

## Archives Conservators Discussion Group 2006: Overall and Local Humidification and Flattening: Tips and Tricks

### ABSTRACT

The Archives Conservators Discussion Group 2006 focused on tips and techniques for humidifying and flattening paper documents. In addition to discussion of the overall decision-making elements for humidification and flattening treatments, the discussion included information on the construction of a humidification chamber, the use of methyl cellulose as a size for flattening creases, the use of capillary matting, and felted weights. Magnets, covered with blotter and non-woven polyester web, can make useful aids to apply pressure for local humidification and flattening of paper documents and for constructing a Guard-o-Matic for guarding the spinefolds of book sections.

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The Archives Conservators Discussion Group met at the 34th Annual Meeting of the American Institute for Conservation in Portland, Rhode Island, June 2006. The discussion took the form of a tips session followed by question and answer. Presented here are a summary of the tips discussed and a list of comments and questions from those present.

### OVERALL CONSIDERATIONS

Why humidify and flatten? Reasons include: to facilitate safe and efficient storage; to facilitate safe access and han-

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This open discussion took place on June 18, 2006, during the AIC 34th Annual Meeting, June 16–19, 2006, Providence, Rhode Island. The moderators organized and led the discussion and recorded notes. Readers are reminded that the moderators do not necessarily endorse all the comments recorded and that although every effort was made to record proceedings accurately, further evaluation or research is advised before putting treatment observations into practice.

dling; and to facilitate high-quality reformatting, exhibition, and publication.

Why might humidification and flattening not be desirable? A moisture-sensitive primary support and/or media may be damaged in the process. For example, humidifying an unrecognized *chine-collé* can cause the thin paper print to bubble up away from its secondary support. Humidification may cause bleed-through of sensitive media or acceleration of deterioration, e.g. Fe II migration from iron-gall ink. Uncontrolled humidification of mold-damaged paper can encourage additional mold growth. Or the treatment may affect the intrinsic value of the piece: will any change due to the added moisture or the pressure exerted when flattening the piece affect the value of the original record?

### PRETREATMENT ASSESSMENT

The pretreatment assessment will involve examination, documentation, testing, and making treatment decisions.

#### Examination

Preliminary examination should look for any problematic features. Does the need to treat outweigh those problems? Are there any pretreatments needed or other considerations, such as removal of fasteners and separation of attachments? A need to remove or clean surface soil? Removal of adhesive tapes or previous mends?

#### Documentation

Skipping documentation may be a problem down the line when a future colleague needs information about a past treatment to decide how to proceed with a new treatment or to decide what may have caused a current condition.

The level of documentation required may vary, for example, for individual items or large groups of records that can be worked in batches. If working in batches, it may be possible to record the documentation on the batch

level as well. Before and after photos supplement the written documentation. Take images of the same records within a batch and the same area of those records. When working in batches it is important to have a system for recording original order or collation to ensure that the records can be placed in order after treatment.

### Testing

Spot testing helps avoid problems during treatment. Consider how much will you test—every item? Even more important—will you test all media types on an item? Testing common media—such as what may appear to be graphite pencil, but is actually a methyl violet pencil—can avoid major problems during the treatment.

### Treatment Decisions

A variety of treatment decisions need to be made before treatment starts. What humidification method will be used: passive? complete emersion? ultrasonic mister? Several options are available for creating a humidification chamber: tank, sink, photo washing tray. A freestanding tank such as those constructed and used in the National Archives and Records Administration (NARA) Regional Archives is described in detail below. What level of monitoring is needed? The frequency should be based on the spot-test results and past experiences. What type of water will be used for humidification: deionized? tap? distilled?

Anticipating unexpected results is key to a successful treatment. Plan ahead—consider potential troubleshooting methods should something go wrong. What criteria will be used to determine when records are moistened to the point that they can be manipulated and flattened? Predetermine the flattening method before treatment starts and have the set-up ready before moving the moist records to the flattening area.

### NARA HUMIDIFICATION TANK

The National Archives and Records Administration (NARA) humidification chambers, approximately 42 x 54 inches, can be constructed inexpensively from Plexiglas. The sides of the chamber are glued together using #16 acrylic cement, which is somewhat less toxic than the pure methylene chloride and is a thicker substance, so it is easier to control. The cement provides good solid adhesion, but the joints may not have the beauty of those on exhibition vitrines. The top edges of the chamber are covered with closed-cell polyethylene foam pipe insulation. The pipe insulation not only protects the worker's arms from the sharp edge of the Plexiglas, it also provides a surface that can grip and seal the soft plastic material that covers the chamber. Pipe insulation is used to secure the polyethylene plastic cover on the humidification chamber: one regional lab has modified the tank by adhering Plexiglas

ridges on the bottom of the tank to evenly distribute strips of moistened blotter, minimizing the amount of moisture that is used. The strips raise the dry plastic grid ("egg crate") away from the wet blotters and in turn raises the original records further away from the wet blotters.

Strips of clean blotters are moistened using a paint roller pan. Add evenly spaced damp blotters to the tank and keep the amount of moisture to a minimum. Two layers of plastic egg crate support and lift the records away from the wet blotters. Polyester web, such as Hollytex, is placed over the plastic egg crate. The polyester web can then be used to support the moist records and provide support when lifting humidified records out of the humidification chamber.

A hygromograph can be used to monitor the moisture level in the closed chamber. It took four hours for the humidity level to raise from 48% to 77%. At that point the records were considered ready to flatten. A fiberglass screen can be placed on top of the tank and under the polyethylene to prevent condensation, which can drop down onto the document.

### LOCALIZED FLATTENING

Localized flattening can be done dry or wet. Finger flattening, while used often, does little to reduce the memory of the fold. Consequently records flattened dry can take up more space on the shelf. Wet localized flattening may use water, methyl cellulose, ethanol, or combinations of these. Moist flattening methods are usually more effective and more permanent and can reduce the amount of space needed to store the flattened records. Testing can determine which liquid can be safely used to relax the paper for flattening.

### LOCALIZED FLATTENING USING METHYL CELLULOSE

Thin onion-skin type paper used in copy books tends to develop multiple sharp creases and have soluble inks, which tend to run when the copies are originally made. In a typical example, flattening can be achieved using 2% methyl cellulose in water and a fine (00) watercolor brush to apply the sizing directly to the crease line. Creasing tends to break down the sizing along fold line which is why at times it can help to use methyl cellulose locally to flatten and resize the creases. After resizing the fold is strengthened and it is less likely to refold along that original crease line. In addition methyl cellulose can lessen the amount of water used to flatten the crease, reducing tide line formation. Cockling is also rare. The dampened crease can then be flattened by drying it under the restraint between layers of Hollytex, blotters, and weights. Another idea is to use color with methyl cellulose if there is a loss of color due to the crease.

## LOCALIZED FLATTENING USING MAGNETS

The magnetic flattening technique was modeled after a kayak repair technique developed by Carole Dignard, Canadian Conservation Institute (Dignard 1992). At the 1994 AIC Poster Session, Anna Stenstrom, Senior Book Conservator at New York Public Library, and Gail Harriman, Senior Book Conservator at the National Archives and Records Administration, presented a poster illustrating novel uses of magnets for book conservation. Since 1994, Gail Harriman has used thin flexible magnets for localized and overall flattening.

Why choose magnets over another flattening method? Magnets are user-friendly; they are lightweight and easy on your wrists. Those who may already suffer from carpal tunnel syndrome or another repetitive stress injury can appreciate the ability to use this lightweight force instead of moving heavy weights on and off a surface. Unlike heavy weights, the magnets need very little storage room. All of NARA's book lab magnets fit in one small drawer. Magnets are highly portable and can be carried elsewhere should a mend need to be done outside of the lab. Magnets can be used to align a tear in a page that has separated. Position the tear so that the edges meet and surround the tear with magnets. Apply the mending tissue, and hold down with another magnet. Once the mend has dried any necessary secondary flattening due to the tear realignment can be done. Magnets can provide force on multiple pages while working in a bound volume, so it speeds paper mending in bound volumes.

What are the drawbacks to using magnets? Magnets can slow drying time.

Flexible magnet is available in a range of widths and thicknesses. Thickness tends to drive the strength of flexible magnets, increasing the force and therefore the holding power of the magnet. An increase in surface area attraction can also be realized by using wider magnets. Flexible magnets come on a roll and can be cut to the size required for specific projects (fig. 1).

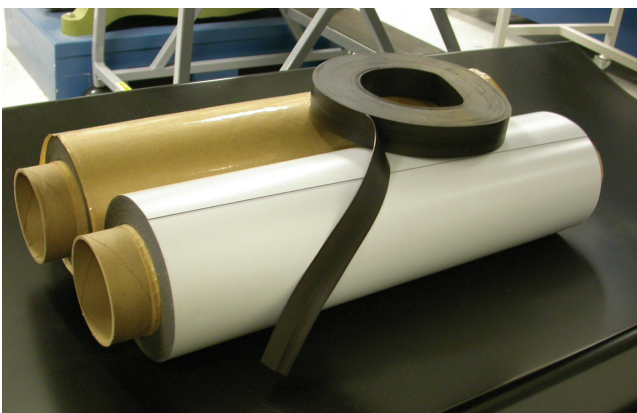


Fig. 1. Three rolls of flexible magnets in varying widths

Cut the magnet into pairs; typically sized magnet pairs range from 2 x 3 inches to 3 x 10 inches. Remember that magnets have two poles, north and south (fig. 2). A magnet will only be "attracted" to another magnet when the poles are opposing. Mark the pole orientation, as has been done with arrows shown in the illustrations, to aid in the mending process (fig. 3). Each magnet is covered with a piece of spun polyester (Hollytex), which is wrapped around and attached to the back of the magnet using a small piece of double-sided tape (3M #415). Thin blotter (10 pt) is cut to correspond with the size of the magnet so that it can be slid in between the polyester and the magnet (fig. 4).

In addition to sets of small, matched pairs, cut a large magnet to the size of the working area. The large magnet is covered with polyester, and a large blotter is inserted. Cover the magnet with a blotter followed by spun polyester. Ensure that you know and mark the orientation

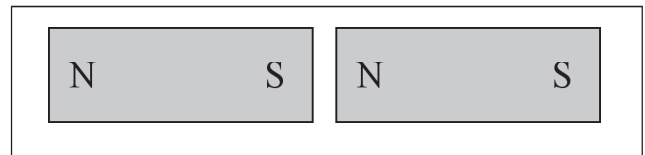


Fig. 2. Magnets have north and south poles; opposite poles attract

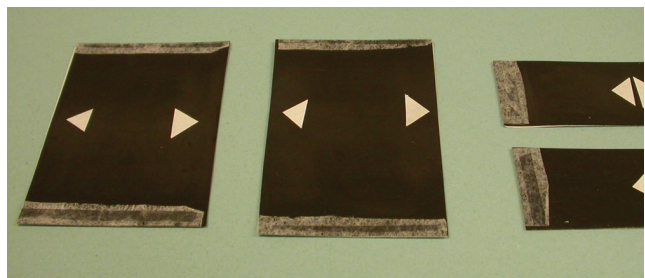


Fig. 3. Arrows mark the poles of the magnets, making proper alignment easier

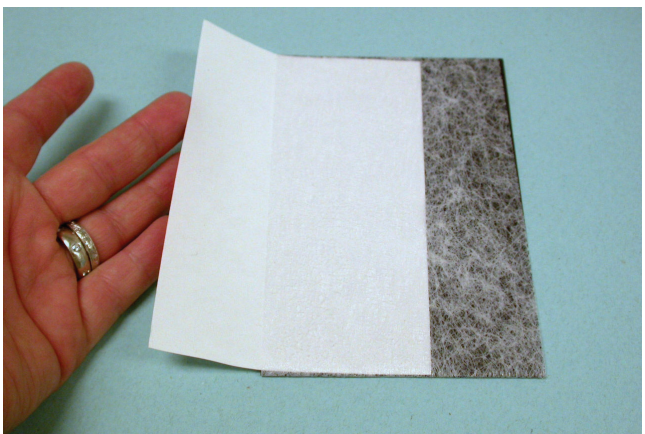


Fig. 4. Slip a clean sheet of blotter between the face of the magnet and the spun polyester wrap



of the large magnet's pole. Flattening can now be done locally using small magnets placed wherever flattening is needed (fig. 5). This process eliminates excessive handling of documents that need to be flattened in several areas.

If finding and marking the poles of the magnets seem too complicated or bothersome, the Adams brand offers "matched pole magnetization." This feature allows magnets to work face-to-face without worrying about aligning the poles. When used in A/B rolls, one can mix and match the direction of alignment without encountering repelling forces.

The magnets are used predominantly for mending and associated flattening, but can be used to lightly humidify a controlled area using dampened blotter squares placed inside the magnet pack. Goretex or Tyvek can be used instead of or in addition to the spun polyester. The magnets are especially useful if working on various pages simultaneously in a bound structure. The magnets hold the blotter and Tyvek in place, preventing slipping.

#### Magnet Guard-o-Matic

A useful application of magnets to help place guard strips on the spine folds of book sections prior to sewing was influenced by the "Guard-o-Matic"—attributed to Barbara Meier-Husby at Library of Congress (Brooks 1984). A piece of polyester web is taped on the bottom of a magnet already covered in polyester web. Paste out a Japanese tissue guard strip and then place the pasted guard strip so that half the strip is lying along the Hollytex-covered magnet, and half is placed over the Hollytex hanging over the table. Place the folded signature (gathering) along the edge of the magnet, and press it gently in place with a bone folder. Fold the Hollytex over the guard strip so that the guard strip is drawn in place against the spinefold; smooth with bone folder. Place the newly-guarded section between two magnet strips, one section per pair of magnet strips. Multiple sections may be stacked atop one another.

#### HUMIDIFICATION USING CAPILLARY MATTING

Capillary matting was originally used in the gardening business as a means to supply continuous moisture in the soil. Conservators began using the white capillary matting as a means to supply small amounts of moisture to humidify and relax papers. Capillary matting is binder-bonded, non-woven polyester, consisting of two layers of lightweight, non-woven polyester bonded with an acrylate adhesive. The ratio of fiber to binder is about 85% fiber to 15% binder. Caution—some capillary matting has a gel in it.

Capillary matting can be used in a "hard-soft sandwich." The hard-soft sandwich was developed by Hildegard Homburger and Barbara Korbel for flattening tracing papers (Homburger and Korbel 1999). The hard-soft sand-

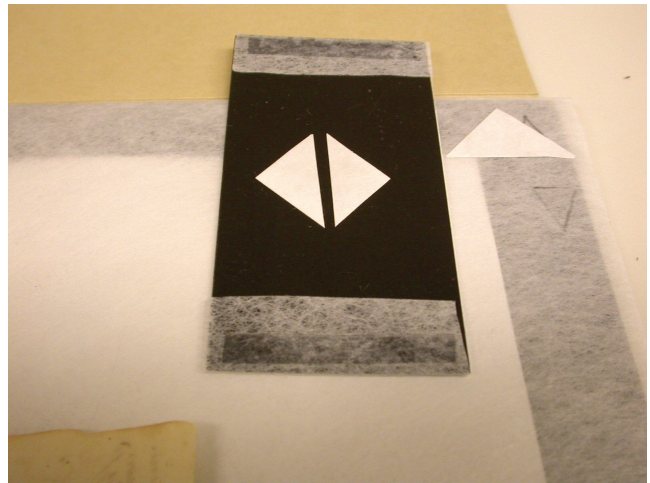


Fig. 5. Covered magnets apply pressure on creases at the edge of a document

wich is a good technique for a fragile document that has strong creases. It is a very gentle technique, one that can be done numerous times, according to Homburger. The only drawback is the possibility that small creases will be smashed flat rather than smoothed and flattened.

First humidify object after testing the media and absorbency. Place the damp object on a mat board. On top of the object place capillary matting, smooth side or rough side towards object. Using a Japanese brush gently smooth out the capillary matting. Either a smoothing brush (*nadebake*), made of hemp fibers, or a paste brush (*noribake*), which is softer and does not catch on fleece fibers, may be used. Perhaps the *nadebake* is best for the smooth side of the capillary matting when the rough side is towards object, and the *noribake* is better for smoothing the capillary matting when the rough side is up. Several layers of matting can be used and overlapped as needed. Cover with a solid board such as an acrylic sheet. Use of heavy weights is acceptable; they will not affect plate marks or heavily applied media if several layers of matting are used.

#### FELTED WEIGHTS

This application of felted weights for flattening is attributed to Susan Page, a senior paper conservator at NARA. Using felted weights (weights lined on the face with papermaker's felt) following humidification aids in smoothing small creases. The result is a flatter sheet, as smoothing creases increases the amount of small undulations, which may look more natural. Drawbacks to this technique: for a tracing or architectural drawing that is particularly weak, even gentle stretching or smoothing by hand and held by weight may be too forceful and lead to elongating tears already present.

## COMMENTS, QUESTIONS, AND ANSWERS

1. Is anyone at other institutions training non-conservators to do overall flattening?
  - Yes. One responder said that they tried to train technicians to brush flatten documents. While this effort went well in the beginning, it was abandoned because the technicians began training others to brush flatten documents and that secondary training was not successful. This institution still wants to train technicians to brush flatten records and is rethinking how to proceed.
  - Someone from the National Park Service said that they also built humidification chambers for their park archives. They spend one week training staff and technicians at each facility. All materials were preapproved. One document was flattened at a time. The training included troubleshooting. This is the only way this entity can succeed due to budget constraints.
  - The Campbell Center offers a course on flattening oversized records aimed at non-conservators.
2. Someone recommended using the Carolyn Horton-style humidity chamber, using a garbage can inside a larger garbage can. Water is placed on the bottom of the larger garbage can. The rolled records are placed inside the smaller garbage can which is sitting in the water inside the larger garbage can. The garbage can lid is used to seal the larger can to hold in the moisture.
  - Use cold water in the Horton-style humidification chamber to prevent condensation. Use humidification strips to monitor progress. This process usually takes one to two hours.
  - Formaldehyde can be used in the Horton chamber to prevent mold growth. Place two baby jars full in the chamber. Formaldehyde can harden protein sizes.
  - More information can be found on the Horton chamber from a Northeast Document Conservation Center brochure and a National Park Service Conserve-o-Gram. The Conserve-o-Gram is currently being rewritten.
  - For non-conservators working flat instead of with a Horton-style chamber reduces mistakes.
3. It is difficult to humidify and flatten modern internally sized papers. These papers have a strong memory. This person's solution is to use a press and blotters to flatten these moistened records.
4. Unfortunately it is difficult to surface clean rolled records before flattening. Does anyone have a solution for keeping this accrued dirt from further contaminating the record?
  - Some institutions set goals for flattening records; the National Archives at times has had a goal of flattening 5,000 records per year. This means flattening 100 records per week or 20 records per day. They have

found that records can still be dry cleaned after humidification and flattening.

- It is often difficult to check tightly rolled records before flattening, especially if those records are brittle. It is important to reevaluate your pre-assessment when flattening a large series to ensure that you are taking the correct approach.
5. It is hard to humidify and flatten heavy paper that is lined with linen. The lining can separate.
  6. Old mold can reactivate.
  7. Modern paper can be difficult to flatten because modern papers often have excess fillers. These papers tend to cockle in every direction. So it is important to experiment to see how the papers will react and to promptly block movement.
  8. Use archival cardboard lined with polyethylene.
  9. Use clean muslin for moisture transfer—it is reusable.
  10. If the record is hard to unroll when dry, how can it be unrolled when moist?
  11. We need good sources for 20-point blotter.
  12. Consider using commercial felts, synthetic felts, paper-making felts, old wool blankets, and even synthetic blankets. These are dimensionally stable, washable, and reusable.
  13. One person used a flat garbage bag laid on the floor.
  14. If the record dries and is not flat, remoisten and reflatten.
  15. Has anyone successfully flattened rolled records that are attached at each end to a wooden dowel?
    - Remove the dowel before flattening.
    - Uneven drying can be a problem; sides dry first and tend to curl.

## ACKNOWLEDGMENTS

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## MATERIALS AND SUPPLIERS

Capillary Matting  
 Conservation by Design, Limited  
 Timecare Works  
 5 Singer Way  
 Woburn Road Industrial Estate  
 Kempston, Bedford MK42 7AW  
 U.K.  
 (01234) 8463000

<http://www.conservation-by-design.co.uk/sundries/sundries54.html>  
 Gardener's Supply Co.  
 1-888-833-1412  
<http://www.gardeners.com/on/demandware.store/Sites-Gardeners-Site/default/Link-Product?sku=31-443&SC=XNET8019>  
 Carlin Horticultural Supplies  
 1-800-661-0271  
<http://www.carlinsales.com/page.cfm/208>

#### Magnets

Adams Magnetic Products  
 34 Industrial Way East  
 Eatontown, NJ 07724  
 1-800-747-7543  
<http://www.adamsmagnetic.com/>

MMC Magnetics  
 175E Commerce Drive  
 Hauppauge, NY 11788  
 1-800-435-1088  
[http://www.mmcmagnetics.com/ourproducts/main\\_Flexible.htm](http://www.mmcmagnetics.com/ourproducts/main_Flexible.htm)

Magnum Magnetics  
 801 Masonic Park Road  
 Marietta, Ohio 45750  
 800-258-0991  
[http://www.magnummagnetics.com/magnetic\\_sheeting.htm](http://www.magnummagnetics.com/magnetic_sheeting.htm)

All Magnets, Inc.  
 2831 Via Martens  
 Anaheim, CA 92806  
 714-632-1754  
<http://www.allmagnetics.com/index.htm>

#### Wool Felts

Aetna Felt Corporation, manufacturer of industrial and consumer felt products  
 2401 W. Emaus Avenue  
 Allentown, PA 18103  
 800-526-4451  
<http://www.aetnafelt.com/>

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