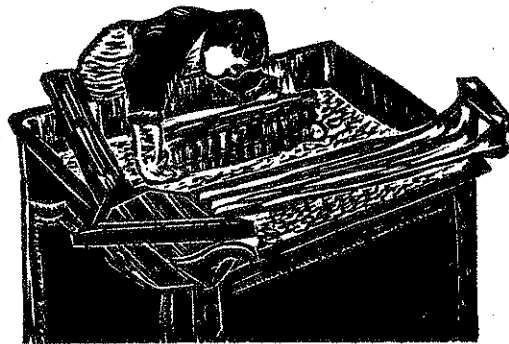


The Ergonomics of Hand Papermaking

Or how to make paper without getting a sore back.

by Peter Thomas



Peter and Donna Thomas, Santa Cruz: 2000



In 1988-1992 I made several trips to Europe to visit old papermills that were still making paper by hand. My initial goal was to learn the exact method I should use to dip the mould in and out of the vat, the motions that made up the *vatman's shake*, but it was not long before I expanded that goal to include documenting the equipment in the mills and interviewing the retired hand papermakers. I was in the right place at the right time, for I found a wealth of information which soon would be lost to the ravages of time. I have made this video and handbook to document what I found and to honor the generosity of the papermakers who shared their knowledge with me.

The papermakers I met were not teachers. They had learned on the job, from other papermakers who were not really interested in sharing their hard earned knowledge. It took time, but in the end their stories, demonstrations and instruction led me to an understanding: to make handmade paper like they did in those old papermills I was going to have to do more than just master the *vatman's shake*, I would have to study all the processes involved and discover how they were interrelated.

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It is easy to make paper with a small mould. By small I mean up to A4 or 9 by 12 inches. Very little technique is required for a fun filled day, with wonderful and interesting results. But, as the scale of the paper increases it is easy for a papermaker to end their day with a sore body and uneven results. As I watched the hand papermakers in a traditional vat papermill, like the one at Lessebo, Sweden, I saw that the workers' motions were fluid and graceful and large sheets of paper could be made easily. I noticed that western papermaking, when practiced by master craftsmen, is effortless, full of dance-like motions; and I realized that many self-taught papermakers work too hard, without sensitivity to the flow of the process.

If there are any ten commandments for papermaking, the first would be STAY RELAXED. The first thing Cyril Finn, the papermaker from Wookey Hole, said as he watched me make paper was "Loosen up man!" What did he mean? I was working like a stick figure. I needed to learn how to let go of tension and stay relaxed as I worked. If you ever get sore from papermaking, try working differently, change the way you stand, or how you use your muscles when holding the mould. Consulting with a physical therapist or taking a yoga class are both excellent ways to learn how to change and improve your work habits.

Before World War II there were still very few cars and all the papermakers I spoke with walked everywhere: to work, to the pub, to town. They were in great physical shape. Today we live comparably sedentary lives, so we need to do warm-up exercises before beginning a physical workout like papermaking. I do a series of stretches before making paper and I have several goals in doing these warm-up exercises. I want to

pre-stretch my muscles so that they are ready for the workout of papermaking. I want to relax my legs, arms, shoulders, back and hips, so that I will begin my papermaking centered, standing evenly so the mould will be held level and the wet sheet will drain evenly. Finally, I want to become aware of where I hold tension, and practice letting it go, so that I don't have to think about relaxing when I am making paper.

I warm up with a series of exercises which I have named using papermaking terms.

1. The Vatman's Pose: I begin by getting centered, standing with my feet directly under my hips and shoulders. I do side stretches and windmills (rotating from the hips) remembering to bend at my waist and hips, not by curving my back. I let my head drop to my feet in a graceful curve, feeling what it is to stretch and curve my back and spine. Then I bend at my hips with my back straight, reminding myself that this, rather than letting my back curve, is how I want to bend when I make paper.
2. The Layboy's Stretch: These stretches are felt from my feet to my hips, and are a preparation for moving around in the shop.
3. The Double Elephant Pose. This is a yoga pose which works to loosen, stretch and strengthen my back.
4. The Coucher's Moves. These stretch my legs, groin and thighs, and help me stand evenly at the vat.
5. The Foolscap Pose. These are stretches which work on my shoulders and arms, getting me ready to pull the sheets.
6. The Hand Stretch. I move in various ways to loosen my wrist and fingers.

All of these exercises are briefly shown on the video. They will be easier to learn by viewing than by reading. Have fun feeling what these stretches and movements do in your body and don't get so intent on the exercises that you forget to breathe.

The vat mills were set up for maximum efficiency, with two or three person teams. The workers were never required to make odd gyrations or uncalculated motions, and I believe this is the secret to achieving effortless papermaking. What follows is a discussion of the papermaking process (sheet forming, couching and how to set up the shop) with my observations of what can be done to make your papermaking easier.

The fact that the quality of handmade paper can be judged good or bad, better or worse, led me to believe that there was a "right" way to make paper. As I studied the vatman's shake, I saw that techniques varied from mill to mill and from papermaker to papermaker. Almost every papermaker I interviewed at some point said that some other papermaker didn't know how to make paper. At first this confused me, but finally I realized there was not a "right way" to make paper. Techniques have to be modified depending on the particular pulp and the equipment being used. As long as the final sheet of paper is first quality, it doesn't really matter how it is made. But I did notice that there were a certain series of motions which were common to all the production hand papermakers I observed. And I believe the fact that those men could make paper all day, five days a week, without getting a sore back or repetitive stress injuries can only be credited to these common techniques.

THE VATMAN'S SHAKE:

1. Center yourself before you begin. Let go of all tension.
2. Don't clutch the mould. Let it balance on your fingers. Let your thumb rest on the deckle only applying pressure to secure it in place when dipping.
3. When you form the sheet, don't fully immerse the mould. Dip only to your knuckles then lift the front edge of the mould up (slightly higher than level) which will cause the pulp to flow over the second half of the screen. You can control the time the pulp stays on the screen to some degree by the speed you dip and choosing whether or not to allow the back edge of the mould to go under the water. You can make fine paper by completely immersing the mould, but water is heavy and the suction created lifting a large mould can hurt your back. Note: If your vat is agitated dip slowly, if not you will need to dip with more speed.
4. After the initial dip, pivot the mould (raising the back edge while lowering the front) towards your body to stop the pulp from flying off the back side of the mould. A small water wave will then be moving towards your body.
5. At this same time start your side to side motion. Use a rocking motion, tilting from side to side on a center pivot point. Do not use a side to side shimmying motion. The shimmying motion works great, but requires more muscle work than tilting motions. Note: With an agitated vat most of the shake should be side to side, to offset the front to back fiber alignment created during the initial dipping motion.
6. Before the small wave of pulp goes over the front edge of the mould and splashes you, pivot the mould (raising the front

edge while lowering the back) away from your body. You can allow the extra pulp and water to flow off the back side of the mould or else you can level the mould and keep the excess on the screen. Note: Hand papermakers controlled the weight of their paper by how much pulp was in this wave they threw off the back side of the mould.

7. Make sure your knees are not locked and let the mould rest loose in your hands.

8. Begin an up and down motion to "set" the sheet. Do small bounces with your knees. The more motion the more the sheet will be compacted. Continue until the water leaves the sheet and the paper takes on a dull sheen (rather than a wet look). Keep your body moving, and don't let any joints lock up.

Note: Cyril told me he usually gave three bounces making parchment paper and seven to ten for ledger or bank note paper. This is where the skill of the beaterman comes into play. If the pulp drains at the perfect rate, the papermaker has sufficient time to do his shake, but does not have to hold the mould suspended for any longer than is necessary.

I found there were also a series of common motions used by the couchers:

COUCHING:

1. Grasp the mould lengthwise. Hold it by your four fingers, dangling downwards. Use your thumb to direct it.
2. Align it with some sort of marks so that each sheet will end up directly on top of the one below it. Note: This assures even pressure over the sheets when they are in the press.
3. Rest the lower edge of the mould on the felt. Remember to bend from your hip joints, don't curve your back.

4. Rock the mould from the right edge to the left edge, applying firm downward pressure. Use the weight of your body rather than solely relying on muscle power. Keep your shoulders relaxed.

5. Allow the mould to roll off of the post in a continuous motion.

6. Return the mould to the vat. If you are both papermaker and coucher, remember to move your feet. Don't just twist your body.

At some point I realized that everything these old papermakers did had a good reason. Just as the papermaking team of vatman and coucher made their work effortless by eliminating odd maneuvers which would wear them out, the equipment in the vat papermills was set up for maximum efficiency. By having the proper equipment and laying it out in a logical manner papermaking was made easier.

EQUIPMENT AND THE ERGONOMICS OF PAPERMAKING:

1. When making paper in a vat papermill the pulp needs to stay on the screen for 3-5 seconds while the vatman gives his shake. Having a beater and knowing how to use it will allow you to produce pulp that drains at the proper speed. The net result is that you will have enough time to properly form the sheet, but will not have to hold the mould in the air any longer than necessary. Thus your work is made easier, which can translate into having more fun. Note: The vats had temperature regulators, so if the pulp was a little slow to drain they could turn up the heat and speed up the drainage (or vice versa).
2. Vat papermills had effortless systems to move pulp from the beater to the vat, usually through pipes or troughs. Be careful

not to strain your back when you are moving buckets of pulp around. When lifting heavy objects or pulp buckets remember to keep your back straight, your knees bent and lift with your legs rather than your back. Consider filling your buckets only half way.

3. These papermills also had methods to regulate a constant flow of pulp to the vat. Be careful to avoid odd twisting motions when adding pulp from a bucket.

4. The vats had mechanical devices, often called hogs to stir the pulp. I realized I spent at least one-third of my papermaking time stirring water, so I built a mechanical device to do it for me. If you can't build a hog, when you stir use both arms to equalize the strain. Be aware of your back: is it straight? Are your heels on the ground? Are your knees bent? Are you leaning at some odd angle? Note: some people stir with their deckle. If you try this technique, move the deckle in a circular rotation from front to back, rather than side to side as I did in the video. The front to back motions use the same muscles as sheet forming and are easier on your body.

5. Traditional moulds and deckles are designed to be light-weight and thus less work to lift and hold extended when sheet forming. The edges of the deckle are tapered so the pulp will flow in and out properly and make sheet forming a joy instead of a chore. The screen is supported by airplane wing-like wooden ribs which are designed to promote water flow, so the mould is easy to dip and drains quickly. These supports also make couching easier than it is with an unsupported screen. Note: If your mould and deckle are too thick, your hands will not be able to relax when holding them. Make sure you have

convenient places to set your mould and deckle between sheet forming and couching. Do not strain to grab them or set them down.

6. The vat had an adjustable platform which the vatman could raise or lower to assure he was at the right height when making paper. The vat is at the proper height when your hip bones are about level with the top of the vat. This allows you to bend at your waist and rest on the edge of the vat while you dip the mould. The vat should not be too deep. The water level should be only a few inches below the top of the vat, so that dipping the mould requires as little motion as possible. You must be able to slide your toes under the vat (about 6 inches or 15 cm). Without this toe space it is difficult to keep your heels on the ground when forming sheets. If your heels lift up, the stress which should be going into your legs will go into your back (making it sore at the end of the day). Note: Do you need hip pads or hand rinsing buckets mounted to the vat, so that you don't have to twist oddly to rinse pulp off your arms?

7. Vat mills had systems for the papermaker to slide the mould to the coucher, so it could be grabbed by stretching out with little twisting. The coucher must be able to grab the mould without over-extending. If the papermaker does both jobs he must be able to move easily to the couching bench. When couching don't twist, move your body so that your feet directly face the couching bench and then bend from your hips. Some vat mills had adjustable couching benches. An optimum height for the bench is just below the mould as it is held to be couched. This is usually somewhere between knee and waist level. Note: When removing the felts and pressed paper from

the post be careful not to overextend or twist.

8. Vat mills had rails to slide the post into the press. Is it easy to get the post from the couching bench to the press? Some people use carts that have hydraulic height adjusters. Never lift too much weight. If necessary, make smaller posts, or develop ways to slide, roll or otherwise get the felts into the press without lifting. I recommend using a big press (the bigger the better) so that you don't have to strain to get enough pressure. Can you adapt a motorized pump to your hydraulic jack? If you use a jack or screw press remember to keep your back straight and use your body weight as well as your muscles to operate it.

9. Make sure your drying system is set up so that you are not required to make odd twists, bends or stretches to load or unload it.

Here is a final review of how to make paper without getting a sore back or repetitive stress injuries. Stay loose. Look for tension and let it go. Don't stand on your toes because if your heels come off the ground all the stress is thrown into your back. Bend from your hips, if you curve your back to reach down you are putting unnecessary stress on it. Lift carefully, because any time you lift something heavy at a stretch or an odd angle you can hurt yourself. Don't clutch the mould, let it rest in your hands. Always keep your knees bent. If you lock your knees when you are sheet forming all the tension is going to lock up in your body. And finally, remember to breathe. Your breath is the rhythm in the dance of papermaking.