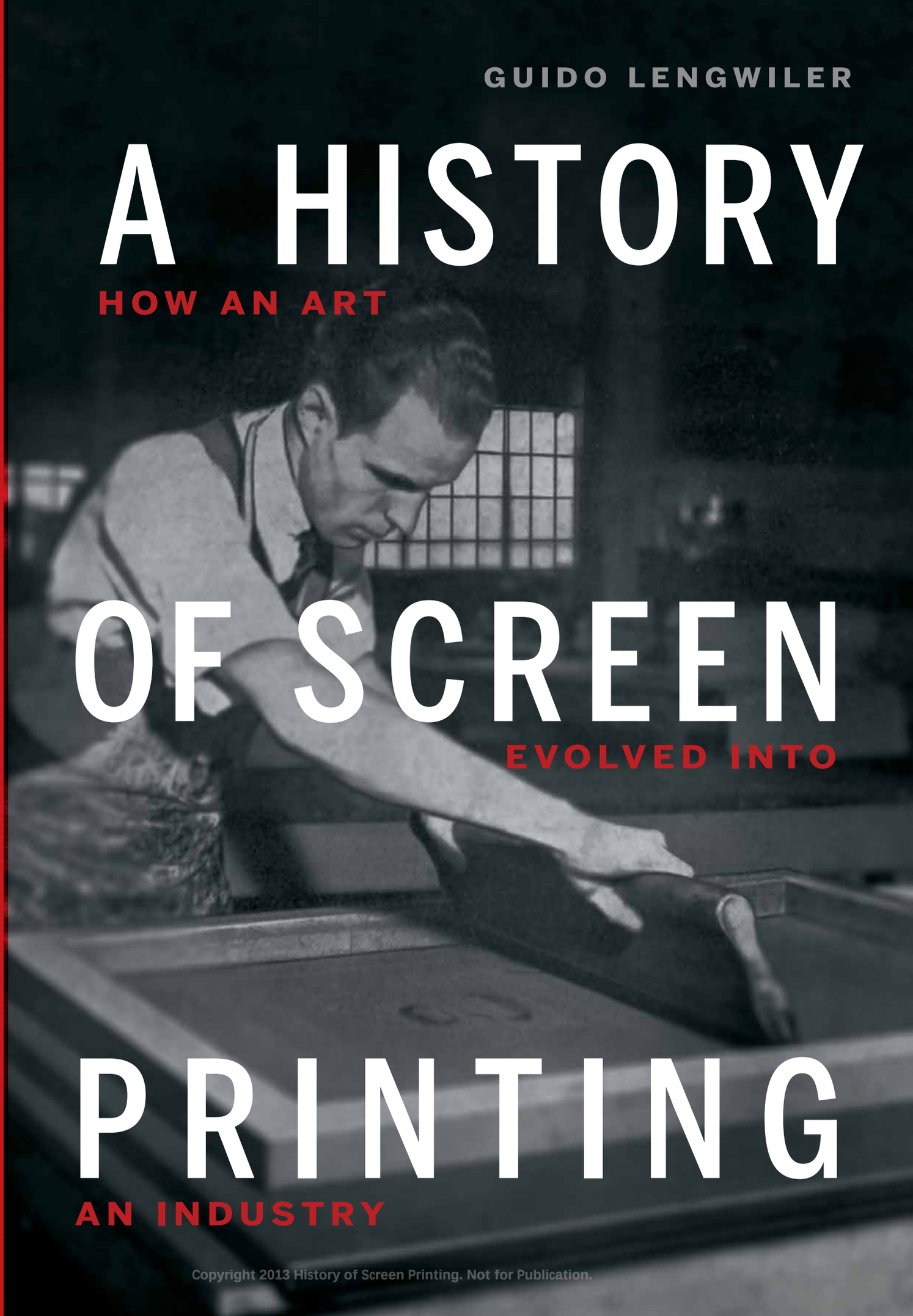


GUIDO LENGWILER

A HISTORY OF SCREEN PRINTING

HOW AN ART EVOLVED INTO AN INDUSTRY

CONTENT

1 / TECHNICAL FOUNDATIONS

1.1 / THE PRINTING PROCESSES
INTRODUCTION TO SCREEN PRINTING TECHNIQUES

THE SCREEN printing process developed around the turn of the 20th century as a complement to the other processes in use at the time. Screen printing achieved lasting success in the printing industry for a number of reasons: Printing plates could be produced economically; inks could be applied in a thick, opaque layer; numerous types of ink could be used on a wide variety of substrates; and the print format could be practically any size.

Before discussing the basic principles of the screen printing process, the dominant printing techniques in the early 20th century will be described briefly. They will be mentioned frequently throughout this book.

Letterpress (relief printing)

In relief printing, the printing areas to be inked are raised, like the letters on a rubber stamp. Relief printing comprises woodcut and related techniques, including movable-type letterpress printing, which was used from the late Middle Ages until the 1970s. After that time, traditional letterpress printing was replaced by photocomposition techniques that made old-fashioned "hot metal" (lead) typesetting obsolete. Filmsetting, in which the text is set on film via a photographic process, could now be used to create plates for offset printing (see below), which helped make the offset technique highly popular. The industrial relief printing process used today is flexography, in which a flexible plate is mounted on a cylinder in the printing press. This technique is used primarily to print packaging. Relief printing was also used to print textiles for centuries up to World War II. In this method, a wooden or metal "stamp" – the block – was used to apply printing paste to a length of fabric.

Intaglio printing

In this method, the printing areas are incised or etched into a plate or engraved on a printing cylinder. The plate is inked, and then the ink is removed from the surface, remaining only in the incised, etched or engraved depressions. The intaglio printing techniques include copperplate engraving, which dates back to the Middle Ages, as well as etching and related methods. The intaglio technique most widely used today is rotary printing (rotogravure), in which the engraved printing cylinder is inked as it rotates and excess ink is removed from the surface by a sharp metal blade. Rotogravure is suitable for very large runs of packaging material and other mass-produced printed matter. Intaglio printing has also been used to print textiles since the late 18th century. Rotary presses first made it possible to manufacture large quantities of printed items cheaply in the textile industry.

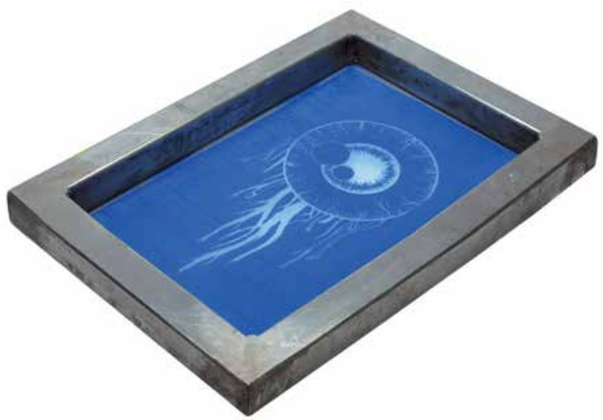
Lithography, offset printing (planographic printing)

In planographic printing, the printing areas are not visibly raised or recessed – they are at essentially the same level as the non-printing areas. In basic terms, this printing method makes use of the principle of mutual repulsion between oil (printing ink) and water. The non-printing areas of the plate are rough and can be filmed with water, which prevents them from absorbing ink, whereas the image areas are smooth and water-repellent, and therefore accept ink.

The technique was invented by Alois Senefelder in Germany in 1796, and was the dominant image printing process throughout the world up to the early 20th century. Senefelder used a limestone slab several inches thick for the printing plate, which is where the technique got its name (from the Greek lithos, "stone"). The stone was sanded smooth and the design drawn onto the surface with lithographic crayon or an oily ink (tusche). The stone was then brushed with a mildly acidic solution. The areas coated with the oily crayon were protected from the effect of the acid, which made the unprotected surfaces more porous. The chalk image was then removed with a solvent, and the plate was ready for

printing. When the stone was dampened with water, the porous areas would attract the water while the smooth areas repelled it. Ink was then applied to the stone, adhering only to the smooth, dry image areas.

Lithography was used for printing labels, posters and many other items. It was also used for art prints starting in the 1890s. In the latter half of the 20th century, lithography was completely supplanted by offset printing. In offset printing, the same basic process is used, but instead of stone, the plate consists of a thin sheet of aluminum with a photosensitive coating. The aluminum plate, only a fraction of a millimeter thick, is exposed, developed and mounted on the cylinder of the printing press. With each rotation of the cylinder, the plate is first moistened and then inked, and the image is finally transferred onto the substrate. This process is used to print newspapers, magazines, books, packaging, posters, and much more.



Screen printing

The printing plate for this method consists of a frame covered with fabric, usually polyester. The printing areas are ink-permeable, while the mesh openings are blocked in the non-printing areas, which makes this a stenciling technique. Screen printing mesh is available in various densities, from about 5 threads per centimeter up to 200. The lower the density, the heavier the ink coverage, which is desirable in applications like textile printing. Ink coverage is lower with high-density mesh, but detail reproduction is better, which is necessary when printing thin lines or fine patterns. Ink coverage can therefore be adjusted to fit the requirements of the printed item by selecting a screen with an appropriate mesh count.

Stencils can be made manually or photographically. Manual techniques were typically used until World War II: The stencil was painted directly onto the mesh, or cutout stencil pieces were glued to the underside of the screen. Today nearly all screen printing is done from stencils produced by photochemical processes. Here the screen is coated with a photosensitive, highly viscous fluid. The design is drawn with opaque inks on a transparent film to create a master copy. Once the fluid coating has dried, the film is laid on the underside of the screen and then exposed from the top side. Exposed areas of the coating become waterproof. The unexposed areas, i.e. the design, can then be rinsed away with water, leaving the meshes open. In newer processes, the design is created directly on the coated screen, without film, using inkjet or laser technology. The ink is then applied to the substrate through the open areas of the screen with the aid of a rubber squeegee.

The screen printing process is used in many industrial fields and in advertising. It works well with a wide range of substrates, including paper products, plastics, metals, glass, ceramic and textiles. Depending on their purpose, items can be screened with inks that are weatherproof and lightproof, transparent or opaque, glossy or matte, chemical-resistant, washable or electrically conductive. The process also lends itself easily to printing with special effect inks, such as metallic, fluorescent, phosphorescent (glow-in-the-dark), pearlescent, scratch-off or scented inks.

As a “printing paste coating technique,” screen printing is a versatile and useful addition to the printing processes. Typical applications include adhesive films, advertising banners, signs, posters, art prints (serigraphs), promotional gifts (lighters, etc.), membrane keyboards, finished textile products like t-shirts and gym bags, printed designs on yard goods (bed linens, garment fabrics, etc.), appliance housings, glass and plastic bottles, ceramic and glass tableware, ceramic tiles, sheet glass (auto glass, facade glass, furniture, gaming machines, etc.), electrically conductive or magnetizable printing pastes for machine-readable cards, printed circuit boards, credit cards, safety inks on security papers, printing with food-grade inks on chocolate or baked goods, printing on metal, stone or wood slabs, labels, and numerous other items.

Handicraft lessons with Markus Obrist, Baden School, 1999.
Photos: Markus Obrist

L'APPLICATION DU POCHOIR

DÉMONSTRATION

Manière de tenir le pochoir. — **Il se tient de la main gauche, le pouce et l'index par-dessus, et bien soutenu en dessous par les autres doigts.**

2 / STENCILING

TECHNIQUES OF THE 19TH AND 20TH CENTURIES

2.1 / STENCILING AND COLORING

STENCILS HAVE been used for many centuries in all cultures. Compared to making forms for other printing processes, creating stencils is basically simple, and duplication does not require a printing press. Stamps have the same advantages, but they must be used on smooth surfaces to obtain acceptable results. Stencils, on the other hand, can be used to decorate even textured or shaped materials.

There are various ways of creating a stencil. In the simplest method, a motif is cut into paper or a plastic or metal film. However, loose sections of the design, such as the area inside the letter O, must remain connected to the surrounding areas by ties. These ties are non-printing elements. To avoid using them, stencils can be created by perforation: The image is punched into the stencil film using a needle or fine punch, resulting in a halftone image. This technique makes it possible to reproduce color gradations, depending on how closely the holes are spaced. However, it is not possible to create continuous lines or solid areas this way. Another method of creating stencils consists of connecting the pieces of the stencil together using fine threads or wires, or attaching the pieces to an ink-impermeable mesh; since there are no ties, the complete image can then be printed without gaps. Stencils of this kind were used by artisans in Japan, for example.

Until the early 20th century, no specialized terms were used to distinguish the various methods of creating stencils. Even today, people still speak of "stencils" in general, regardless of whether cutout or screen printing stencils are meant. In 1936, the American screen printing pioneer and author Harry Hiett was the first to make a terminological distinction between screen printing stencils and those cut out of paper or film. He referred to the latter as "open stencils." However, his terminology was rarely used by others who wrote on the subject later on. Hiett's distinction between open and screen printing stencils will be observed in the remarks below.

OPEN STENCILS

Medieval stenciling techniques will not be discussed here in greater detail, as the period from the 19th to the early 20th century is more relevant to the history of screen printing. At that time, sign painters and interior decorators in both Europe and America were using open stencils. The change over to the screen printing process took place at the start of the 20th century in the USA. This did not happen overnight, however; in fact, both techniques – stenciling and screen printing – were used concurrently wherever they might have artistic or economic advantages. For example, large quantities of felt pennants would be printed in white ink using the screen process, and then colored manually with open stencils. The stencils thus lent themselves to cheap production of multicolored pieces, and in addition the colors could be applied using the increasingly popular airbrush technique, which permitted fine shading.

Rather than describe all the numerous applications for stencils, this section will deal briefly with the fields of decoration, coloring art prints, the pochoirs of the Art Deco era, and Japanese textile printing stencils.

Decoration and sign painting

Open stencils were used for decorating walls, furniture, textiles and other everyday objects into the 20th century.[6] In both Europe and America, churches and public buildings, as well as upper middle class homes, were decorated using stencils, usually in bold colors. This was the simplest method for creating colorful ornamentation or other repeating patterns in rooms or stairwells. House painters and ornamental painters both used this technique. In many cases, a selection of prefabricated stencils was available from which the client could choose the desired pattern. Sometimes stencil techniques would be combined with painting as well. The work of the American Moses Eaton, Jr. (1796–1886) serves as an example of the numerous stenciled decorations that have survived. Some of his projects have been preserved, along with his brushes and stencils. Eaton worked from a set of 78 stencils, which he combined to create designs, often with floral elements. The stencils do not have any register guides, so Eaton apparently placed them freehand. Paint residue tells us that he stenciled in green, red and yellow.[7]

In the 20th century homeowners increasingly turned to printed wallpapers, and stencil work began to decline in popularity. There was also a trend away from ostentatious wall decoration in interior design. However, open stencils are still being used today in more technical fields, such as for road marking or applying lettering to train cars and crates.

OPPOSITE: Lettering kit with tin stencils, USA, probably late 19th or early 20th century.

LEFT: Japanese perforated stencil, 19th century (10.5 × 8 cm/approx. 4 × 3 in.).

ABOVE: Stencils for decorating building facades, France, 20th century (approx. 32 × 35 cm/12.5 × 14 in.).

LEFT: Wall with stenciled decorations in the style of Moses Eaton, Jr. The "Stencil House" in Clifton, Tennessee, built ca. 1835.

Photo: Library of Congress

LEFT: Road marking with plywood stencils.

Advertisement for Harbor Plywood Corporation, USA, 1957

ABOVE: Stencil decoration for chair back, USA, undated.

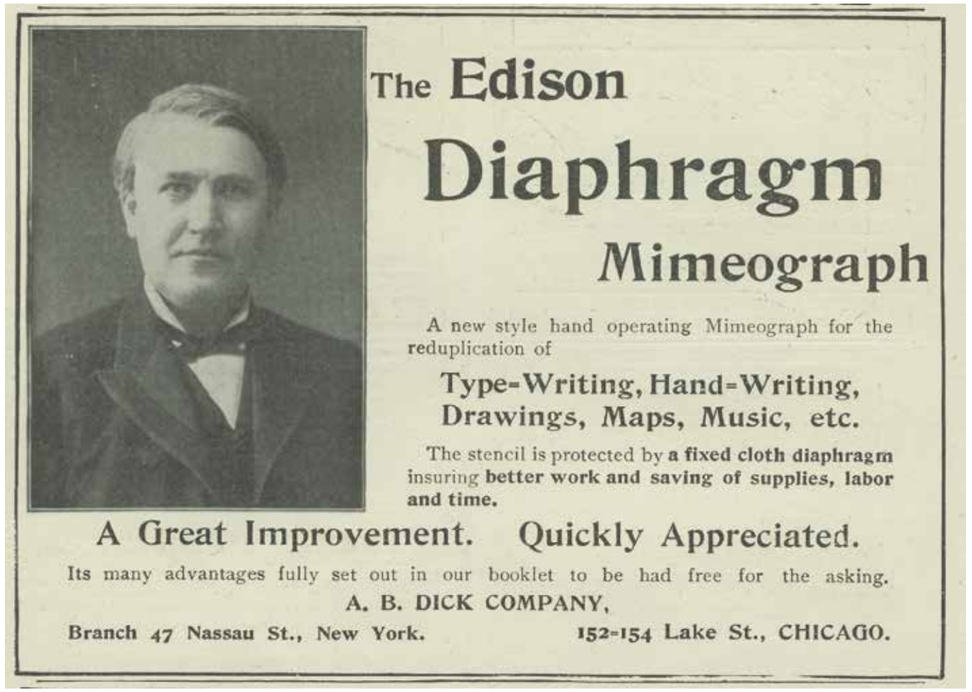
Stencil coloring

Until the 20th century, printed matter in Europe and Asia was colored largely by means of stencils. First, the outline of a motif was printed in a single color (in woodcut technique, for example) and the other colors were stenciled on afterward. Stencil coloring required less technical effort than multicolored woodcut printing, and was more economical than hand coloring.[8]

In medieval Europe, colored playing cards were among the first types of popular printed material to be produced in large runs. In the 19th century, stencil coloring was used mainly to produce illustrated broadsheets in France and Germany. These depicted subjects from religion, folklore, the natural sciences, militaria and fairy tales, among others. At the beginning of the 19th century, they were still being printed in runs of a few hundred, but with the introduction of lithography at mid-century, the print runs grew to tens of thousands in many cases. The prints were produced in factories where the work process was divided up to be performed by various specialists: illustrators, lithographers and colorists. The sheets were colored primarily by means of cardboard stencils and brushes. Large factories employed hundreds of colorists for this purpose, often including children. Sometimes coloring work was done as home labor, or contracted out to prisons.[9]

With the introduction of the high-speed lithographic press after 1870 and of multicolor lithographic printing, or chromolithography, the labor-intensive stencil coloring process was abandoned to an increasing extent. The rise of new media, such as illustrated magazines, ultimately made the broadsheets irrelevant.[10]

The most important image factory in France was the Imagerie Pellerin in Épinal, founded in 1796 by Jean-Charles Pellerin (1756–1836). As early as 1820, the business employed about 100 workers to make the printing blocks and stencils and to color the sheets. The stencils were made of cardboard, but tin plates were also used later on. The stencil openings were cut into the plates using a "Pédalette," a device similar to a sewing machine in its design, but with a saw blade instead of a needle. The colors were applied to the printed sheets manually using boar bristle brushes. In 1852 the Imagerie began using the lithography process.[11] Now Pellerin was printing about five million illustrated broadsheets

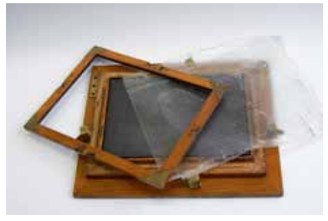


2.2 / STENCIL DUPLICATORS

DUPLICATING MACHINES in which the printing form consisted of coarse-fibered stencil paper (the master) were used in office work well into the 1970s.[25] They made it possible to produce several thousand copies of texts or simple artwork with little technical effort.

Eugenio de Zuccato (1845–1905) developed a process for duplicating handwritten texts in London in 1878. In his device, the Trypograph, a thin sheet of waxed paper was placed on a metal plate with a roughened surface similar to a file. Text was written on the paper using a blunt metal stylus, which perforated the wax layer, resulting in a stencil for printing. At first, a rubber squeegee was used to make the prints; however, the squeegee method did not become the standard in the further development of the stencil duplicator – it was replaced by hand rollers. Zuccato marketed his system in England and the United States, where it was used in office work in the 1870s and 1880s.

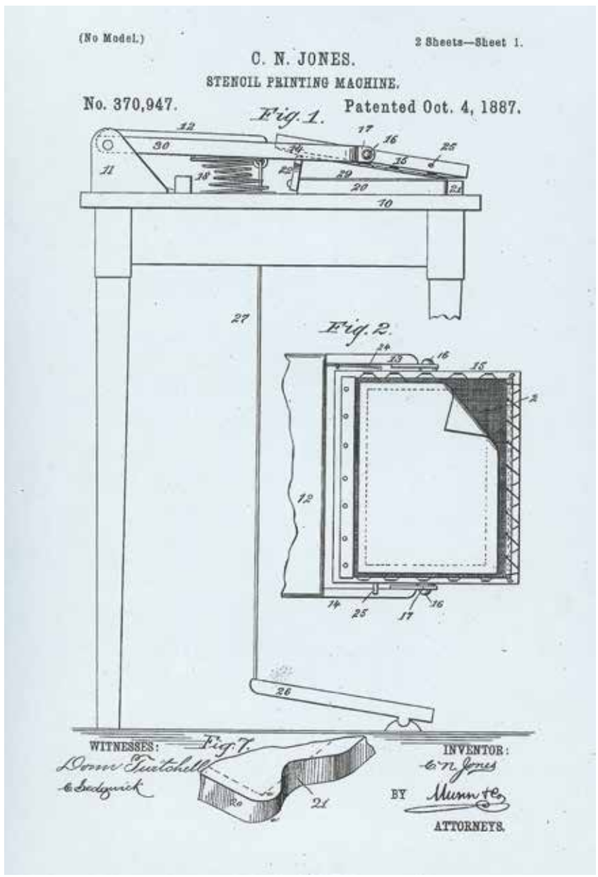
Between 1880 and 1885, David Gestetner (1854–1939) followed this with his own stencil printing system, which he called the Cyclostyle. It consisted of a press with a smooth printing plate and a special stylus for perforating the waxed paper. This "Cyclostyle pen" had a small toothed wheel at the tip that created the perforations. The inscribed paper was clamped into a folding frame in the press, and then copies were printed from it using a roller, with an output rate of about six copies per minute. The lifespan of a stencil ran to about 2,000 copies. Gestetner patented his first rotary printer in 1891. The printing system invented by George Richard Hildyard in England also deserves mention in this context. Hildyard, a lithographer, patented a stencil printer in London in 1895 that was reminiscent of the rotary printers used in office work.[26] Unlike the latter devices, Hildyard's was designed for printing "show cards," which were small-format advertising signs, as well as for larger

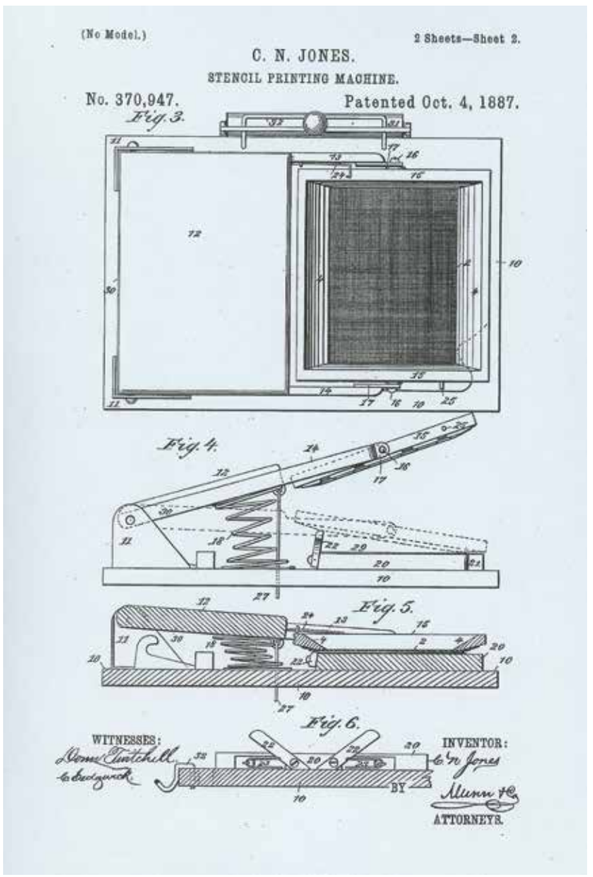


OPPOSITE: Advertisement for the Edison Mimeograph, USA, ca. 1900.

ABOVE: Gestetner's Neo-Cyclostyle Stencil Duplicator, late 19th century

Gestetner's stencil paper.
Neo-Cylostyle pen with perforating wheel.





ABOVE: Illustrations from Charles N. Jones' patent application, 1887.

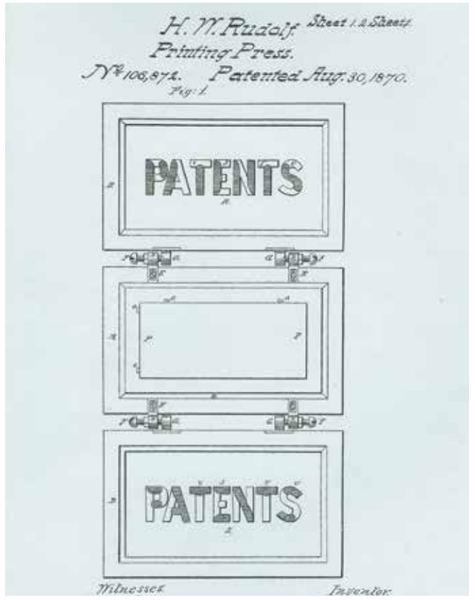
Charles Nelson Jones.
University of Michigan

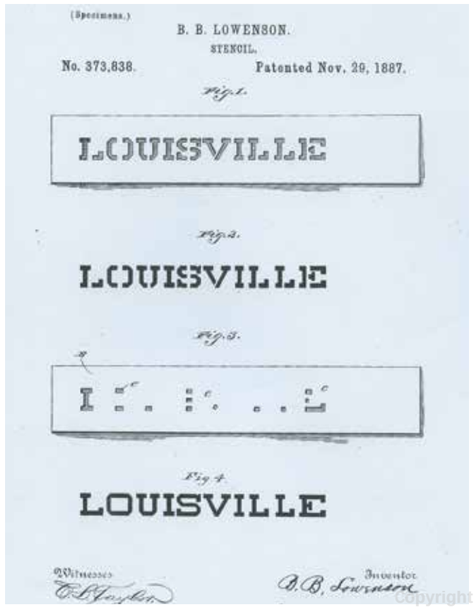
2.3 / FIRST PATENTS FOR TIELESS STENCILS

STARTING IN the mid-19th century, patents were filed in the United States and Europe for methods of creating open stencils, the pieces of which were connected to one another by ties. In the decades before the turn of the 20th century, methods were patented that attempted to eliminate these ties, since they were nonprinting elements. The various methods proposed involved connecting the stencil sections with overlying bridges, wires or grids, or the use of a second stencil in order to avoid nonprinting areas.

DOUBLE STENCILS, MALE AND FEMALE STENCILS

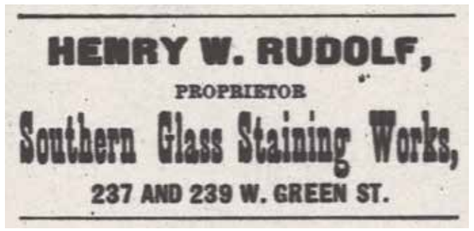
Paired stencils that together made up a complete printed image were used until the 1930s. These were known in the USA as double stencils or male and female stencils, and they were largely used for small runs of signs. However, they could also be used in other fields, such as production of enameled advertising panels.[39] The first patent for this was filed in 1870 by Henry W. Rudolf, a sign painter in Louisville, Ky. Rudolf was listed as the proprietor of a glass staining works in 1890. He proposed placing two stencils on opposite sides of a printing plate; these could be raised and lowered in turn in exact register, making it possible to reproduce the image in question without any undesirable non-printing areas. The device was intended for decorating glass, but was also suitable for other hard materials. Oil paint was applied with a simple "type roller" of the kind used in stencil duplicators for office work. Hiett mentioned that, with the rise of airbrushing after 1910, such devices were often used in the sign industry for decorating large numbers of display cards.[40] A comparable patent was filed in 1887 by Bernard Lowenson, also of Louisville. However, he did not use a "printing press," but rather hand-placed a second, complementary stencil over the first printed image. To ensure that the two prints would fit together in exact register, Lowenson left the same areas open in each stencil to act as register marks, which would line up with one another during printing. In the diagram in his patent filing, these were the first and last letters of a printed image of the name "Louisville." The stencils were made of impregnated paper or thin tin and the colors applied with a brush.





RIGHT: Illustrations from patent applications by Henry Rudolf (1870) and Bernard Lowenson (1887).

BELOW: Louisville Directory, 1889.



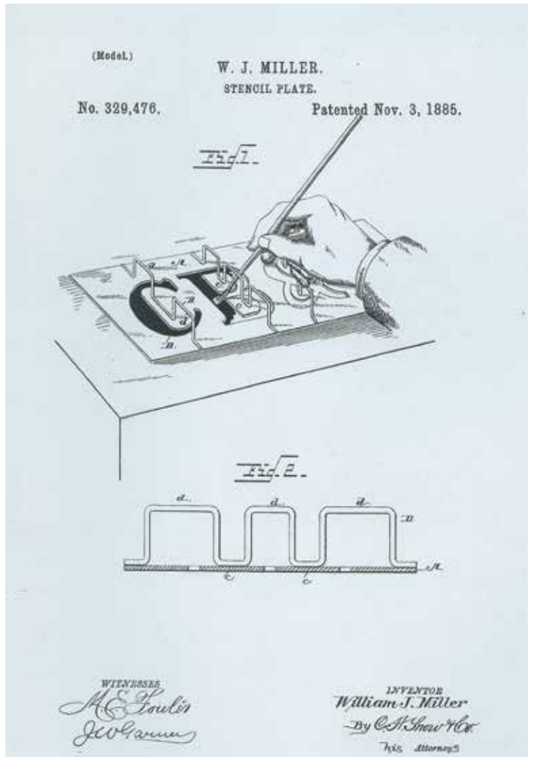
TIELESS STENCILS

Other patents from this period described stencils whose loose sections were fixed in place with wires or other connecting elements, making the use of a second complementary stencil superfluous. In America these were referred to as "tieless stencils."[41] This term was being used as early as the 1920s, but only in reference to screen printing stencils, as opposed to the open stencils used by sign painters at the time.

William John Miller of Aurora, Ill., patented a stencil in 1885 whose sections were connected by overlying bridges; these were intended for use in sign making. In 1880, David Ream of Detroit patented a stencil where the free sections were connected by wires. Ream was born in Pennsylvania around 1831, and later listed his profession as painter.[42] His stencils were made of paper or cloth. He used strips of paper and glue to fasten the connecting wires to the stencil elements, and then brushed on the color through the stencil. In 1885, Michael William Stines (1837–1911) of Dayton, Ohio, also filed a patent for fastening loose stencil elements with wires. Stines, born in Ireland, worked as a painter like Ream. In 1890, the Irish-born Thomas J. Mullaley, working as a painter in Chicago, also proposed connecting stencil elements together with wires. His stencil consisted of two layers of paper with a layer of cloth in between. This composite material was waterproofed by impregnating it with a solution of shellac, a resin secreted by lac insects. The wires that fixed the loose stencil elements in place were stitched onto the paper. Mullaley was the first to mention the use of a stencil frame in this patent. He pointed out that his invention would save a great deal of time compared to working with the "old methods of stenciling": Non-printing areas would not have to be filled in by hand or by using a second stencil. The "wire inlay" technique proposed by Ream and Mullaley is reminiscent of traditional Japanese stencil making.

An 1884 patent by Benjamin Walker, in which mesh was used as the stencil carrier, further advanced the technology. Walker, born in England around 1851, was listed as a painter in Detroit in 1880, and then between 1890 and 1920 as a foreman in the painting department of the Michigan Car Company, one of the leading manufacturers of railroad cars and locomotives. The company employed 6,000 workers in the 1890s and produced 10,000 rail cars a year. Walker used a wire mesh, to which a stencil made of paper or thin tin was attached. Color paste would then be applied with a brush as was typically done at the time. Walker listed "lettering" as the field of application for his stencils; we can assume that they were used in the Michigan Car Company's industrial production process for the numerous car markings.

Further patents involving the use of wire mesh as a stencil carrier were later filed by William Henay of Boston/Cambridge, in 1897 and by Albert Haberstroh, also of Boston, in 1899. Henay, born in 1855, worked as a fresco painter, house painter and designer like his father. His patent was used for stenciling ornamentation on walls and ceilings. Haberstroh, whose father was from Germany, was born in 1855 like Henay. He studied art and later took over his father's interior decorating business. "He is the inventor of several patented mural processes of decoration, and his work is shown in theatres,


(Model.)

W. J. MILLER.

STENCIL PLATE.

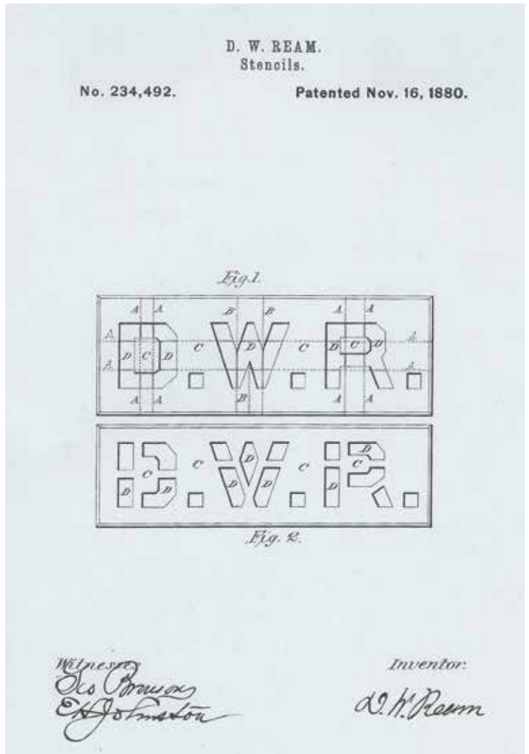
No. 329,476. Patented Nov. 3, 1885.

Fig. 1.

Fig. 2.

WITNESSES
M. C. Fowler
J. C. Dewey

INVENTOR
William J. Miller
By C. A. Snow & Co.
his Attorneys


D. W. REAM.

Stencils.

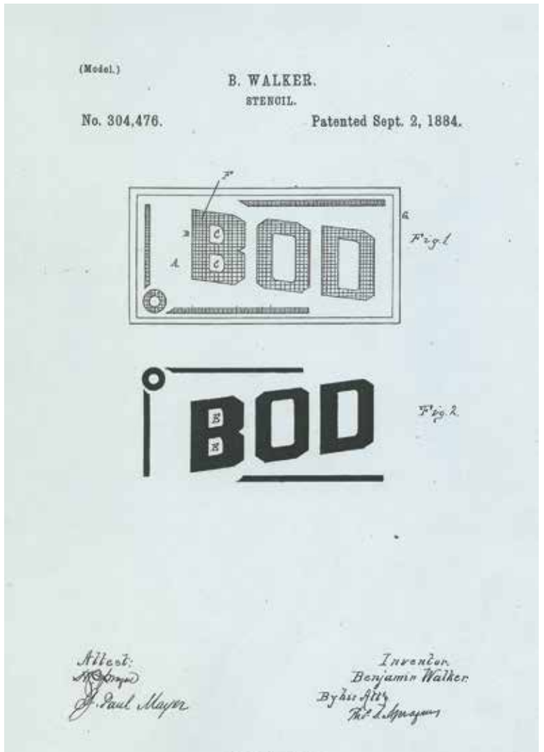
No. 234,492. Patented Nov. 16, 1880.

Fig. 1.

Fig. 2.

Witnesses
Jos. Bowers
E. A. Johnston

Inventor:
D. W. Ream


(Model.)

B. WALKER.

STENCIL.

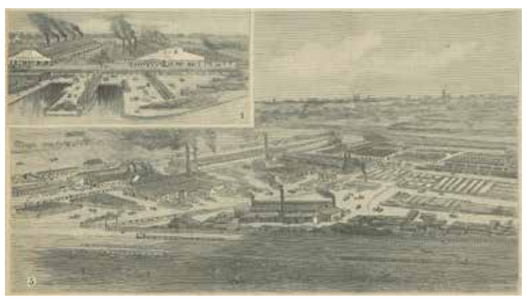
No. 304,476. Patented Sept. 2, 1884.

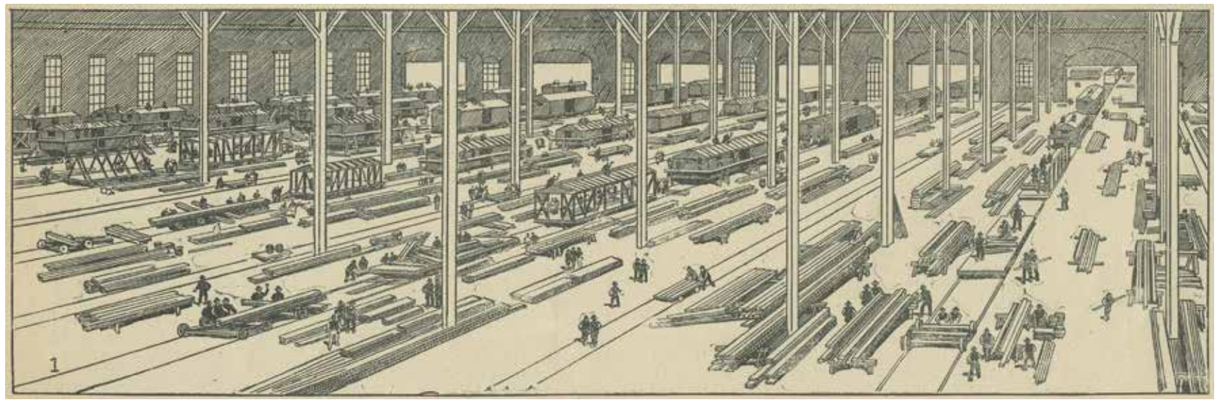
Fig. 1

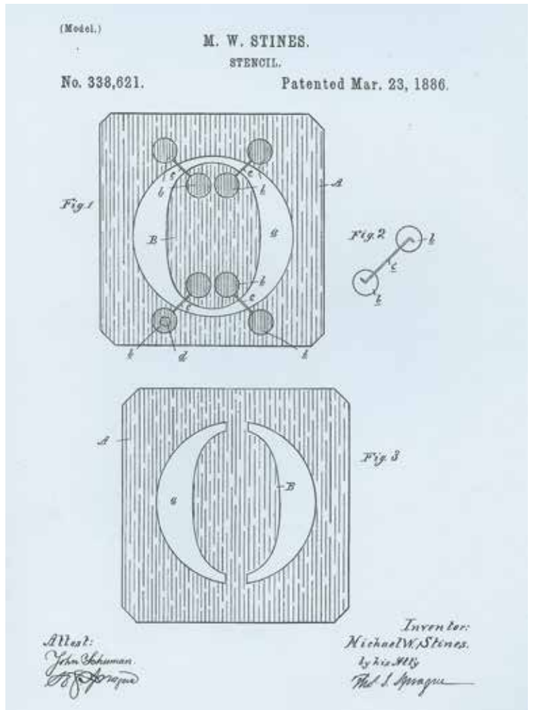
Fig. 2

Attest:
J. Paul Mayer

Inventor.
Benjamin Walker.
By his Atty
Thos. L. Sprague






(Model.)

M. W. STINES.

STENCIL.

No. 338,621. Patented Mar. 23, 1886.

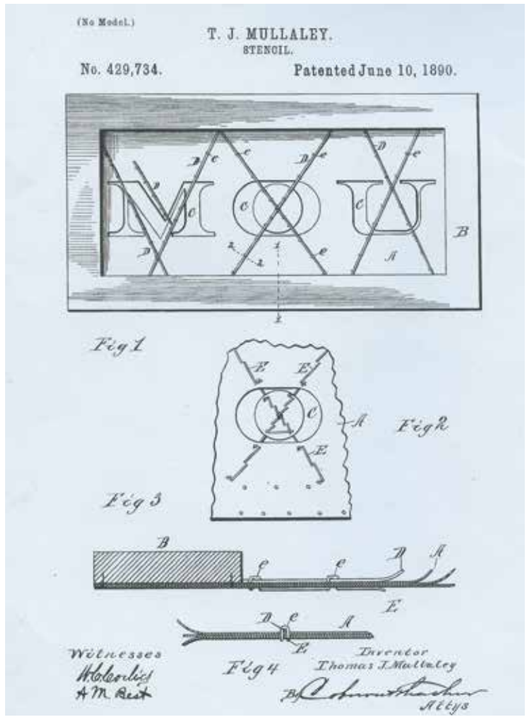
Fig 1

Fig 2

Fig 3

Attest:
John Dickman
Thos. L. Sprague

Inventor:
Michael W. Stines.
by his Atty
Thos. L. Sprague


(No Model.)

T. J. MULLALEY.

STENCIL.

No. 429,734. Patented June 10, 1890.

Fig 1

Fig 2

Fig 3

Fig 4

Witnesses
H. Colerick
A. M. Reid

Inventor
Thomas J. Mullaley
By Edmund Burke
Attys

OPPOSITE: Illustrations from patent applications by William Miller (1885), David Ream (1880), Michael Stines (1886) and Thomas Mullaley (1890).

ABOVE LEFT: Illustration from patent application by Benjamin Walker, 1884.

ABOVE RIGHT: Michigan Car Company ad, 1892.

CENTER AND BELOW: Michigan Car Company, 1889.

Frank Leslie's Illustrated Newspaper, 1889

3 / ORIGINS OF THE SCREEN PRINTING PROCESS IN THE USA

3.1 / FIRST AMERICAN PATENTS FOR SCREEN PRINTING

NUMEROUS PATENTS from the late 19th century document the development process from simple tieless stencils connected by wires or grids to the use of mesh as a stencil carrier. Fabrics like silk bolting cloth made it possible for the first time to create stencils with a high level of detail reproduction. During this period, when the technique was still being used for lettering and for wall and textile decoration, the final step was made into commercial/industrial applications – and the screen printing process was born. Here too, as with previous developments, a great deal of information remains obscure. Nevertheless, two patent filings mark the transition from decoration and lettering method to printing process. They were filed by Antoine Vericel and Hiram Deeks, both working on the East Coast of the USA. Each describes a comparatively advanced system already exhibiting strong similarities to the modern screen printing process.

ANTOINE ALMA MARIE VERICEL (1873 – 1960)

In April 1902, Antoine Vericel submitted a patent for a carousel-like printing apparatus for multicolor printing on household textile items like cushions, pillows and covers. Vericel pointed out that other materials could also be printed using his device. It consisted of a six-sided printing plate with stencils attached to five of the sides by hinges, each of which was held in the open (vertical) position by a pull cord with a counterweight. The printer operated the device from the unoccupied sixth side of the "carousel." J. Duff McDonald had already patented a similar device for printing on textiles in New York in 1874, but only for single-color printing using a perforated paper stencil stretched on a frame.

Information about Vericel is spotty. He was born in Paris in 1873 and emigrated to the USA. In the patent application he refers to himself as a French citizen, residing in Manhattan, N.Y.; in the census records for 1910 and 1930, he is listed as a "designer, fancy goods" and a "designing engineer" respectively.

For the stencil mesh Vericel recommended bolting cloth (silk gauze) of the type used in milling machinery, or another similar cloth with appropriately large meshes. The stencil was made of paper and then glued to the mesh. Vericel's patent is the first to mention and illustrate a squeegee, which he called a "scraper," without mentioning a suitable material for it. Harry Hiett mentioned that printing was done with wooden scrapers in these early days of the process; these were later replaced by leather squeegees, and finally by the rubber squeegees in use today.[45] One of the advantages Vericel listed for his stencil was its user-friendliness: "The desired color of paint may be quickly and easily applied by an unskilled operator to the fabric."

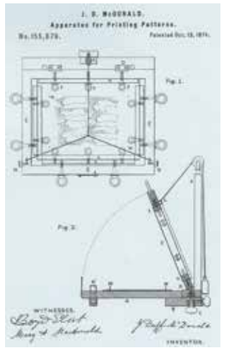
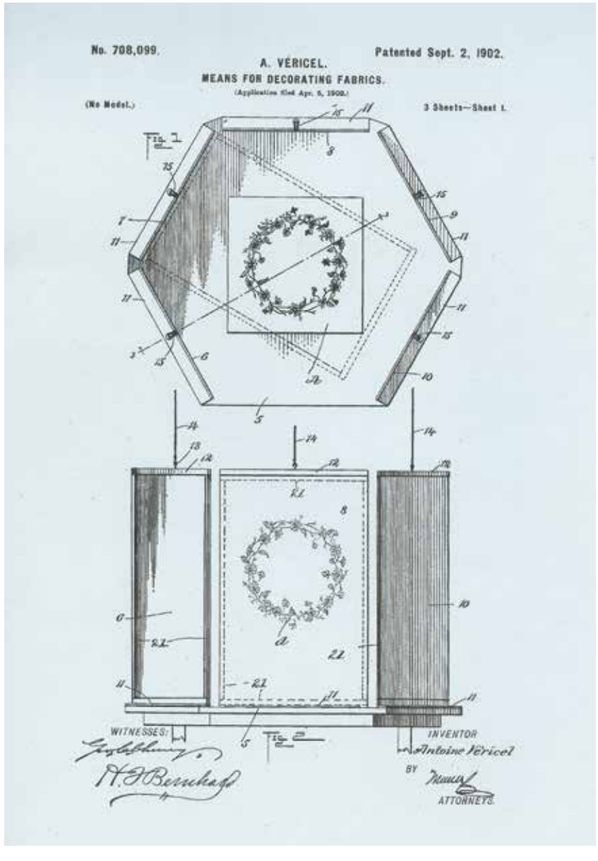
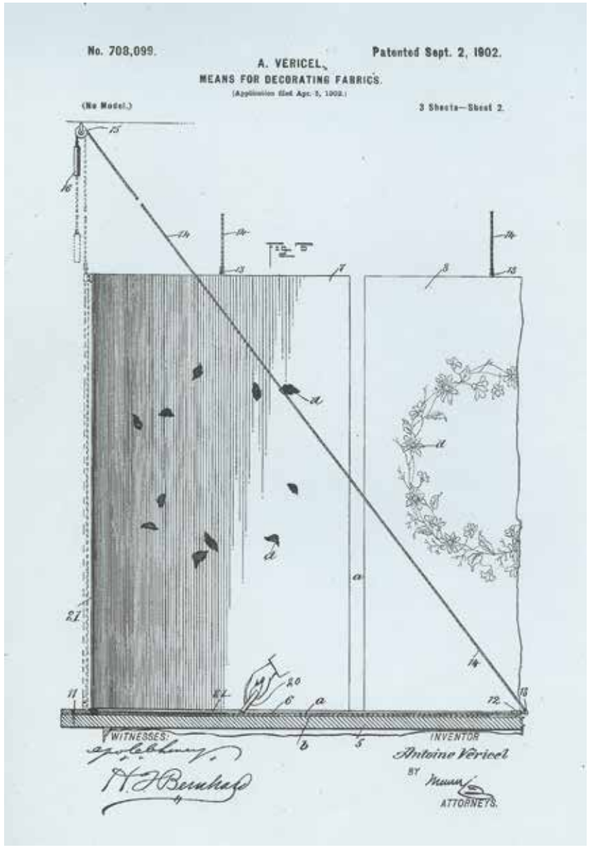


Illustration from patent filing by J. Duff McDonald, 1874. McDonald's "stencil duplicator" uses the same design as later screen printing presses.





ABOVE: Illustrations from patent filing by Antoine Vericel, 1902.

RIGHT: Ad for Vericel's "Vanity Box." His work as a designer included cosmetics utensils.

The Billboard, July 17 1920

Vericel apparently did not work in the printing industry, and may have developed his printing device in the course of his work as a designer of household items. Later he moved on to the cosmetics industry: In 1918 his job was "Manager of chemical factory" at the French Medicinal Company, and in 1919 he was a co-founder of La Fluerette Inc. in Manhattan, which made toilet articles. Beginning in 1920, Vericel applied for a number of patents for cosmetics tools and furniture designs – nothing related to printing. He then moved to California in 1945, where he worked as an industrial designer, and died in San Diego in 1960.

HIRAM CODD JOSEPH DEEKS (1880 – 1952)

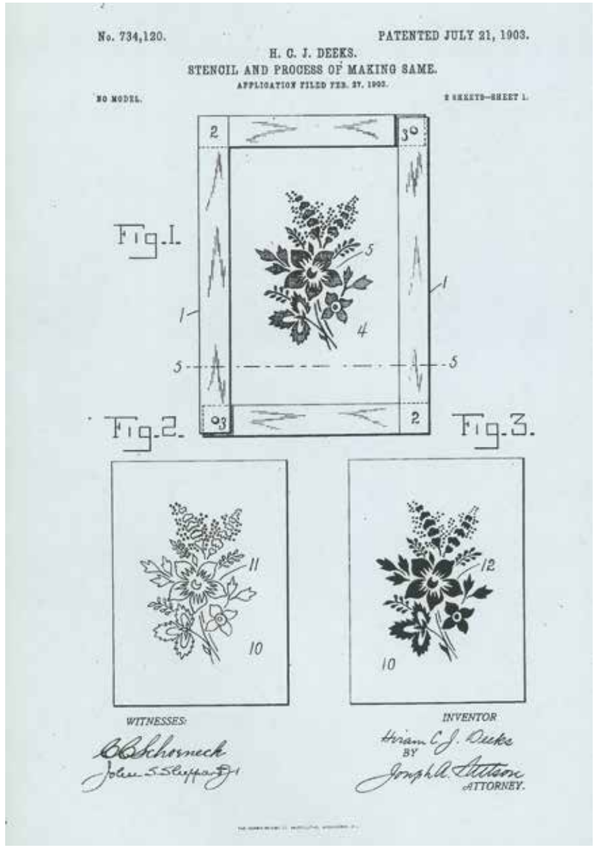
The second patent that can be definitely classified as a screen printing process was filed in 1903 by Hiram Deeks in Paterson, N.J. Deeks was born in London in 1880, and emigrated to the USA with his parents and family in 1893. As a 23-year-old textile designer, he applied for a patent on a stencil for printing on "fabrics, paper, walls, or similar surfaces."

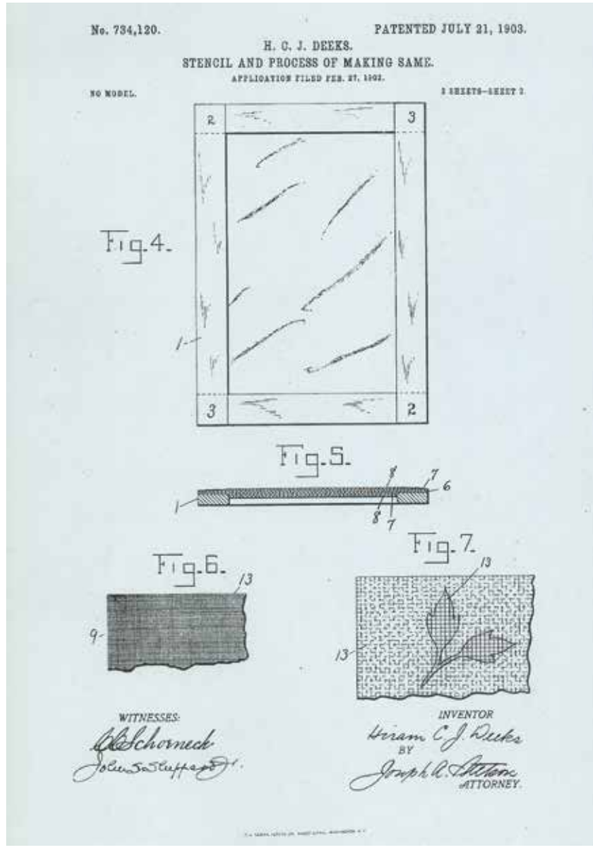
The patent described creating a stencil on a wooden frame "like the frame of an ordinary school-slate" covered with bolting cloth. The fabric was adhered to the frame with "glue or paste, so that the sheet of gauze is smooth and tight like a drum. […] I then dip the frame covered by the gauze into melted wax or other suitable plastic material." Once the wax had hardened, the coated gauze was laid on a piece of blotting paper on which the design had been drawn. "I then employ a hot sharp implement like a darning-needle, which has been heated by a flame or by an electric current, and follow with this implement upon the upper face of the coated gauze the design which is on the background beneath. The implement will melt and displace the wax from the gauze and cause it to be transferred to, deposited upon, and absorbed by the background of blotting-paper." The areas where the wax had been removed from the silk gauze were now ink-permeable. Next, Deeks coated the stencil on both sides with varnish for durability. He removed the varnish from the ink-permeable open areas of the stencil with cotton wool. Deeks pointed out that his method was simple and resulted in thin, transparent, durable stencils that produced sharp images but did not "involve chemical action." He did not, however, give any further explanation as to the "chemical action" that was being avoided.

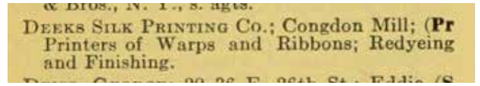
As mentioned above, Deeks was a textile designer in Paterson when he submitted this patent application. That same year, he filed a second, similar patent in both England and France. While the US patent mentioned general graphics applications for his stencils, the European versions referred to textile printing. As a native Briton, he was probably aware of the worldwide importance of the European textile industry, which may explain the more specific orientation of these patents. As a textile designer, he may well have been familiar with the textile printing processes in use at the time – and Paterson, known as "America's Silk City," was the hub of the US silk industry in the decades around the turn of the 20th century. (A strike in 1913, which drew national attention, gives some idea of the size of the city's textile mills and dye works: 25,000 textile workers stopped work for seven months to fight for better working conditions.) It is not entirely clear why Deeks did not focus specifically on the American textile industry with his US patent.

In Deeks' English patent, screen printing was intended for creating proofs of textile items for the client's approval. The actual printing work for large runs was done on a rotary intaglio (gravure) press. Deeks also mentioned printing small runs of cushions and similar items that were not suitable for the complex gravure process. In Deeks' method, the ink was sprayed through the stencil and onto the textiles with a spray gun. In March 1903, almost simultaneously with his stencil patent, Deeks filed a patent for just such a spray gun ("atomizer"), but did not mention any specific applications.

Soon after his stencil patent, Deeks turned to photography and rotogravure. In 1906 he invented lenticular images or "flicker pictures," where a ribbed film was used to show two different images on the same surface, depending on the viewing angle. He ran a souvenir postcard company in Paterson around 1907, and then was president of his own firm, the Deeks Silk Printing Company, between 1910 and 1917. In 1920 he was listed as an "Inventor, photography" in New York; although he did not have any academic training, Deeks worked on the development of color photography in his own laboratory and also designed cameras starting in the mid-1920s.


No. 734,120. PATENTED JULY 21, 1903.
H. C. J. DEEKS.
STENCIL AND PROCESS OF MAKING SAME.
APPLICATION FILED FEB. 27, 1902.
NO MODEL. 2 SHEETS—SHEET 1.
Fig. 1.
Fig. 2.
Fig. 3.
WITNESSES:
INVENTOR
Hiram C. J. Deeks
BY
Joseph A. Sutton
ATTORNEY.


No. 734,120. PATENTED JULY 21, 1903.
H. C. J. DEEKS.
STENCIL AND PROCESS OF MAKING SAME.
APPLICATION FILED FEB. 27, 1902.
NO MODEL. 2 SHEETS—SHEET 2.
Fig. 4.
Fig. 5.
Fig. 6.
Fig. 7.
WITNESSES:
INVENTOR
Hiram C. J. Deeks
BY
Joseph A. Sutton
ATTORNEY.


& Bros., N. Y., s. agts.
DEEKS SILK PRINTING Co.; Congdon Mill; (Pr
Printers of Warps and Ribbons; Redyeing
and Finishing.

ABOVE: Illustrations from patent filing by Hiram Deeks, 1903.

American Textile Directory, 1913: Deeks Silk Printing Company, Paterson, N.J.
It is not known whether Deeks used his screen printing method here. However, the screen process was especially well suited for printing on silk as it did not damage the fabric.

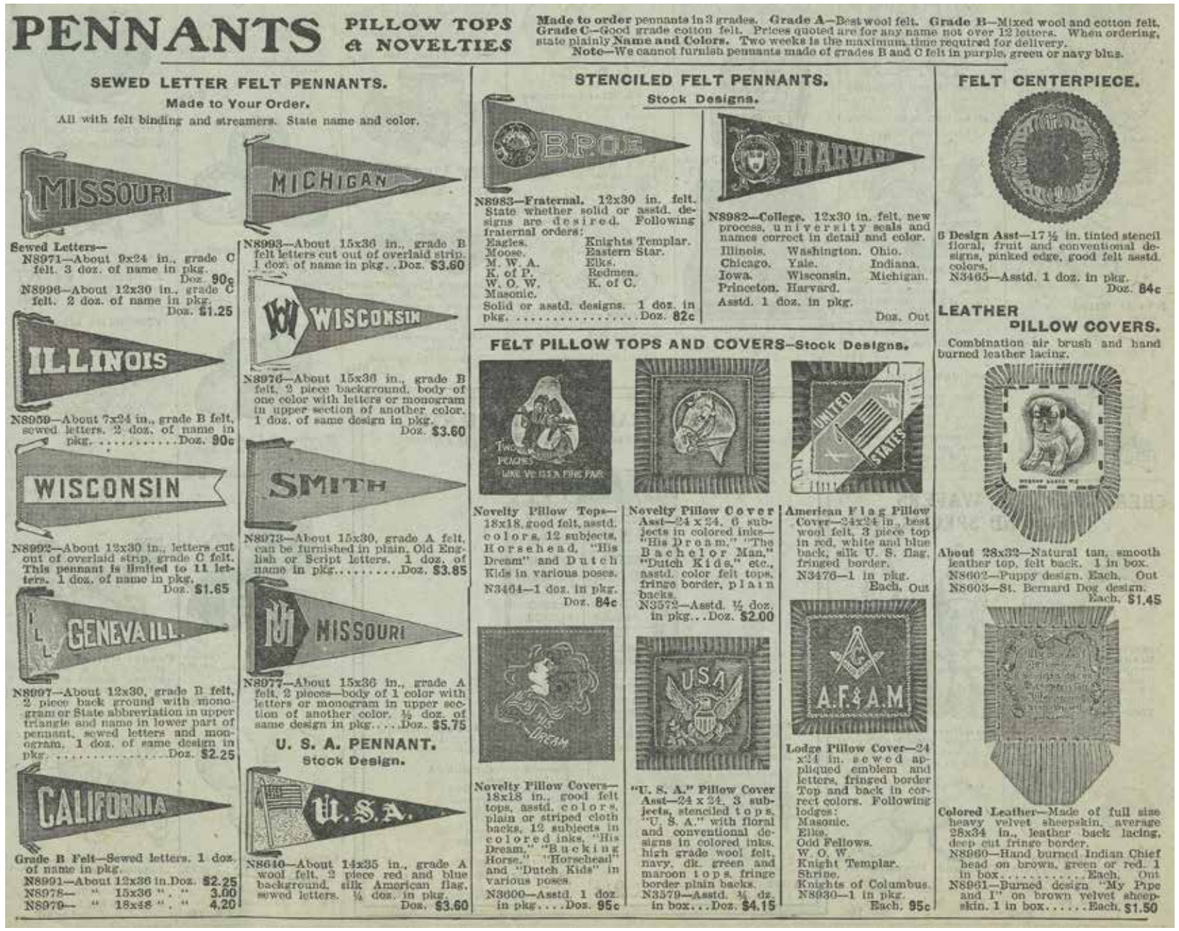
LEFT: Hiram Deeks and wife Lillian.
Family records of Daniel Deeks

3.2 / PENNANT PRINTING AS THE PRECURSOR OF GRAPHIC SCREEN PRINTING

THE DEVELOPMENT process that led to modern screen printing originated in both New York and the Midwestern states of Illinois and Michigan. Without giving further details, Hiett mentioned that felt pennants were already being screen-printed in 1900 in New York; he also referred specifically to Detroit, where it was happening at almost the same time.[47] He stressed the importance of felt pennant printing as the "forerunner to our modern system," from which the later developments derived.[48] Hiett divides the evolution of screen printing into three stages:

- Beginning of the 20th century: Felt pennant printing as the origin of screen printing
- Ca. 1915 to the early 1920s: Early stages of graphic screen printing, during which the process was used to print signs, posters or displays (i.e. shop displays)
- Post-1920s development, leading to modern screen printing

"[…] I can remember distinctly the early years when the screen processors of the country (the pennant printers with their closely guarded secret process) could be counted upon the fingers of either hand. I have observed the advancements made by many pioneers from those early days on up to the present time."[49] The first companies to use screen printing on felt pennants were in the business of novelties or promotional items. Although Hiett dates the first experiments in screen printing to approximately 1900, it would be several more years until the process achieved real importance.



OPPOSITE: Postcard, 1910s.

ABOVE: "Stenciled Felt Pennants – new process." 1916 ad.

FELT PENNANTS AS THE FIRST MAJOR SCREEN-PRINTED PRODUCTS

Felt pennants were popular souvenirs in the USA starting in the early 20th century. They sold very well at major events and fairs, in amusement parks, schools and colleges, and on commemoration days and holidays. They came in various sizes ranging from about eight inches to a yard in length. By the end of the 1900s, the pennants were being lettered with simple texts, such as the name of a city or a school. Each letter would be cut out individually from felt and sewn onto the pennant by hand, a time-consuming task. This production method called for fairly large letters, since small ones did not lend themselves to the sewing process. The ability to print on felt made it possible to produce the pennants more efficiently, and opened up the creative possibilities to include illustrations as well. The screen printing pioneer Edward Owens described the situation as follows in 1927: "Twenty-five years ago a popular form of decorative souvenir was at its height. This was the college pennant and consisted of felt letters sewed upon a felt field of contrasting color. The vogue of the all-felt pennant gradually widened to other uses. Gradually souvenir merchants began to sell them bearing city names or commemorating special events and celebrations. As automobiles increased in numbers the custom of flaunting a pennant from the home town also became prevalent. It was immediately following this era that advertisers saw possibilities in the pennant for advertising their wares, but the limitations of the all-felt sewed pennant for pictural illustration and small lettering was far from adequate for their purpose. It was with open arms that the advertiser took a new type of pennant which presently appeared. The 'innovation' was of the same general character as the college pennant, but in place of sewed letters it bore in paint colors a fairly representative illustration of a product and well executed lettering, sufficiently small to enable an advertising text to be displayed on the felt field. The tieless stencil made this possible."[50]

Before screen printing became the established method for printing on pennants, illustrations (quite unusual at the time) were applied by block printing, or automated letterpress for larger runs. The weakness in this process proved to be the thin color application: Single-color printing with black ink was the only way to get opaque prints on colored pennants. For multicolored illustrations, the outlines of the design had to be printed on white felt, then colored in with airbrush using cutout stencils and transparent inks. If the customer desired, the decorated white felt piece could then be sewn onto colored felt to make a complete pennant. The screen process made it possible for the first time to print a complete colored pennant with opaque ink coverage in any color desired, thus eliminating the need to stitch pennant sections together or sew on letters – both text and images could now be printed in a single step. Often the design would be printed in white ink and then colored with airbrush, which was typical at that time. The technical aspects of coloring will be dealt with in greater detail at the end of this section.

The change over to screen printing took place within a short time: Until the late 1900s, pennants were still mostly being made with sewn-on lettering, but then the screen printing process, which was more economical and provided better ink coverage, took hold. Manufacturers in New York and the Midwest led the way. Examples of pennants dating from 1908 already exhibit high-quality screen printing work. After that time, only elaborately decorated pennants in small runs were still being made with sewn lettering.

In the "Utica" pennant (ca. 25 in. long), the image was block-printed in black on white felt with airbrush stencil coloring in five colors. However, the light ink coverage characteristic of the block method meant that the letters in "Utica" could not be printed in opaque white on blue felt, so they had to be cut out of white felt and sewn on.

These two pennants show the transition from the old production method—sewn-on lettering and images applied by block printing—to screen process printing.

With screen printing ("Coney Island" pennant, ca. 11.5 in. long) the image and text could be applied to the blue felt background in a single printing pass with opaque white oil-based ink. The image portion was then stencil colored with a brush in three colors. The dates and manufacturers of these pennants are unknown.

Brant and Garner's first studio at 966 Market Street, San Francisco, 1908. Center: Frank O. Brant, right: Joseph A. Garner.
Family records of Raymond Brant

Brant & Garner studio, Market Street, San Francisco, 1913. This is the earliest photographic record of the screen process. Left: Joseph A. Garner, center: Frank O. Brant.
Family records of Raymond Brant

3.3 / THE ORIGINS OF GRAPHIC SCREEN PRINTING

ACCORDING TO a 1947 article in *The Pacific Printer & Publisher*, a trade journal, "The exact date when this medium was introduced in the United States is not known. Commercial silk-screen printing, as we know it today, was perfected in San Francisco. The modern process is the result of intensive pioneering, extending over a period of years, by a diligent group of San Francisco artists, photographers, engravers, printers and other craftsmen. Several of the most prominent of this group were: [...] J. Pilsworth, Edward Owens, J. Steinman, Roy Beck, R. G. Tonge, J. A. Garner and F. O. Brant. All of these men were skilled technicians, and their collaboration was an important factor in the successful development of the process. The last two mentioned, J. A. Garner and F. O. Brant, formed a partnership approximately forty years ago, and are still operating under the trade name of the Velvetone Company. Probably the oldest screen processors in the country."[85]

Graphic screen printing originated in California. The process was actually borrowed from the field of felt pennant printing and then adapted for printing signs, posters, displays, etc. *The Pacific Printer & Publisher* article mentions the most important figures involved in making the process a technological and commercial success. However, the collaboration among these parties also contained an element of competition, apparently even to the point of conspiracies.

Three companies played a decisive role in the development of graphic screen printing: Velvetone and Selectasine in San Francisco, and Vitachrome in Los Angeles. The Velvetone Company, founded as a sign painting shop by Frank Otokar Brant in 1908, led the way. Velvetone did its first screen printing jobs starting in 1912, and for decades it was among the leading graphic screen printing firms in America. Selectasine was founded in 1915 and Vitachrome followed one year later. During this early period, the three companies were connected in a variety of ways. The events can be reconstructed from four sources: Brant's autobiographical notes, the sometimes divergent reports from Selectasine's founders, Roy Beck and Edward Owens, and those of Charles Peter, a graphic artist who was a friend of Owens.

BRANT & GARNER COMPANY (VELVETONE POSTER COMPANY), SAN FRANCISCO

Frank O. Brant, "Granddaddy of Screen Process Operators"

Frank Otokar Brant was born in 1881, in the small city of Kutná Hora in what is now the Czech Republic. He studied art and designed embroidery patterns before going into the giftwares industry, manufacturing and selling his own products. In 1899 he emigrated to the United States to look for work in the textile industry;

FRANK OTOKAR BRANT (1881 – 1967)
JOSEPH ANASTASIO GARNER (1886 – 1966)

Frank O. Brant and
Joseph A. Garner, ca. 1947.

FRANK O. BRANT and Joseph A. Garner were the founders of the Velvetone Poster Company in San Francisco, one of the most important pioneering companies in graphic screen printing. Brant was born in Kutná Hora, about 45 miles from Prague in the modern Czech Republic. He studied art and then emigrated to the USA in 1899, settling in San Francisco in 1906. Garner was born in San Jose, Calif., and worked as a sign painter. Brant acquired a sign shop in 1908, which Garner joined the following year; the two became business partners shortly thereafter, and company was renamed to Brant & Garner. Their friendship lasted for the rest of their lives.

In the early years of the business, Brant was responsible for day-to-day operations while Garner handled most of the technical work. They printed their first screen process job in 1912. The company changed its name to the Velvetone Poster Company in 1918 after acquiring the Selectasine shop and achieved a national reputation for its high-quality screen printing work in advertising and art. The firm experienced both prosperous and lean times. It was sold in the 1980s and liquidated in 1991. Garner died in 1966 in San Mateo, and Brant one year later in Oakland.

the cities of the East Coast held little fascination for him, however, so he moved westward. Along the way, he worked as a window dresser and interior decorator, and painted chinaware and signs. Brant settled in San Francisco in 1906, after the great earthquake. Once he had become sufficiently familiar with American business practices, he decided to set up shop for himself as a commercial artist in 1908. He was able to acquire a small sign shop, and despite difficult startup conditions, he made a success of it.[86]

Brant's autobiographical notes provide unique and previously unknown glimpses of the development of the modern graphic screen printing process, and will be quoted at length here:[87] "I walked down to work all twenty blocks to save a nickle and brought my lunch to save time and money and pitched in. Soon I discovered this was no business for one man. Answering the telephone, waiting on customers spending $1.00s worth of the time to get 50 ct orders, then work and deliver and keep books. Immediately I had to hire an errand boy to shop for supplies and make deliveries at $5.00 per week plus carfare, etc. […] I worked twelve to fifteen hours every day, and at the end of the month I was real lucky to take in $100.00 – and out of this rent was $25.00 and the boy $5.00 and if I could collect the $100.00, I took home $70.00. […] The more business came in, the less I could produce."

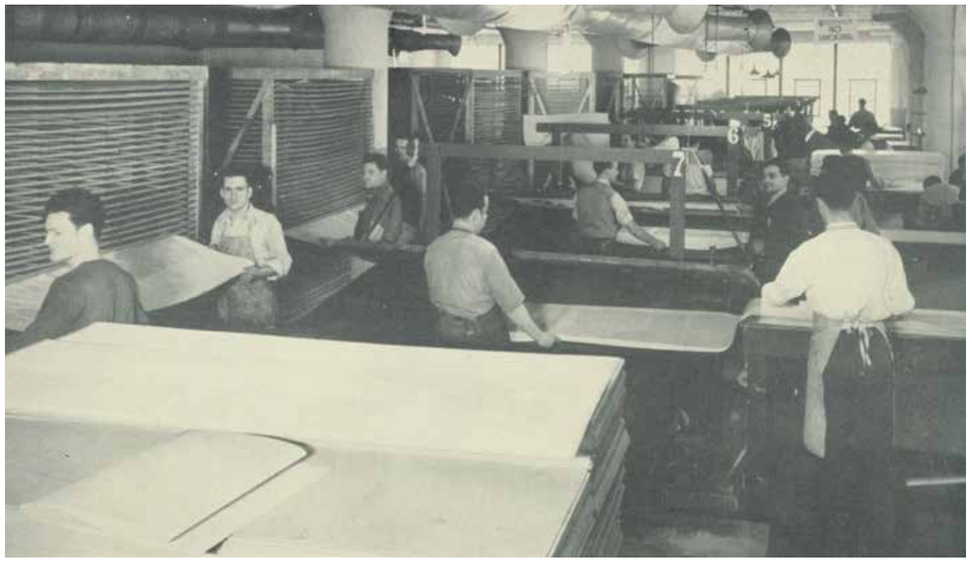
It became increasingly clear to Brant that he would not be able to advance any further as a one-man operation, so he looked for a qualified employee to take on some of the burden. He put an ad in the papers, and after several unsuitable candidates came a man "looking the Spanish type – a young fellow whose name was Garner. He was fast, fine style and most agreeable type of person. Wages 50ct per hour. At times we had to work overtime, other times there was hardly enough for one man. So, at 50ct an hour he made more money than I. Sure not a very satisfactory deal for either. Pretty soon we learned to like one another a lot. […] Both of us wanted to stay and work together sharing 50-50 both the expenses and the profits. In the daytime, I had to go out and hustle new business and help out nights if necessary." While Brant mainly dealt with sales, Garner handled the technical execution of the jobs.

Once again, the firm quickly reached the limits of its capacity. Another employee was sought to take on some of the work: "Well, we found one, or he found us. George La Roche was of French descent and the fastest lettering man of his time, especially doing gold leaf lettering on glass. So we did advertise and solicited this type of

ABOVE: Frank O. Brant, ca. 1914.
Family records of Raymond Brant

Brant & Garner Company ad, 1915.
San Francisco Directory, 1915

LEFT: Market Street, San Francisco. Postcards, ca. 1915.



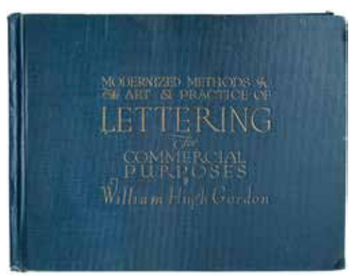
American Display Company, specialists in screen-printed theater posters. The company had over 300 employees in its New York branch alone.
Signs of the Times, February 1937

3.4 / SCREEN PRINTING IN THE USA BETWEEN THE WORLD WARS: "THE MOST ACTIVE PERIOD OF ADVANCEMENT"

THE SCREEN printing process was first established in the graphics industry by the California-based Selectasine Company, which employed a sophisticated system for licensing the rights to its patented stencil production and printing methods. Nevertheless, after World War I the screen process also began to spread independently within the advertising industry on the East and West Coasts. Both large sign makers and small shops used the process without bothering with licenses – after all, Selectasine did not hold any patents for single-color printing or for multiple-screen processes. Articles and books explained the new technology to an interested audience, which facilitated its spread. As Hiett pointed out, "Development in any field of creative endeavor is not the achievement of any one individual. The more persons that become engaged in a certain profession or trade, the greater are the possibilities for development and advancement. I have witnessed the various stages of progress in screen process almost from its crude and humble beginning, when it was known to only a few." However, he also commended the achievements of the pioneers: "While the early processors did not have the materials, implements, and possibly the know-how, for producing the various kinds of screen process printing

ABOVE: Illustration from the first article on screen printing, written by William H. Gordon in 1916.
Signs of the Times, October 1916

RIGHT: Gordon and his 1918 book on typography.
Signs of the Times, June 1917



TYPE DESIGNERS USE THE SCREEN PROCESS; FIRST PROFESSIONAL ARTICLES ON THE PROCESS

The first article on the screen printing process appeared in the journal *Signs of the Times* in October 1916.[166] Its author was William Hugh Gordon, an important American type designer of the early 20th century, who would publish a book on typography in advertising two years later.[167] Gordon was born in Canada around 1867 and lived in San Francisco and Los Angeles during the 1910s, then in Seattle around 1920.[168] We can assume that he became familiar with screen printing during his years in California, which was the center for the new process at the time. In his article, he discusses felt pennant printing and then deals in some depth with the use of screen printing for graphics work, such as displays and show cards. Gordon describes stencil making in detail, particularly photographic stencils, as well as the actual printing process. Here he gives a detailed description of the single-screen method, i.e. multicolor printing from a single screen, which is also shown in the illustrations accompanying the article. Unlike Selectasine, which patented the method, Gordon did not use traditional lacquer to coat his screens, but rather a photosensitive emulsion, which was then exposed like a photograph. In fact, Gordon does not even mention Selectasine.

In the final part of the article, Gordon stresses the economic benefits of screen printing compared to letterpress and lithography. Because of their high base costs, the latter two methods were cost-effective only for large print runs. Screen printing, on the other hand, required only "a wooden frame covered with bolting cloth and the price of the colors used on the job and a few simple chemicals," which made it particularly

attractive for smaller businesses, such as sign shops. Print runs could be anywhere from "one to a million."

Gordon's book on typography influenced Ross Frederick George, another sign writer and designer of advertising displays.[169] Born in 1889, he, like Gordon, lived in Seattle and worked with the screen process. It is safe to assume that the two knew each other. In 1917 George ran an advertisement for his photographic stencils: "Can you make process signs? A new photo process formula discovered." Type designers of the time were well aware of what was going on in the burgeoning screen printing industry; for example, George took note of the fact that "Brant & Garner had bought the Selectasine Process Sign Company and renamed it Velvetone Advertising Company."[170]

Albert Max Imelli (1875–1967), another type designer, was part of the pioneering generation of screen printers and knew Gordon.[171] Born in San Francisco, Imelli grew up in Los Angeles, working first for a lithographer and then as a sign painter. In 1911 he attended a sign painting school in Hawaii for several months, and later held management positions with several Los Angeles firms in the field.[172] This is probably when he became acquainted with the screen process. Like Gordon and George, Imelli advocated the photographic stencil technique early on. With Charles Lelegren (1880–1937), a well-known sign painter from Chicago, he founded the Pacific Sign Service in Los Angeles around 1920, which specialized in making theater displays. Imelli's work was often praised in *Signs of the Times*. Like Gordon, Imelli wrote a book on typography for sign and poster painters, as well as a 1928 article on the screen printing work of Gilbert Tonge.[173]

Because of Gordon's article, "the secret of screen process was given out to the sign and show card field," as Hiett remarked.[174] Gordon, George and Imelli promoted the use of the screen process in type design and sign making on the West Coast, while Hiett, Zahn and Louis D'Autremont did the same in the eastern half of the country. D'Autremont also developed the first knife-cut stencil film, which he patented in 1929. All of them wrote articles for *Signs of the Times*. However, this increase in coverage was met with some antagonism from others in the industry who saw their trade secrets suddenly revealed. "I recall the criticism directed not only at me, but also others who gave some detailed instructions in *Signs of the Times* 25 years ago on silk screen work," Zahn remarked in 1947. "The complaint, overcrowding the field."[175]

The main concern at that time was keeping the screen printing technique a secret, even though well-financed industrial enterprises showed considerable interest in adopting the process. Resourceful "agents" exploited this situation and offered their "inside knowledge" of the screen process at prices of $100 to $500; companies that took them up on the offer were often surprised to discover that other, less prosperous parties in the same city were getting the same information for just $25.[176] Despite all the secretiveness, the spread of the process could no longer be stopped.

As the technical refinement of the screen process continued, the pioneers sought contact with the graphics industry. Screen-printed signs were exhibited for the first time at the National Exhibit of Advertising in St. Louis in May 1917.[177] Six years later, both signs and displays produced by the screen process were exhibited at the Sign Convention held at the Hotel Gibson in Cincinnati. Hiett gave a talk on the basics of the process. With some 200 exhibits in an area reserved exclusively for screen printing, this was the first major presentation of the new technique to a professional audience. Vitachrome was heavily represented, exhibiting prints in up to 24 colors produced by the Selectasine process. Other firms also had similar items on display, including the David A. Coleman Company, as recounted by Hiett.[178] There would not be another exhibition devoted entirely to screen printing until the Process Show in Chicago in November 1937.[179] The various possible applications of the process were introduced, accompanied by numerous lectures. The two-day event, with Hiett, Zahn and other leading figures in attendance and more than 600 guests, was intended to educate professionals, but was also an opportunity to look back at the developments over the past 30 years.

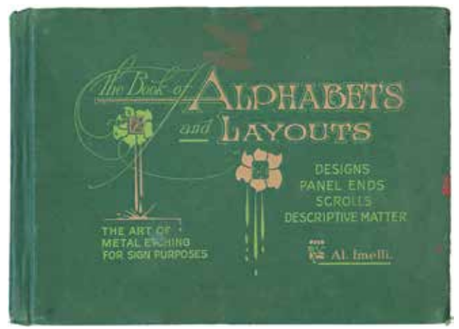
USE DURING WORLD WAR I

With the outbreak of the First World War in Europe, the USA fell into a brief recession, but this was quickly resolved when arms production began shortly thereafter. However, the economic situation continued to be difficult for the advertising industry, and essentially would

ABOVE: Charles Lelegren (left, kneeling) and Albert Imelli (standing, eighth from left) outside the Pacific Sign Service shop.

CENTER: Albert Max Imelli.
Signs of the Times, February 1922

RIGHT: Imelli's 1922 book on typography.
Signs of the Times, May 1922



Screen printing studio in New Zealand, 1931.
Signs of the Times, October 1931

3.5 / THE WORLDWIDE SPREAD OF THE SCREEN PROCESS

SCREEN PRINTING began to spread outside the USA after World War I, though it did not become firmly established in other countries until the mid-1920s. Its growth followed nearly the same course outside the USA as inside, but with a later start. Once again, Selectasine played an essential role. Starting in 1917, the firm filed for patents in Australia, New Zealand, Canada, and finally Europe, and quickly acquired licensees in countries where the advertising industry was on the upswing. *Signs of the Times* made its contribution by keeping professionals all over the world informed about the new technique.[209] The process was first adopted in countries with close economic ties to the United States.

CANADA, AUSTRALIA, NEW ZEALAND

Information about the use of the screen process outside the USA is sparse during the period prior to World War I. Hiett mentions only "several small shops" in Canada.[210] The process did not experience growth on a large scale there until after the war, as was also the case in the USA. One of the first printers mentioned is Sampson-Matthews Ltd. in Toronto, founded in 1918 by two Englishmen, Joseph Ernest Sampson (1887–1946) and Charles Andrew Graham Matthews (born 1890).[211] Sampson had studied art in Liverpool and Paris, and Matthews was a photographer and printer.[212] Their company did letterpress and lithographic printing, and probably added screen printing in the early 1920s; it is not clear whether it was a Selectasine licensee. Sampson-Matthews was involved in advertising, letterpress printing and publishing until the 1970s, and quickly gained a reputation for producing beautifully designed printed work. Beginning in the 1920s, the firm employed major Canadian artists, and within a decade it had become the leading screen printer in the field of art reproductions, producing twelve- to fifteen-color prints in oils on cardboard. The Canadian Advertising Sign Company in Toronto also printed art reproductions using the "oil paint process." An advertisement from 1930 showed ten designs, printed in twelve to twenty colors.[213] The St. Thomas Signs Company was one of the pioneers of industrial applications of screen printing in Canada.

The first indications that the process was spreading beyond North America come from Australia. In 1920, the Charles Steele Company in Melbourne expressed an interest in acquiring a license for the Selectasine process covering the Australia region, including Tasmania and New Zealand. The company, founded by John Burra Fletcher (1883–1959) around 1911, offered a wide variety of products and services, describing itself as "calendar printers, paper box makers, general printers, lithographers, stationers, engravers, publishers, book and print sellers, bookbinders and art journalists" as well as "dealers in prints, pictures, engravings, printing inks, papers of all kinds and articles made from paper or pulp."[214] It also imported consumer goods from England and America on a large scale.

Developments in this region proceeded along the same lines as in the United States: Starting with felt pennant printing, the screen process was used primarily for advertising items starting in the early 1920s, and was soon used for graphics work as well. However, the Australian printers were not inheriting a mature process, and, like their American counterparts, they struggled with considerable technical difficulties: "All colors had to be mixed by hand, with clogging or sissing always prevalent. Jigs had to be devised for various methods of production. Stencils had to be cut from loose paper, and unless adhered with glue they would shift on the silk, causing bad registration with the following color."[215]

Ad in *Signs of the Times*, 1930.
Signs of the Times, January 1930

ABOVE AND LEFT: Canadian screen-printed posters, 1941 and 1939.

Signs of the Times, February 1941 and October 1939

BELOW: Large-format outdoor advertising company, Australia, 1926.

Signs of the Times, October 1926

ABOVE: Screen printing studio in New Zealand, 1931.

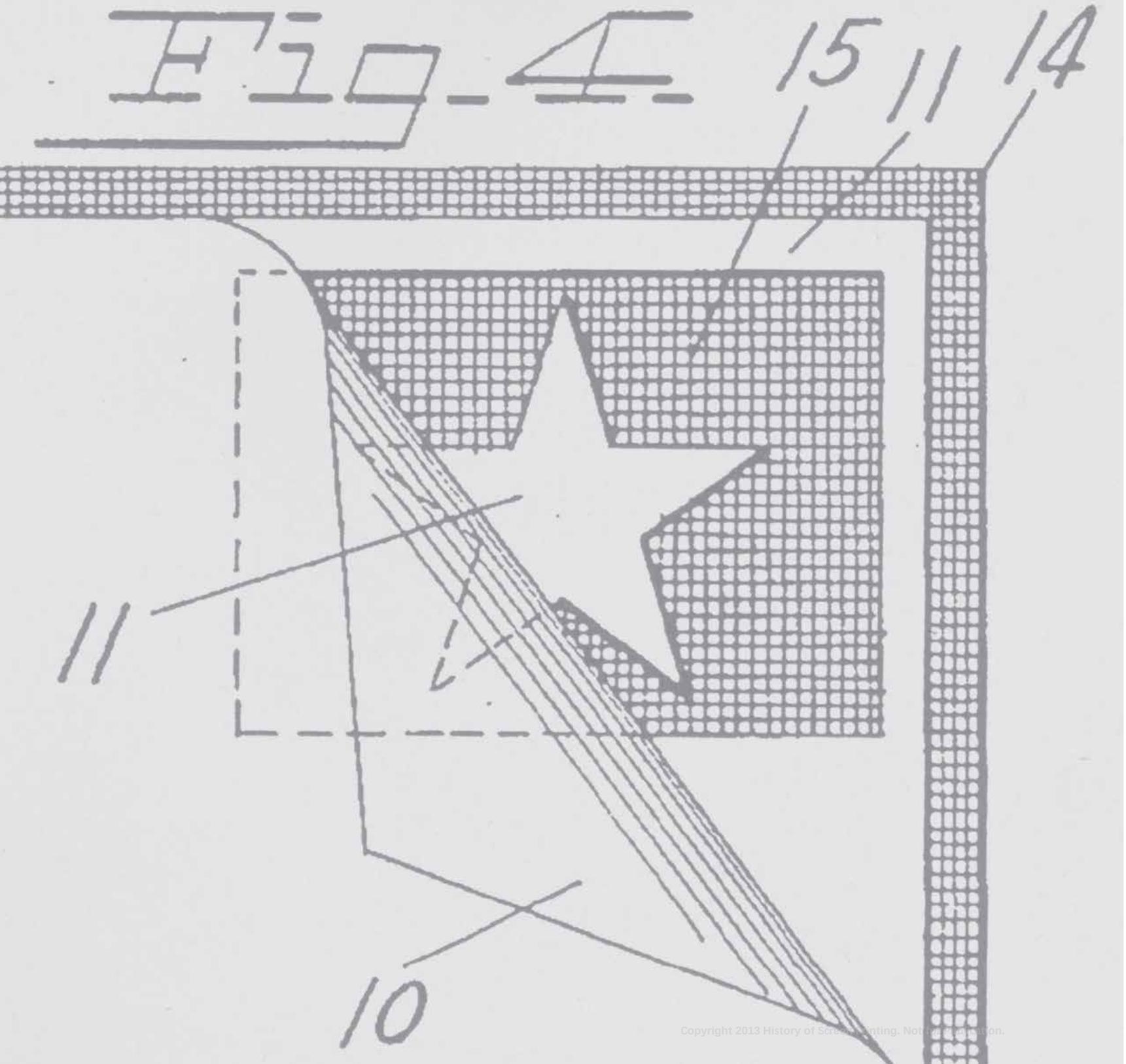
Signs of the Times, October 1931

CENTER: Outdoor advertising in Auckland, New Zealand, 1926.

Signs of the Times, October 1926

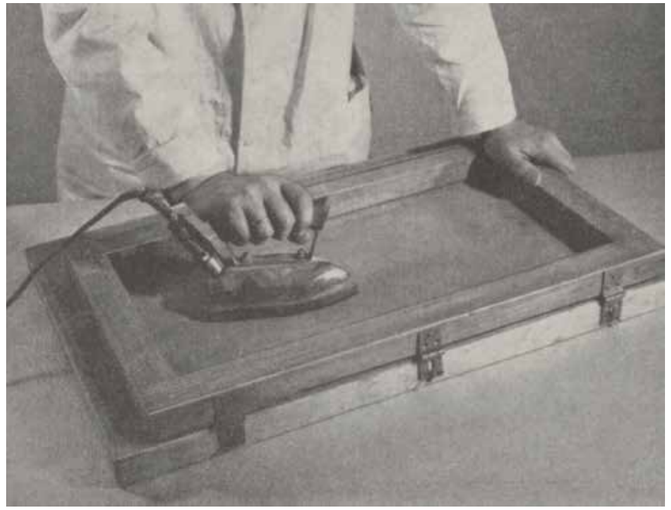
LEFT: Printed menu boards for restaurants.

Signs of the Times, July 1924



4 / TECHNICAL DEVELOPMENTS IN SCREEN PRINTING

Making stencils with shellac-coated paper, Germany, ca. 1950.
Der Druckspiegel, 1951



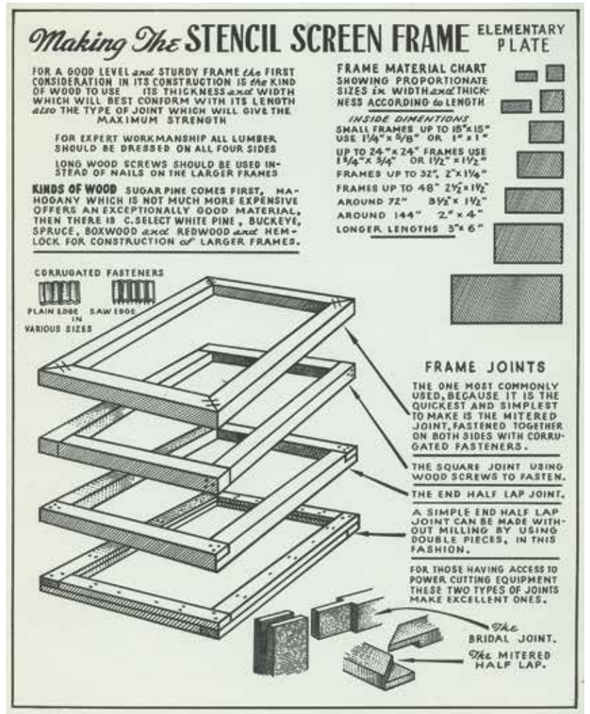
4.1 / STENCIL PRODUCTION

STENCIL MAKING represents just a small part of the overall production process today, but in the first few decades of the 20th century it was one of the biggest jobs. Creating stencils by hand required intricate drawing or cutting work, and photographic stencils often involved numerous steps, from preparing one's own photoemulsion to post-hardening of the exposed screens. Thanks to modern materials, good printing results that once required years of professional experience can now be achieved by laymen, sometimes after just a one-day training course. "It used to take a stencil maker a day to make a screen that is now cut in 30 minutes," Bert Zahn recalled in 1950.[231] That made it all the more painful to lose a screen, perhaps because the stencil pieces failed to adhere properly or the mesh ripped. At that time there were many more potential sources of trouble during stencil production than there are today. Nevertheless, even with the rudimentary tools at hand, it was possible to achieve results that come up to modern standards of quality.

FRAMES

Frameless stencils were being used for lettering or decorating walls and textiles until the turn of the 20th century. The stencils were simply laid on the substrate and the colors were rubbed through the open spaces with a brush. Frames covered with mesh, which acted as a stencil carrier, were used in the "stencil duplicators" found in offices in the late 19th century, and were first described by Nelson Jones in his 1887 US patent filing. In addition to their office applications, covered frames are also mentioned in European patents filed by François Schreurs (Belgium, 1892), Jehan Raymond (France and England, 1906) and Samuel Simon (England, 1907). In the USA, Hiram Deeks first described a stencil frame covered with silk gauze, of the type later used in screen printing, in 1903. His frame had mitered corners that could be adjusted to tighten the mesh.

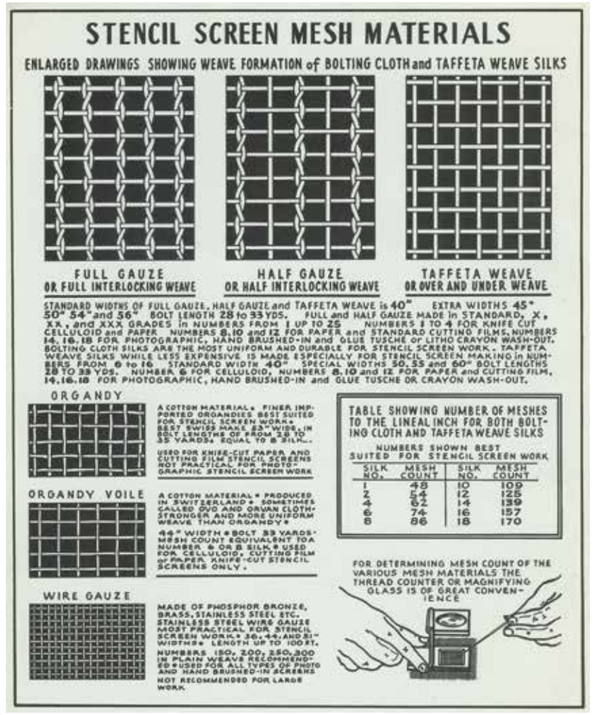
Frames were made of wood into the 1950s, which made it possible to cover the frame and fasten the mesh in place by simply tacking it down.[232] The frames were usually made out of cheap, well-dried pine or spruce. The wood was impregnated with linseed oil or a shellac solution to protect it from moisture and warping. Non-warping metal frames were sometimes used in textile printing, which involved water-based inks; here wooden cleats were used to lock the screen fabric into a U-shaped metal groove along the sides of the frame. A similar method was used in graphic screen printing: A groove was cut lengthwise into each side of the wooden frame, and then the screen fabric was laid over it and stretched. Strips of wood were pressed down into the grooves to hold it firmly in place.[233] Floating bar frames made it possible to readjust screen tension.[234] Steel and aluminum frames have been the norm for all types of screen printing since World War II. Special tensioning devices are used to stretch the screen tightly and then bond it to the frame.



Hiett's instructions for making a stencil frame, 1945.
Signs of the Times, April and May 1945

CHEESECLOTH AND BOLTING CLOTH

Harry Hiett lists the mesh materials that were used in the early days of screen printing: "Cheesecloth was the first material to be used, then came bolting cloth, organdy, voile, linen scrim, on up to the use of wire cloth."[235] Cotton and silk fabrics were most commonly used for screens until the mid-1920s. Cheesecloth, a loosely woven, large-meshed fabric originally used in

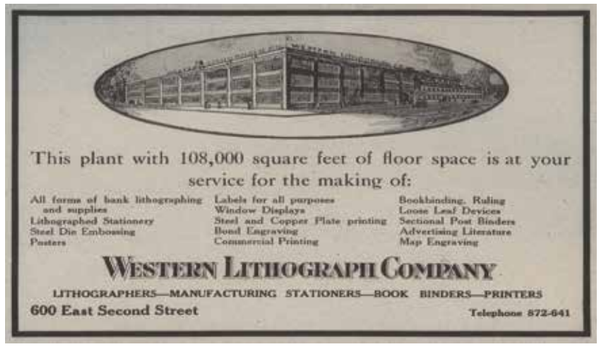


LEFT: Hiett's chart of mesh materials, 1945.

Signs of the Times, June 1945

BELOW: "The finest kind of work" with organdy: Western Lithograph Company, Los Angeles.

Los Angeles City Directory 1924



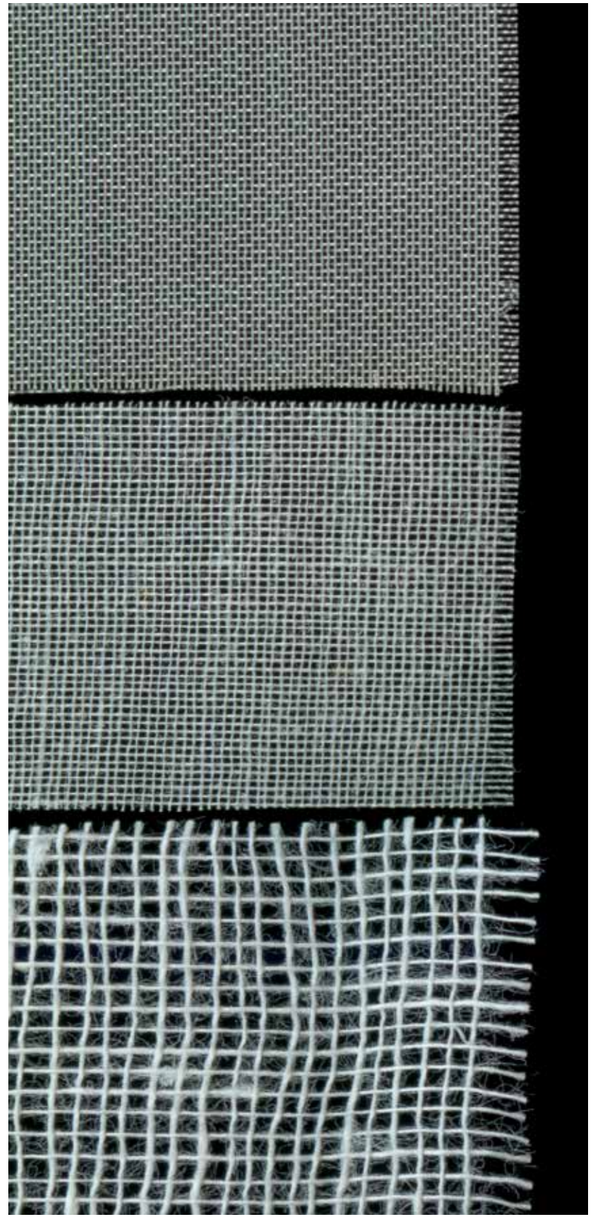
cheesemaking, was used as a stencil carrier at the beginning of the century,[236] as was window screening.[237] Soon, however, bolting cloth became the fabric of choice; this was precision-loomed, fine-gauge silk gauze that was used in mills for sifting flour, and it was comparatively expensive.[238] Cheaper alternatives were sought during the Depression, and eventually Edward Owens (one of the owners of the Selectasine Patents Company) had to inform American importers of Swiss bolting cloth that "I have some bad news for you since taking a trip to Los Angeles. […] The Western Lithograph Co. are now producing the finest kind of work on photo stencils (carbon tissue) made of organdie. I was rather surprised to learn that these stencils easily stand up to 10,000 impressions. […] Necessity is the mother of invention, they say."[239] Organdy was still used in the 1950s specifically for printing large-format posters, since the large amount of silk needed for such jobs was a huge expense.[240] Metal mesh made of bronze, copper or steel was used for printing on ceramics and textiles, since it could withstand abrasive or alkaline inks.[241]

The natural-fiber meshes used at that time were often stretched over the frames while damp. They shrank as they dried, which resulted in the proper degree of tension; however, this process worked both ways, with the undesirable result that the mesh would lose its tension again if it came in contact with water, which in turn distorted the printed image. This could occur when water-soluble screen fillers were used, for example, or with photographic stencils.[242] Renowned printers like the Faithorn Company in Chicago therefore decided to avoid stencils of that kind. The development of synthetic screen printing meshes made of nylon, and later polyester, brought a significant improvement in dimensional stability: They were highly stretchable and absorbed very little moisture, which resulted in distortion-free prints. Their monofilament thread structure and fine gauge also made it possible to achieve previously unattainable levels of print quality. After World War II, the comparatively cheap synthetic meshes supplanted bolting cloth entirely.

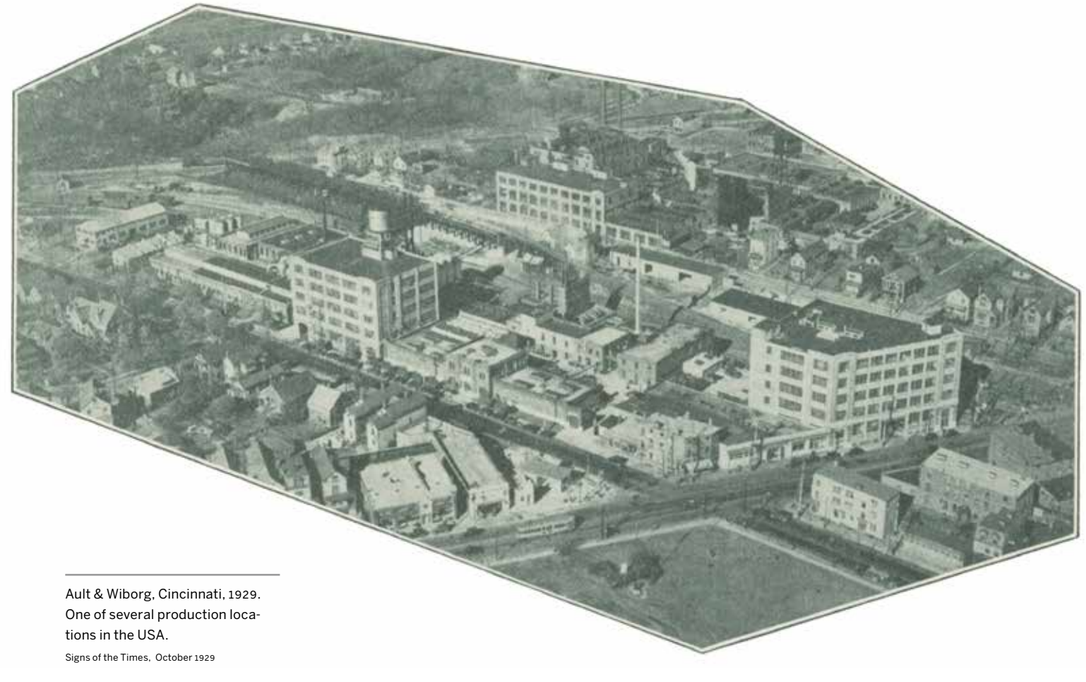
ABOVE: Ads in *Signs of the Times*, 1925.

Signs of the Times, January 1925

RIGHT: Mesh comparison: No. 9 bolting cloth (94 threads/in.), organdy and cheesecloth.



Mixing inks to print instruction posters for the US Army, 1944.
Signs of the Times, April 1944



Ault & Wiborg, Cincinnati, 1929. One of several production locations in the USA.
Signs of the Times, October 1929

4.2 / PRINTING INKS

IN THE early days of screen printing there were numerous technical problems to be conquered, such as creating sharp-edged stencils that would produce high-resolution prints in exact register. One of the greatest challenges was developing inks that were suitable for screen printing, which needed to combine properties like high levels of durability and printability with the shortest possible drying time.[281] Letterpress and lithography inks did not meet these criteria, nor did house paints. Inks had to adhere equally well to a wide variety of substrates – paper, metal, textiles, glass or wood – and, if they were intended for outdoor use, had to be weatherproof as well. They could not dry out during printing and clog the open areas of the stencil, but at the same time they had to dry as quickly as possible after printing so as not to interfere with production. Because screen printing involves heavy ink coverage, the ink film on the printed surface had to dry quickly and thoroughly, especially for multicolor printing; it was not uncommon for stacked prints to stick together (known as "blocking") if the ink film was not fully cured. Hiett therefore considered ink to be "the most important material" in screen printing.[282]

As the screen process spread, manufacturers began to develop suitable inks. In the United States this happened in the late 1910s and early 1920s, and in Europe about five years later. Manufacturers of industrial paints and letterpress or lithography inks branched out into the increasingly lucrative screen printing market. Selectasine often received advice from its licensees as to which manufacturers offered inks and additives that could be adapted to the screen process, and passed the information on to its clients, which may have helped to speed the development process along.

FROM HOMEMADE COLORS TO THE SCREEN PRINTING INK INDUSTRY

Until the 1920s, most screen printers made their own inks. "Prior to the time that special colors for screen process were made, we used to go to the local paint store, buy colors in oil, leave them stand until they settled, drain off the oil on the top, then mix starch to get a body or puffiness, and add a Lithographers #3 Varnish to keep the color open on the screen," Bert Zahn recalled.[283] Raw oil was also added as a retarder. Other additives included grease, syrup, honey, water or petroleum jelly. These mixtures resulted in inks that "were anything from house paints to japan colors."[284]

Although a number of factories were producing screen printing inks in the 1930s, the professional literature at that time still included detailed lists of the raw materials needed for making one's own inks. The primary reason for this was probably that the manufacturers of ready-made screen printing colors were located in the larger cities but still lacked a nationwide sales network. Hiett recommended that printers use these factory-made inks for quality reasons, since they were the end result of years of development work. Zahn agreed: "It is folly to think it possible to obtain good results with ordinary paint, as it is not properly ground and may contain ingredients that work well with a brush but will not go through the silk. Process paint should be purchased from a paint store catering to the process trade, as these paints are made for this purpose after careful study and research by the manufacturers."[285] Chicago-based Nazdar, founded in 1922, was the first to manufacture high-quality oil- and water-based screen printing inks,

A European pioneer of screen printing inks: Hermann Pröll.

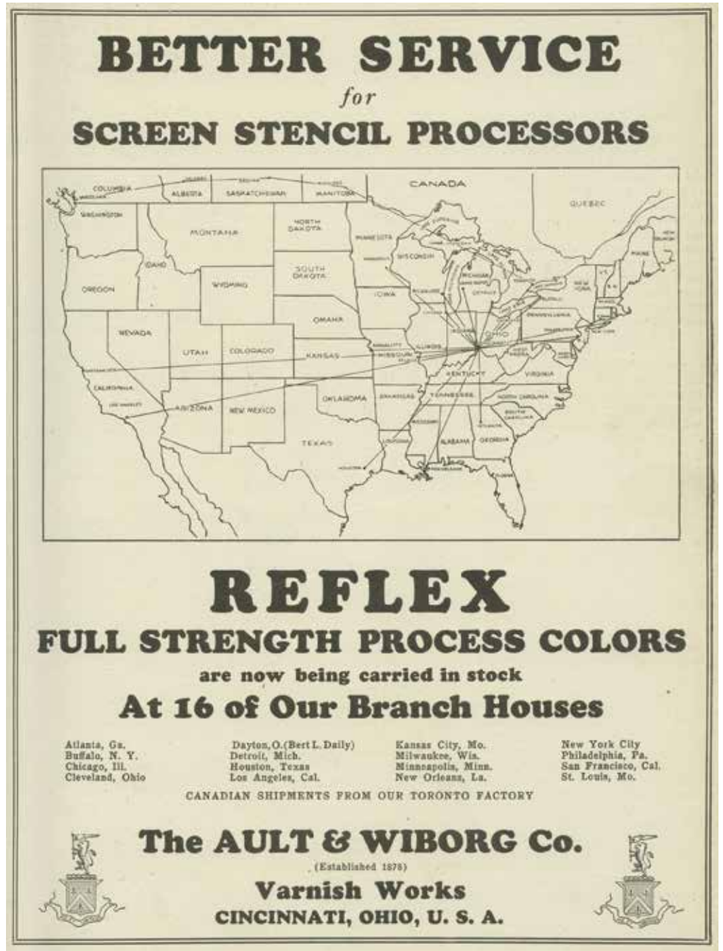
Factory in Möhren (near Treuchtlingen in Bavaria), newly erected after the devastation of World War II (early 1950s).

Pröll KG company archives

which were especially well suited for the Selectasine process.[286] Nazdar first advertised its "Oil Stencil Pastes," available in twelve different shades, in the ad section of the August 1923 issue of *Signs of the Times*. Further ads for its "oil paints for silk screen stencil reproduction work" appeared monthly after that.

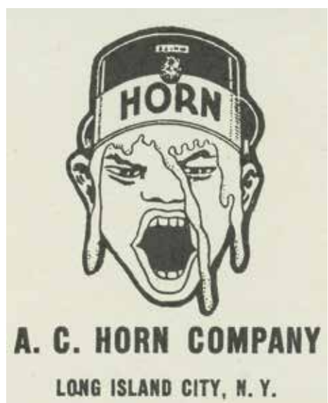
Other manufacturers began adding screen printing inks to their product lines in the mid-1920s, most notably Ault & Wiborg in Cincinnati (established 1878); Acme White Lead & Color Works in Detroit (est. 1884), and later Sherwin-Williams in Cleveland (est. 1866).[287] Companies operating overseas could offer the products through their foreign offices, as Ault & Wiborg did in England from about 1926 on. Dane & Co. in London (est. 1853) had actually begun to manufacture this kind of printing ink the previous year. In Germany, Hermann Pröll began manufacturing oil-based colors for sign printing early on, around 1926, but his business was destroyed in the war. Manufacture of screen printing inks in Europe essentially did not begin until after World War II; before that time, inks for graphic screen printing were generally imported from the USA because there was no comparable selection of products available in continental Europe.[288]

The printing inks used during the early years of screen printing – oil-based, water-based and solvent-based – will be described below. Oil-based inks were used from the early 20th century until World War II; water-based inks came along in the 1910s, and solvent-based inks around the mid-1920s.



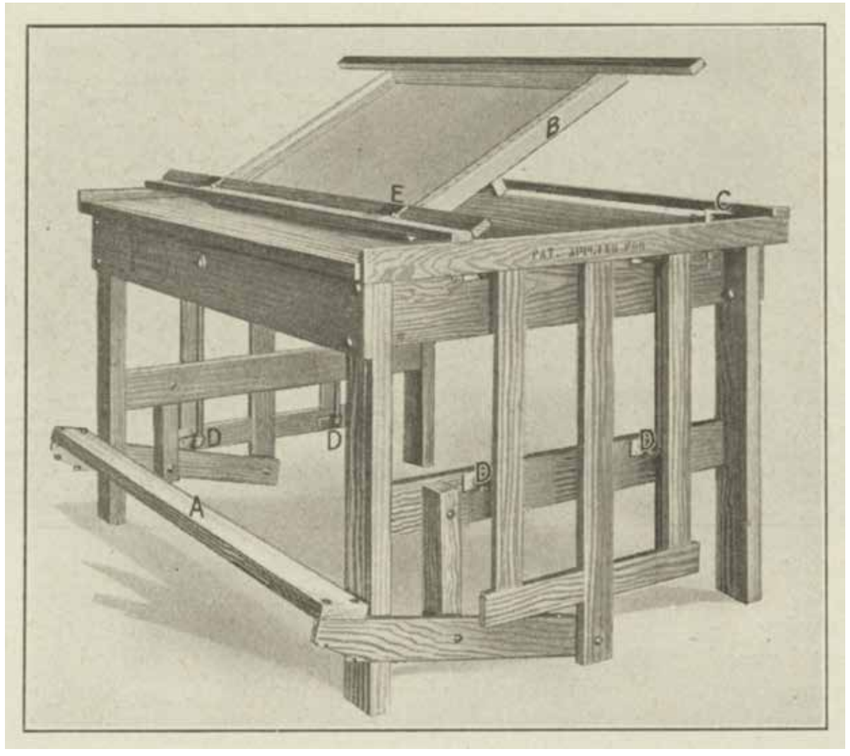
A nationwide supplier of screen printing inks: Ault & Wiborg, 1928.

Signs of the Times, January 1928



Logos of two screen printing ink manufacturers: Horn and Sherwin-Williams, 1936.

Signs of the Times, February and May 1936



Recommended by Hiett: the "Paint Process Printer" by gauze importer Kress & Co., 1925.
Signs of the Times, July 1925

4.3 / PRINTING PRESSES

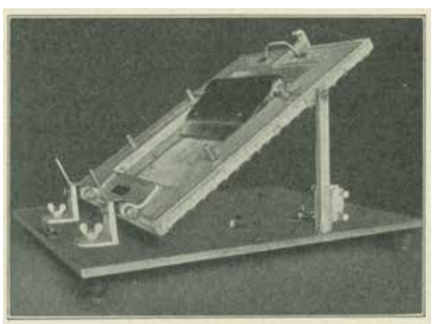
BOTH STENCILS and presses were significantly cheaper for screen printing than for the other processes; silkscreen artists mentioned in the 1940s that "the equipment needed is inexpensive."[322] Even for commercial screen printing, one often needed little more than a wooden board to which the screen could be attached with simple hinges.[323] This kind of basic printing table played a major role in the screen printing industry until well after World War II, since anyone could build one and easily get started with the screen process. Nevertheless, even the earliest books on the subject warned the enthusiastic beginner that such simple equipment would not necessarily produce the best results: "It must be remembered that the finished work will be criticised by people who know nothing of the [screen] process, and it will also probably be compared with lithographic reproductions."[324]

HAND PRINTING TABLES

Hand-operated printing tables were first described in the 1923 *Selectasine Hand Book*. They were made of wood and used a clamshell design with hinges to raise and lower the screen. To ensure that the screen would not drop down unexpectedly, smaller tables were equipped with a prop bar on one side to hold the screen in the open position, while the larger ones had a counterweight system, in which a rope was attached to one side of the frame near the front edge and passed over two pulleys bolted to the ceiling behind the table, with a counterweight hanging from the other end of the rope – Selectasine's manual shows "a pail of junk" used for that purpose. The detailed construction diagrams were protected by copyright, and Selectasine provided such equipment only on loan under its licensing agreements.[325] Nazdar began making similar small printing tables in Chicago in 1924, and three years later it offered a sturdy metal version.[326]

Both Hiett (1929) and Zahn (1930) discussed construction of these clamshell-type printing tables in their books.[327] In addition to the hinged style, there were also table designs in which the screen was raised and lowered parallel to the table surface. Kress & Company, a New York-based importer of Swiss bolting cloth, offered this type of parallel-lift wooden printing table in 1925, with a foot pedal to raise the screen;[328] it is mentioned in the professional literature in 1929, which suggests that it was fairly widely used. Other hand-operated printing tables were patented around that time, but there is no evidence indicating that they had any great success in the market.[329] Printing stock was generally placed in position using register marks attached to the printing plate, similar to the stencil duplicators used in office work. The kind of vacuum system that is typically used today to hold the stock in place had not been invented yet, so smaller sheets often remained stuck to the screen after printing and had to be carefully pulled off.

Although the low cost made printing tables attractive, Edward Owens took care to mention their drawbacks, which became especially evident with longer print runs: "Hand operation is strenuous work. It requires that a man use heavy pressure on the squeegee to force the thick paint through the screen and as this operation is ordinarily repeated several thousand times during a day's work, it can readily be imagined that work is, comparatively speaking, exhausting. General observation has shown that the quality of the work decreases as the operator tires, that is, uniformity of product is not obtained, the output decreases and the paint employed is either wasted or disadvantageously employed."[330]



Small-format hand printing press by Selectasine, 1930.
Klimschs Jahrbuch 1930

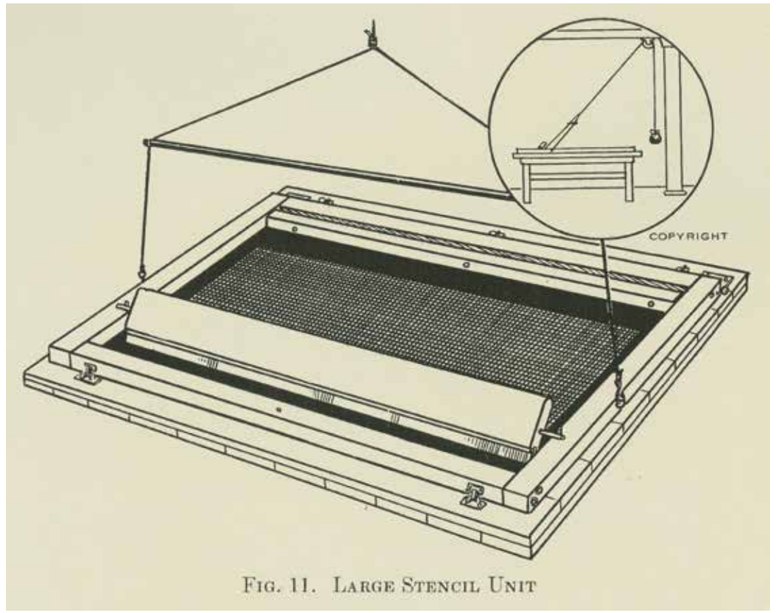
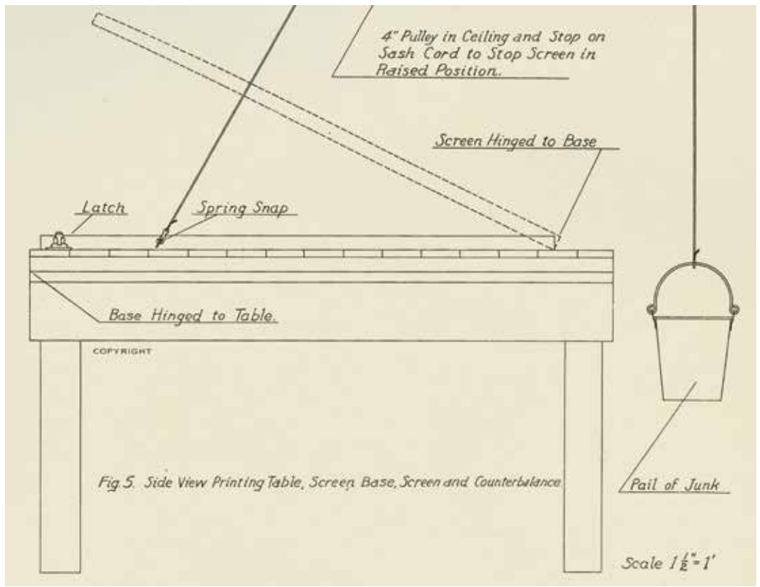


Fig. 11. Large Stencil Unit



"Pail of junk": Large-format hand printing press by Selectasine.

Selectasine Handbook, 1923. Serico-Eich company archives

THE REPRODUCTION EQUIPMENT CO.

Manufacturers of rapid reproduction apparatus and screen stencils for reproductions in any number of colors, from a post card to 5x75 feet.

Are you one of those who know just enough about the process system to make it a burden to you? If so, get our SIX Sections of Descriptive Matter, including 50 illustrations, covering this work completely.

Sent on Receipt of **$25.00.**

Interest in you does not cease with the purchase of these illustrated instructions. You will have the privilege to use our information bureau for one year. We know a few things some of you other boys have overlooked.

No one man or group of men have gathered together all the secrets and successes of process reproduction under one roof; the writer of this work has traveled and successfully installed equipment for all classes and sizes of Reproductions half way around the earth and 4herefore can be of service to you.

BOB BEDFORD, Color Engineer, of Davenport, Iowa., writes:

Received the process literature, photos, etc., and must say it is well worth the $25.00 and contains a number of helpful hints.

I have been working on process systems (I think all of them) for four years. You are certainly to be complimented on the thoroughness with which you cover the game.

Yours Sincerely, Bob Bedford.

This sign was made by us with the process system at a labor cost of $1.05. Its actual size is 3 feet wide by 33 feet long.

PROCESS SUPPLIES AND EQUIPMENT

Silk, Glue, Protection, Squegees, Am. Bichromate, Stencils, Etc.

DON'T BUY JUST BOLTING SILK—BUY FROM US THE RIGHT KIND

REPRODUCTION BOLTING SILK

No.	Standard	X Heavy	XX Heavy	XXX Heavy
8	$3.90	$4.25	$4.55	$4.80
9	4.20	4.60	4.85	5.05
10	4.60	4.90	5.15	5.35

"STIXTITE" Protection (Quart Cans Only), Red $2.00; Black $1.75; Thinners $1.65.

This protection is easily removed from the mesh of used stencils, works easy under the brush and will not spring leaks when making impressions.

Portable and Adjustable-Shelf Drying Racks

These Racks are made of well seasoned lumber, are 5 ft. 6 in. long, 6 ft. 3 in. high and 1 ft. 6 in. wide, on rollers. Each **$19.50.**

Single Shelves

With drying space for 250 reproductions, **$7.50** each.

Double Shelves

With drying space for 250 reproductions, **$10.50** each.

A rack with three double and two single shelves will hold for drying 2,000 reproductions, 12 in. by 15 in., or 1,000 reproductions, size 15 in. by 20 in., on card board, metal or paper.

Apparatus built for any size reproduction up to 5 ft. x 75 ft.

WRITE FOR ILLUSTRATED PRICE LIST TODAY—IT'S FREE.

THE REPRODUCTION EQUIPMENT CO.

537 COURT STREET, READING, PA.

The process system is a money maker—are you getting your share?

LEFT: Screen printing materials and equipment, 1922.

Signs of the Times, July 1922

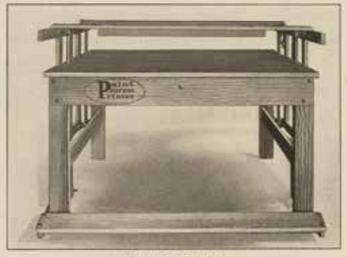
BELOW: Suitable for "any other work" after removing the screen: Kress & Co. printing table.

Signs of the Times, May 1925

MODERNIZE YOUR PROCESS DEPARTMENT

with the

PAINT PROCESS PRINTER



(Patent Applied for)

Heretofore the paint process business has been operated on a more or less hit or miss method, with home-made equipment, which has made it difficult to turn out large quantities of work on an economical basis.

To overcome this condition, we have developed our PAINT PROCESS PRINTER, a number of which are now in successful use in New York City.

The table is constructed of solid maple, bolted together with a 36" x 50" top over all. With the PAINT PROCESS PRINTER, as many as fourteen complete signs a minute can be turned out with any known process method in use at the present time. The table can be used after removing stencil for any other work in the shop.

This is the only product for use in process work, outside of Bodmer Stencil Silk, that we have ever handled, and we absolutely guarantee the PAINT PROCESS PRINTER to be serviceable in every particular.

The PAINT PROCESS PRINTER sells for $75.00, complete and ready to operate.

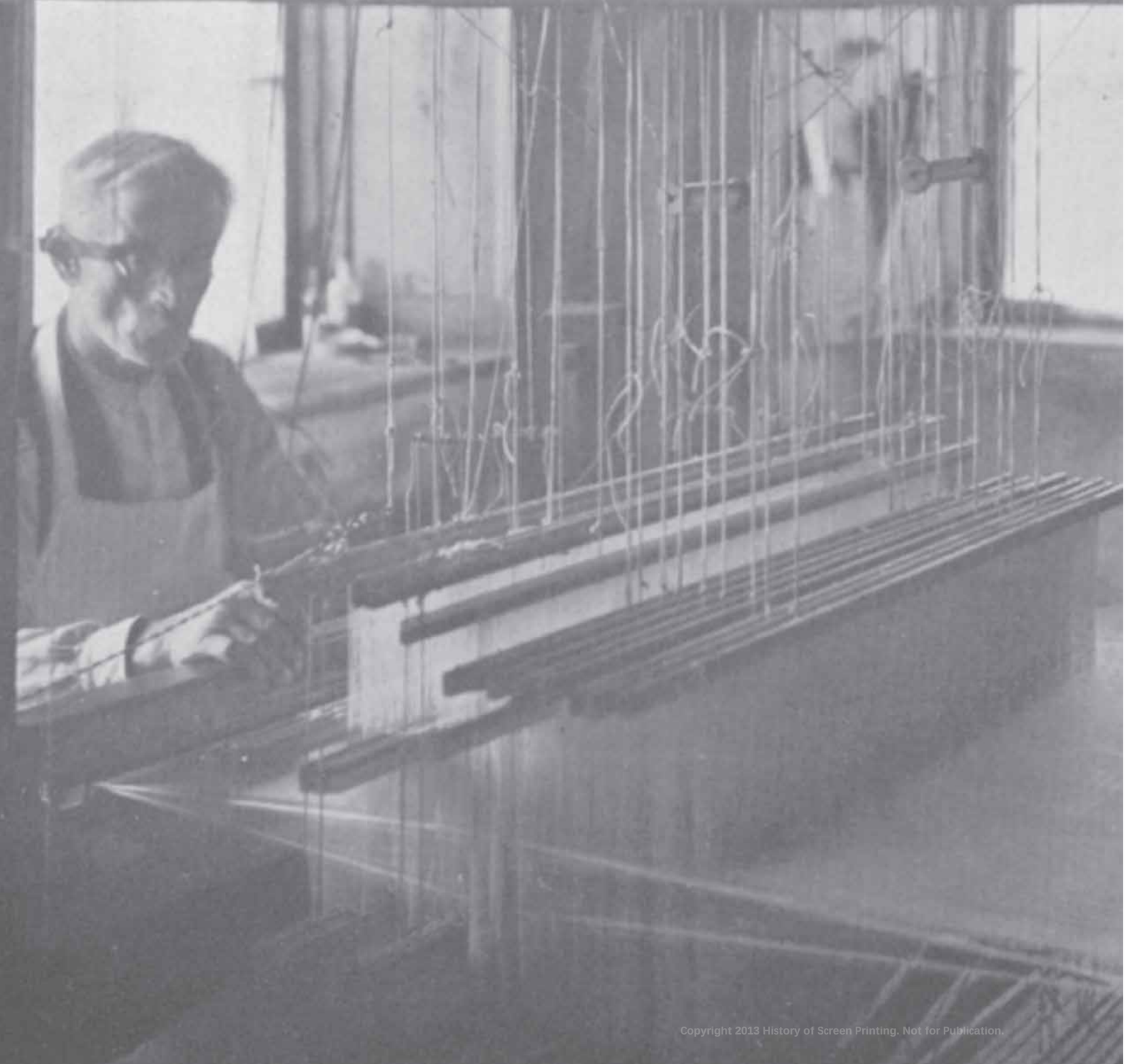
Terms: 50% with order, balance within thirty days.

Write for Further Information, if Desired

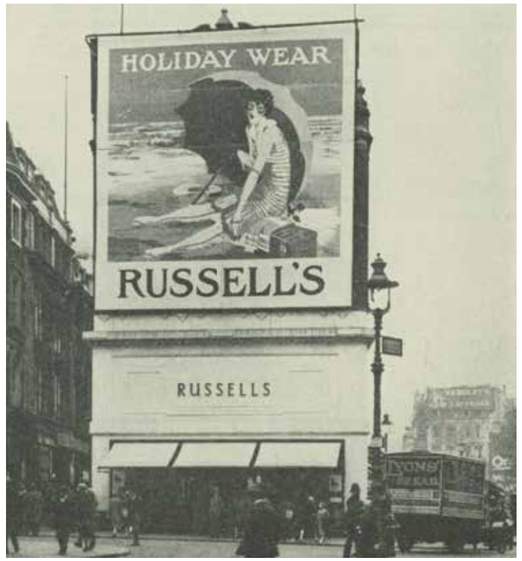
KRESS & COMPANY

Distributors of the Celebrated "BODMER" Stencil Silk

372 GOLD STREET BROOKLYN, N. Y.



5 / FROM THE USA TO EUROPE



OPPOSITE: Printing displays at Display Craft, London, 1930. Display Craft was a Selectasine licensee.

Display, May 1930

LEFT AND BELOW: Hand-painted large-format advertising in London, late 1920s.

Signs of the Times, October 1928 (left) and May 1930

5.1 / THE INTRODUCTION OF SCREEN PRINTING IN ENGLAND

WHILE SCREEN printing was still in its early stages of development in America, patents for the process were already being filed in Great Britain. Hiram Deeks (a Briton who emigrated to the USA) applied for a patent for stencil production in 1903, followed by French-born Jehan Raymond in 1906 and Samuel Simon a year later. Raymond's patent involved graphic applications, such as printing drawings and illustrations of an "artistical character," while Deeks focused on textile printing. Simon listed cloth, paper or just "any substance" as suitable substrates for his process. As with many historical patent filings, it is unclear exactly how far these contributed to the development of screen printing.

A few articles from the 1930s deal briefly with the origins of the process in England, but they contain contradictory information and do not list any sources. One stated that "screen prints were being produced commercially before 1914." Another claimed that photographic stencils using carbon tissue ("gelatin tissue") were already patented as early as 1911, and were then used by the Royal Aircraft Factory to print numbers on doped (specially coated) fabrics during World War I. A patent for photostencils of this kind was in fact filed, but not until 1917, and Autotype, the first manufacturer of such stencil materials, dates the introduction of the technique much later, to the late 1920s. According to "reliable information," "materials" for the coronation ceremonies for George V in 1910 had been printed with photostencils; and finally, it was claimed that "in 1917 commercial production of screen prints began in earnest."[341] There is evidence, however, that screen printing was first used to make enamel display signs in London in 1923 (see Chapter 7.3). The method for this particular application began to develop in Europe and the USA several years later.[342] Mark Mayhew, who played a vital role in introducing screen printing in England, said that the method was still largely unknown there until the mid-1920s.

FLOUR MILLING AND SILK SCREEN PRINTING

Mark Mayhew owned a major London milling company and came from an upper-class family. The London harbor strike of 1911 was a serious blow to his business, and he was forced to sell it. He moved to the United States, where he started another mill in Owensboro, Ky., in 1912. He served in the military in England during the First World War, but returned to his new homeland afterward. In 1920 he became the president of Anglo-American Mill in Owensboro, the largest manufacturer of milling machinery in the world. He returned to England permanently in 1923, and began to get involved with screen printing in addition to his work in the milling industry. He founded Selectasine Patents in London as a branch office of the parent company in San Francisco;

MARK JAMES MAYHEW (1871–1944)
HILTON PHILIPSON (1892–1941)

MARK MAYHEW was the son of a well-to-do mill owner. He attended the elite Harrow School and then took over his father's large milling company in the Battersea area of London.[345] Mayhew also enjoyed ballooning, and was one of the first proponents of the automobile in England even before the turn of the century. He came to believe very early that the automobile had a future, and already called it "a coming revolution" in 1902.[346] He participated in many international racing events and was a founding member and vice president of the Automobile Club of Great Britain and Ireland. One of his friends was Charles Rolls, of Rolls-Royce fame.[347] Mayhew had a career in the British Army, where he served as a cavalry lieutenant until 1903, and was then promoted to lieutenant colonel. He was deeply involved in motorizing the British forces, commanding the Motor Volunteer Corps until 1906.[348]

Apart from his military service, Mayhew remained loyal to the milling industry. The London harbor strike in 1911 caused him serious financial difficulties and ultimately forced him to sell the company.[349] He decided to try his luck in America, and moved his family to Owensboro, Ky., in 1912, where he established a milling business.[350] When World War I began, Mayhew returned to his old home, where he served until the end of the war and was decorated twice.

TOP TO BOTTOM:

Mark Mayhew (undated photos)

The Veteran and Vintage Magazine, November 1958; family records of Jonathan Teale

Balloon race, England 1906.

Frank Hedges Butler: Fifty Years of Travel by Land, Water, and Air (T. Fisher Unwin Ltd., London 1920)

Mayhew (at the wheel) the race car driver, 1903.

Motoring Annual and Motorist's Year Book, 1903

Mayhew with his 100-horsepower Napier race car, ca. 1903.

The Car Illustrated Magazine no. 86, 1904

ABOVE: Mayhew's mill in Owensboro, Ky.; Anglo-American Mill, Owensboro.

Midget Marvel. Anglo-American Mill Company, February 1915

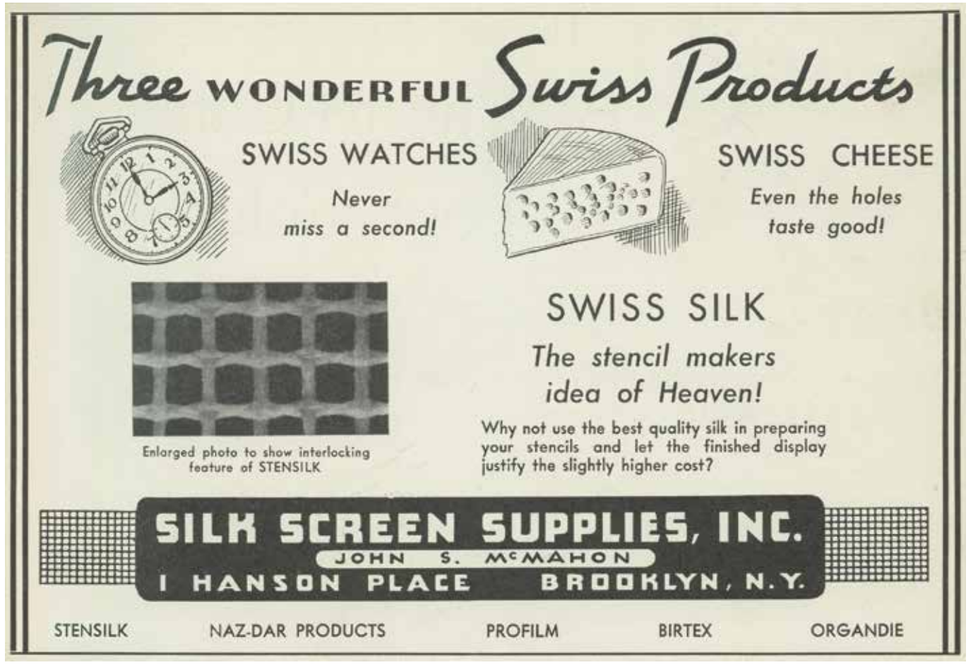
BELOW: Hilton Philipson, with wife Mabel, 1917 and 1927 (right).

Left: By permission of topfoto.co.uk. Right: By permission of the National Portrait Gallery, London

He returned to the USA in the spring of 1920 and became president of the Anglo-American Mill in Owensboro, the world's largest manufacturer of milling machinery. Mayhew designed this type of machinery himself, and was involved in developing and patenting groundbreaking equipment. Just three years later, however, he was back in England, and lived in London from 1923 until his death.

After returning to England, he worked as a flour mill engineer, but also began to take an interest in the screen printing process. In the mid-1920s he started Selectasine Patents Ltd. in London, acting as an agent of California-based Selectasine. The business contacts that led to the establishment of the London office came from Mayhew's days in Owensboro. He was not trained as a printer, but with his technical experience as an automotive pioneer and in mill construction, he was able to recognize the possibilities of this new printing process and believed that it had a future. The chairman of Selectasine Patents was Hilton Philipson (1892–1941), a businessman and politician, whose wife Mabel (1887–1951) was a Member of Parliament in the House of Commons. The company played a vital role in establishing the screen process in England and continental Europe.

Mark Mayhew died in November 1944. Selectasine continued to exist as a small screen printing supply company until quite recently, while its parent company in America did not survive much beyond the end of World War II.



5.2 / SWISS BOLTING CLOTH AND BOLTING CLOTH MANUFACTURERS

SILK FABRIC was used as a stencil carrier in screen printing until after World War II. The American technical literature recommended "original Swiss bolting cloth" (silk gauze) because it had such a uniform weave. This type of fabric had been woven primarily by home-based workers in the Swiss canton of Appenzell since 1830, and it was used to sift flour in mills all over the world. The damp climate of the Appenzell region was favorable for weaving because it kept the silk supple. Silk gauze was also made in France, Japan and Germany, but the high quality of the Swiss product made it the market leader despite its higher price.

BOLTING CLOTH IN THE MILLING INDUSTRY

"All agricultural countries are aware of the important role played by Swiss bolting cloth in the milling industry. […] It is common knowledge that the most uniformly woven and finest grades have been made in Switzerland for the last hundred years," a Swiss manufacturer noted in 1930. "Many attempts have been made to produce woven bolting cloth in other countries as well. However, any miller who knows his business has found time and time again that only the time-tested Swiss product, manufactured under Switzerland's special climatic conditions, will produce completely satisfactory results."[359] Until the end of the 19th century, flour was sieved by means of a tube-shaped sack made of this type of cloth, which was filled with flour and then shaken automatically by a forked wooden rod – hence the name "bolting cloth" (bolting = sifting).[360] The smallest grains of flour passed through the meshes of the cloth, leaving the coarser particles (including bran) inside. Bolting cloth was made in various degrees of fineness, so that different grades of flour (up to coarse semolina) could be sifted out according to the size of the mesh openings.

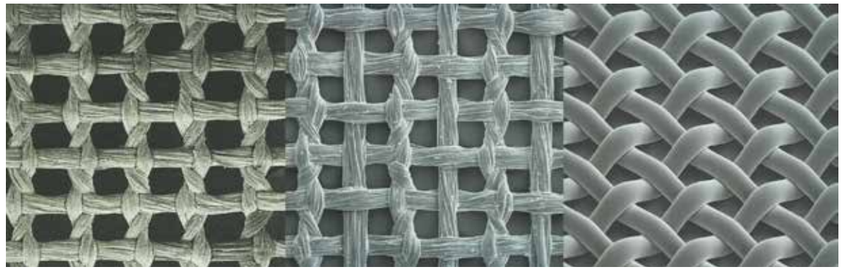
OPPOSITE:
Ad for Swiss silk gauze, USA, 1935.
Signs of the Times, May 1935

RIGHT: Eastern Switzerland, the center of silk gauze weaving in Europe. Marked in red: Manufacturing locations in Thal and Heiden.

Clothing fabrics were already being woven by machine in factories in the 19th century, but silk gauze was still being made largely on hand looms by home workers until World War II. The reason for this was the special weave used for the gauze, an interlocking or leno weave. In the textile industry, "weave" refers to the way in which the warp and weft threads – the threads that run lengthwise and crosswise through the fabric – cross each other during the weaving process. In an interlocking weave, two warp threads are twisted around each other where they intersect with weft threads, which requires a complicated loom design. This kind of "anchoring" weave prevented the threads from sliding around during the sifting process and altering the size and shape of the mesh openings. Silk gauze made without this special interlocking weave is taffeta, which is cheaper, but the manufacturers pointed out that "such fabrics are of course prone to thread slippage. Therefore they are not used in mills, but mainly as a stencil fabric in screen printing shops. Interlocked gauze can also be used as a stencil fabric, of course. The printers even prefer it over taffeta. However, price is a major consideration."[361] Bolting cloth made strictly for technical applications was a niche product within the textile industry. Unlike the textile industry in general, the bolting cloth business was not affected by fashion trends and was therefore not so vulnerable to slumps.[362]

Home workers

Although the makers of bolting cloth often called their businesses "manufacturing companies" or "factories," the product was woven not in centralized fabrication plants, but in private homes. Home weaving – of both clothing fabrics and bolting cloth – was a very important part of the economy of Eastern Switzerland. The bolting cloth manufacturing companies of Thal and Zurich alone employed over 700 weavers each at the start of the 20th century. These were often small farmers who wanted to make a better living by weaving. Although the pay for bolting cloth was better than for other kinds of home weaving work, it did not generally



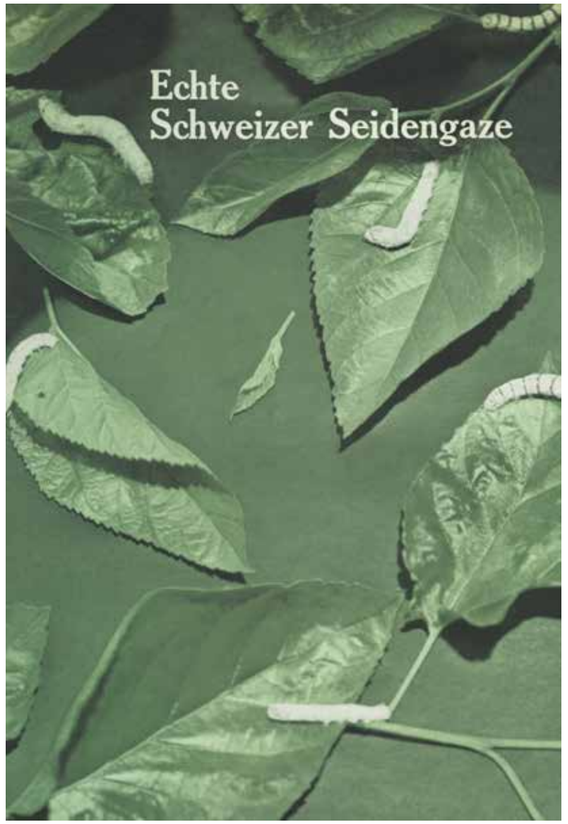
Silk gauze with interlocking weave, which prevented distortion of the mesh openings, with modern polyester mesh on the right for comparison.
Sefar company archives

ensure an adequate and reliable income.[363] The work was done in the basement of the weaver's home, which would generally be two-thirds underground, unheated, and damp, reached by a steep staircase. The basement floor consisted of hard-packed dirt, and a row of windows let in the daylight.[364]

The weavers were not paid by the hour but by the meter of finished product. It was often necessary to put the whole family to work in order to make a living. Accidents or illnesses, mandatory military service or a pregnancy could mean a loss of income for the person concerned, as home labor was not subject to statutory insurance coverage at that time.[365] The physical toll of this life was often obvious, even in the young[366]; one official inspector described the weavers' difficult situation around the turn of the century: "The silk is not the only thing that rots from being so long in the cellar – even wood and iron succumb to it. The weaver is the one who has to withstand all of these unfavorable conditions."[367] The weavers generally accepted their situation as their God-given lot in life, since this was all they knew.[368] In keeping with the times, there was no contact between the factory owners and the home workers. As farmers, they appreciated the fact that they were, in their own view, "independent," and not forced to earn their living in a regular factory like most in the textile industry.[369]

Machine production of bolting cloth in Switzerland first began in the early 1930s, but did not become the norm until after World War II. The manufacturers built modern production facilities, and the home weavers – after some initial resistance – shifted their work to the factories, which brought their wages and social benefits up to the modern nationwide standard. At the same time, silk was being replaced by a new synthetic fiber, polyamide (more widely known as nylon), and later by polyester, which resulted in massive growth in the industry. The shift from home weaving to the factories and the introduction of synthetic fibers were a devastating blow, marking the end of a century-old working method and the start of modern production. The few remaining silk gauze orders were assigned to older home weavers who were still practicing their trade. The remarkable tradition of home weaving finally came to an end in 1978, after nearly 150 years.[370]

Swiss Silk Bolting Cloth Manufacturing Company of Thal, ca. 1969.
Foreground: Former headquarters of Dufour & Co., built in the 19th century. Background: The factory today.
Sefar company archives

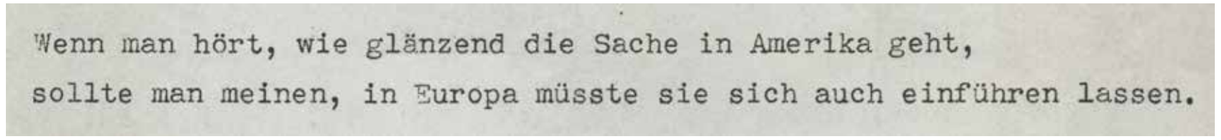


"Original Swiss Silk Gauze": Company publication by the Swiss Silk Bolting Cloth Manufacturing Company of Thal, 1930s.
Sefar company archives

BELOW: Appenzell region, 1930s; "weaver house" ca. 1906.

Farmers and home textile workers in Appenzell, 1930s.
Left and below: Alfred Egger: Die Appenzeller Wirtschaftsgesinnung (O. Kübler, Trogen 1939).
Right: Gertrud Villiger-Keller: Die Schweizer Frau (F. Zahn, Neuenburg 1906)

"When you hear how brilliantly this is going in America, you have to think that it could also work in Europe."


Wenn man hört, wie glänzend die Sache in Amerika geht,
sollte man meinen, in Europa müsste sie sich auch einführen lassen.

Comment in a letter from Ulrich to the Swiss Silk Bolting Cloth Manufacturing Company of Thal, January 1935.
Sefar company archives

5.3 / HANS CASPAR ULRICH (1880 – 1950)

THE SELECTASINE process made its way from England to Zurich in 1926, with the direct involvement of the painter Hans Caspar Ulrich. With support from the Swiss bolting cloth manufacturers, he became deeply involved in learning the process and spent several months studying it in the United States. While there, he had contact with the leading screen printing firms of the day. His observations – several notebooks full of handwritten comments and drawings – give us unprecedented insight into the early years of the process, and complement the records left by the American pioneers.[395]

Art school and training as a lithographer

Ulrich was born in Zurich and grew up in a middle-class family. The loss of his mother – she died shortly after giving birth to him – and an unkind stepmother made for an unhappy boyhood. He attended high school and then started art school in 1896, hoping to have a career in the field. His parents showed no understanding for their son's future plans and pressured him to learn a "proper profession." Ulrich recalled, "I had been designing a lot of posters at school lately. And then I found that, if you wanted to be at the top of the field, you had to know lithography. And since that was supposedly something you could only learn in a proper three-year apprenticeship, I was happy that my uncle could arrange one for me at the Karlsruhe Artists Association's fine art printing house. I didn't find out until later that I could have learned as much about lithography as I needed to in a few weeks of coursework at a place like the academy in Karlsruhe. But that didn't matter. I was more than happy to get away, to be someplace different."

Ulrich's apprenticeship would prove to be a key event in his career when he became involved with the screen printing process. As a trained lithographer, he was familiar with "printing chemistry" with all its day-to-day technical challenges. In Karlsruhe, however, Ulrich did not have any opportunity to pursue his own artistic interests, instead reproducing other artists' work as a skilled craftsman. At that time, fine art lithography was beginning to establish itself as a separate field within commercial lithography. "Artists were sitting at the tables lithographing their own work, some of them doing it well, some less so. I first worked with a hand press as the shop drudge. I had to keep the stone wet, turn the crank and clean the roller and plate. And sweep the shop after hours, and then grind the tusche for my artist friends in the morning." The nineteen-year-old art school graduate quickly found this kind of work "deadly dull and kind of humiliating." Because of his skill, he was promoted to lithographer, but this did not strike him as a brilliant career prospect: "Now I regret that I spent so little time working on my education in those days. I was nothing but a skilled worker, doing strenuous, mostly dull work all day, having a beer with friends at night. […] After a while I moved on to the transfer press, where I was only allowed to watch for three whole months, because the press operator wouldn't let me do anything out of a sense of responsibility. Then I spent about three months on the high-speed press, which I only learned to operate in an emergency." He was promoted again, this time to technical manager. "I got my high salary and that was that. But my yearning for artistic training and the freedom of an artist's life had grown too great, and it wouldn't go away."

Ulrich went to Munich in 1904 to study at Heinrich Knirr's private art school, and then moved on to Paris, where he trained at the prestigious Académie Julian until 1910.[396] After that he returned to his hometown of Zurich and worked as a freelance artist. He continued to work as an artist throughout his life, even when he was involved in screen printing, but he never experienced the success that he hoped for in that field. This had its financial consequences too: In the 1920s and 1930s, he was repeatedly forced to rely on support from his relatives. He hoped to make a better living from screen printing, and that this would eventually enable him to devote himself entirely to painting again.

Hans Caspar Ulrich, 1949.
Ulrich family records

INTRODUCTION OF THE SELECTASINE PROCESS IN ZURICH

Screen printing got its foothold in Canada and Australia after World War I and in England in the mid-1920s, but it took longer to reach the European continent. The Swiss bolting cloth manufacturer Theodor Pestalozzi first contacted Selectasine's London office in 1926 to secure the rights to the company's patented screen printing process in several European countries. The Swiss companies' American offices were well aware of this rising technology, and sales to the "stencil industry" were considerable; information

ABOVE: Hans Caspar Ulrich, 1910s.
Ulrich family records

BELOW: Landscape of Weissbad, Appenzell canton, 1913. Oils, 27.5 × 21 in.

"...AND I'LL NEVER GET PAST MY TROUBLES THIS WAY."

HANS CASPAR ULRICH grew up in a middle-class family. His father was a city councilman but an architect by profession, and was Zurich's last city architect; his mother was part of the German Junghans family, who were among the largest watch manufacturers in the world. Ulrich saw the loss of his mother — she died of puerperal (childbed) fever after his birth — as a great misfortune all his life, and he was prone to depression throughout his youth. "If only my real mother hadn't died — but a stepmother is stepmother, after all, and mine deserved to be called 'wicked.' She scolded me and beat me day in and day out. The worst period was when I was in high school; I thought about suicide quite often in those days."

Ulrich was unhappy that he never achieved a comfortable middle-class living despite coming from a well-to-do family. He thought of himself as "not rich and not poor, not stupid and not clever, with some talent, but not very much," and he saw his life as "a constant battle between two poles," which often made him "melancholy." "The terrible pragmatism of the people and society in Zurich prevented me from becoming a real artist. Perhaps my real mother might have been able to raise me that way with loving involvement in my dreams and artistic desires. My stepmother, who was the most unimaginative kind of money-grubber, kept me from developing my talents in any way, and I didn't have the energy to really resist."

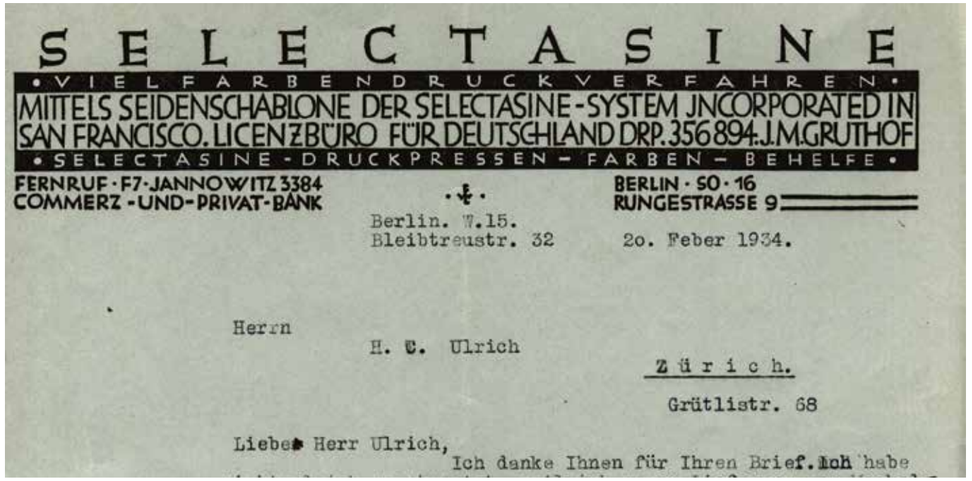
Ulrich's entire life was marked by the conflict between his aspirations toward working freely as an artist and the need to adjust to a less creative career in order to earn a living. Although his paintings and drawings were shown in several exhibitions, he never achieved the success he wished for as an artist. During the economic crisis years in the 1920s and 1930s, he frequently did wage work, "boring portraits, which often have nothing to do with art." Despite his original plans, his life turned in another direction — into the pioneering phase of screen printing. Financial support from the Swiss bolting cloth manufacturers, who wanted to bring the process to the European continent, kept him afloat during the Great Depression and enabled him to continue painting. In 1937 he observed that "from my own experience I can now state that it is immeasurably easier to be successful as a businessman than as an artist."

ABOVE: Landscape of Weissbad, Appenzell canton, 1918. Pastels, 22 × 15 in.

BELOW: Appenzell woman with gold-embroidered neckerchief, ca. 1920. Oils, 14 × 17 in. Appenzell farmer, 1947. Watercolor, 9.5 × 12 in.

Ulrich's early artwork was influenced by the Jugendstil movement and Expressionism, but later moved in the direction of more formally rigorous landscapes and portraits. Despite his pioneering work in screen printing and the many crises in his life, he left behind a substantial artistic oeuvre. During the latter half of his life he devoted himself mainly to landscape painting in the canton of Appenzell, and produced numerous portraits of the inhabitants, firmly rooted in their pastoral traditions. His designs helped to revive the local hand embroidery trade. Ulrich's art is still admired in the region.[397]

Selectasine's "license bureau for Germany"; J. M. Gruthof.
Serico-Eich company archives


SELECTASINE
• VIEL FARBENDRUCKVERFAHREN •
MITTELS SEIDENSCHABLONE DER SELECTASINE-SYSTEM INCORPORATED IN SAN FRANCISCO. LICENZBÜRO FÜR DEUTSCHLAND DRP. 356894. J.M.GRUTHOF
• SELECTASINE-DRUCKPRESSEN – FARBEN – BEHELFE •
FERNRUF · F7 · JANNOWITZ 3384
COMMERZ-UND-PRIVAT-BANK
BERLIN · SO · 16
RUNGESTRASSE 9
Berlin. W.15.
Bleibtreustr. 32
2o. Feber 1934.
Herrn
H. C. Ulrich
Zürich.
Grütlistr. 68
Liebe Herr Ulrich,
Ich danke Ihnen für Ihren Brief. Ich habe

5.4 / FROM SWITZERLAND TO GERMANY

"HOW LONG has screen printing been going on in Germany?" Karlernst Weiler, a German industry writer, put this question to "every screen printer, every screen printing supplier" in the late 1950s. "The answer was usually: Since the end of the war! The Yanks brought screen printing with them!"[423] In the course of his research, however, Weiler found evidence that the process had not been "brought by the Yanks in 1945," but had been used in Germany even before World War II began. Hermann Pröll (1900–1980), who had been manufacturing screen printing inks since 1926, confirmed that "the first ones to use screen printing commercially around the mid-1920s – usually as a jealously guarded secret process – were the sign and poster makers."[424] The screen process took hold in both textile printing and the graphics industry between 1925 and 1927.

Germany played a significant role in launching the process on the European continent. With financing from the Swiss bolting cloth manufacturers, Selectasine set up a "license bureau for Germany" in Berlin in 1928. Friedrich Beckert, one of the country's early screen printers, confirmed this in 1951: "As stated previously, the process is nothing new for us Germans. It came to us by way of Switzerland about 25 years ago, when it was still in its infancy."[425]

SELECTASINE STUDIOS BERLIN AND J. M. GRUTHOF

"Selectasine Studios of Berlin has introduced a printing process in Germany that is based on an ancient Chinese process, but has been adapted to modern technology and is now patented in every country," the German trade press reported in 1930.[426] Selectasine Studios was headed by Josef Gruthof (1890–1942), who had been involved in Selectasine's negotiations with the Swiss bolting cloth manufacturer Theodor Pestalozzi in Zurich. The Berlin licensing office was founded after the Serico company in Zurich was temporarily closed down; the bolting cloth manufacturers apparently considered the important German economic zone a higher priority than the more limited Swiss market, and Berlin itself was one of the largest cities in the world at the time.

Josef Gruthof, 1940; the woman to his right is presumably Cäcilie Gruthof.
Family records of Michele Javanshir

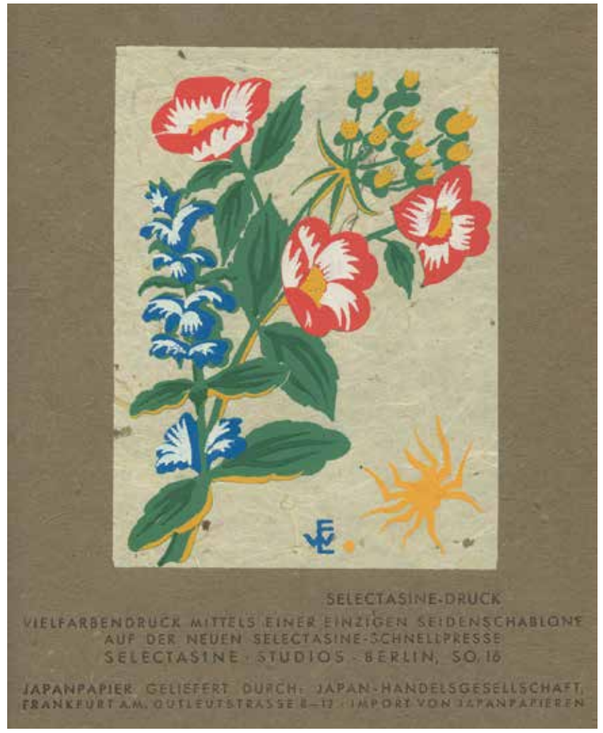
Gruthof was born Josef Gabriel Maria Gruschownig in Marburg (Maribor), Slovenia. After World War I he tried his luck in Vienna, where he changed his name to Gruthof and met his future wife, Cäcilie Egger (1908–1975). She was the daughter of a mechanical engineer and an "artiste" by profession. Gruthof had a rather eventful career: City records list him variously as a clerk, salesman, factory owner, commercial agent, grocer and "dealer in illuminated signs," and as the owner of a "foreign technology distributorship."[427] It is unclear how Gruthof became familiar with the screen printing process. He lived in London from September to December 1927, where he filed a patent for illuminated signs and married Cäcilie Egger. It is possible that he learned about screen printing during that time and had contact with Selectasine.[428]

Gruthof saw great potential in a Selectasine office for Germany. "This company more than lived up to all the expectations within a very short time, and Selectasine's sales in the USA are currently estimated at about 20 million. The rapid spread [of the process] in the United States prompted the company to set up offices in every country in the world, and especially Europe, and they have been consistently successful."[429] Selectasine Studios sold screen process licenses for 200 reichsmarks and also operated a print shop, with fully automatic Selectasine cylinder presses on loan from the main office in London. Gruthof also acted as the German distributor for Profilm, the American knife-cut stencil film, and added Serico films around 1934.[430]

Selectasine Studios closes

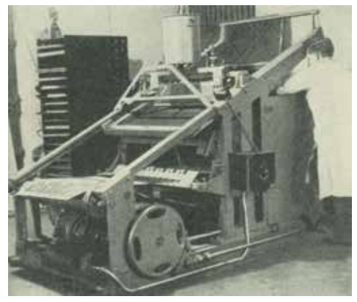
Gruthof started having money problems around 1934. Pestalozzi, who had been providing financial assistance to Selectasine Studios up to that point, reduced his support. In February 1935 Gruthof wrote in a letter, "Last year I had a generous amount of support from my friend Pestalozzi, so I could afford not to be making money," and complained that his friend "unfortunately can't provide as much help any more, so I'll have to shift for myself for the next little while."[431]

Selectasine was forced to close. It is doubtful whether the company made a profit or did an effective job of disseminating the process. Hans Caspar Ulrich explains why: "Shortly after June 18, 1935, Mrs. Gruthof suddenly arrived from Berlin and revealed that her husband was a crook and a swindler." Cäcilie's accusation was not unfounded; even his relatives had unfavorable things to say about his business practices ("He constantly has disputes with his stencil customers and always loses when it goes to court").[432] Ulrich continues: "To this day I have not [received] any money from her husband for the stencil film we delivered. I then gave her the distributorship [for Serico stencil films] for Germany." In their contract, Mrs. Gruthof undertook "to pay the patent fees incurred in Germany for Serico stencil film," and, "if absolutely necessary, to use Profilm in addition to the patented Serico stencil film."[433]



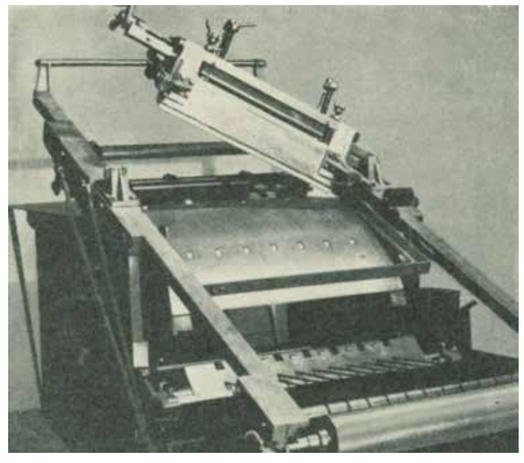
OPPOSITE AND ABOVE: Prints by Selectasine Studios Berlin, 1930 and 1932.

Inserts in Klimschs Jahrbuch, 1930 and 1932. Above right: Insert in Seidels Reklame—Blatt für Werbewesen und Verkaufstechnik, March-April 1932



Selectasine cylinder press in Berlin, 1932.

Klimschs Jahrbuch 1932



6 / THE WORLD WAR II ERA

Screen printers turning out propaganda posters: Bryan-Elliott Company, New York City, 1943.

Signs of the Times, February 1943

6 / THE WORLD WAR II ERA

THE OUTBREAK of World War II caused a dramatic decline in the advertising industry, which often threatened the survival of the printing houses. They faced additional difficulties in the form of government rationing programs, which affected even common items like paper and cardboard, and the loss of trained workers to the draft. The sharp decline in indoor and outdoor advertising and lettering work is attested by the size of the journal *Signs of the Times* during the war years: Throughout the 1930s and up to America's entry into the war in 1941, issue length was 100 to 110 pages, but in 1942 this dropped to 80 pages, and then to an average of 60 pages in 1943. The last two years of the war saw an increase to 80 pages or more.

For the screen printing industry, this slump in the advertising sector was offset by an increase in government work, which included propaganda posters and various military applications, ranging from maps to marking aircraft and other equipment. "The importance of screen process printing to many manufacturers can best be demonstrated by the extensive development and use of it in this wartime period. To all of us in the process field this is obvious, as we are working on orders that seem quite divorced from the advertising field, for which we know the method was originally developed."[444]

BELOW: Headline in *Signs of the Times*, 1943.

RIGHT: Ad in *Signs of the Times*, 1943.

Signs of the Times, below: September 1943; right: June 1943

"LET'S PRODUCE! PRODUCE! PRODUCE!"

"1942 was very good to screen process, and 1943 holds much encouragement for the medium," *Signs of the Times* wrote optimistically. In the USA, screen printing was used in the rapidly growing munitions industry to print dials and faceplates, instruction posters, maps, propaganda posters, banners, markings for vehicles and aircraft, stickers, Civil Defense armbands, medical materials, signs and crates. Dials printed with white or fluorescent inks were needed for electronic devices like radios and gauges, and in fighter planes, transports and tanks. Sometimes dangerous self-luminous radioactive inks were used; the relevant authorities supervised work with such materials, but regulations at that time did not come up to modern safety standards. Another important product was self-adhesive decals, produced either by independent printers or by in-house print shops within the munitions plants. Decals had countless uses; a single B-29 Superfortress bomber contained about 2,000 of them.

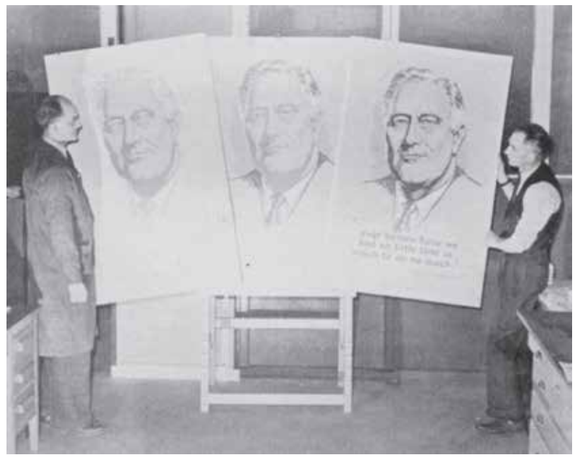
Sometimes screen printing jobs involved very long runs. For example, tens of thousands of books were produced for the government that included maps printed in fluorescent ink on black paper; opaque coverage with this kind of ink could be achieved with screen printing, but was not possible with traditional letterpress or lithography.[445] Propaganda posters commissioned by the government were also printed by the screen process, though these may have been shorter runs.[446] Businesses also took advantage of the strong patriotic mood by using posters with the same color scheme to advertise their products, sometimes in an ironic comic book style.

Screen-printed posters, 1943
Signs of the Times, September 1943

Because of wartime secrecy policies, very little information about the production process was disclosed, which explains the small number of articles published about the use of the screen process in the war industry. As a piece about camouflage manufacturing in *Signs of the Times* admitted, "of this activity little can be said because of censorship requirements."[447] For the same reason, reports on printed circuit manufacturing, a revolutionary technology at that time, could not be published until after the war.

While government contracts naturally took priority and were not subject to any constraints, screen printing in the advertising sector was affected by rationing of materials and supply bottlenecks: "The silk situation is very critical and will become even more so; therefore we will all have to take care of what we have. Organdy will have to be used wherever possible."[448] Ink manufacturers could no longer get the necessary raw materials and had to resort to unproven substitutes. Some printers were not hit as hard as others, however; while the Michigan-based firms Bradford Company and Kalasign focused entirely on the defense industry, Velvetone did very well with both government and commercial work: "Velvetone Poster Company, San Francisco screen process house, has been very busy on government work, according to F. O. Brant, manager of that organization, who is looking for a great boom in display advertising even before the close of the war. They have recently produced over half a million pieces of various insignia on cloth, decolmania and Velva-Glo [with fluorescent colors]. Commercial work is holding up well. A thousand dimensional displays were produced for the Bank of America, and their regular customers have kept them in full operation."[449]

Printing propaganda posters, Twin Cities Ordnance Plant, New Brighton, Minn., 1943.
Signs of the Times, July 1943



7 / SPECIAL APPLICATIONS

Harry Sternberg and his cover design for the journal A–D, 1941. Printed by Masta Displays, New York City.

A–D, October-November 1941

7.1 / SERIGRAPHY

SERIGRAPHY IS the term for fine art printmaking using the screen process. Unlike commercial screen printing, it has a well-documented history.[468] During the Great Depression, artists in New York discovered that the screen printing technique made it possible to produce art prints economically. Today serigraphs are often produced by print shops in close collaboration with the artists, but in those early years artists printed their own works in their studios, using simple self-built printing equipment.

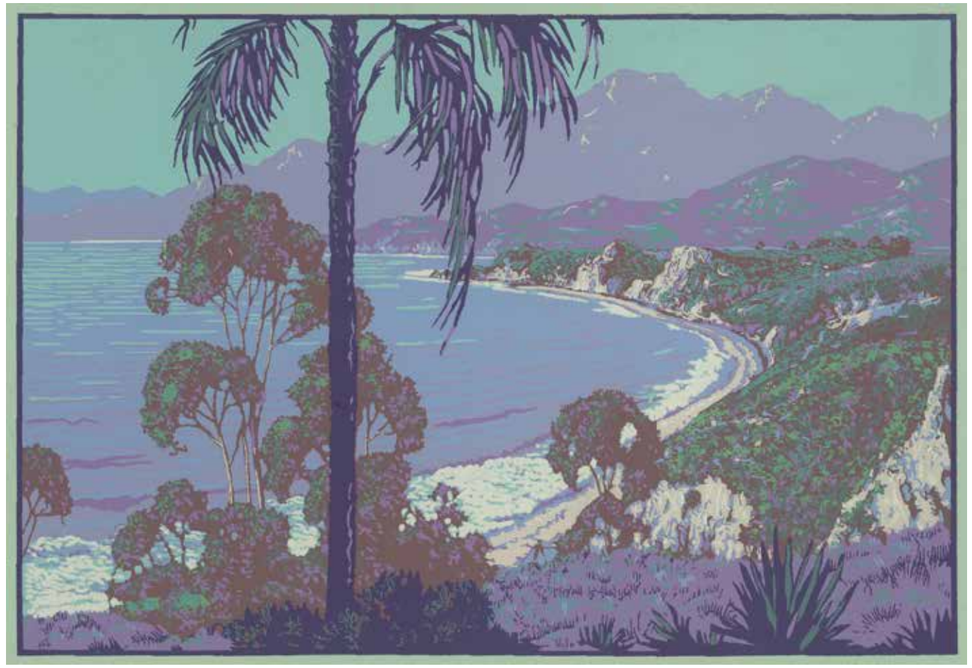
The evolution of serigraphy cannot be viewed separately from the development of commercial screen printing, since creative artists were adopting a process that had already been refined through years of commercial use. As Harry Sternberg noted in 1941, "For approximately thirty years there has been in use a color printing medium known as silk screen. Artists have been in daily contact with this medium in posters, wall papers, textiles, etc., and its esthetic possibilities have been demonstrated by the better 'commercial artists.' Yet, astounding as it may seem, it is less than three years ago that 'fine' artists began to use silk screen for the production of color prints."[469]

"PRINTED OIL PAINTINGS": THE EARLY YEARS OF SILK SCREEN PRINTMAKING

The birth of serigraphy is generally dated to the late 1930s. However, silk screen art prints had already been produced in the 1920s, primarily in California, the "cradle of graphic screen printing." In addition to displays, signs and posters, printers were already turning out pieces with no advertising message.[470] They were designed by freelance commercial artists or employees in the art departments of the shops, most of whom had graduated from the art schools that could be found "in practically every city of size in the country […] These schools invariably have a class in commercial art, where students are trained to create ideas, understand composition, mix colors and absorb the basic principles that apply to the technical nature of all reproduction processes. […] The greatest number of experts working in the craft today were recruited from art school sources."[471] Graphic artist Clement Henri Andreani (1899–1953) was hired by Selectasine in 1917, George Carvell Ashley (1891–1971) and Gilbert Ross Tonge (1883–1970) by Velvetone at about the same time, and Eugene Pierre Franquinet (1875–1940) by Vitachrome. Vitachrome also commissioned work from commercial artist Charles Dennis Barnett (1882–1960) in the 1920s and from Edward Cecil Northridge (1902–1949) and Lee Chase ("Cleaver") Jennings (1892–1963) in the 1930s. Jennings had previously worked for the David A. Coleman Company in 1921.[472] Artists like Leopold Krumel (1879–1966) and Boris Riedel (1895–1969), who would later make screen prints of their own art, worked in the graphics industry in the 1920s – Krumel in the field of photolithography and Riedel at the Oil Print Poster Company in Chicago, which used the screen process.

The heavy ink coverage typical of screen printing made it possible to print large-format jobs in bright and opaque colors, and even to produce pieces with a textured surface reminiscent of an oil painting. The fascinating technical possibilities led to an extraordinary flowering: "In no other field of poster advertising has such remarkable progress been made in so short a time as has been accomplished in the silk screen process industry, in fact the effects obtained by this method have become so popular that an effort to imitate it by lithography has been noted in recent pieces of advertising material."[473] It is not surprising that artists began to take an interest in the process and its properties in the 1920s. Without naming names, Edward Owens described this

Vitachrome print, undated, 1920s or 1930s. Printed in 13 colors using photostencils. 10.8 × 7.7 in.



change of attitude: “Noted artists who formerly held that the process’s limitations were too acute now maintain a profound respect for it. […] They now use full freedom in preparing sketches without questioning whether or not the process operator can faithfully reproduce their work. […] Not only has the process won its place in the commercial field as a recognized graphic art, but it has also taken form as an applied art. Numerous other leading artists have had their original paintings reproduced, as can be seen in the best art dealers’ windows.”[474]

The screen-printed art produced into the 1930s appealed to a wide audience: Still lifes, landscapes and ships on the high seas were popular subjects for calendars and art prints. In 1923 the Vitachrome Company advertised the “oil-painted feel” and highly decorative qualities of its “bright, colorful and out of the ordinary” calendar art.[475] However, art critic Paul Richard commented in 1980 that prints of this kind looked like “oil paintings in which something is slightly wrong.”[476] Swiss artist Hans Caspar Ulrich was also bemused the first time he saw a silk screen print: “The flat and rather paste-like color application reminded me of hand work, while the absolutely uniform shades appeared to be produced by a printing press.”[477]

Commercial art or fine art?

In the 1980s a discussion arose in American museum circles as to whether the graphic art produced by the screen process in the 1920s should be treated as fine art or as commercial art of the kind intended “to decorate calendars or, cheaply framed, middle-class parlour walls.”[478] This is not an easy question to answer – too little is known of the intended purpose of the images, the print runs and the overall oeuvre of the artists and graphic designers. In addition to inconsequential pieces, they created works in the Art Deco style; this new movement, which dissolved the distinction between “high art” and commercial art and appealed to a broader public, influenced artists like Krumel, Riedel and Claude Millard (1887–1960). Krumel’s silk screen prints and his advertising displays were designed in this same style, and both were printed by Velvetone.[479] Riedel’s prints were sold in department stores; at first his signature was only stamped on, but he began signing reproductions by hand in the 1930s.

The New York artists who had discovered screen printing during the Depression did not stop with Art Deco – American art at that time was experiencing an upheaval that would culminate in postwar modernism.[480] The artists looked to new movements coming from Europe and experimented with design and printing techniques; they took their subjects from everyday life, sometimes with a message of social criticism.

ABOVE: Leopold Krumel, above: about 40 years old, below: with grandson Karl, ca. 1954.
Family records of Karl Krumel

LEOPOLD KRUMEL (1879 – 1966)

LEOPOLD KRUMEL collaborated with the Velvetone Poster Company in San Francisco in the 1920s and 1930s. In addition to his work as an artist, he designed displays and art prints, which Velvetone printed by the screen process. Krumel was born in what is now the Czech Republic and worked there as a sign painter. He emigrated to the USA in 1905, settling in San Francisco. There he found work as a graphic artist with the Sierra Art & Engraving Company, which specialized in cartography and photolithography. According to his grandson Karl, Leopold Krumel was an introvert who rarely spoke of his professional and artistic career. In his old age he destroyed all of his own works that were still in his possession; pieces that survived include his 1927 screen print “Swans” — printed by Velvetone using the Selectasine process — and probably a sample print in the Selectasine manual, as well as two watercolors and an oil painting. Krumel died in Alameda, Calif.[499]

LEFT: Art print and advertising display designed by Krumel and printed by Velvetone, 1927 and 1928.
Display: Signs of the Times, March 1928

Textile printing stencil, ca. 1950
(detail ca. 2.4 × 2.0 cm)

7.2 / TEXTILE SCREEN PRINTING

DECORATIVE TEXTILES have been made by all the world's cultures since ancient times. While techniques like embroidery or batik were often used to decorate individual pieces of clothing, plain lengths of fabric were printed with stamps and stencils. Carved wooden stamps, or woodblocks, were the preferred method in Europe and India, while stencils were more popular in Japan. These ancient techniques still survive in craftwork today, but with the industrialization of textile manufacturing in Europe in the early 19th century, textile printing also became a more mechanized process. Short and medium lengths of cloth were still printed with woodblocks, albeit in larger factories than before, while mass-produced goods were made with high-capacity printing presses.[500]

The origins of textile screen printing must be understood in the context of the rapid advance of automation, which continued well into the 20th century.[501] Screen printing ultimately prevailed during the Great Depression, as it was cheaper and more flexible than other techniques.

Block printing: Rapping on the block for a clean print. Alsace, 1940s.
Bi-centenaire de l'impression sur étoffe en Alsace. Société industrielle de Mulhouse, 1946

THE INDUSTRIALIZATION OF TEXTILE PRINTING: FROM BLOCK PRINTING (RELIEF PRINTING) TO ROLLER PRINTING (GRAVURE PRINTING)

Block printing

"Not so very long ago, hand printing [block printing] was really the only major textile printing process," textile expert Otto Nentwich wrote in 1938. "At first it was used in small and medium-sized operations, but at its peak it also made its way into substantial industrial conglomerates, even though it did not require any mechanical assistance to speak of. This was perhaps an inevitable result of the constant growth of the market and the rapid increase in demand for printed goods that came with it, because what is now considered an average daily output for a small screen printing operation would have employed dozens of small businesses back then, or hundreds of hand printers in a large multistory factory building."[502]

The oldest surviving printed textiles and woodblocks in Europe date to the 14th century, about a hundred years before Gutenberg invented movable type printing.[503] Designs were carved directly into blocks made of pearwood or another hardwood; this method did not allow for reproduction of fine details, and repeated use wore the blocks down fairly quickly. The addition of metal parts to the blocks in the 19th century was a step forward: Pieces of brass were hammered into the woodblock to form the design, such as pins to produce stippling or thin strips to create lines. For larger designs, the edges of the motif would be made from brass and the areas inside the shapes covered with felt to improve ink absorption and transfer. For more delicate designs, the whole thing might be cast in metal and then affixed to the block.[504]

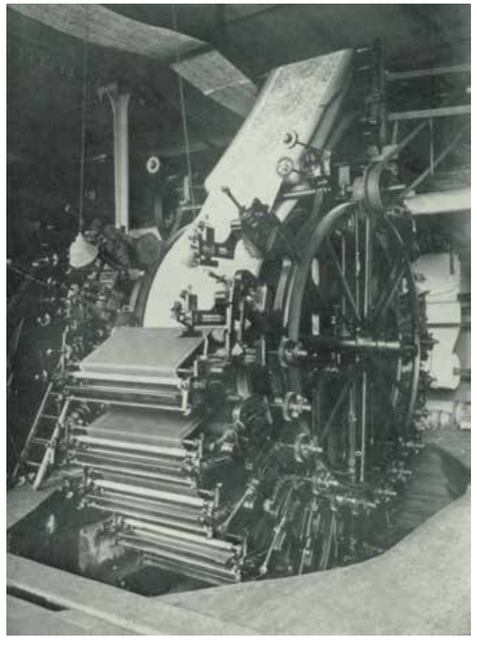
To begin the printing process, the length of fabric was unrolled on a long table and fastened down at the sides. Inks and resist paste were kept in containers similar to a stamp pad, and a "tearer" – usually a boy, though girls also did this kind of work – stood by to assist the printer by keeping the pad coated between printing passes. The printer inked the block by pressing it on the pad, then pressed the inked surface against the fabric and rapped the block with a heavy mallet to ensure uniform ink application. For multicolor designs, the different inks were applied in succession, each by a different printer with his own tearer. The blocks had a sharp pin on each corner, which left small marks on the fabric to help the other printers to align their blocks correctly.

A revolution in textile printing: Roller printing

Textile manufacturing became one of the most important sectors during the Industrial Revolution, first in England and then throughout Europe. At the same time, textile finishing – dyeing and printing – was also making enormous strides: "The total number of workers in English cotton printing factories was 57,328 in 1818, which rose to 419,519 in 1839, of whom 192,800 were children," reported Wilhelm Heinrich von Kurrer.[505]

The development of the machine-powered rotary gravure printing press was the technological breakthrough that led to the mechanization of textile printing. In this process, known as roller printing, the design was engraved on a metal cylinder, which revolved in the press; once the cylinder was inked, a sharp metal blade scraped any excess from the surface and the ink remaining in the depressions was transferred onto the fabric. The rotary mechanism made it possible to print at previously unimaginable speeds. Roller presses that could print several colors at once came on the market in 1785.[506] This method could accomplish "in a few minutes what would have required one or two thousand impressions with a woodblock before. The speed of production and the time saved reach astounding levels, and a machine of this kind with multiple engraved rollers propelled by steam or water power can produce more in one day than a hundred hand printers with a like number of tearers."[507] Presses with up to sixteen inking units became available in the late 19th century.

"The development of roller printing [...] knocked hand [woodblock] printing out of its dominant position."[508] However, it was never completely driven out of the market, and found a niche in printing smaller lengths of fabric that would be too complicated for roller printing, and therefore unprofitable. Kurrer's reports on the textile industry in England (including Scotland) illustrate the astonishing growth in production that was made possible by roller printing: With 15,800 block printing tables and 800 roller printing presses, England's output of finished textiles in the year 1840 was four times that of France. Some 1,000 block printing tables and 63 roller presses were in operation in Manchester alone (England's "Cottonopolis").[509]



Roller printing, Alsace, 1940s.

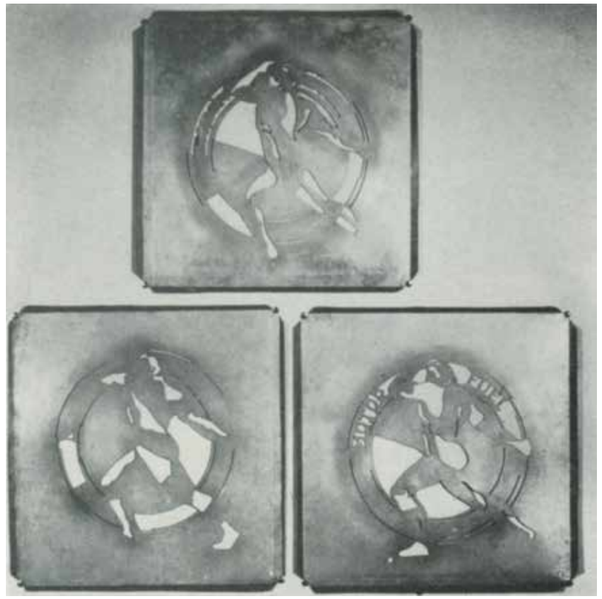
Bi-centenaire de l'impression sur étoffe en Alsace. Société industrielle de Mulhouse, 1946

ABOVE: Working with the Pantograph. The enlarged version of the design is transferred onto the printing cylinder at a reduced size and engraved on the cylinder surface with a diamond point. USA, ca. 1923.

Keystone View Company

BELOW: Manual engraving of a printing cylinder, Alsace, 1940s.

Bi-centenaire de l'impression sur étoffe en Alsace. Société industrielle de Mulhouse, 1946



OPPOSITE: Enamel sign, USA, ca. 1930. Left: Three stencils for applying the color blue.
Better Enameling, September 1930

RIGHT: "Defacement caused by outdoor advertising": enamel signs, Hamburg, Germany, 1910s.
Werner Hellweg: Die Außenreklame in Stadt und Land (Hanf, Hamburg 1919)

7.3 / CERAMIC AND GLASS PRINTING

SEVERAL YEARS after screen printing had found its place in textile manufacturing, the glass and ceramics industry also recognized its potential. Here too the printing process and methods of creating printing forms were borrowed from graphic screen printing, then refined to suit the materials and the manufacturers' needs. "With the adoption of the stencil screen method by the glass industry for the application of fusable enamels, I dare say that no other industry, except possibly the textile printing industry, has made such rapid advancements mechanically for quick production in so short time (seven to eight years) as the glass industry," Harry Hiett remarked in 1938.[545] Prior to the introduction of the screen process, decorations on items like porcelain tableware, enameled signs, containers, appliance housings and glasses were painted on by hand using open cut stencils, or applied in the form of decals, which were printed in lithography. Enamel colors, which bond permanently to the substrate when fired in a kiln, are still in use today. The colors are fired at temperatures ranging from ca. 1,110° (for glass) to 2,200° F (for porcelain).

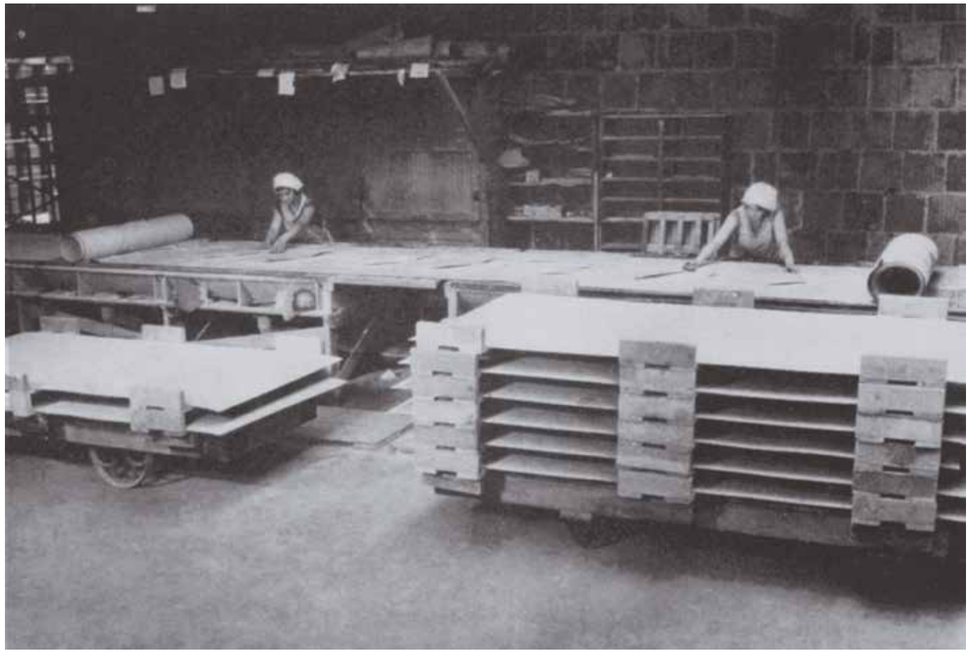
ENAMEL SIGNS AND POSTERS

Enameling evolved over many centuries, used in numerous applications ranging from jewelry to clock faces to rustproofing iron vessels to signs and posters.[546] When baked onto a metal surface, enamel produces an extremely durable coating, a very useful feature in sign making. The first enamel signs, sporting basic logos or company names, were manufactured in the late 19th century in both Europe and the USA. Production increased rapidly, and by the turn of the century signs with complex multicolored designs were fairly common. The USA became the world's largest producer of enamel signs in the 1920s, and by World War II American and European enameling plants were turning out millions of signs and billboards.[547] While the growth of outdoor advertising was considered a sign of progress in the increasingly prosperous United States, it was viewed as a "tin plague" in continental Europe in the early 20th century – a wave of "intrusive billboards" that spoiled the appearance of both cities and towns and "blighted the whole area."[548] The signs began to gain acceptance in the 1920s as designs became more sophisticated. Enamel signs were expensive to make and long-lasting, while advertising campaigns were growing shorter and shorter; these factors and the rapid changes in advertising media led to the gradual disappearance of enamel signs in the 1950s.

"Brushing out" with open stencils

According to a 1936 trade journal, "There is only one method of producing [enamel] posters that is appropriate for the materials involved, and that is stenciling. True, it does not allow for halftone effects [shading], but those are, after all, the domain of paper posters, and enamel signs have other advantages."[549] The signs were generally decorated using open stencils, with ties connecting the individual sections. Once the number of colors had been determined, the outlines of the design were drawn at their actual size; based on this master copy, the stencils were then cut from zinc, tin or brass foil, with the fine details sometimes etched in with acid. Thick paper, which was much cheaper, was sometimes used for shorter runs. The industry began using plastic films in the late 1930s.

"Brushing out" was a special method for stenciling decorations on enamel. Stencils are normally "positive" – that is, the colors are applied through the open areas. Brush-out stencils, however, are cut in such a way that the "closed" areas create the image, like a photo negative; the open areas were used to remove the enamel that was not part of the design. In this process, the whole sign was sprayed with a diluted enamel



glaze. Once it was dry, the stencil was placed on top of this layer and the enamel removed from the open areas with a brush, while the closed areas protected the glaze beneath. A vacuum system removed the powder as it was brushed away. The process was then repeated to remove any enamel that was covered by the stencil ties; this task was performed by hand for single pieces or a limited series, but for longer runs a second stencil was made that included only the small areas under the ties that still needed to be removed.[550]

These simple cut stencils could not accommodate delicate designs, color gradients, shading or halftone techniques, so the transfer method was used to achieve such effects. In this process, the design was lithographed on tissue paper with lacquer. Ceramic pigment was dusted on while the lacquer was still tacky, and the image was then transferred onto the enamel sign. As lithography fell out of use, the transfer technique was replaced by halftone screen printing.

BOTH PAGES: "Brushing out" with paper stencils; removing ties. USA, ca.1930.
Better Enameling, September 1930