



*A newly formed sheet of paper, on the mold, showing watermarked images. All photographs by Katie MacGregor.*

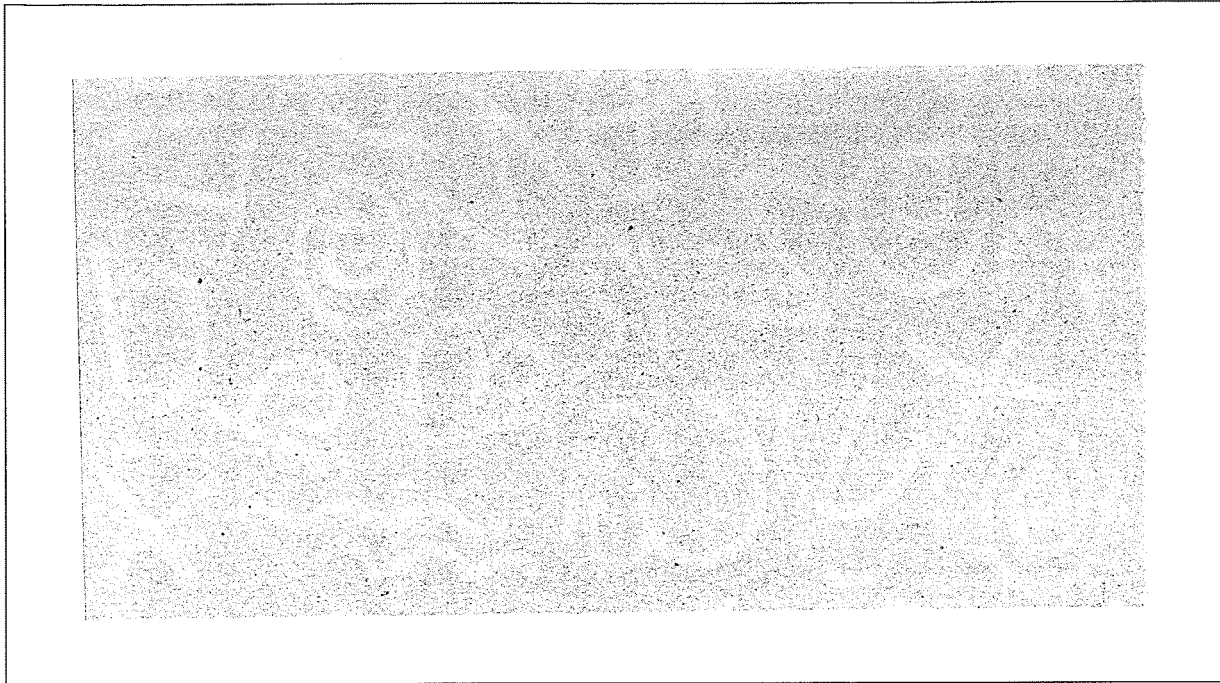
## Computer- Generated Watermarks

*Katie MacGregor & Bernie Vinzani*

In the summer of 1993, we spent a morning visiting our friend, Elliot Fishbein, in Eastport, Maine. Elliot is a sign maker who works in our Downeast area (in the far Northeast United States, near New Brunswick, Canada). A few years before, Elliot had expanded his tooling to offer computer-generated vinyl graphics. During our visit, we inquired about these vinyl graphics, and Elliot demonstrated the technology by cutting a vinyl sheet into a detailed typographic design. Since we are always looking for new technical applications to use with hand papermaking, we immediately saw the potential for its use as a watermarking device. That same summer, we received an inquiry regarding the possibility of making a full sheet watermark as part of a book design. We asked Elliot to cut a few experimental marks so we could begin making trial sheets.

We followed procedures similar to the method Elliot used to mount the vinyl. After the cutting, we peeled and removed unwanted vinyl from the typographic image. We then covered the portion of the vinyl to be used for the watermark with a low-stick adhesive tape made especially for the transfer of the vinyl material onto another surface.

Initial experiments worked very well on a 40 mesh wove mold surface. After correct placement on the mold, we used a burnishing tool to adhere the vinyl onto the screen surface so that we could remove the transfer tape. This we removed slowly, at a sharp angle, to prevent thin lines or serifs of the design from lifting. We then applied heat from a hair dryer to the vinyl, which softened it, and at the same time used a stencil brush to gently tap the vinyl into the recessed areas of the screen. We had to take care not to overheat the vinyl. The heat and the force of the brush made the vinyl conform to the screen. We could then dip and hose down the mold without



*The watermark in this sample was made by scanning an original calligraphic image, drawn by artist Nancy Leavitt. The image has been cut in vinyl and adhered to a bronze wove mold surface. The paper is made from cotton muslin rag beaten two hours in a Hollander beater, sized with an internal dimer sizing, and colored with aqueous-dispersed pigment. The sheets were formed on a 12" x 18" mold, Western-style, and couched on thin woven wool felts. The sheets were then restraint dried in a stack drier.*

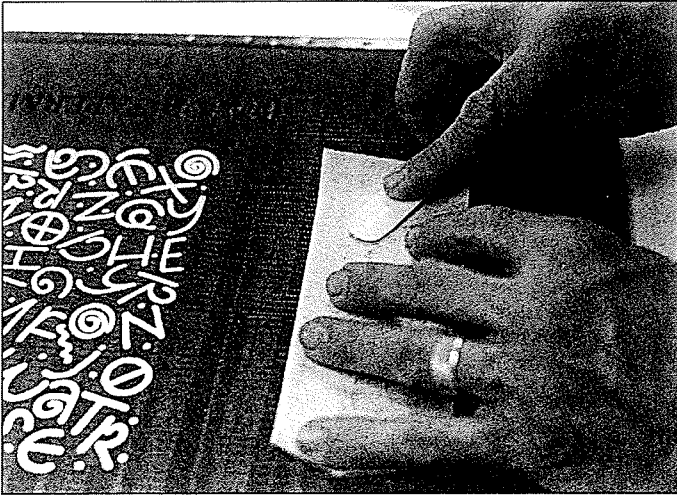
the watermark becoming detached. To remove the watermark from the mold, we simply peeled the pieces off with tweezers. We found no adhesive residue on the screen after use. Additionally, although the vinyl watermark itself cannot be reused, we saved the design electronically on computer disk, so we could easily recut it.

The low relief of the vinyl watermark allows us to make a text weight sheet without a pronounced paper surface indentation, as is often found with thicker wire and magnesium watermarks. For thicker sheets, or to adhere a mark on a laid surface, we can use a heavier, rubber resist material, made for use as a mask in sand blasting signs. We can also laminate the thin vinyl sheeting in multiple layers, to make watermarks of various thicknesses.

On full sheet watermarks with complicated designs or bits, the ease of applying the vinyl eliminates endless hours of sewing. We have a large font selection available and scanned artwork and calligraphic marks can be successfully transferred into the cutting program. Images can be reversed on the computer and then cut backwards, should the papermaker desire a reversed image on the mold.

As with all papermaking, one needs to develop techniques which best suit the material being used. We had to keep line thicknesses under  $\frac{3}{8}$  inch to maintain a watermark that would not be distorted or left with interior holes. When couching, if the felts are too wet, holes can open up in the watermark. After the curve has been established on a post, we have found that rolled couching transfers the watermark with the best result.

Other applications of this process allow for multiple-couched sheets, resulting in an overlapping of typographic images. When making cotton rag text weight sheets, we have made successful watermarked images without compromising design, length of



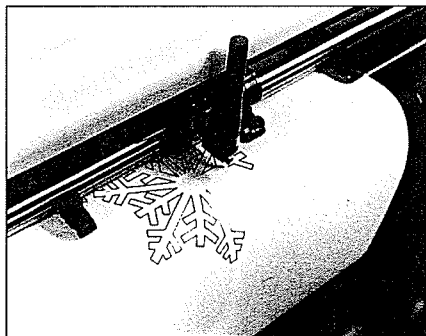
*Burnishing against backing paper, to adhere a cut vinyl image to the screen surface.*



*Using a stencil brush to tap the vinyl into recessed areas of the screen.*

pulp fiber, or the strength of the sheet. Papermakers who use long-fibered pulps or make heavier weight sheets with this watermarking process may find the clarity of the watermark image affected.

We think this technique offers endless possibilities in watermarking to papermakers who have access to sign makers with this technology.



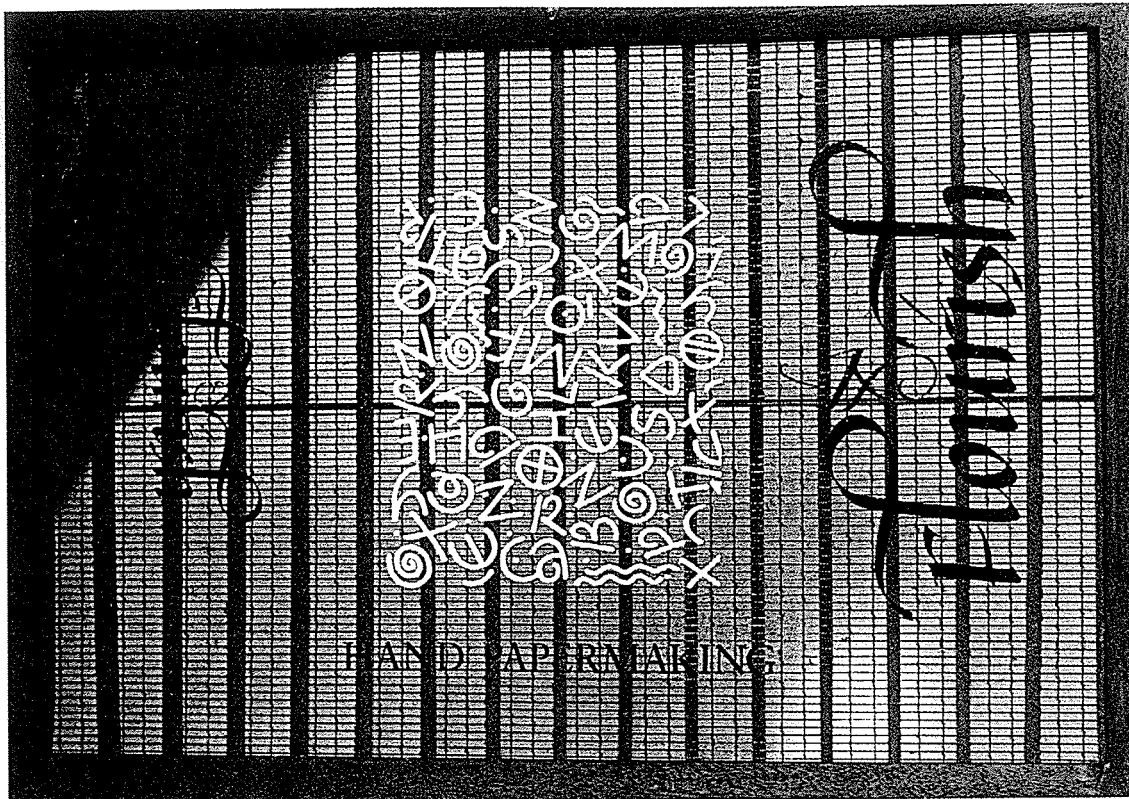
*Vinyl cutting plotter, with computer-generated design.*

## Technical Details for Computer-Generated Watermarks

### *Elliot Fishbein*

Computer-assisted design and manufacturing came to the sign industry about a decade ago. The technology was borrowed from the garment industry, which used a computer-controlled plotter to cut fabric patterns. Today this technology has largely displaced the traditional sign maker's tools: brush, paint, pencil, and paper. The computer screen replaces paper and pencil and the vinyl cutting plotter takes the place of paint, and brush. The computer and vinyl cutter have been revolutionary in changing the way the sign industry works.

Graphic design software can be used to manipulate images quickly and easily, eliminating the labor of erasing and redrawing. The sign maker can achieve changes of scale, color, and typeface by the simple selection of software menu options. He can store images for future use or recombination. Cutting these computer-composed images into pressure sensitive vinyl film is the basic transference technology now used by sign makers.



The mold surface, with various vinyl watermarks.

Computers can receive graphic information through an optical scanner, which converts an object on paper into a digital format composed of a mosaic of small square dots. A designer can manipulate this mosaic, called a "bitmap image," in a paint program or bitmap editor. As a bitmap, the object is not defined by a smooth linear outline but rather a volume of small divisible points, with jagged edges. Vinyl cutting plotters are controlled by instructions that define objects by the mathematics of lines and curves, so bitmaps must be converted into the language of vectors before they can be cut. Tracing software performs this translation, following the contours of bitmap images and redefining the object as lines and curves. Vector drawing programs can then manipulate this vector format. Those specific to the sign industry have the ability to control cutting plotters.

Pressure sensitive vinyl film is manufactured in rolls of various widths and colors. The thin film adheres to a carrier paper, so the adhesive is protected until the paper is peeled away. This two layer composite of vinyl and paper is fed into a computer-driven cutting

plotter. The knife blade or stylus of the plotter is adjusted to cut through the vinyl but not the carrier paper. Software translates images composed on the computer into instructions that control the x and y movements of the plotter. The plotter responds by cutting the image outline into the vinyl film. Once cut, the sign maker removes the vinyl with its carrier paper from the plotter and then separates the waste areas of vinyl in a process called "weeding." He or she then covers the weeded design with a sticky paper called "transfer tape," which, when pulled up, will take the vinyl away from its underlying carrier sheet. After placing the taped design onto a surface, he rubs it down to activate the vinyl's adhesive and carefully pulls the tape off, leaving the vinyl design stuck in place. Outdoor life span for pressure sensitive vinyl ranges from three to eight years.

The power of graphic design software makes the manipulation of images easy and vinyl cutting technology allows the perfect reproduction of these images. Nonetheless, the skills required to achieve good design are still the domain of the designer's talent.