

Technological Advances in Rotary & Flatbed Printing (Part 2)



By:
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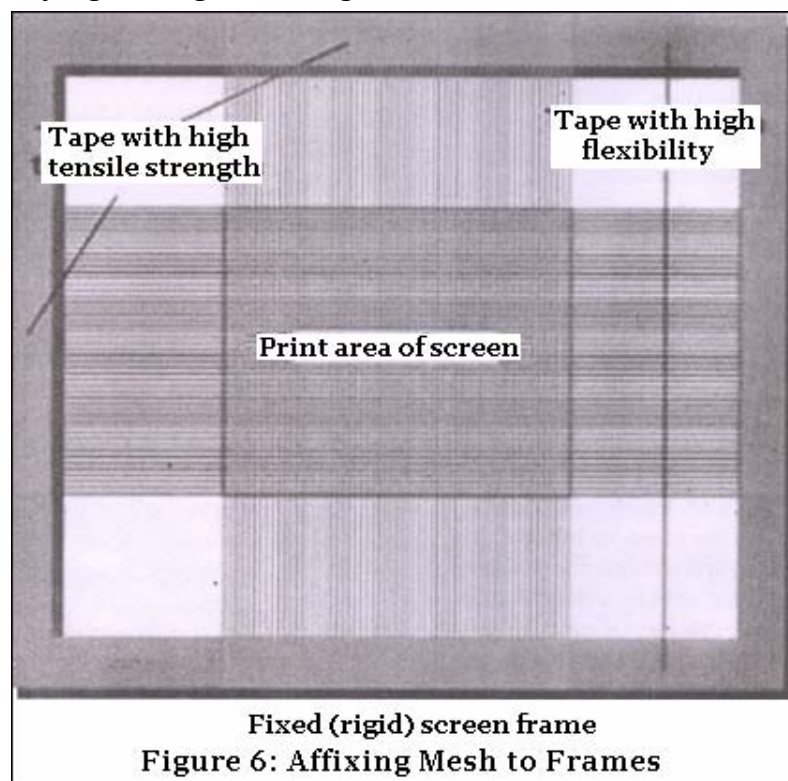
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Ink and Drying/Curing Technology Advances

Roller squeegees offer the potential to operate presses at much higher speeds than is currently possible. So inks must be modified in order to transfer consistently and curing equipment must be introduced that will dry prints effectively at these speeds.

The rapid ink transfer demanded by high-speed printing requires the development of inks to match the quality demands as speeds continue to rise. It is seen that this occurring as a natural development of existing ink technology, not a change that requires new inks to be for in tandem with ink development is the need for enhanced drying/curing technologies.



My roller-squeegee experiments were conducted using a modified cylinder press, UV inks, and a dual-lamp UV curing unit. Even when the curing system was operated at maximum power, it could not fully cure the prints at the press's maximum operating speed. For high-speed printing with roller squeegees, flash-cured UV inks show the greatest potential. Uses of ink technologies that dry by evaporation of solvents are highly limited because of the minimal time available for drying (or by the extraordinary length of the dryers that would be

required). After printing blanket moves back underside of the machine and printed fabric moves on to the drying unit. The speed of the blanket and drying unit of blanket is synchronized by means of photovoltaic cells [8].

Disposable Screen Systems

Screens represent a major expense for screen printers, both in terms of mesh cost and labor in screen setup and reclaiming. To make screen printing far more economical in

serving the growing demand for rapid turnaround, it is imperative to eliminate many of the labor-intensive steps by employing disposable screen systems. Mesh would be pre-stretched using highly repeatable equipment and would exhibit more consistent tensions levels from screen to screen.

In some markets, such as CD printing, this already is common practice. Many CD screen printers throw away screens after they are used because it's simply cheaper to replace the small-format screens than reclaim them. Creating comparable screen systems for larger printing applications would require the development of new stretching systems and more versatile- and economical mounting systems than current frame technology.

Precoated Mesh

Another potential option that goes hand in hand with disposable screens is to offer the screens precoated with emulsion so that they are immediately ready for exposure and developing. This also would significantly simplify screen printing by eliminating the many steps required to coat and dry a screen prior to exposure. Precoated mesh also would lead to greater consistency since screens could be coated to more exacting tolerances with the heavy-duty coating equipment that suppliers would employ.

Screen Mounting Once Stretched

For many years the only way to reliably mount the screen on a frame was to glue the mesh in place. This was a permanent solution that did not allow easy removal of the mesh or adjustments to screen tension after the mesh was affixed. Printers simply had to live with any tension loss experienced after the screen was attached. The introduction of retensionable frame systems addressed the tension-loss problem, but the frames had the drawback of higher cost. No cost-effective, retensionable framing system yet exists as a replacement for rigid frames in disposable screen systems.

One possible solution to this dilemma may be to modify a technology currently used in flexo-graphic printing for mounting the printing plate to the printing cylinder/sleeve. The technology involves a specially engineered double-sided adhesive tape that holds the plate in position during printing, but allows quick and simple removal once printing is complete. If the same technology were applied to screen printing, it would allow a stretched screen mesh to be attached to a fixed frame, prepared with a stencil, used in printing, then quickly removed for disposal when the job was complete, bypassing the time and expense of the reclaiming process.

For the best results with such a mounting system, double-sided adhesive tapes with the greatest strength would be used to secure mesh threads that run through the image area of the screens, as shown in Figure No. 6. A more flexible tape would be used in the corner regions to hold the mesh in position while allowing it to flex and avoid damage caused by the printing action. Combined with a stretching method that could efficiently produce stable and repeatable screen tensions, such a frame-mounting system could eliminate any justification for reclaiming and reusing stretched screens.

For disposable screen systems to become practical, a new method for mounting mesh on frames must be introduced. One possibility for use with rigid frames is to employ

specially engineered double-sided adhesive tapes. Tape with high bond strength could be used to secure threads that make up the image area of the screen, while a flexible tape could be used in the corner that allows the mesh to give and avoid damage due to squeegee pressure or movement [9].

Nonwoven Mesh Materials

The concept of replacing woven screen mesh with a nonwoven material is not new. Nonwoven alternatives to woven mesh could include perforated or ablated materials. Materials could be selected that offer greater stability and support of the print image than conventional mesh, low-friction surfaces, greater ability to recycle waste materials, and simplicity of use. Several patents exist for such mesh alternatives, but their successful implementation has yet to impact any screen-printing market. If such materials were perfected for screen - printing, they could allow the process to expand into new, tight-tolerance applications, such as producing bio-medical, sensors and small, dense, electronic circuits.

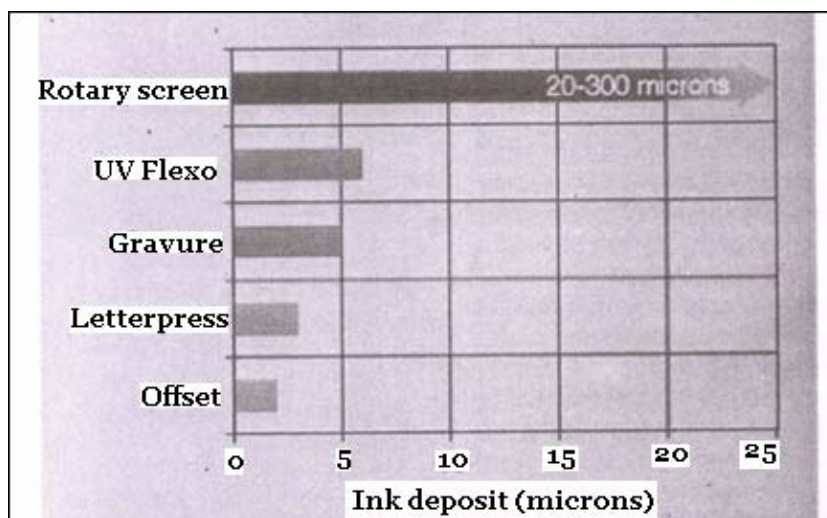


Figure 7: Ink-Deposit Capabilities of Various Print Methods

Single-pass Multicolor Printing

Over the last decade, the concept of screen-printing multicolor images in a single pass has drawn increasing attention. The introduction of this capability would reduce or eliminate the occurrence of color-to-color registration errors and significantly decrease production time, as well as waste. The improved economies of scale that would come from completing a screen printing job in one or two passes, rather than seven or eight, would inevitably lead to the greatest attraction for customers, to achieve lower prices on the final products.

Combination Presses

The use of screen-printing technology in combination with other print processes has greatly increased in the last five years. This is particularly true with web-fed rotary screen-printing, which often is joined with flexography, digital printing, and/or finishing technologies in advanced, automated production machines. The addition of rotary screen-printing to web production lines has expanded the range and value of the products that can be printed. However, the maximum speed of such combination presses normally is limited by the speed of the screen-printing units [10].

Combination printing allows users to take advantage of the various ink deposit and detail-resolution characteristics of different imaging methods, which vary considerably. Looking at Figure No.7, it is apparent that if a combination-system user wants to deposit UV ink at a thickness of 30 microns, a rotary screen module would provide the best solution--rotary screen presses support deposits from 20 to as much as 300 microns, depending on the ink. But if the job calls for very fine details or high resolution halftones, using the flexo or offset printing modules of the combination system would be a better option. The point here is that combination units bring together complementary technologies to provide the most production flexibility.

Rotary screen printing's ability to deposit heavy coating thickness makes it a popular complement to flexo, offset, and letterpress print methods on combination printing units. With its heavy ink-deposit capabilities, rotary screen-printing delivers the most opaque and brilliantly colored prints of the technologies employed in combination printing systems. For this reason, it often may be used to apply high visibility image elements or produce undercoats in applications that will subsequently be printed with flexographic or offset images. Rotary screen is also the best choice for coarse halftones and specialty inks, including metallic, thermochromic, and electro-luminescent formulations.

Another speciality of rotary screen is producing tactile images, such as Braille text. Rotary-screened varnishes and coatings are commonly applied to provide extra resistance to chemical and environmental exposure.

If web systems were to incorporate roller squeegees along with improved inks and drying devices, screen printing rates could be raised to match the production speeds of the other technologies employed. The result would be machines that could produce an even wider range of products with minimal waste and lower cost, which translates to maximum profitability.

Today, companies use most combination presses that feature rotary screen-printing where the main strengths are in other print process, such as flexography. These businesses add screen-printing capabilities because of what the process can provide, but discover that screen-printing is one of the most difficult printing methods to understand and implement successfully. There is no reason why screen-printing companies cannot, and should not, add other print processes and finishing.

Recent Technological Developments in Flat Screen Printing Machine

The development in this machine aims to towards the large repeat size, improved dryer design, modified feeder unit, suitable punch card programmer etc. following are the some of the some of the developments that took place over the years to improve upon the productivity, quality of printing and trouble free running of the machines [11].

1. Hydra Flat Bed Screen Printing Machine

Here the feeder unit is fitted with photovoltaic cell for automatic fabric alignment and also equipped with electronic device to feed in and center automatically the textiles like towels, scarves and other fabrics with weaving pattern which is expected to be quiet

useful from the viewpoint of reduced damages due to misfit or nonalignment in the printing of such textiles.

2. Reggiani's AVANT model

Glueing can be done with either thermoplastic' adhesives or water soluble adhesives. This model has Dynaplast unit, which gives pressure and required temperature condition for getting adhesive paste or tack for thermoplastic adhesive. It takes care of blanket stop and go motion.

The glueing unit provides the automatic supply of the glue drawn from a container, to be distributed over the portion of blanket matching the width of printed fabric. The gluing unit either uses the dyanaplast roller to couple the fabric to the blanket, or more simply a rubber coated pressure roller is mounted right after the gluing unit. In this machine both system can be used alternatively.

3. Storks FMX-I model

Repeat Size 300 cm and 1 to 4 Squeegee Strike, with intermittent programming unit and nozzle injected in dryer.

4. Viero Italy's sigma DG-160

This offers automatic carriage which performs the most sophisticated ~ solution in high quality table printing machine. Electronically controlled carriage allows an optimum use and accuracy together with considerable saving in dwell time. Single squeegee programmable both tilting and pressure, guarantee the control of the color transfer in the desired way and quality. The number printing cycle available and management through keyboard with LCD display allow easy access and management of the machine function.

5. Reggiani's Prim A

It is equipped with database a management system (DBMS) for continuous printing of terry towels, with self-positioning printing unit and self centering of terry towels. This machine is equipped with new printing unit having a bridge structure and friendly access interface for the direct programming of the speed, the lifting height, number of squeegee passes and pause and the printing pressure. Further, one or more printing screen can be fitted on the machine to operate alternatively with rotary and flat screens.

6. Zimmer's Magnoprint

It has magnoprint electric device which controls the movement of machine viz. fabric advance movement, squeegee movements well as lowering and lifting of screen and these movements are controlled by both electrically and electronically. It has printing blanket advances speed up to 120 mts/min. ACR computer control system with design memory gives highest capacity and exact reproducibility of all the printing parameters. Another special feature is movement of the squeegee either in warp direction or weft directions per requirement the electronically controlled. The machine offers unique possibilities of screen lifting of one side after the other, both sides together each one of the four corners separately for achieving time saving per lowering of the screens. The

machine can give-printing either by roll rods or rubber squeegee production, upto 25 mts/min. for large repeats and 22 mts/min. for small repeats.

7. Lyprinter LX

The machine is specially equipped with precision in its lowering and lifting of screens and squeezes, and squeezes strokes across the table that is in the direction. of the fabric weft, also the precision in the transfer movements with its deblocking travel and blocking sequence. The transfer movement is produced by the combined action of the pneumatic cylinder and air motor. Adequate fastening aids fastened to the table ensure the correct emplacement and arresting of the carriage

8. Reggiani's Meccano

Suitable for simultaneous printing of bed sheets, pillow covers with repeat size as large as 390-cm.using complimentary screens of 260 cm and 130 cm. It is also equipped with punch card programmes computer for printing cross border designs on sari having production speed of 30 meters/min.

Rotary Screen Printing

Sources of Rotary Screen Presses

Gallus: Gallus has supplied rotary screen-printing modules for years as part of its combination presses, which are primarily marketed for their letterpress-, flexo-, and offset-printing capabilities. Gallus presses can be equipped with one or more rotary screen-printing modules, as well as hot-foil-stamping and inline-die cutting units. Gallus supplies the R200 system for maximum web widths of 8 in. (203 mm). The company has an installed base of more than 1100 of these presses worldwide. A modular machine, the R200 allows quick and easy exchange of print units, including modules for letterpress, UV-varnishing, rotary screen printing, and curing. The Gallus EM 260, EM 410, and the EM 510 models support several configurations consisting of flexo, rotary screen printing, varnishing, laminating, and embossing modules.

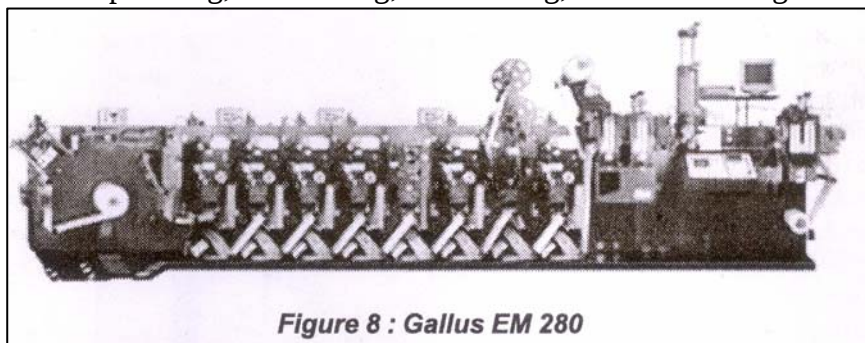


Figure 8 : Gallus EM 280

If desired, these units will even print the web on both sides. Each of these machines can be expanded to as many as 24 stations for producing labels, decorating cardboard products, and printing flexible

packaging: The print width of these presses varies from 10 inch (254 mm) for the EM 260 to 20 inch (510 mm) for the EM 510.

The Gallus EM 280 machine has a modular, open structure (Figure No.8). The machine, which is popular because of its high registration accuracy, is available with flexo and rotary screen printing modules (up to 10 print stations total). The machine accepts rapid

material loading, setup, and cleaning, and it supports a maximum web width of 11 inch (279 mm).

Rotary screen modules configure easily into multi-station production lines. The modules can be quickly swapped with flexo, offset, die cutting, or other modules.

Gallus also supplies the TCS 250, which takes a slightly different approach than most web-fed printing systems in this category. While the machine supports offset, letterpress, and rotary screen-printing modules, it is considered an intermittent press because the web does not move continuously through the machine. For its rotary screen modules, Gallus offers Screeny mesh, a nickel-plated stainless-steel fabric that is used to form Rotascreen printing cylinders. The fabric comes precoated with a photopolymer emulsion and a protective film, and the meter in rolls or in sheets offers it.

Gallus offers eight standard types of Screeny printing plates, which vary from coarse meshes with approximately 64 openings per linear inch (ideal for Braille-printing applications) to fine fabrics with as many as 400 openings per linear in. (designed for halftone and fine-detail work). Turning the Screeny mesh from a flat printing plate into a Rotascreen complete with imaged stencil is similar to making screens for flatbed screen-printing. First, the film is punched with register holes. Then, the Screeny mesh is cut to the required printing length and punched with register holes that correspond to those in the film. Next, the protective foil over the emulsion is removed and the film positive is positioned by means of register pins.

The mesh is exposed while flat under high vacuum to ensure that stencil captures even the finest image elements. Next, the photopolymer stencil is developed with a powerful water jet. Brief drying with hot air is required before continuing [11].

To create a cylinder form, the ends of the printing plate are connected with a plastic sealing device that is locked by means of heat. End caps, called stencil rings (Figure No.9), are then attached to create a stable cylinder. The stencil rings also make it possible to connect the finished screens to the drive unit of the printing press. After printing, the Rotascreen ink is cleaned from the screen cylinders using a special automated screen cleaning device. If the screens are no longer needed, the stencil rings are removed from the printing cylinders. The rings can be reused for another job, but the mesh cannot be reclaimed--a new Rotascreen is created for every new job.

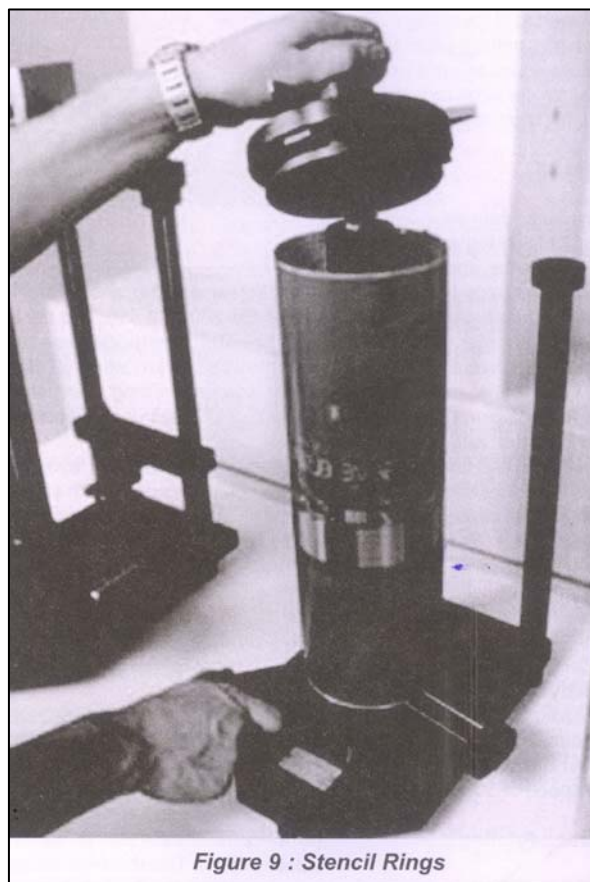


Figure 9 : Stencil Rings

Gallus Rotascreens feature stencil rings that both support the cylindrical screen and allow it to be attached to the printing module.

Stork: While Gallus developed rotary screen printing units as a part of a combination configuration within the Gallus press; in the 1990s Stork developed the Rotary Screen Integration (RSI) program. The RSI concept is also based on compact rotary screen modules (Figure NO.10), but they are designed primarily for integration into existing roll-to-roll flexo, letterpress, offset, or gravure printing systems built by other manufacturers.

Stork presently cooperates with more than 30 'OEM partners to integrate rotary screen modules with their printing equipment. Stork will also provide standalone single or multicolor rotary screen systems. The RSI module can be integrated on fixed positions in most existing narrow-web presses. Alternately, it can be mounted on a rail system that allows the user to move the module to any position in the printing line. RSI print modules are available with web widths of 10, 16, 20, and 24 inch (254, 406, 508, and 610 mm) and support for screen cylinders with a circumference of 1224 inch (305-610 mm).

The screen cylinders used in Stork RSI print modules are made with RotaMesh, a non-woven screen that is made by electroforming thin sheets of nickel. The basic structure of the screen openings is hexagonal (Figure 11) to ensure optimum screen stability and promote registration accuracy. The screen material is essentially a rigid plate with holes. Unlike the Gallus screen material, which is provided in flat form, Stork's RotaMeshes are pre-manufactured. The material is supplied to press users as cylinders that are welded for durability.

The material is available in 10 standard versions ranging from RotaMesh 75 (75 mesh openings per linear inch) for tactile-printing applications to RotaMesh 405 (405 openings/in.) for printing very fine detail.

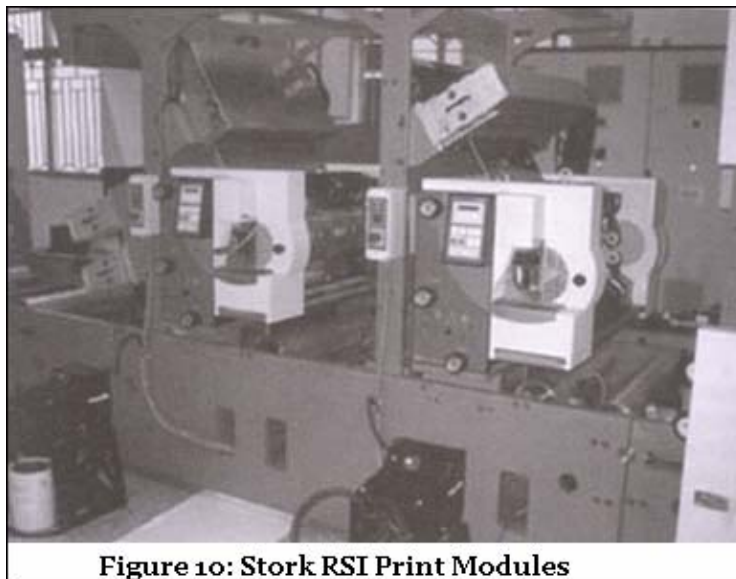


Figure 10: Stork RSI Print Modules

The hexagonal openings in Stork's nickel-based RotaMesh give the screen stability for long runs and allow the material to be reclaimed and reused.

Because the screens are provided in cylindrical form, the stencil making process is much different than the flat processing method used with Gallus's Rotascreens and requires special coating, exposure, developing, and cleaning equipment. First, the user applies stencil rings to stabilize the cylinder. Next, the

RotaMesh is degreased in a tank built for the purpose. Then, direct emulsion is applied by means of a cylindrical emulsion applicator. After coating, the screen is dried and the

film positive is mounted to the outside of the cylinder. Permanent registration marks on the RotaMesh are used to ensure proper film alignment. For exposure, Stork has designed a unit specifically for its cylindrical screens. The system prevents undercutting of light during screen exposure. Finally, the screen is placed in a developer/stripper to resolve the stencil image. After drying, the RotaMesh screen is ready for use in printing. When printing is complete, screens are placed in a screen washing system to remove ink. Once clean, the screens can be stored for repeat orders, or they can be returned to the automatic developer/stripper for reclaiming. Unlike the Gallus screens, Stork's Rotamash can be used several times.

Developments in Squeegee for Rotary Printing

The following four major developments are existing. They are as follows:

1. Unica Rotary:

Printer can print 24 colors on any kind of fabric and width ranging from 180320 em. other features are individual screen drive, blanket screen drive (syncrodrive) electronic screen tensioning, screen width presetting, servo controlled transverse land/ diagonal repeat setting, rapid pump washing, color recovery, color filtering, fabric and blanket heating, also Washing Online (WOL).

Washing Online (WOL): Initially color change has to be carried out number of times for the same design (as per requirement) by removing all the screens and squeegee and wash them separately in appropriate machinery or even manually if none were available. At the same time the color prints and pipes have to wash for next design to print. This operation always involves considerable loss of time, water consumption, labour and risk connected with handling of screen (breakage).

In addition, the remounting of these parts on the machine always meant resetting values, since the exact position of the screen and squeegee could not always be matched.

WOL covers the whole color supply and distribution system, which delivers water and air under pressure during washing operation by means of stencil squeegee connected to a suction system. The colours dissolved and eliminated by the suction, the whole system is perfectly dry and ready for fresh printing operation. It requires about seven min without any manual action. This WOL allows the simultaneous execution of the washing operation on any number of colors installed, with a maximum water consumption of 150 liter of the water per color. This technology allows to wash highly viscous pigments as easily as more liquid dyes.

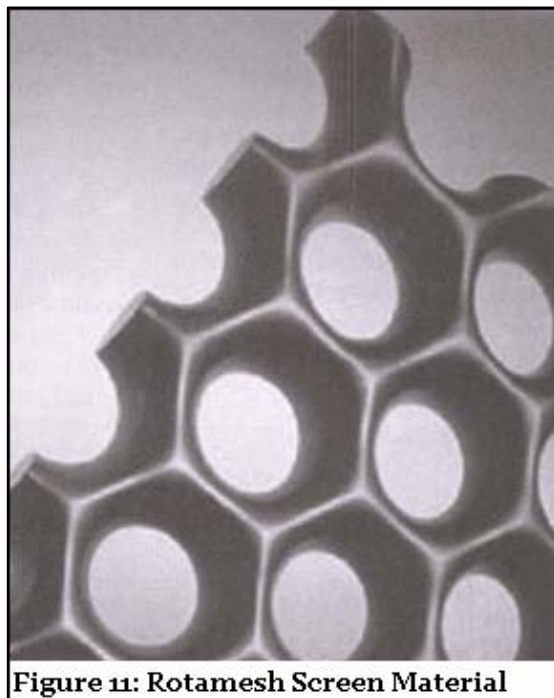


Figure 11: Rotamash Screen Material

Unica has two impressive features one is DTD (Digital Twin Drive) and WOL for printing screen the machine has programmable color feeding system with mechanical memory probe and pneumatic pump for high viscosity servo control for rapid change of screen width with automatic presetting also available for printing protocol management.

2. Rotascreen of Zimmer:

In this latest model, screen bearing systems have both Closed screen bearing system "G" and Open screen bearing system "V". Both these new models are designed according to the newest standard of the machine drive and control technology. For the basic requirement, three alternatives can be selected. They are as follows:

1. Standard roll rod including color pipes ultra light.
2. Easy clean. Print and wash equipment.
3. The various color equipment.

The uniform wet gluing equipment, which adheres the fabric to the blanket, works as follows:

1. Magnetically pressed on squeeze blade from underneath.
2. Magnetically pressed on squeeze blade from top
3. Mechanically pressed on squeeze blade from top.

3. Rotascreen V of Zimmer:

This machine has new handling system for screens and color pipes. This machine features 26 print stations that either works simultaneously in the 'flying change mode'. This mode allows the automatics preregistration of the second pattern while the machine is printing and flying change can automatically switch between the two patterns without operators assistance. Also, it has quick change screen and color pipe preparation next to machine. The multiple crane system helps for easy removal and installation of screen and color pipes.

The other special features are as follows:

1. Rotor washer for printing blanket which is maintenance free.
2. Printing width of maximum 320 cm.
3. Ultra light carbon fibre lightweight color pipes for paste saving and easy handling.
4. ACR repeat and setting control.
5. Magnet doctor blade color application.
6. No foundation required due to new low profile design of the print bed.

4. Pagasue' of Stork Brabants

This machine is specialized for printing long runs and also small uneconomically through 3 E system to optimize paste consumption, recycling to economize water consumption, ergonomic design storks latest software is the most innovative feature for the nonstop printing. The operator lowers the squeegee for new designer the end of programme on the completion of printing run, the first screen stops printing followed by other screen in order. When the last screen stops printing, the first screen of the new

design starts printing automatically and immediately followed by other screens of the new design.

The advantages of this nonstop printing are as follows:

1. Minimum wastage.
2. Saving in time which could be more than a hour.

In this machine special shield is used drawn from the beneath of the machine to prevent soiling of printed fabric. The machine has got 8 to 24 color station to print 162 cm to 320 cm with open and closed bearing system. [12]

Digital Printing

When a great deal of researching the screen-printing process in 1993, digital printing was emerging as the greatest threat to the screen-printing industry. In those days, most research and product development was geared toward fighting off the digital threat to screen printers who do not offer digital printing services along with their traditional screen services.

While some digital-output devices are better suited to certain applications than conventional screen-printing, more can deliver the volume of ink or the range of inks and other fluids that screen-printing can. So it is unlikely that digital printing will ever be able to replace screen-printing entirely.

The future for the relationship between the screen-printing process and digital imaging technologies will be one of continued coexistence and expanding cooperation. But it is up to users of screen-printing to ensure that the screen-printing process remains a competitive and profitable aspect of their businesses.

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