

The Development of Rotary-Screen Printing

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At the beginning of the 20th century, most textile printing was done on engraved roll machines. Dyes were selected according to the substrate to be printed—vat dyes for cotton and acid dyes for wool and silk. Vat printing was made possible by the discovery of sodium sulfoxylate formaldehyde as a reducing agent and the use of flash agers.¹ Synthetic pigment systems were first used in the 1930s.²

In the 1930s, flat-screen printing began to be accepted in Europe and the United States. Using engraved rolls took too long when changing patterns and the open-mesh silk gauze was much cheaper to produce. Roller printing was justified for long production runs and screen printing was used for short runs. Roller printing had been a continuous process as early as 1793 when Thomas Bell developed the first roller print machine. Could

a continuous process be developed for the flat screens?

Semi-continuous automated screen-printing machines were developed after World War II. By 1950, companies like Buser (Switzerland), Reggiani (Italy), Stork (Holland), and Zimmer (Austria) had developed automated moving blankets or belts to transport the print goods under the lifted screens. To stabilize the ground, the goods were gummed to the belt, which was subsequently washed after use. The intermittent starting and stopping of the belt made this a discontinuous process.³ At the same time, people hoped the flat screens could somehow be joined into a roller-like configuration that would enable the same continuous nature as roller printing. U.S. patents, issued as early as 1899, proposed a continuous movement of goods through or under a rotating screen. Others around the world investigated the possibilities. Patents were filed and issued far earlier than the appearance of a commercial machine. This paper will attempt to document the trials and tribulations of the people who eventually introduced commercially acceptable

machines and one young man who was not able to realize his dream—the commercialization of an automated rotary-screen print machine.

William Hoffman's Print Machine

William A. Hoffman, recently released from military duty following World War II, enrolled in the Philadelphia Textile Institute in pursuit of a degree in textile engineering. Part of the degree requirements was the completion of a thesis. In 1945, while Hoffman worked at the Coldspring Bleachery in nearby Yardley, Pa., he became intrigued with roller print machines and flat-table printing. He wondered whether a machine combining several of the features could be developed. During 1946-47, he attended classes and worked on his ideas. He proposed wrapping metal screen wire around mahogany disks each fitted with a hollow, perforated shaft supported with bearings at each end of the screen assembly. The perforated shaft permitted delivery of print paste to the screen, while the screen was in motion.

ABSTRACT

Automation and increased productivity were the watchwords in the textile industry following World War II. A number of engineers in different countries sought a means of merging the expensive engraved metal roll printing with the cost benefits of flat-screen printing. William A. Hoffman of the United States developed a prototype in 1947 as a part of his senior thesis at Philadelphia Textile Institute. The first commercially introduced machine by de Barros of Portugal in 1954 was succeeded by the galvano direct engraved process of Peter Zimmer in 1959 and the less costly lacquer screen process of Stork in 1963. By 1978, rotary-screen printing had eclipsed roller printing as the new technology was widely accepted. Today, well over 60% of all textile printing is performed on rotary screen machines.

Key Terms

History
Printing
Rotary-Screen Printing

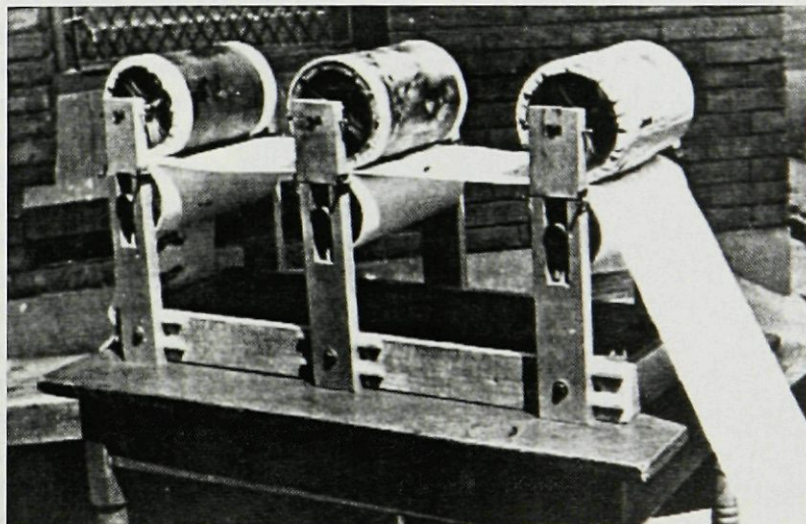


Fig. 1. William Hoffman's three-color rotary-screen print machine prototype.⁴

The first sub-unit was completed on April 5, 1947.⁴ The final version, documented in his senior thesis submitted in June 1948, enabled him to print a three-color pattern continuously by spreading fabric on a flat table, mounting detachable screens above, and passing the fabric beneath the turning screens (Fig. 1).

At the suggestion of his classmate Bob Smith, he was invited to show his thesis to the Smith Drum Machine Works of Philadelphia, manufacturers of textile dyeing machinery. Smith Drum offered him \$50.00 for the right to see the thesis and after studying the thesis, decided "it was not their cup of tea."⁵ Later, Hoffman discovered the original thesis had been checked out of the textile library by the H. L. Yoe Engineering Co. and not returned. This was to cause Hoffman some speculation later when Morrison introduced a machine from Portugal.

Aljaba Machine

No rotary-screen machines were commercialized until Jaime de Barros, a Portuguese printer and inventor from Lisbon, introduced the Aljaba, a rotary-screen machine based on his 1954 British patent.⁶ Aaron reported that de Barros had made rotating screens and used them on a flat manual screen printing table as early as 1947.⁷ This work is commonly regarded as the date for the first rotary-screen machine. Commercial machines based on the patent and earlier work were sold in Germany and England. These machines looked like a roller print machine with the screens mounted around a large central cylinder. In June 1960, a seven-color machine was used at Walsden Bleaching and Dyeing Works in the U.K.,

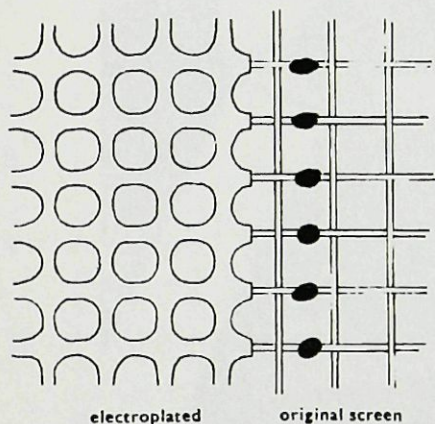


Fig. 2. The Aljaba screen—soldered (black circles) and electroplated.⁹

where candlewick material was printed using an 80-mesh phosphor bronze screen. Operating speeds were in the range of 20-50 yards per minute.⁸ Pattern selection was limited since the screen had to be soldered together, then electroplated, resulting in a wavy line across the screen (Fig. 2). No stripe or blotch designs could be printed. de Barros described his machine in a general paper delivered to the Society of Dyers and Colourists in 1966 (Fig. 3).⁹

Morrison Aljaba Machine

In 1961, Morrison Machine Co. of Paterson, N.J., began offering a version of the Aljaba to U.S. customers.¹⁰ When Hoffman saw an article in *Textile World*, he wrote to the editor inquiring about the origin of the machine since he saw several items related to his thesis.⁵ The editor replied that the machine originated in Portugal and that was all he knew. F. Raff reported that four of these machines were sold and installed in New England and New Jersey.¹¹ The machines did not satisfy the demands of U.S. printers and were eventually withdrawn from the market by Morrison.

Peter Zimmer's Machines

Blanket Print Machines

The family of Franz Zimmer began building textile machines in 1874 in Warnsdorf, which is located in the present day Czech Republic, just across the border from Germany. In those days, this region was united under the Austro-Hungarian Empire. In the late 1930s, Franz' son, Heinrich Zimmer, received a commission to build a duplex blanket printing machine for van Heek of Holland. World War II interrupted the development of that machine and the beginning of a textile engineering education for Peter Zimmer. Peter was "a permanent guest" in his father's works as early as age nine.¹² After the war, the family was scattered as all Germans were forcefully relocated from the new Czech Socialist Republic. They relocated at the home of a family member in Austria and began life anew.

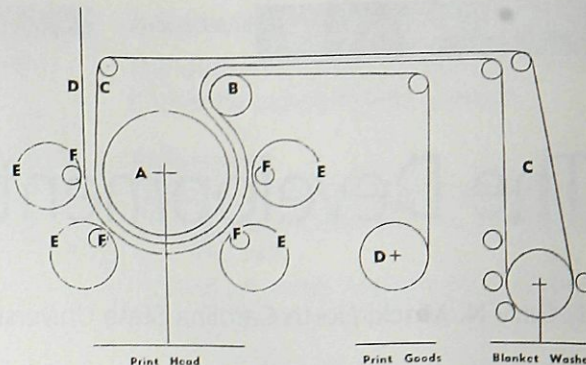


Fig. 3. The Aljaba Simplex rotary-screen print machine schematic¹⁰ (A) pressure bowl, (B) jockey roller, (C) blanket washer, (D) print goods, (E) rotary-screen, (F) pressure roll.

In 1950, Heinrich contacted van Heek to see whether they were still interested in the blanket machine and, finding that they were, secured funding of 30,000 Austrian Shillings for a new start by a banker in Kufstein, Austria. Peter was in engineering school in Bregenz, Austria, but was more interested in an acting career than in engineering. The city of Bregenz offered scholarships to budding actors and that helped pay his expenses. However, when he came home for the Easter holiday in 1951, he found that van Heek's technical manager, Mr. Pikard, had rejected two proposed designs and the family was in need of new ideas for the design. With the help of Mr. Kantor, a mechanic, Peter spent the entire weekend building a 60-cm wide prototype. With three rolls and a colorbox on either side of the blanket, Pikard accepted the idea and the new business was saved. A roll squeegee and the large blanket-sized flat screen were incorporated in the final machine. Peter rejoined the family business and put his engineering studies and acting aside.

Automation was the word in the 1950s as firms such as Bayer and Hoechst developed wet-on-wet printing chemistry. A number of companies worked on automatically spreading the print goods, automatically moving the "print table" by means of a moving belt, and automatically lifting the print screen, and thus moving the squeegee. The Zimmer family business reestablished the flat table and automated the machine, as had others such as Buser, Reggiani, and Stork. Peter's project was the vertical Duplex blanket printing machine. During the installation at van Heek, Peter spoke with

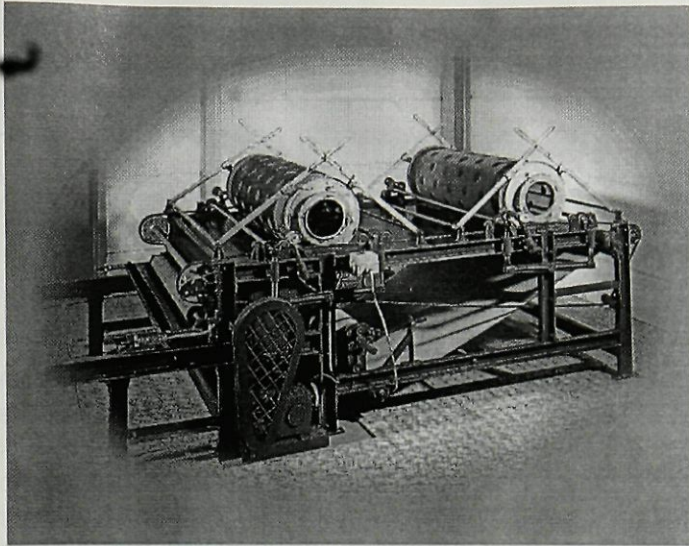


Fig. 4. Peter Zimmer's first rotary-screen printing machine.

the company colorist, Mr. Ribbers, about the possibility of continuous screen printing. Could a hollow cylinder be used instead of a flat screen or a rolled screen? Ribbers knew a company that manufactured a cylindrical nickel gasoline filter body. At the end of 1951, Peter paid a visit to VECO in Eerbeek. They did build such a filter body, 50 cm in length and 45 cm in diameter, but did not wish to build a larger one. Peter took a sample filter back to Kufstein, painted a design on the screened body to cover some of the holes, and put a rod and print paste into the contact area of the screen. He pushed the assembly with his hands along a flat table and printed the design. Further work was needed and the idea was set aside for awhile while the flat screen business flourished.

Rotary Screen Printing

The days of the copper roller print machine were numbered by the time Heinrich Zimmer, the family patriarch, died in 1953. The cost of engraving, the handling of the heavy rollers, and the eight hours needed to change an eight-color machine over to a new pattern would prove too costly in the emerging markets of the times. There was a great future for a new automated screen print machine and the low cost of screen production. When Heinrich died, Johannes, the youngest son, took over the financial part of the business and Peter took over the technical part. The company's name was changed to Zimmer's Erben KG.

On a routine sales call, Peter visited a scarf printer, Bauendahl in Viersen, Ger-

many. The rotary print idea was mentioned by chance and Bauendahl ordered the development of a machine. The prototype, built with two screens rotating over a flat table and moving belt, was delivered in 1955. This was the first commercial application.¹³ That original machine was preserved by Bauendahl and later lovingly restored at Zimmer, Kufstein (Fig.

4). (It is to be the centerpiece of a planned printing museum.)¹⁴

The first screens were produced in a vertical nickel bath. The anode was placed in the center of a hollow tube made by Mannesmann, a gun barrel manufacturer. The tube was prepared without the long spiral of rifling needed to give spin to the warhead. When the plating was complete, the barrel containing the thin (0.1 mm) nickel sleeve was removed from the bath and the nickel sleeve separated from the barrel mechanically. Etching similar to that used to etch copper rollers allowed the pattern to be transferred to the nickel sleeve. During etching, the cylindrical sleeve was supported internally by an expandable mandrel. The first commercial galvano direct designed screens were manufactured in Kufstein in 1957.

A contract was written for the first commercial machine in 1959 (model RSDM Rotations-Schablonendruckmaschine—Rotary-Screen Printing Machine in German) with six colors and 130-cm print width, and delivered to Van Vlissingen in Helmond, Holland, in 1960.¹³ The machine was installed behind locked doors and only the machine operators, the director of the company, and Peter Zimmer had a key to enter the room (Fig. 5). As experience was gained, the Zimmer

firm struggled with deciding when to announce this newest breakthrough. Johannes wanted to concentrate on the successful flat-screen printing machine business, while Peter wanted to push the rotary idea. As ITMA '63 approached in Hanover, it was decided to go to the show with the flat-bed printing machine and take along photos of the van Vlissingen production machine to show to special customers. The decision to show only a photo of the rotary machine turned out to be unfortunate.

Stork's Rotary-Screen Machine

In the 1950s, Gebr. Stork of Amsterdam had developed a very well received automated flat-screen printing machine. Peter Leijdekkers, who was a textile colorist by education and had worked with a Buser machine at Hatema in Helmond, Holland, joined Stork in May 1954. Wim Teuling, an engineer with Stork, had the privilege of working closely with Leijdekkers right from the start. He remembers Peter, shortly after they met for the first time, saying, "if only we could make seamless cylindrical screens, what a future that would be for the printer . . .". His dream would become true and how!¹⁵

During the late 1950s and early 1960s, printed fabrics were produced predominantly on roller print machines for long-run, low-priced products and on flatbed printing machines for shorter yardage and higher-priced, more exclusive designs. Specifically in Europe, the productivity of roller printing decreased dramatically due to ever-increasing demand for shorter



Fig. 5. Peter Zimmer's RSDM operating at van Vlissingen.

runs and more variety in designs. One of the few printing companies using only roller printing machines, the Nederlandse Stoom Blekerij (NSB) in Nijverdal, Holland, tried to reverse this trend and increase productivity by installing an electronic engraving machine made by Standt, a German company. This machine, however, was capable of only "shallow" engraving suitable for lightweight fabrics. The chief engraver, Hendrik deVries, tried to find alternative outlets for the Standt engraving machine. He contacted VECO, an electroforming company. VECO subsequently developed an electroforming process to produce a thin-walled sleeve on the electronically engraved copper roller, which could be removed after electroplating was completed. Thus, in mid-1958, the first "galvano screen" was born, but at a high cost because the copper roller had to be engraved first and prepared for the electroforming process. As is often the case, a similar development occurred at one of the Van Vlissingen printing plants in cooperation with Peter Zimmer.¹⁶

Stork Builds a Rotary-Screen System

In the fall of 1961 Stork had supplied a small, narrow, flatbed screen-printing machine to the textile ribbon manufacturer Van Engelen & Evers in Heeze, Holland. This company used extremely thin nickel screens, bought from VECO, a galvanic processor in Eerbeek, Holland. The design was engraved into the material, but how? Teuling and Leijdekkers were anxious to know. Several months later they visited VECO, the same company Peter Zimmer had visited several years earlier. In the owner's office was a display of the galvanic products that the company made for a variety of industries. One product in particular drew their attention—a circular strainer, five inches in diameter and six inches long with *no sign of a seam*. They looked at each other with a knowing glance. "*This is it!*" During the ensuing conversation, they were told that VECO was in contact with a textile printer who was interested in their screens as well. Although neither the name of that printer nor the method by which the small nickel screens were perforated were disclosed during that meeting, Leijdekkers had heard enough. The next day he was on his way to Twente, a county in the

eastern part of Holland with a concentration of textile mills. Leijdekkers was a native of the region and spoke the local dialect. He knew all the leading textile engineers in the plants he visited. One of them, deVries of the NSB, a large roller printing operation at Nijverdal, appeared to be engaged in the development of a nickel rotary-screen in collaboration with VECO. Leijdekkers also talked with Mr. Stork, managing director of the plant. From this moment things went extremely fast.

Leijdekkers' view at that period (as sales director of Stork – Boxmeer, one of the major suppliers of flatbed screen printing machines) was that rotary-screen printing could cause a revolution only if the price of the screen was acceptable to the industry. Within a fairly short time, the first "perforated" screens were produced. More than 20 screen cylinders could be made before the mill engraved roller got damaged! Stork obtained an exclusive license. He contacted manufacturers of screen-making equipment and roller-exposing machines as well as the companies producing lacquers for the screen and roller engravers. However, since Stork had only the pre-prototype device, they did not have any positive response. They decided to design the coating system, the exposure machine, and auxiliary devices themselves. In Leijdekkers' mind, the marketing of rotary-screen printing as a system was entirely different. "Make plain mesh rotary screens that can be supplied to textile printers and screen makers just like wire mesh materials for flat screens were supplied. In addition, produce and sell the printing machines, the machine that is needed to put a light-sensitive lacquer onto the screens, the exposure machine, and other equipment to get the design in the lacquer. Finally, make the cleaning machines for rotary screens and squeegees." And so it was.¹⁵

In a very short time, a cooperative agreement was made between Stork, VECO, and NSB. Stork would adapt a printhead to one of NSB's roller print machines for trial purposes. VECO would make the rotary screens according to the photoengraving method. Stork was granted the exclusive manufacturing rights for "plain mesh" screens at a licensing fee depending on the number of

screens manufactured and sold by Stork. Because no one believed in the marketing concept for plain mesh screens, the fee was almost negligible when a somewhat substantial (Leijdekkers remembers 10,000 for 1964) number of plain mesh screens were manufactured by Stork.¹⁶

1% Inventivity, 99% Sweat

In the summer of 1962, Stork had acquired all the essential ingredients for an exquisite rotary-screen dinner, but the meal was yet to be prepared.¹⁵ Time was extremely short. The next ITMA was in Hanover in the Fall of 1963. This meant that in less than 12 months, a completely new technology had to be developed by Stork in Boxmeer. Top priority was the formation of the following team that could bypass the existing organization:

- Peter Leijdekkers as team leader.
- Henk Wagter, general manager, was to design everything needed for the galvanic process to make plain mesh screens.
- Jacques Vertegaal, head of the drawing office, was to design the rotary-screen printing machine.
- Cor Muselaers, technical director, was to design the squeegees, make a trial machine for testing of the plain mesh screens, and make the rotary-screen printing unit for testing the (as they were called) photo-screens on one of NSB's roller print machines.
- Hendrik deVries (who came over from NSB to join Stork Boxmeer) had the know-how and experience to engrave copper rollers and had initiated the rotary-screen project at NSB in cooperation with VECO. He was to engrave the rollers needed in the galvanic process, engrave the design in the coated plain-mesh rotary screens and the rollers needed to produce photo screens in the galvanic process, and do all that was necessary to produce both printable photo- and plain-mesh screens.
- Henk Edens, plant manager (freed from his normal work), had the task to get the production of plain mesh rotary screens off the ground in a shielded-off section of the factory.
- Gan Cornelissen, field engineer, was to assist in the fabrication of auxiliary equipment and fabricate the trial machine for the plain mesh screens.

- Wim Teuling would coordinate and plan all activities and make all preparations for ITMA '63.
- Lo Anselrode, chemist, came over from Stork Amsterdam to solve a (seemingly unsolvable) problem at a later date after the ITMA.

Sheer Luck Intervenes

The test machine for the screens was ready in early 1963. It was a contraption made of the frame of a flat-bed screen printing machine, blanket, blanket-drive by a roller, one rotary-screen drive and squeegee assembly, a fabric gluing arrangement, and a simple fabric winding-on device. According to Leijdekkers, the main criterion for a good test result would be the printing of an even blotch by means of a plain mesh screen. The result should look like a dyed fabric. The Aljaba machine could not print such a blotch due to the joining of the screen.

At the end of a long day of trials they had gotten nowhere. The print was far from even; in fact it had all shades of red. Whatever they tried, the picture did not change. At around 9 o'clock that night, Cees deRidder, the big boss of Stork Amsterdam (of which Stork Boxmeer was a subsidiary) appeared with his wife. He had authorized the funding of the project. With wet pieces of fabric scattered all over the floor, the place was a big mess. He didn't say anything, watched yet another trial failing, shook his head, took his wife by the arm and left. After he left, they decided to make one last trial that day. Suddenly after having printed less than five yards, the picture changed—a beautifully and extremely nice-looking, evenly-colored fabric came from under the screen and stayed that way for the remainder of what was left of the fabric. They were amazed.

"What the hell did you change?" Leijdekkers asked Muselaers.

"Nothing. What did you do?" asked Muselaers.

"Nothing . . . no . . . wait a sec . . . I touched something with my knee," answered Leijdekkers.

It appeared that Leijdekkers, when leaning over the machine had touched the lever of the variable speed drive of the blanket drive roller with his knee and consequently changed its speed. Muselaers

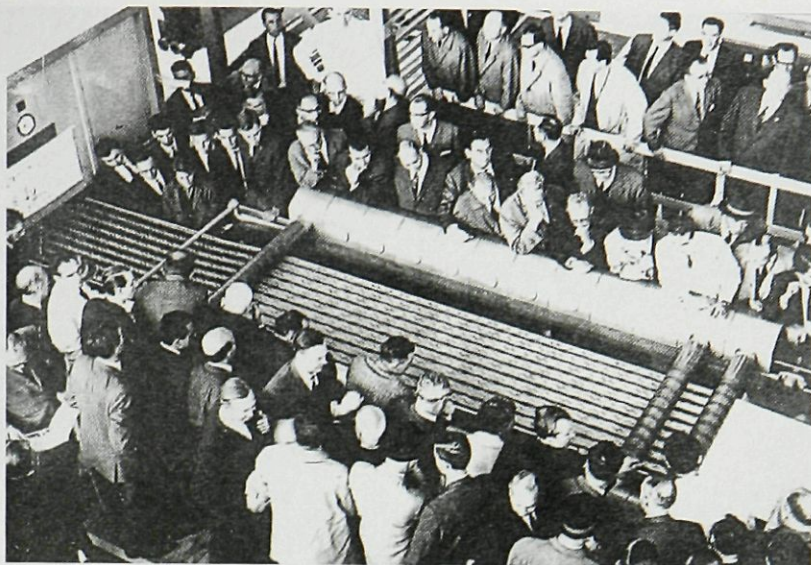


Fig. 6. The Stork booth at ITMA '63.

measured the speed of the blanket and the circumference speed of the screen . . . the speed of the blanket was somewhat higher, whereas before the speeds had been carefully set to be equal. Thus the principle of "blanket-overspeed" was discovered as a must in rotary-screen printing. The next day a patent application was filed.¹⁵

Leijdekkers remembers the effort to get repeat accuracy. By accident, one of the mechanics, left one of his tools inside the printing blanket. When the machine started to run, the tool damaged the blanket beyond repair. They had a second blanket in stock. However, this blanket was some two millimeters thicker than the damaged one. All along, they had assumed that the surface speed of the blanket had to precisely match the speed of the screens. They had almost taken the main driving roller out of the machine to trim the diameter, when Muselaers said, "Why don't we give the new blanket a try without changing the main roller?" Much to their collective surprise, the accuracy that resulted was beyond expectations. An important side effect: the screens were driven by the blanket, thus avoiding or preventing wrinkling of the screens.¹⁶

Stork at ITMA '63

Stork had heard rumors that Peter Zimmer would be demonstrating a rotary-screen printing machine as well. After all, you never stay alone long in the marketplace.¹⁵ To their relief, Zimmer was showing only a tabletop model with two screens and pitch marks to show that the second pitch mark on the screen exactly met the first pitch

mark. (Remember that Peter had not planned to show the large rotary equipment, but took leaflets and film of the operating machine at van Vlissingen to give to special customers.)

The demonstration at the Stork stand attracted a large crowd on the opening day (Fig. 6). Fortunately they had foreseen (and hoped) that this would happen. Therefore they had erected a half-circular steamer side by side with the rotary-screen printer model RD I (Rotatie Druk I or Rotary Printing I in Dutch). Underneath this printer was sufficient space to erect the "grand stand" that was to become an eye-catcher in the photograph that appeared time and again in textile publications following the show.¹⁵

During the exhibition, German and French printers were the first to "go for it." Cranston Print Works; Montreal Fastprint; and Bernard Printing Co., Long Island, N.Y., as well as others from around the world were prepared to place firm orders at the show. Stork had to tell them, though, that they needed at least another ten months to develop a production system. The problem areas were:

- No suitable light-sensitive lacquers were available
- The lacquer used at ITMA became porous after a few hundred yards (they had a fresh set of the three-color design for every demonstration run!)
- Shipment and packaging of the virgin screen cylinders had to be developed
- An adequate dryer had to be engineered

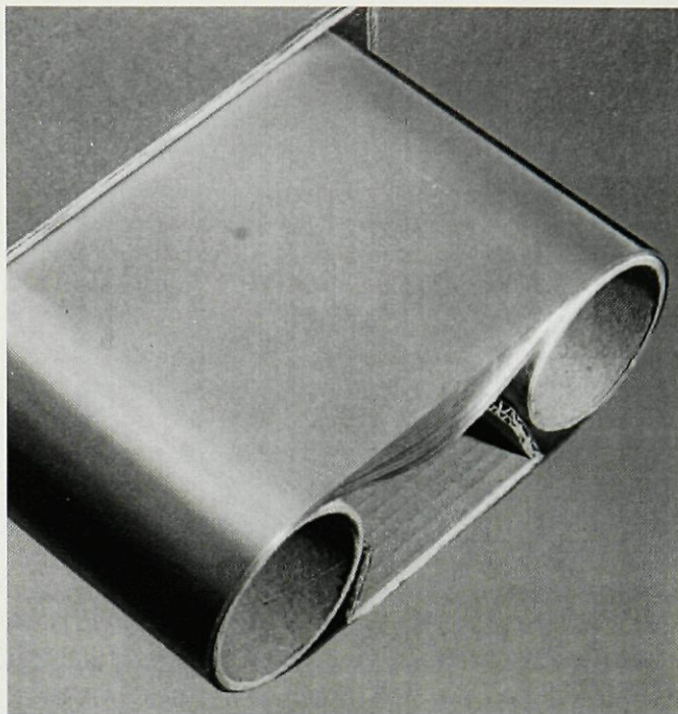


Fig. 7. Stork screens stored one inside the other for shipment.

Final Hurdles

During the development stage it had been taken for granted that photoengraving the coated plain mesh screen with a design would not be different from the process of engraving flatbed screens. How wrong they were . . .¹⁵ After printing less than a couple of hundred yards, the lacquer would not stick to the nickel surface of the screen. Experts from Germany, Holland, Britain, and other countries were contacted. They all came forward with the same answer: "Forget it. What you ask is impossible in the present state of ink-lacquer technology." "Well, then we have to bring that technology on a high level ourselves," the Stork team decided. Management in Amsterdam decided to make Anselrode, manager of their laboratory, free for this impossible mission. He came to Boxmeer and developed suitable lacquers in less than two months.

Screen delivery proved to be another big problem. The first few hundred screen cylinders arrived at the customers' plant with dents and wrinkles in more than 80% of the screens. They were fighting with their back against the wall facing lawsuits and threats to send the machines back. Then almost simultaneously the technical manager, Wagter, arrived one morning with the idea to package the screens inside each other by bending the screen in a kidney form, thus placing ten

screen cylinders inside each other (Fig. 7). This system worked quite satisfactorily, especially after cardboard boxes lined with a spongy material became available, holding six cartons each with ten screens. This compact packaging system allowed for low-cost transportation even by air freight. Lawsuits were stopped, friendship restored.¹⁶

The first commercial run on the RD I was at Lohmann in Lemgo, Germany, on August 15, 1964. This was an RD I 1280/12 (1280 mm maximum printing width/12 print-position machine). The first U.S. installation, identical to the Lohmann, was at Cranston Print Works in Cranston, R.I. The first yardage ran on December 1, 1964.

Zimmer's Response

Peter Zimmer was completely scooped at ITMA. The showing of the Stork RD I caught everyone's imagination. However, Zimmer started selling immediately—after all, they had been operating a successful machine in a commercial environment for three years. The first customers were Renz, Langenbrücken, ordered August 8, 1963, before ITMA; Modedruck, Gera; Lohmann, Lemgo; NAK, Augsburg; Rawe, Nordhorn; and Textil-drückerei, Heidenheim, all in Germany. The first U.S. machine, a 109-inch wide rotary-screen with 16 colors was delivered in 1965 to Chero-

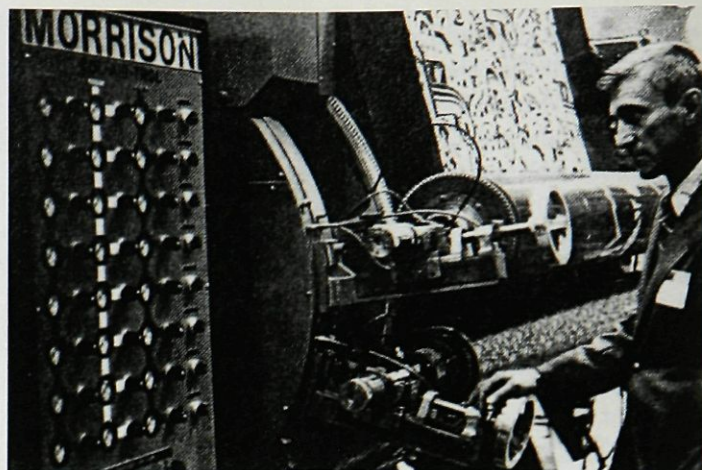


Fig. 8. The Morrison Roto-Screen rotary-screen print machine.¹⁸

kee Finishing in Gaffney, S.C. In early 1998, this machine was sold to Springs, Grace Finishing Plant, and will be completely refitted!¹⁷

By 1998, the Galvano Direct Designed screen system was supplied to nearly 50 customers around the world who could make their own screens, capable of half-tones and degradation. The Stork lacquer screens were cheaper to produce and production and price were controlled by Stork at their plant, but could not produce half-tones. More customers preferred the cheaper route offered by Stork. The new laser engraving technology for Galvano Direct Designed screens promises to lower the price below lacquer technology.¹⁷

Morrison's Roto-Screen Machine

By June 1973, the Morrison machine shown first in the early 1960s was redesigned for the U.S. market and introduced as the Roto-Screen. The first installation was at Perennial Print Corp., near the Morrison plant in Paterson (Fig. 8).¹⁸ A pneumatic color supply system called Col-Air-Trol was very well received and was deemed much better than the hand-dipping used for roller print machines. Several of these were sold and installed at the JP Stevens plant in Clemson, S.C., where the machines were used for a number of years to print sheeting fabric.¹⁹

Conclusion

Who invented the rotary-screen printing machine? Was it the American who filed a patent in 1899 or those in the years after? Was it William Hoffman? de Barros and probably others will claim they were

the first. In the Stork-Boxmeer 40-year memorial book of 1987, deVries is credited.¹⁵ Peter Zimmer undoubtedly was the first to commercialize a rotary-screen machine without a pattern-limiting screen. "One thing is clear. Without the enormous progress made in the galvanic industry, but primarily thanks to the never-faltering vision and no-nonsense approach of one man, Peter Leijdekkers, who made the process affordable, rotary-screen printing might still be in its infantile stage."¹⁵

In the end, the flat-table machines of Stork and Zimmer would prevail over the Aljaba and Morrison ideas of a rotary machine that would fit onto the footprint of an old roller print machine. The number of colors would not be limited to those that could fit around a central drum and the top-down loading and the open-bearing system of Zimmer would prove superior for the quick-change needed. Also as the 1960s evolved, wider fabrics were being woven. New print machines were needed. Rotary-screen printing surpassed roller printing in total volume years ago and now controls over 60% of the entire textile printing in the world.

Acknowledgements

The idea to write about rotary-screen

printing was formulated when I wrote an earlier paper on "75 Years of Change in Dyeing and Finishing (1921-1996)" on the occasion of the 75th anniversary of the founding of AATCC. Roland Zimmer contacted me and told me there were commercial machines before the 1963 ITMA. William Hoffman contacted me about his thesis and supplied a photocopy for this project. I thank all those listed below for sharing their thoughts and pointing me in the needed direction to find the truth. I hope I have included enough truth to satisfy my audience and enough insights to make it interesting.

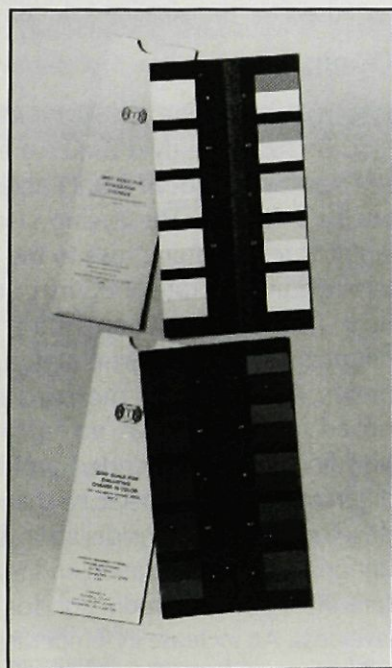
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