Printing and converting: the narrow web perspective

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Technological advances over the last 10 years have elevated the print quality and production speeds available from narrow-web printing and converting.

The narrow-web industry is large, diverse, and dynamic. It is not easily categorized. Generally, a press with a maximum web width of less than 609 mm is considered to be a narrow web. Some would place the transition at 508 mm, and this demarkation would include perhaps 99% of the equipment encompassed by the higher figure. The majority of narrow-web equipment is 254 mm wide or less, although recent trends have been to presses in the 406-mm to 609-mm range.

All of the major printing methods are used in narrow web, including lithography, gravure, flexography, letterpress, and screen printing. Multiple printing processes on a single press is a well accepted practice, although not common. In the United States, flexography is the most commonly used printing process for narrow-web equipment. Rotary letterpress and gravure follow in popularity. Outside of the United States, rotary letterpress and flexography are used about equally.

Narrow-web equipment is manufactured as in-line, central impression, or stack-type presses. These categories define the positioning of the printing stations. An in-line press is built with separate print stations arranged horizontally to each other. A central-impression press has all print stations clustered around a common cylinder. Stack presses have the printing stations arranged vertically on a common press frame.

Narrow-web gravure utilizes the in-line design as does lithography. Rotary letterpress and screen printing are predominantly of a stack or central-impression design, although both are available in in-line configurations. Flexographic presses are commonly in-line or central impression, with the stack design much less common.

Narrow-web presses differ from their wide-web counterparts in a number of ways in addition to width. A primary distinction is the ability to do multiple converting operations simultaneously with printing.

Converting capabilities

Typical converting steps would be over-lamination of a protective film; diecutting the web in a series of complex shapes and removing the resulting waste area; slitting the web into multiple ribbons; perforating the web; and line hole punching. Most converting operations are done with rotary tooling. Reciprocating flat-bed diecutting is also used, particularly on letterpress presses. Other less common converting steps would include creasing, embossing, folding, and foil stamping.

All of these converting operations are done in special positions which are normally located after the printing stations. For rotary tooling, these converting positions or stations typically consist of two vertical frames with a series of parallel slots cut out of the frames. The slots of one frame are aligned with those of the other. At the base of each pair of matched slots is a hardened steel gear-driven roller called an anvil roll. This forms the surface against which the various cutting and other converting operations are performed.

The converting tool or die is also a hardened steel roller. This roller consists of locating journals, a gear, bearers, and an area engraved with the shape or shapes to be cut or punched. A hold-down mechanism consisting of bearers aligned with those of the die is then added. Screw or hydraulic pressure is applied to the hold-down mechanism. The height of the engraved area of the die relative to the bearers is precisely controlled to ensure a proper cutting depth.

Special platforms will be supplied for male-female line hole punching units. These units will often include a second position for perforating. This type of unit is used extensively in the production of electronic data processing (EDP) labels, which are normally then fan-folded.

Another typical feature of narrow-web equipment is the ease of changing the printing cylinders and the converting tools. A narrow-web print shop will have a large selection of printing cylinders of various diameters. The cylinders will be categorized according to the number of teeth on its associated gear. For instance, one might have 44-tooth plate cylinders and 72-tooth cylinders. On a press with 1/8-in. circular-pitch gearing, each revolution of these cylinders would print 5 1/2 in. (139 mm) of web and 9 in. (228 mm), respectively. These lengths are referred to as repeat lengths. Typically, repeat lengths can be varied in increments of the gearing through a range of about 100 mm and 609 mm. The most common gearing on narrow-

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web presses is 1/8 in. circular pitch. Occasionally, 1/16-in. and 1/4-in. circular pitch, and 32 diametral pitch will be used.

The advantage of varying the repeat length lies in minimizing the nonprinted area as various-size products are printed. A press with a fixed repeat will be confined to printing a limited number of products or will be penalized by increased scrap. For some printed matter, there is a great deal of size uniformity because they are produced on fixed repeat equipment. Newspapers and forms come readily to mind along with magazines and books, although these have more variations. The myriad sizes and shapes used for product identification and packaging represents the other extreme. This area of printing is the niche of narrow webs.

Labels

The largest single use of narrow-web equipment is to produce labels, primarily pressure-sensitive labels. It is estimated that US$ 1.5 billion of pressure-sensitive labels are used yearly in the United States (*1*). A similar amount is used in Europe, including Britain. The rest of the world will again use roughly the same value of labels (*2*). Use of pressure-sensitive labels has increased at a minimum of 8% per annum for the past 15 years in the United States, and Europe has shown comparable growth in label consumption. This growth has been driven both by new product introduction and by changing packaging methods.

The substitution of plastic containers for metal and glass has been a significant factor in the growth of the pressure-sensitive label industry. Labels for glass bottles and for metal cans normally are applied with a wet glue at the filling line. The labels are typically made of paper and have a simple geometric shape to facilitate feeding from stacked sheets.

The properties of plastic containers as well as the demands placed on the labels require different adhesives than those used for metal or glass. Due to the various uses of the final product, a variety of adhesives and label materials are often required for a given range of labels. These varying requirements are more easily met with pressure-sensitive labels than with glue applicators.

Pressure-sensitive material is a multi-ply construction consisting of a face stock of paper, foil, or film, an adhesive, a silicone release coating, and a carrier liner, normally of paper. The face stock, which will form the label, and adhesive are easily peeled away from the silicone release coating and liner material. The label can then be applied to a surface with hand or machine pressure.

Pressure-sensitive labels for application to consumer products are typically supplied in a roll form. The converting capability of narrow-web equipment was discussed earlier. In the manufacture of pressure-sensitive labels, the engraved dies will be made to cut through the face stock and adhesive, but not the release coating and liner. A slight (3 mm) area around each label is allowed as scrap. This scrap area forms a matrix which is peeled away and disposed of. The liner material with evenly spaced labels still in position is then rewound into roll form on the press. High-speed label applicators are used to dispense the labels from the liner and apply them to the container.

Simultaneous or in-line converting, variable and easily changed repeat lengths, and the relatively short runs for most labels combine to make narrow-web a popular choice for pressure-sensitive labels. At the same time, the graphic impact required of a label to differentiate a consumer product from similar items on a supermarket shelf has created a continuing and escalating quality demand on the narrow-web converter. This, in turn, has generated continuing technological advancement in all areas of the narrow-web industry.

Technological advances

Three developments particularly stand out. First has been the development and perfection of the photopolymer flexographic printing plate. Flexography uses a soft, pliable, raised-relief printing plate. It is affixed to the printing cylinder with a mounting tape that has adhesive on both sides. Initially, rubber was used for the plate material. In the 1970s, the photopolymer plate was developed. This plate greatly simplified the platemaking process and enhanced the detail obtainable on the plate.

Similar advances were made with the inks used in narrow-web printing. Two advances were made with inks. First, in flexographic printing the transition from solvent-based (normally alcohol) inks to water-borne ink was widely made. The water-based inks are more stable and have higher gloss characteristics than alcohol-based systems. They also provide significant environmental advantages, both in the pressroom and in the community.

The second technological advance in inks occurred initially with lithographic and letterpress inks. This was the development of inks which are set or cured through exposure to ultraviolet (UV) light. Lithography and letterpress use heavy, paste inks traditionally requiring high temperature, time, and often undesirable powders to dry. The cost and difficulty of accomplishing this on a narrow-web press that also does multiple converting operations severely limited the use of these processes. Although screen printing uses a viscous liquid-type ink, the same drying concerns applied. Here too UV-curable inks have been developed. Flexography also uses a viscous ink, and UV inks are being developed for this process also.

The advent of UV-cured inks made possible the third major development in narrow-web label production: the wider use of letterpress and screen presses. Each printing method has characteristics which make it best suited for certain types of graphics, e.g., the bold, almost three-dimensional quality of screen printing. The expansion of printing processes available to the narrow-web printer better positions him or her to continue meeting the quality requirements of his or her customers.

Areas of growth

Labels for consumer products form the largest category of narrow-web pressure-sensitive labels and represent the greatest value-added segment. They have also been the driving force in improving printing capability. However, the fastest growing label category has been EDP labels (*3*). This would include all pressure-sensitive labels intended for use in computer printers. Often little or no graphics is printed on these labels by the narrow-web converter. However, diecutting, line hole punching, and

perforating is required. The labels are normally fan-folded into stacks.

Although growing less rapidly than either EDP or consumer product labels, industrial labels form a significant portion of the pressure-sensitive label market. These labels range from barcodes on printed circuit boards to shipping labels to bulk container identification. A large portion of this segment overlaps with EDP production due to the need to add variable information. As dot matrix, ink jet, ion deposition, or other forms of computer-driven printing systems are adapted to narrow-web presses, industrial label production will surge forward.

Although label production is the largest user of narrow-web equipment, the presses are also utilized in many other fields. Ticket and tag production is commonly done on narrow-web equipment. Lottery ticket production has been a recent high-growth area. Both flexographic and gravure presses are used to produce bottle wraps and other flexible packaging products. Suture wraps are produced on narrow-web equipment, as are the pinstripes used for automobile decoration. Potentially any material between 0.0254 mm (0.001 in.) and 0.5 mm (0.020 in.) that is flexible enough to be put in roll form can be printed and converted on narrow-web equipment.

A market that offers great potential for narrow-web equipment is folded boxes and cartons. Both narrow-web gravure and flexographic equipment have had some success in this area as has rotary letterpress. It is anticipated that more of this work will be shifted to narrow-web as just-in-time delivery practices become more widespread. Focused marketing concepts may also tend to reduce order quantities to levels that justify narrow-web production.

The folding-box market is one of the factors leading to wider narrow-web presses. It is also accelerating design concepts for reduced downtime and higher throughput of product. These are key issues in the traditional markets for narrow-web presses but are absolutely critical for long-term success in penetrating the folding-box market.

One approach to this issue has been the development of a computer controlled narrow-web press. This system will preset printing plate impression, pre-position the plates for proper registration, and select the appropriate tension level for the material being printed and converted. When equipped with an electronic register control system, the computer will analyze the type of register movement and the corrections that are made to fine tune the responsiveness of the control system. Where appropriate, it will alter tension settings to improve web control. Repeat order jobs can be stored in the computer memory for quick recall. Diagnostics and job control and tracking information are also supplied.

All of these features will help to reduce downtime and to increase job efficiency. They are supplemented through changes in functional design such as development of a flying-splice unwind stand. This system will allow a new roll of material to be fed into the press without stopping the press to change rolls. Similar units have been used on wide-web equipment for many years. However, the wide-web presses can allow an overlap of the old and new webs which is not possible when converting operations are done. Systems are now available to meet the narrow-web requirements. Since folding-box work is typically blanked out or sheeted for conveying, and since the waste area is vacuumed away instead of being rewound, a single-splice system will allow continuous production. Other applications such as label production would require turret rewind units for both the product and the waste matrix.

The folding-box market is also creating a new interest in flatbed diecutting. Higher speeds, nominal cost, and multiple sources for the tooling gave near total dominance to rotary dies in the U.S. pressure-sensitive market. Due to the larger sizes and the complexity of the tooling, as well as the number required for each job, the cost of rotary tooling for box work has a significantly larger impact. This has led to a new look at reciprocating flatbed die technology.

The increased width of the presses and the heavier caliper of materials being converted naturally have an impact on the robustness of the equipment. These obvious changes require more subtle changes in web-handling concepts and techniques. The principles that are developed for folding carton work in turn will feed back to the designs incorporated in narrow-web presses for the more traditional markets.

Conclusion

Narrow-web printing and converting became a major industry in the 1970s and 1980s. It is well established in label production and has a strong presence in tags, tickets, and specialty items. Various advances in printing technology have elevated the quality level available from narrow-web equipment to par with that available from wide webs.

The industry is poised to branch into new major markets in the 1990s. This, in turn, will bring further improvements and capabilities in the traditional markets for narrow webs.□

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