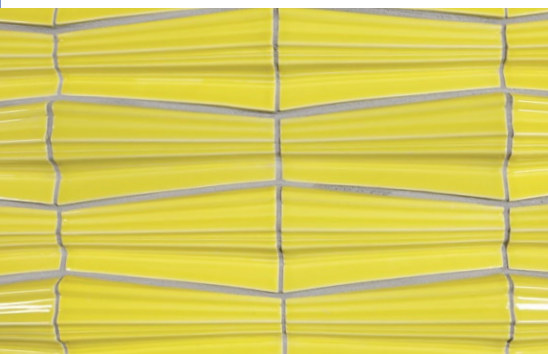
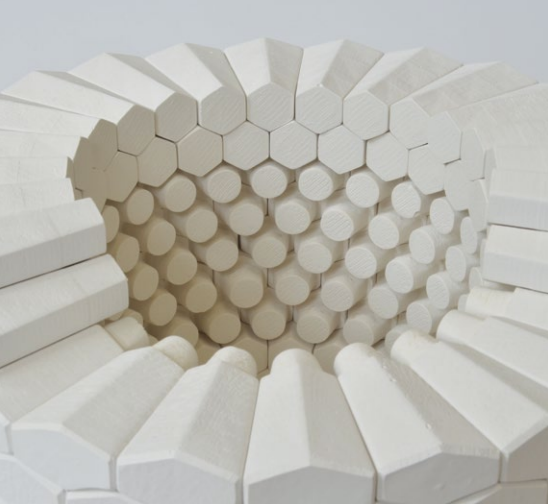




# THE MOLD-MAKING MANUAL

THE ART OF MODELS, MOLDS,  
AND SLIP-CAST CERAMICS

by Jonathan Kaplan



———— THE ————  
MOLD-MAKING  
MANUAL

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AND SLIP-CAST CERAMICS

by Jonathan Kaplan

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Westerville, OH 43082

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# Contents



|                                                                                                               |      |
|---------------------------------------------------------------------------------------------------------------|------|
| <b>Introduction</b> . . . . .                                                                                 | vii  |
| <b>Personal Thoughts on My Plaster Journey</b> . . . . .                                                      | viii |
| <b>Foreword</b> <i>by Joe Zeller.</i> . . . .                                                                 | x    |
| <b>Chapter 1: The Basics</b> . . . . .                                                                        | 1    |
| <b>Part 1:</b> An Introduction to Plaster and its Usage . . . . .                                             | 1    |
| <b>Part 2:</b> The Plaster Workspace . . . . .                                                                | 7    |
| <b>Part 3:</b> Basic Guide for Using Plaster . . . . .                                                        | 15   |
| <b>Chapter 2: Models</b> . . . . .                                                                            | 23   |
| <b>Part 1:</b> Basic Constructs . . . . .                                                                     | 23   |
| <b>Part 2:</b> Industrial Applications . . . . .                                                              | 36   |
| <b>Part 3:</b> Model Materials and Methods . . . . .                                                          | 39   |
| <b>Part 4:</b> Turning Plaster . . . . .                                                                      | 55   |
| <b>Part 5:</b> Other Modeling Methods . . . . .                                                               | 72   |
| <b>Chapter 3: Casting Molds</b> . . . . .                                                                     | 79   |
| <b>Part 1:</b> Plaster Molds—Thinking Visually . . . . .                                                      | 79   |
| <b>Part 2:</b> Introduction to the Slip Reservoir,<br>Spares, Mold Keys, and Natches . . . . .                | 89   |
| <b>Part 3:</b> Mold Parts, Configurations, Parting Line,<br>Plane of Separation, and the Block Mold . . . . . | 98   |
| <b>Part 4:</b> Additional Casting Mold Examples . . . . .                                                     | 117  |
| <b>Part 5:</b> Other Casting Concerns . . . . .                                                               | 123  |
| <b>Chapter 4: Master and Production Molds</b> . . . . .                                                       | 129  |
| <b>Part 1:</b> Coming Full Circle . . . . .                                                                   | 129  |

|                                                                     |     |
|---------------------------------------------------------------------|-----|
| <b>Chapter 5: Casting Slip and Rheology</b> . . . . .               | 141 |
| <b>Part 1:</b> An Overview of Casting Slip . . . . .                | 141 |
| <b>Part 2:</b> Rheology and Slip . . . . .                          | 148 |
| <b>Chapter 6: Slip Casting in the Studio</b> . . . . .              | 161 |
| <b>Part 1:</b> Your Expectations . . . . .                          | 161 |
| <b>Part 2:</b> Special Topics in Plaster and Slip Casting . . . . . | 168 |
| <b>Chapter 7: Artist Profiles</b> . . . . .                         | 183 |
| <b>Chapter 8: The Teapot Chronicles</b> . . . . .                   | 213 |
| <b>Part 1:</b> My Teapot Design Process . . . . .                   | 213 |
| <b>Appendix I</b> . . . . .                                         | 233 |
| <b>Part 1:</b> Recommended Reading . . . . .                        | 233 |
| <b>Part 2:</b> Resources . . . . .                                  | 234 |
| <b>Part 3:</b> Glossary . . . . .                                   | 242 |
| <b>Part 4:</b> Safety in the Studio . . . . .                       | 245 |
| <b>Part 5:</b> Acknowledgements . . . . .                           | 247 |
| <b>Part 6:</b> Afterword . . . . .                                  | 248 |
| <b>Part 7:</b> About the Author . . . . .                           | 249 |
| <b>Appendix II</b> . . . . .                                        | 251 |
| <b>Part 1:</b> Notes . . . . .                                      | 251 |
| <b>Part 2:</b> Index . . . . .                                      | 252 |



## Part 2: The Plaster Workspace

### The Work Table

Your workspace can be as simple or as complex as you wish—designed to maximize your work flow, and be efficient, clean, and well organized. While some studio spaces have a separate area for plaster work, it is not essential that it be a stand-alone space. If your studio is small, plaster work can be done on any table. For many years I worked on a 24-inch-square piece of marble that I leveled on a work table. The downside of working with plaster in a common space is the necessity to work clean to avoid any cross contamination of plaster into the clay-working area.

Understanding plaster will reduce the fear of using it in your clay studio. If very small amounts of dry plaster powder somehow find a way into your clay, there is little likelihood of any detrimental effects. On the other hand, if chunks of cured plaster enter the clay stream, when the ware is bisque fired, the plaster will expand more than the clay of

a piece and cause a pop out. By working cleanly and in an organized fashion, you can integrate your plaster practice within the confines of your clay studio (if you have enough space to have a dedicated area, this is preferable, of course). Regardless, learning to work with plaster without creating a mess is a matter of keeping the area clean, having a proper place for each of the tools you use, developing organized work habits that decrease clutter, and allowing enough space to set up, pour plaster, and make a mold part.

In my experience, the best way to organize your plaster working area is around the mold table. A mold table (or your choice of work surface) is the central part of your workspace. On this table you will build setups, pour plaster and rubber, make models and molds, and organize your workflow. It is essential that this table or work surface be perfectly level and stable, with the top hitting approximately at your hip height. The design of this table allows



Part of the author's work space, with work stations for turning plaster, mold making, and mixing and spraying glaze.

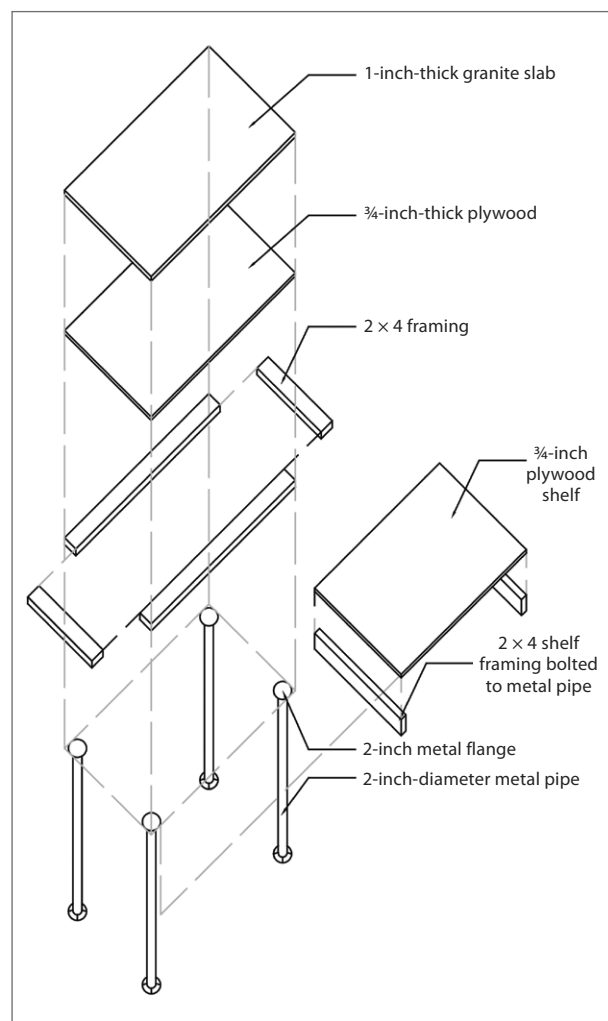
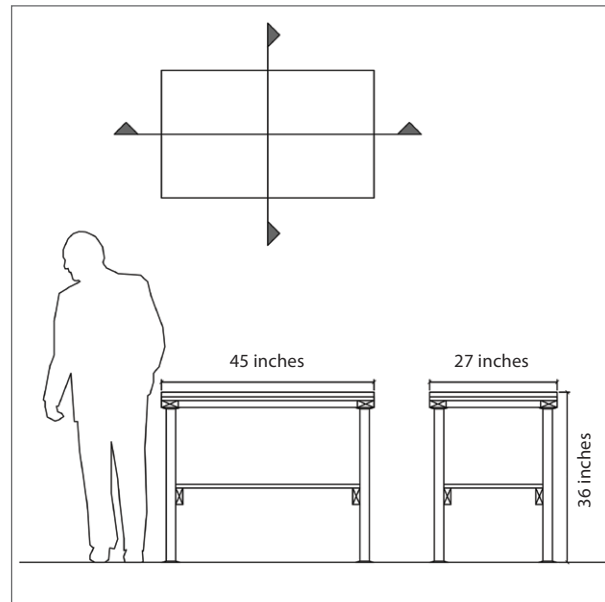
you to use your hip to bump the table to level the plaster after pouring. Hitting the table lightly with your hip will move the table slightly from front to back or side to side, leveling the poured plaster to the table surface. This slight agitation of the liquid plaster helps any air bubbles to migrate to the top of the mold and not appear on the casting surface of your mold.

### TIP:

Anytime a wet solution is poured into, onto, or over a dry surface, the surface tension can entrap air. In pouring wet plaster over a dry mold setup, reducing this surface tension will prevent air bubbles on the casting surface of the mold. Use a surfactant to spray the dry surface of the mold on which you will be pouring wet plaster before you pour. I use a diluted solution of Mold Dressing from Perma-Flex.

Your work table can take many forms and be constructed in many ways. A stout frame made with 2×4 or 4×4 lumber with a plywood underlayment is sufficient. My mold table has 2-inch-diameter pipe legs. Each end of the pipe is threaded and matching-diameter pipe flanges are screwed to each end. The bottom flanges can be used to adjust the table to be perfectly level, and the top flanges are screwed into the frame of the table. You can also secure a shelf between the four legs for the storage of items. The plywood underlayment forms the bottom substrate of your slab tabletop. The slab can be a gypsum cement slab made from Ultracal 30 or Hydro-Stone; a granite, marble, or engineered stone; or poured and dressed concrete. Do not use No. 1 Pottery Plaster for your work surface as it is softer than the gypsum cements and subject to rapid wear, as well as marking and gauging. Whatever your choice of slab material, it can be leveled and secured to the wood tabletop by wads of modeling clay in between the plywood top and the slab. The slab should be the same size as the plywood tabletop and not move independently of its wood frame. My suggestion is to construct this work table to last. If you use a gypsum cement material such as Ultracal 30, always make sure to dress the surface between pours with mold soap or parting compound. Keep this top surface clean, flat, and coated with a good layer of parting compound so that you can work directly on the plaster surface of your mold table.

Over the years, I have made several modifications to my table. I added a small electric vibrator mounted to the underside of the table. Connected to a momentary push-button switch, when activated, this device vibrates the table to level the plaster and release any entrapped air in a pour. The intensity of vibration is adjustable within the vibrator itself.



**Top:** Illustration of the author's plaster work table at hip height. **Above:** Plaster work table schematic. *Illustrations: J. Harley Nalley.*



A small electric vibrator, mounted under the author's table.

## Tools

My tool board is situated directly behind me as I work at my table and is arranged so that all tools for a certain task are grouped together. For instance, all my C-clamps and spring-loaded clamps are in the same area. Measuring tools, squares, straight edges, etc. are all grouped together. I have spray bottles of various liquids such as mold dressing, water, WD-40, and alcohol hanging close to each other. I don't like to waste time looking for a particular tool or having to walk extra steps because I did not remember to replace the tool in the same place after using it. With my tool board behind me, it is merely a function of turning around, and locating the correct tool. The small shelving unit below the tool board holds small hand tools, containers of mold and aerosol releases, boxes of rubber gloves, non-woven abrasive pads, and some notebooks.

### TIP:

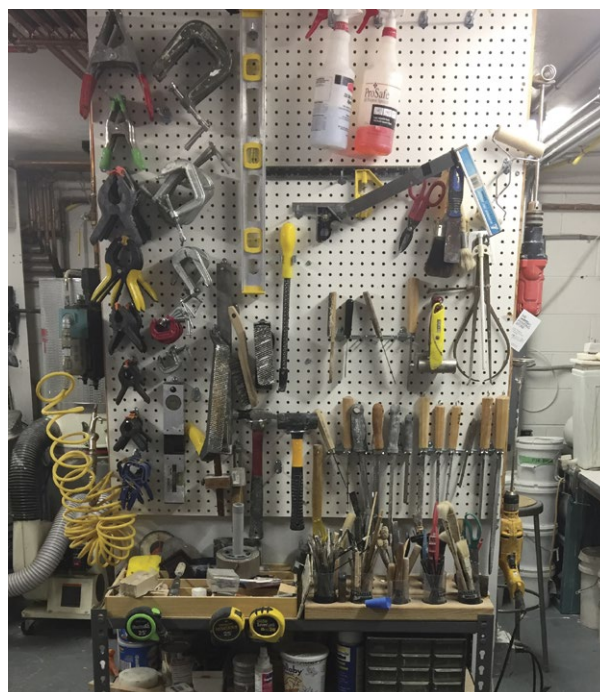
Use pegboard to mount your tools. Do not compromise on the quality of the hooks!

The hardware store variety of peg-board hooks are really not well designed and always move or come off the pegboard. The best brand of pegboard hooks I've found are DuraHooks, which are available from any number of online vendors. They come in bulk packs in an array of sizes and shapes. They attach securely to the pegboard with a tab and a screw and will stay secured no matter how many times you remove or replace a tool.

Tools are a matter of personal preference. Treat them with respect and they will last you a lifetime. As an accumulator of tools, I have an extensive array to choose from.

My approach to tools follows the idea of "The Right Tool for The Right Job." Tools are an extension of your hands and make a job easier. Note that to make molds, you certainly do not need all of these tools—accumulate them over time should mold and model making become an essential part of your studio practice. And always buy the best tools you can afford. A list of suppliers is located in the Appendix.

My go-to sources for tools are McMaster-Carr Supply and W.W. Graingers. Big box home improvement stores are also good sources. What I avoid are the discount tool stores that seem to be everywhere. Their tools do not last and are a waste of money, in my opinion.



**Top:** The author's tool board, directly behind the mold table. **Above:** DuraHooks provide a secure mounting for every tool.

**TIP:**

After you are finished with a tool, clean any plaster residue from it. All steel tools should also be treated with some WD-40 to prevent rust.

**Hand Tools**

- Stainless steel cabinet scraper (rectangular)
- Burnishing tool to keep the burr on the scraper active and sharp
- Bubble levels—small and medium (12 inch and 24 inch)
- Plastic ribs
- Rasps and files in different profiles
- Files and a file card for cleaning them
- Pencils—colored pencils as well as plain graphite, and sharpener
- Drawing/drafting tools—compass, dividers, 90-degree triangle
- Measuring tools—tape measures, flat steel rulers in assorted sizes
- 0-degree adjustable squares, assorted blade sizes
- Rasps and Surform tools in flat and curved profiles with extra replacement blades
- Single-edge razor blades
- X-Acto knives and blades
- Needle tools
- Flexible metal ribs
- C-clamps in sets of four, in assorted sizes with various jaw capacities and throat depths
- Spring-loaded clamps, assorted sizes in sets of four
- Pony pipe clamps for ½-inch- or ¾-inch-diameter pipe
- Jorgensen or Irwin bar clamps
- Fettling knife
- Surgical scalpel with spare curved and straight blades
- Markers, China pencils
- Sandpaper blocks
- Dremel tool with assorted burrs
- Foredom tool with assorted burrs
- Hacksaw and extra blades
- Roll of galvanized flashing, 10-inch or 12-inch width
- Assorted wooden stick tools
- Tongue depressors
- Clothes pins
- Dowels, ¼-inch or ⅜-inch diameter
- Assorted spade bits to grind down to make various diameter dimple keys

**Supplies and Consumables**

- Wet-dry sandpaper, assorted grits, including 60, 80, 120, 400, 600, 1200
- Screen cloth—220 grit
- Emery cloth 100 grit–200 grit
- Screen-cloth holder
- Parting compound
- Crisco (paste variety)
- Pure castile shampoo
- Shellac
- Mold dressing
- Assorted tapes—duct tape, blue masking tape, gaff tape, packing tape
- Wood spacers (you can make what you need)
- Modeling clay—Chavant Fill It Clay
- Box of white clay or low-temperature earthenware clay (no grog)
- Thin plastic sheets (dry-cleaning type)
- Spray bottles
- WD-40
- No. 1 Pottery Plaster or Duramold for molds and models
- Hydro-Stone, Hydrocal, or Ultracal 30 gypsum cements for case molds
- Rags
- Paper towels
- Sponges
- Ground glass slab
- Assorted sizes of buckets
- Disposable gloves
- Disposable bucket liners
- Pourable urethane rubber for case molds
- Platform scale—1–50 pounds in ¼-pound divisions
- Small digital scale
- Tin snips
- Scissors
- Assorted solvents—acetone, mineral spirits, denatured alcohol

### Powertools and Accessories

- Bench-type wide belt sander
- Bench-type narrow belt sander
- Bench-type oscillating spindle sander
- Drill press (bench or floor type)
- Scroll saw
- Cordless power drill
- Table saw
- Band saw
- Vacuum cleaner with HEPA filter
- Dust collection system
- Potter's wheel
- Giffin Grip
- Jiffy mixers
- High-shear mixing blade for power drill
- Hand drill (corded)

### Slip Mixing and Pouring Equipment

- Blunger (self-contained mixer) or a 5-gallon pail
- Heavy-duty electric drill with chuck for ½-inch-diameter shafts
- High-shear mixer on shaft
- Triple-beam balance with accessory weight set or digital scale
- Specific gravity measuring device
- Viscosity measuring device
- 5-gallon buckets
- 1-gallon plastic buckets
- Plastic pitchers with lids
- Large sponges
- Casting table or separate table to pour slip
- Notebook
- 40–60-mesh sieve
- Stopwatch

### Specialty Equipment

Turning plaster on vertical and horizontal axes are essential plaster-working skills. You can easily modify a potter's wheel for turning vertically. Such a dedicated machine is called a whirler and is available commercially. You can adapt standard Dolan trimming tools to use in conjunction with a belly stick for stabilization during turning. In another variation, you can equip your modified potter's wheel with an adjustable steady-rest or a set of parallel ladder steps to secure your turning tools over a horizontal brace.

### Additional Basic Hand Tools

I have used many of the same hand tools for many years. Some tools will wear out. Others, when cared for properly, can last you a lifetime.

- A flat mill file
- A wooden stick tool (Kemper #MKN)
- Stanley 21-399 6-inch Surform pocket plane and replacement blades
- Assorted Sherrill ribs—blue series that have a right-angle edge



Some essential hand tools for making molds and models.



Long-handled plaster turning tools for use with a belly stick.



A selection of specially made turning tools in various profiles.

To turn plaster or a styling board such as RenShape on a horizontal axis, I have modified a standard Grizzly wood lathe. The factory drive system uses a mechanically adjustable pitch drive pulley and a V-belt with an AC motor, and this mechanism does not offer a precise degree of control. I fit a Brent ½-horsepower DC motor to the Grizzly lathe with a Dart controller. While it took some time to design, fabricate, and install the metal attachments, it is a perfect combination with very accurate speed control and enough torque at low RPMs. I use a special bucket head and mandrel to support solid cylinders of plaster. I designed another system for turning REN Shape that requires a lathe tailstock.

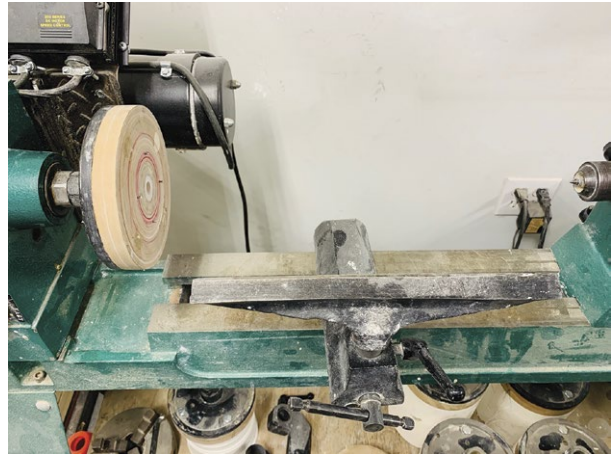
### TIP:

RenShape 440 is a medium-low density polyurethane modeling and styling board used for master models, CNC styling models, prototypes, and visual models. RenShape 440 machines easily at fast cutting speeds, finishes to a good surface with excellent edge definition, and produces very little tool wear.<sup>4</sup> It can be worked easily with hand tools, cut and shaped with power tools, or turned perfectly on a lathe. It is dimensionally stable and has its own adhesives and patching compounds. It is an excellent choice for model-making applications.

Another very special piece of equipment is a variable-speed, air-powered, high-shear mixer. It moves up and down with a counterweight system and can also swing about 90 degrees to the left and right. This is very useful in mixing large batches of plaster or rubber. A high-speed/variable-speed shear mixer can be made using off-the-shelf parts, a stainless steel shaft, and shear blade.



A potter's wheel adapted for vertical turning and jiggering plaster forms.



**Top:** A system using a standard lathe faceplate to secure RenShape. **Middle:** Lathe with special bucket head and mandrel. **Above:** Solid plaster cylinders ready for turning.

## Other Useful Systems

In my studio, a water line above the mold table is attached to a food service wash-out spray unit. Below this water line is my wash-out bucket and empty plaster bags. Before I wash out my plaster mixing buckets with the spray unit, I dump any excess wet plaster into these bags (if there is any left after pouring small bats or other extra pieces). When the bags are about 75% full of excess plaster, they go to the dumpster. When the water and plaster slop have filled the wash-out bucket, I take the water off the top and allow the plaster slop to harden. This, too, goes into the empty plaster bags and then to the dumpster. Any water can go down the drain as there is no raw plaster that might clog them. I try to keep my plaster waste to a minimum, but after a lengthy mold-making session, it is usually necessary for me to scrape and clean out the wash-out bucket. Remember: do not dump freshly mixed plaster into your sink!

My air compressor is in another part of the building and there are multiple air lines running into my studio. There are multiple drops from each line in specific locations equipped with a desiccant water filter, an oil trap, a filter regulator, and quick-release couplers.

I have industrial-sized Utilatwin sinks in the studio. The mold-room sink is behind the tool wall and close to my spray booth. All of my sinks (and the spray booth as well) have traps underneath. The solids settle to the bottom and the water on the top goes into the city system. These traps sit on small, wheeled dollies and detach from the plumb-

ing system with a union fitting so they can be emptied and cleaned on a periodic basis.

I store my plaster in two industrial plastic food-storage wheeled bins: one containing Hydrocal/Hydro-Stone or Ultracal 30, and the other containing No. 1 Pottery Plaster. I transfer the dry plaster from the bag to these containers, and each wheeled plaster bin can hold up to three 50-pound bags.

These can be conveniently wheeled close to the table to weigh out a dry batch. I have a tall rectangular trash container that sits at the very end of my mold table. The proximity of this trash container allows me to use a scraper and move the plaster scrap directly from the tabletop into the trash. Finally, I stand on a thick anti-fatigue mat on the concrete floor to cushion my feet during the many hours spent in front of the mold table.

I have a wall of industrial boltless shelving that has all my other supplies and mold-making materials. My mold boards are sorted by height and arranged by length. These shelves also hold bulk rubber, extra cast plaster slabs, models, molds, and whatever else I need.

My workspace is designed for minimum steps or movement so I can effortlessly pick out a tool, grab a compressed air hose, weigh out dry plaster, or scrape off and clean the table surface. My tables and equipment also have small attachments to secure a desk lamp with an LED bulb to better illuminate my work. This current workspace has evolved over the years. I am fortunate to have enough space, and over time, I have learned how to effectively manage it.



**Left:** A variable speed high-sheer mixer made by the author using off-the-shelf parts. **Middle:** The spray system and washout tub. **Right:** A typical airline drop with filters.



**Top left:** Utilatwin double sink with angled drain tray. **Top right:** A large tank traps any solids, then the water goes into the city system. **Middle right:** Plaster storage and plaster scrap and trash. **Above:** A wall of boltless shelving provides convenient storage.