Stretching Fine Art Canvas

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The following is an excerpt from an upcoming book, "Framing Paintings: A Preservation Approach," which will be available from PFM PubCo. in early 2001.

Stretched canvas has been used as a painting substrate since the early Italian Renaissance. Venetian painter Sandra Botticelli's "Birth of Venus" (1482 A.D.) is recognized as the first large scale decorative painting (approximately 5'8" x 9'1" or 1.727 x 2.768 meters) to be executed on a stretched fabric support. The painting is on a hemp canvas, woven in a herringbone pattern, and the medium is tempera. Although the term "canvas" originally referred to a cloth woven from the bast fibers of the plant Cannabis Sativa, it is now a generic term for a woven textile designated as a substrate for artwork.

Textiles

Art canvases are of various fiber thickness, weave patterns, and surface conditions, each with varying performance characteristics requiring individual stretching strategies. Fabrics used as substrates for artwork include linen, cotton, hemp, and synthetics.

Linen, woven from the bast fibers of the flax plant Linum Usitatissimun, has a high tensile strength due in part to the long bast fiber (up to 36" or one meter) used for weaving. Painting on linen has been dated to the 12th Dynasty in Egypt (2000-1788 B.C.). Although linen is grown throughout Europe, for centuries Belgium linen has been considered the finest for painting canvases.

Hemp textile, woven from the bast fibers of the plant Cannabis Sativa, produces a textile that is believed to date to the eighth millennium B.C. The high cellulose content and long fibers (up to 8' or 2.438 meters) produce a resilient textile that has been used

as a painting substrate for centuries. Prior to the Venetian painters who were the first to stretch hemp canvas, it was imbedded in the gesso of panel paintings and used for reinforcement in the wall frescos of Medieval Europe.

Cotton yarn, derived from the seed hairs of the plant Gossypium, has been used for textile production since pre-historic times. Cotton gained widespread acceptance as a painting canvas in the early Twentieth Century due to widespread availability, lower cost (compared to linen or hemp), and stretching performance. Cotton fibers possess more stretch than linen or hemp, producing a taut surface with minimal effort, as well as less overall strain on the stretcher bars.

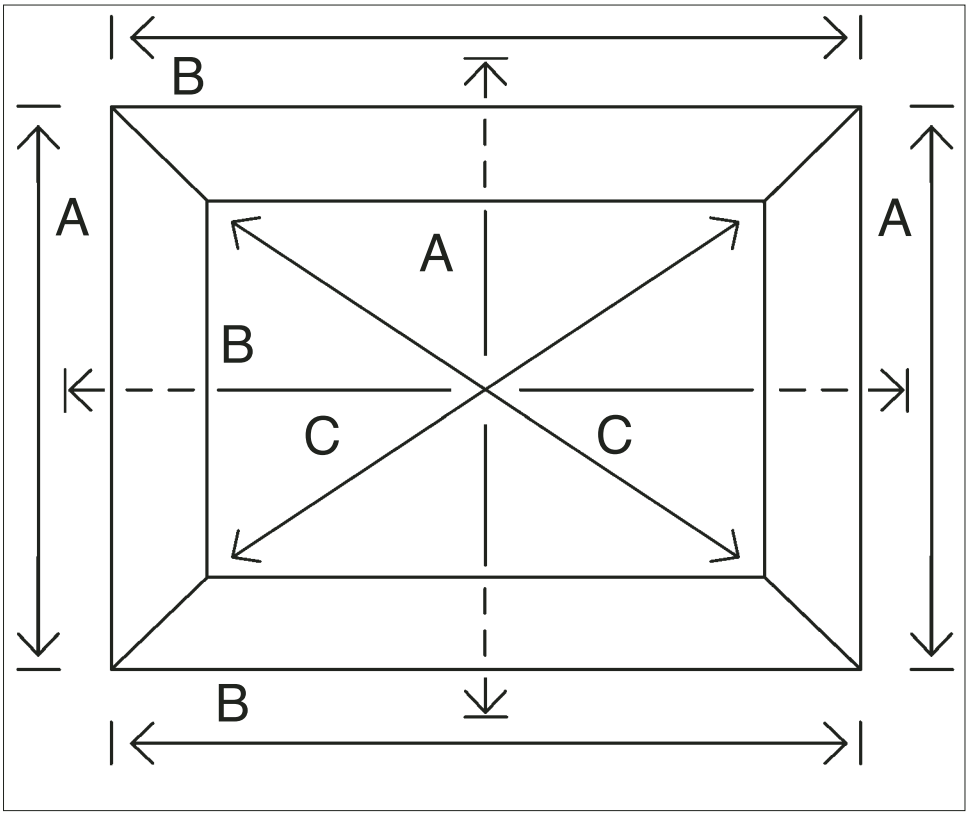

Figure 1: Artwork to be stretched is measured in the same manner as the stretcher bar. Height and width are measured in both directions at the edge and centers, and then diagonal (corner to corner) measurements checked. If they are equal, it is square. All measurements are made to the outside edge of the corner. Remember, C=C, A=A=A, and B=B=B

Synthetic canvas was first marketed in the late 1960's and early 1970's as a companion product for acrylic paints and grounds. Polyester emerged as the preferred fiber, producing a textile that is dimensionally stable and absorbs less moisture than fabric of plant origin. The uniform characteristics of polyester make it an acceptable substrate for photographic and digital printing applications, and in most cases it is simpler to stretch producing minimal stress and strain on the stretcher bars.

Any textile that is to be used as an art substrate should be in its natural or loomstate condition, free of post weaving fabric processes such as chemical sizing and bleaching, commonly used to finish commercial fabrics. These treatments make the textile questionable as fine art substrates due to potential priming and paint adhesion problems.

It is also important that all the fibers used in the canvas be of the same origin. Blended textiles consisting of warp and weft threads of different origin, such as cotton and linen, may stretch unevenly and respond to changes in relative humidity and temperature differently, expanding and contracting at unequal rates with serious potential for damage to the artwork.

Stretching Categories

Canvas stretching is divided into two primary categories: 1) stretching loomstate, unprimed and primed canvases for the purpose of painting in oil, acrylic or other mediums; and 2) stretching artwork that was originally created on an unstretched surface, or a painting that has been removed from its original support. Paintings that were under tension on a strainer or stretcher and then removed should always considered fragile; some paintings may be old and brittle while others are new and not yet properly cured.

The bead edge is often extremely fragile on older paintings, a result of the canvas having been sandwiched

under pressure between the acidic frame or liner rabbet and the unsealed stretcher bar. A word of caution—it is not recommended that the framing technician re-stretch mature paintings if *any* sign of compromise exists; damage is often complex and interrelated, and therefore not often readily visible. Always use a condition report to document the artwork prior to committing to the stretching or framing process, and know when to call a conservator.

Photographic or mechanically printed canvas processes include photo transfer, offset lithography, serigraphy, and digital inkjet. Many canvases used for mechanical printing are of cotton or polyester with a surface designed and conditioned for the specific printing process. Although the quality of the printing process and the media incorporated vary widely from inexpensive reproductions to original artwork, the surfaces of these canvases must be considered fragile in the context of stretching, although many are extremely durable.

Measuring and Layout

Artwork to be stretched is measured in the same manner as the stretcher bar. Height and width are measured in both directions at the edge and centers, and then diagonal (corner to corner) measurements checked. If they are equal, it is square (see Figure 1).

Paintings previously stretched and removed from the original bars may be out of square, and in extreme situations the new bars will need to be assembled to match the painting, especially if the painting will return to the original frame, also out of square.

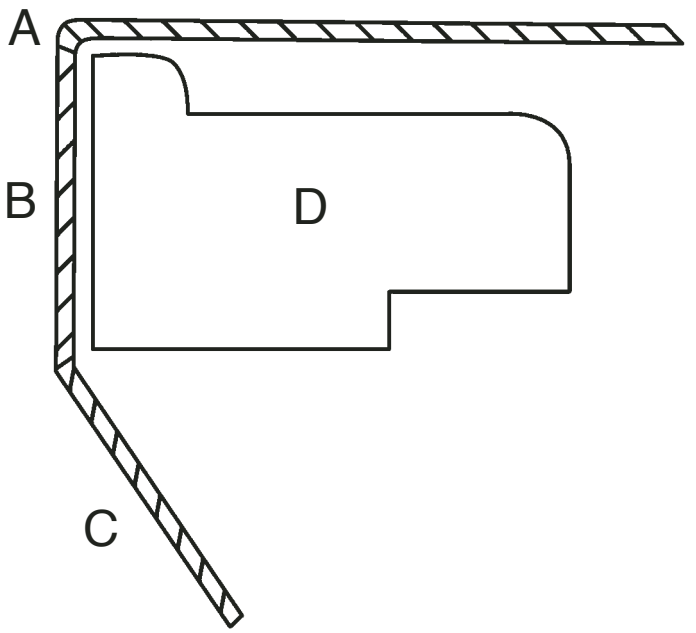

Figure 2: A=Bead Edge, B=Tacking Margin, C=Jacking Margin, and D=Heavy Duty Single Side Bar with Backing Panel Recess.

The area of the fabric the tacks or staples go into is termed the tacking margin. The fabric that is gripped by the stretching pliers is the jacking margin. The tacking margins width should be equal to the thickness of the side of the stretcher bar; or the side and the back width of the stretcher bar if the canvas is to be attached to the bar verso (see Figure 2). An extra 2" of fabric on all four sides should be allowed on the jacking margin to assure a solid grip.

When working with artwork to be stretched, the stretcher bars should equal the outer dimension of the artwork (image field) and no portion of the image should be folded over the bead edge. If the canvas is to be attached to the back of the bars instead of the tacking edge, the fabric margins around the perimeter of the artwork must be measured to ensure an adequate amount is available to wrap around the edge of the stretcher bar and onto the verso, with enough canvas to properly tack or staple.

Commercial mortised corner stretcher bars are often manufactured ¼" shorter than their stated dimension to allow for the keying out a sagging canvas during the priming stage of preparation and to accommodate the fabric folds at the corners. When using commercial bars for photo or mechanical printed canvas, key them out to the exact dimension needed and check to ensure it is square; then staple a backing to prevent any movement during the stretching process. Stretcher bar systems that allow for direct mitering to exact measurement are recommended for use with photo or mechanical printed canvas.

Stretcher Bars

Fabrics of organic origin are hygroscopic and have an affinity for moisture. Oil paintings on stretched canvas contract (shrink)

in a high relative humidity (RH) and relax (sag) in a low one. Other stretched artwork will react to changes in environment in different ways depending on variables such as fiber origin, weave pattern, and surface preparation. The stretcher bars should be able to keep the canvas under reasonable tension maintaining the painting in plane.

If a change in the canvas tension occurs, evidenced by sagging or puckering at the corners, the canvas may need to be re-tensioned. There must be a method of expansion designed into the bars to facilitate this tension. A canvas support that is joined at the corners and cannot expand is termed a strainer. The strainer should not be used with a canvas that will ever need to expand. Expansion capacity is also important in the preparation of linen, hemp and cotton for painting, as the canvas will expand and contract during the surfacing and priming procedures, often requiring a second stretch, but sometimes rectifiable with a subtle keying out.

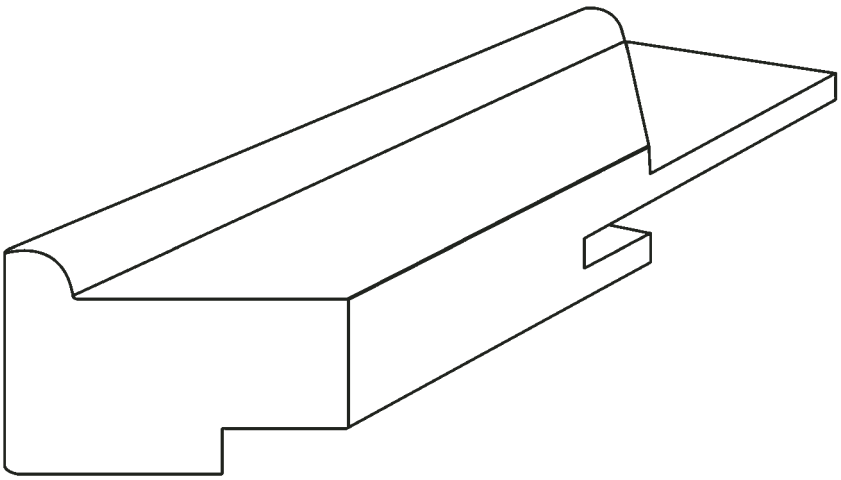

Figure 3: Double mitred mortise and tenon stretcher bar

There have been dozens of American and European patents issued for stretcher bar systems over the past 150 years, and research and improvement is on-going. The assembled stretcher and bracing is termed the chassis. Custom manufactured chassis are used for various fine art and preservation applications and differ widely in profile design, materials, and expansion method. The framing technician must be familiar with the specific requirements of the system before using it.

The stretcher bar most commonly used today is a double mitered mortise and tenon system based on the U.S. patent of F.P. Pfleger, awarded February 2, 1886; although variations of the expandable corner design predate this patent (see Figure 3). The E.H. Friedrichs (now Fredrix) Company, originally located at 28 Prince Street, New York, began marketing standard sized mortised stretcher bars in 1875.

The rails are interchangeable and manufactured in one or two inch increments allowing for a wide range of standard size chassis. Standard bars are available in different thickness and widths for lightweight to heavy-duty applications. The design of a raised bead edge coupled with an inward sloping bar face minimizes contact between the canvas and bar; wedges or keys are employed to moderately expand the chassis.

Cross braces eliminate the possibility of the stretcher bar bowing inward, a result of fabric tension. The cross bar is attached to the stretcher bar in a manner that does not interfere with the expansion of the chassis. Crossbars are generally placed every 24" to 36", a chassis sized 36" x 48" would have a brace at the center of the 48" side, and a 48" x 48" would have both a vertical and horizontal brace. For chassis that require vertical and horizontal bracing, a lap joint is employed at the intersection of the cross braces, allowing them to maintain an even plane.

Commercial stretcher bars may be milled from several species of hard and soft woods. New designs of inert plastic and extruded metals are seeing an increased acceptance; however, pine bars are still the standard for most of the art industry.

Wood, acidic by nature, will have a detrimental effect on the alkaline canvas when it comes into contact. A barrier between the bars and canvas will help deter or prevent long-term damage. The stretcher bars should be coated with a sealant (such as acrylic gesso, shellac, or polyurethane); apply several thin even coats, allowing each to completely dry before reapplication. Caution

should be taken to prevent any sealant from penetrating the mortises, as this will inhibit the corners from fitting and expanding properly. Clamping the bars to a flat surface to dry will help prevent possible warping or twisting. An alternative to liquid sealing is the use of a multi-layered frame sealing tape to cover the bead and tacking edges and to serve as a deterrent to acid migration.

permanently secure the canvas to a bar assembly was popular in Europe by the mid 1700's. Brass and copper tacks became the standard in the US and Europe by the mid 1800's, solving the potential for damage associated with rusting iron and steel nails. Rustproof canvas tacks are still recognized as the best for most applications, although since the mid 1900's rustproof staples (stainless or Monel—a metal developed by International Nickel Company) have become widely accepted due to low cost and ease of application.

edge at 1" to 2" intervals; this placement provides a more secure attachment because the staple will bridge several threads of the canvas. Stapling parallel to the bead edge will often repeatedly pierce the same thread of the canvas, severely weakening the textile.

There are two accepted patterns for staple placement. In the first, each row of diagonal staples should point toward a different corner of the canvas, all staples on a side leaning in the same direction. The second technique is to set the first (center) staple parallel to the bead edge with the remaining staples on each side of the center pointing to opposite corners (See Figure 4).

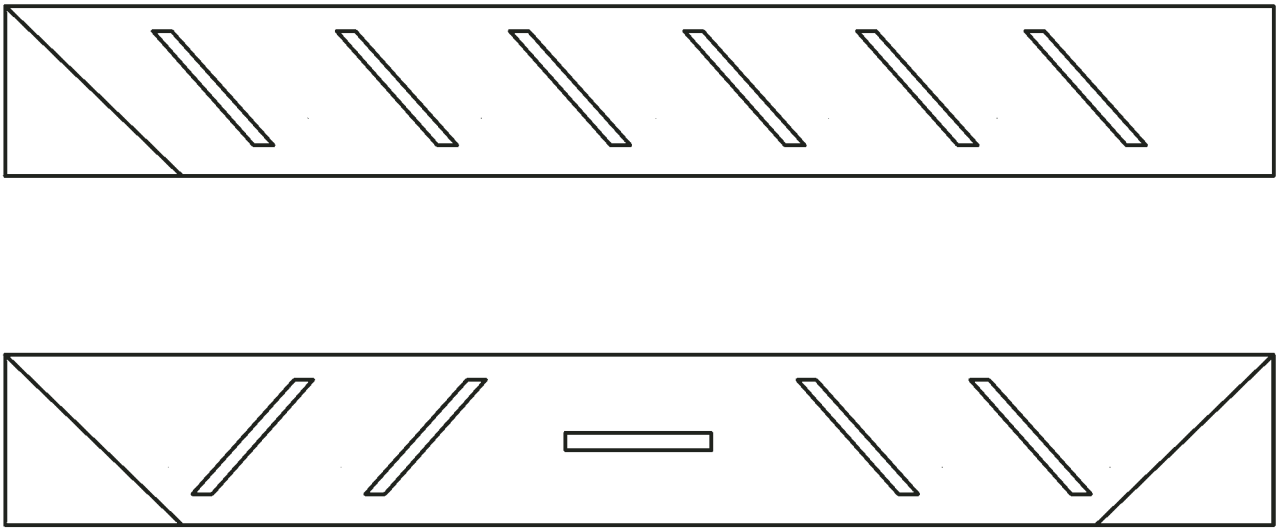

Figure 4: There are two accepted patterns for staple placement. In the first, each row of diagonal staples should point toward a different corner of the canvas, all staples on a side leaning in the same direction. The second technique is to set the first (center) staple parallel to the bead edge with the remaining staples on each side of the center pointing to opposite corners.

Fasteners

Early painters stretched the canvas by lacing the canvas over the non-expandable bar; to tension the canvas the lace simply needed to be tightened. "The Painter In His Studio" by Dutch artist Peter Codde (1600-1678) is an illustration of a painting canvas laced to a frame.

Pegging, the process of pounding wooden pegs through the canvas into the bar, is believed to date to the early 1600's and was practiced throughout the 1700's. The use of hand forged iron nails to

Tack/Staple Placement

Tacks are placed in the center of the tacking edge at 1½" to 2" intervals; canvas with minimal stretch such as primed linen will require more closely spaced tacks. Staples are placed at a diagonal to the bead

Stretching Canvas

Canvas varies widely in its stretching behavior, depending on fiber origin and surface preparation. Cotton and synthetics are easy to

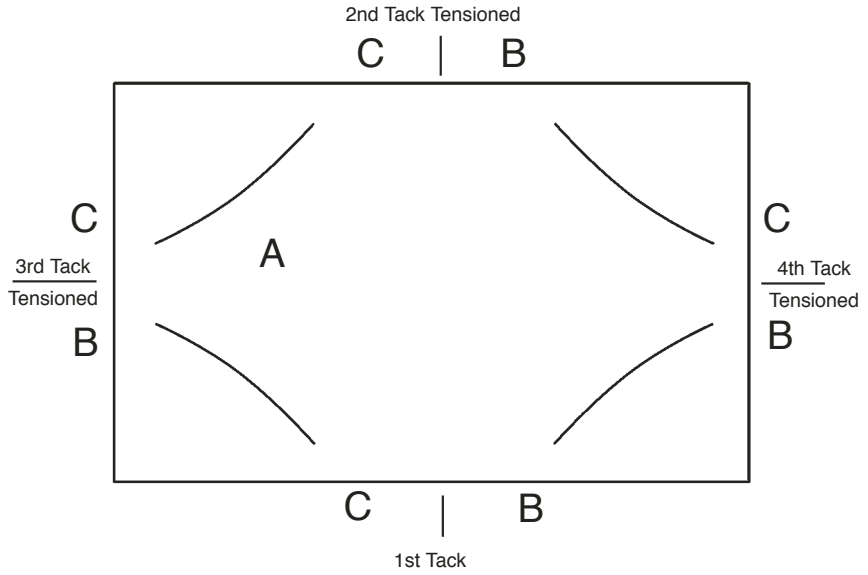

Figure 5: In this illustration, A is the diamond crease pattern, B is the second tack placement in the rotation, and C is the third tack placement in the rotation. The diamond crease pattern will work out to the corners.

manipulate, while linen and hemp are more difficult. An oil-primed linen painting canvas has almost no stretch and is therefore more labor intensive. When stretching a large, loomstate linen or hemp canvas, it is recommended to put the canvas through a preliminary stretch, allowing it to rest for several days, then removing it from the bars and stretching it a second time.

Previously stretched paintings often have no elasticity, and extreme care must be taken not to over-tension them. The same applies to digital or photographic processes on textile; they will have a minimum of stretch and must be handled accordingly. Do not attempt to moisten the back of the newly stretched canvas to remove wrinkles, this practice can damage the prime or art medium layers, and on a raw canvas, it will most often return to its wrinkled state upon drying.

Stretching Process

1) Assemble the stretcher bars. If using common sectional bars, assemble the rails by gently taping them together with a rubber mallet. Tighten and square up the corners gradually; do not force them. The miters should fit snugly together. Measure the diagonals for square and lay the assembly on a flat surface to be sure it is in plane. All corners should touch the surface evenly. Install cross braces if required. To help keep the assembly in square while stretching, staple across the miters on small sizes; for larger works use a matboard or hardboard right triangle that is tacked or stapled in each of the corners on the verso.

2) If stretching canvas for painting, add the required extra fabric to accommodate the tacking and jacking margins to the outside bar dimensions. If possible, check this measurement by laying the stretcher assembly over the canvas and inspecting the textile for imperfections. When satisfied, cut the canvas to size. When preparing to stretch artwork of any kind, carefully lay the work over the assembled and squared bars, checking that all the corners and edges line up properly. Check the tacking and jacking margins; often there will be little to work with. Develop a stretching strategy accordingly.

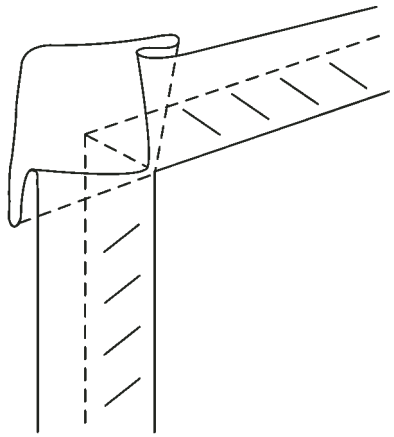

Figure 6: Fold to both sides of the corner.

3) Seal or line the bars to prevent direct contact between the raw wood and textile.

4) Begin on a long rail, attaching the canvas by folding the jacking margin (2") over the back of the bar. Make sure to have an even amount of fabric along the entire length of the bar and align the weave (threads) of the canvas to run parallel to the bars. At the

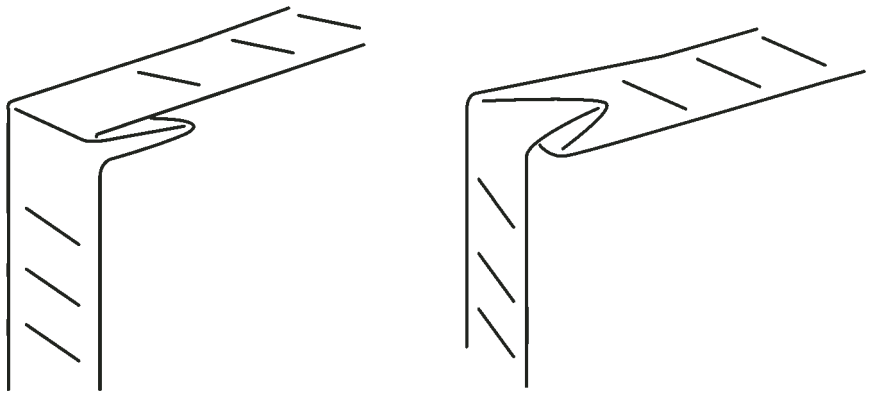

Figure 7: On the left, a blind single corner tuck is shown. On the right, a single fold over.

center of the stretcher bar put a tack/staple into the tacking edge, or, if attaching to the verso, place the tack/staple ¾" or more from the outside edge.

5) Move to opposite side. With the canvas in an upright position and facing you, grip the jacking margin in the center with the canvas pliers. Hold the pliers in the left hand if right-handed, the opposite if left-handed. Pull the canvas until a straight crease runs between the opposite tack and the pliers. Place a tack/staple in the tacking edge at the top of the crease. Rotate the canvas clockwise to the adjacent side. Repeat the process, pulling the canvas until a crease appears. There now should be a triangular crease pattern. Place a tack or staple at the top of the crease. Move to the opposite side (a diamond crease pattern will appear), maintaining the tension, and place another tack/staple (see Figure 5).

6) Return to the beginning edge. Grip the canvas about 1½" to 2" to the right of the first tack or staple and place the second. Follow the original rotation, always pulling against a tack or staple on the opposite side. When back to the starting side, place the third tack/staple to the left of the first. Begin the clockwise rotation again, placing a tack/staple on each side. The diamond pattern will work outward from the centers as the tacks/staples approach the corners. On smaller cotton or synthetic canvases it is often possible to affix several tacks/staples to a side at a time after the first two or three rotations.

Most of the damage that happens to a canvas occurs on the verso.

7) Stop the tacks/staples about 2" to 3" from the corners. Inspect the stretched canvas, looking for slight ripples in the surface or puckers between the tacks/staples. If there are any problems, remove the necessary tacks/staples and work to correct the problem until the canvas is smooth and taut.

8) Remove the staples or right-angle corner braces from the bars. Finish the corners by pulling the corner of the canvas snugly over the corner of the bars. A flap will form on each side of the corner; tuck in the flap creating a tight, creased fold (see Figure 6). Tack the fold to the edge or back of the bar, avoiding the miter and mortise. Evenly distributing the canvas to each side of the corner maintains an even tension to the corner and also allows for minor keying out if needed. Fasten the jacking margin canvas to the back of the bar with a few tacks/staples in case the canvas needs re-stretching in the future. Corners may be folded snugly to one side if preferred. When doing this, fold the canvas to the right side of each corner, so that each rail has only one fold. (see Figure 7)

9) Place the keys in their proper slots. The wooden key has a straight side with the wood grain running parallel to it and an angled side that tapers to

the point. The angled side should run parallel to the stretcher bar. Set the keys gently but firmly. A square headed hammer may be used if a section of matboard is placed between the bars and canvas to protect it from a glancing hammer blow. A safer method for setting the keys is to use an adjustable brad or point setting tool such as the Fletcher Framemate to gently squeeze them into place. Set the key in the corner slot, adjusting the point tool to fit snugly over the bar and the wide end of the key and as close to the stretcher bar as possible. Key in all the corners equally, tightening the tool with each rotation. Over keying the corner will drive the bars out of square. In extreme cases, the key will come through the outer edge, causing a bulge in the corner.

10) Most of the damage that happens to a canvas occurs on the verso. Grabbing a canvas by the top bar, curling fingers around between the canvas and bar, or resting the canvas against an uneven surface like an arm of furniture, causes serious and possibly permanent damage. Cut a backing board to protect the finished canvas. The backer can be made of rigid foam-center board, corrugated plastic, or lightweight acrylic sheet. Attach the backer to the bars with several small tabs of a re-closeable fastener such as 3M Dual Lock so it may be removed when necessary. ■