THE BUCKAPOUND BREWERY

One Beer Geek's Search for Total Brewhouse Automation For a Dollar a Pound

By Randy Mosher

For many homebrewers, equipment is simply a means to an end—simple, functional—something that has to be addressed before the real work of brewing can begin.

For me it's a little different. Of course I enjoy making and sharing homebrew, but my real love is hardware. For me, the thrill of a good scrounge combined with the rewarding handwork of cutting, shaping and fusing stainless steel suits me perfectly. Part NASA, part Frankenstein's lab and part Snuffy Smith, I view my Buckapound Brewery as functional kinetic art.

It's called the Buckapound Brewery because for a long time this was the price of scrap stainless. Now the price is $1.25, but that just doesn't have the same ring.

I've been working on this outrageous brewery-building path since 1986 or so, and have gone through numerous variations, not all of them successful. I now have it to the point that it is functioning smoothly; it's a rare brew day now that I have to get out the tool kit. Parts of it are still pretty rough looking—prototypes really. My current thrust is toward making it all attractive as well as functional.

The lauter tun is the first piece of this better-looking gear; wood cladding will complete the classic look. A copper and stainless brew kettle is in the works. How I ever ended up with a hobby that involves so much plumbing is a cosmic mystery I'll never fathom, except to acknowledge that the universe does have a sense of humor.

I thought it might be amusing, or possibly even informative, to share some of my principles and practicalities with you. Few would want to follow me all the way down this path, but I think there are ideas here that are well worth considering, no matter what sort of homebrewery you're assembling.

One more thing. I am an artist by training, not an engineer. So those of you without technical training should know that this deficiency is no barrier to making the homebrewery of your dreams. Those of you who are engineers (and who may have designed some of the castoffs I'm using) can laugh if you want, but this thing *does* brew beer.

Planning and Goals

You can just start building stuff willy-nilly, but the beginning is a good time to pause and decide what you are trying to accomplish with all this grinding and welding. You will want to formulate some sort of a plan.

Some possible goals are (some of these may conflict):

- Shorter brew day
- Less effort/attention
- More complete control
- Special processes like adjunct mashes, decoctions
- Really cool looking
- Built around a unique found object/vessel/part
- Historical authenticity

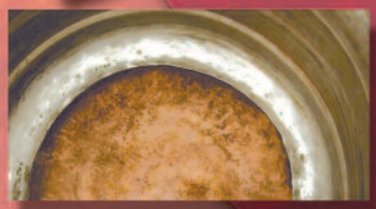
You will also have some limitations to deal with:

- Your personal skills
- Access to tools—your own or otherwise
- What's available for $1 per pound
- Space available for brewery
- Brewery energy source(s)

You also have to ask the hard question: will the new doojiemaflopper work for you? It's easy to make brewing more difficult as things get more complex. There are issues of coordination and reliability; the more pieces you have, the more time it takes to hook it up and then take it apart. And more to wash, at the very least. You need to coldly decide if the benefit is worth the effort.

I must mention safety at this point. Many of the improvements discussed here involve electricity, which can be a lethal hazard when combined with copious amounts of randomly squirting water. Start with a GFCI outlet and press the test button before every brew. And any equipment you build should be well insulated, well constructed and properly grounded. I recommend low-voltage switching for things like float switches and thermostats.

Also, rotating motors and things like stirring paddles connected to them can be dangerous as well, so try to design them in such a way as to keep fingers out of the way as much as possible.



Cool looks: a basic brew kettle I built for my brother, with a kind of artful, stylized design.

Hot water is another danger. A loose hose clamp can result in a boiling hot geyser of wort, which will burn you most painfully.

Interchangeability, Modularity

This is crucial for an easy-to-use system. Standardize all hose connections with the same type of connector. I like 3/8" Swagelok® compression fittings. Other, quicker disconnects are available, but are usually pretty expensive, even on eBay. Valuable components such as pumps need to do multiple duty, making an even stronger case for a unified system of hookups.

Left, NPT threaded plumbing fittings, not quick; center, Swagelok® tubing fittings, sort of quick; right, quick disconnects, expensive and hard to clean.

On larger vessels it is helpful if components, especially electrical stuff, can come off for cleaning. I have installed sanitary (Tri-Clover®) fittings to all my larger vessels, so thermometers and large valves can quickly pop on and off for cleaning or reconfiguration. You will see this as we tour the brewery later on.

Reliability

It's a problem sometimes with surplus, but more often it's:

- Poor planning
- Improper usage
- Quickie (duct tape) construction

Hot and cold water can be hooked up with readily available (and inexpensive) garden hose disconnects.

Take the time to install something properly, and resist the urge to put something to use as soon as you can.

Simplicity

Well, this is a beautiful idea, and I highly recommend it to others, but it's really not the path for me!

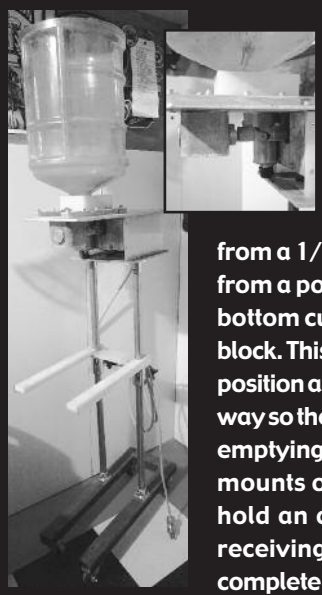
Automation

My goals are, in order of importance:

- Faster brewing
- Easier setup/takedown/cleanup
- Better beer, more flexible process

The length of the brew day is important, but also how much energy and attention is required for each stage. I like to have things running without a lot of intervention so I can do something else.

A TOUR OF THE BUCKAPOUND BREWERY



MALT MILL

Using a geared motor from a copy machine, I motorized a PhilMill. I hung both motor and mill housing from a 1/4" plate. The hopper is made from a polycarbonate carboy with the bottom cut off, which fits into a plastic block. This block slides on guides from a position above the mill to back out of the way so the mill can be accessed without emptying the hopper. The whole thing mounts on removable legs that also hold an adjustable platform for the receiving vessel. Wheels on the base complete the mobility.

ADJUNCT MILL

This is an old grocery store coffee grinder, a "pin mill," which gives a shearing action useful for cutting up wheat, oats, etc., to a fine grit.

MASH KETTLE

This vessel has a copper bottom and sits directly above a stove burner. A reversing DC gear motor attached to a stainless paddle stirs the mash. The sanitary fitting in the middle holds a (nine wire!) probe for the NIST-certified RTD pasteurization thermometer bought for $42 on eBay.

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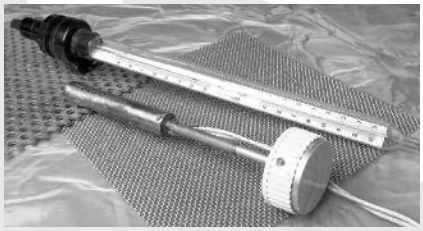


Three different salvaged temperature control devices. Top, process controller accepts thermocouple or sometimes other types of probes; top right, a highly accurate mercury in glass incubator thermostat; bottom, Fenwal-cartridge thermostat.

Temperature Control

I have implemented some temperature control measures in these areas: mashing, sparge water and fermentation. Fortunately this a common occurrence in the industry, so the parts and pieces are readily available on the salvage market.

The Buckapound's mashing and boiling vessels both have copper bottoms installed for more even heating.

Mechanical Mixing

This has been a big success at the Buckapound. I always hated stirring, but with flame-heated step mashes, the scorching and sticking required constant stirring and even that wasn't enough. There are geared motors available with speed reduction built in. You want something around 60 rpm or somewhat lower. If you can find a reversible one, even better. The bigger problem with stainless vessels is the scorching. I solved this by cutting out the bottom of the vessel and replacing it with 0.090" copper sheet. This isn't easy to do, but silicon bronze or aluminum bronze rod with a TIG process will stick permanently to both metals.

I have installed a solenoid valve on my filtered tap water line. This may seem like a pointless luxury, but when controlled by a float switch at the top of my kettle or liquor back, it saves me hours of mopping up water which used to spill out when I forgot to stand there and monitor the fill level.

I have a couple of other uses for float switches: one in the lauter tun, which monitors the sparge water level and kicks on a pump to keep the bed from drying out. The

A mash-stirring paddle based on Donald Put's design (*Brewing Techniques* November/December 1994).

GLORPING TUBE

A 2" ball valve and a flexible stainless steel hose attached with sanitary fittings allow the converted mash to be "glorped" directly into the lauter tun.

GRANT

Made from an industrial pressure vessel-sort of a beefed up corny keg—this is the vessel into which the sparged wort flows. A float switch turns a pump on when two-thirds full, which then transfers the wort to the brewkettle.

LAUTER TUN

This vessel was made from scratch, designed to have a wider profile than the mash or boiling vessels in order to end up with a shallow lauter bed. Unusual features include a vacuum gauge that can tell when a too-fast runoff is compacting the grain bed; and a manifold of tubing that routes incoming sparge water around the bottom of the wall to help maintain the heat of the tun. As mentioned earlier, an adjustable float switch attaches, which can automatically turn on the flow of sparge water when the level gets low. An oak jacket will clad the outer walls.

SURPLUS SCROUNGING STRATEGIES

"If you don't buy it when you see it, you'll need it next week."

"Buy half of something. You'll find the other half eventually."

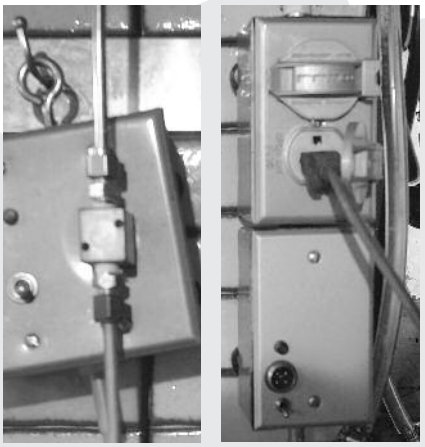
"If it looks cool, put a bid on it."

This ceremonial brew kettle assembled for the Bloatarian Brewing League was based on a 100 year-old steam-jacketed vessel found on eBay. Decorative jester figures were cut on a computer-controlled plasma cutter.

A pair of pumps: left, a magnetically-coupled self-priming gear pump used for wort transfer; right, a direct-drive centrifugal pump that will move several gallons a minute.

second is attached to the grant, and, when a certain level is reached, turns on a pump that moves the wort to the brew kettle. With these two devices, I can let the sparge go almost completely unattended, freeing me to get the next stage of brewing setup.

These float switches work on a low-voltage signal, which, when connected to a relay, switch the 110 volts the pumps require. This is a necessity, as the float switches have a very tiny switch and are not suitable for more than just a trickle of electricity, but it's also a great safety feature as it keeps the line voltage high and dry on the wall or ceiling. I have one freestanding relay box, and have another one built into the control box of a pump.



Left: Solenoid valve accepts low-voltage switch input from float switch.

Right: This low-voltage switching relay box accepts inputs from thermostats or float switches, and has outlets that either turn on or off with a positive signal.

A Note on Surplus

As Los Angeles-based homebrewer Steve Casselman noted, if it's somebody else's, it's junk. If it's yours, it's stuff. It is a sign of the great abundance of our civilization that massive quantities of perfectly useful industrial parts and pieces are scrapped out and end up for sale for just

BREW KETTLE

Made from a half-barrel with a quarter-barrel welded on top, this keg-and-a-half has enough room to boil a full 15-gallon batch. Interesting features include a copper bottom and a 1.5" ball valve that allows hop cones to flow easily into the hop back. Note the world's largest dial thermometer.

A dedicated light was fashioned from a tapered sanitary fitting. A tall vessel like this with a mostly closed top can sure get dark inside, and the light really helps when it comes time to clean up. A fitting and dip tube allows the wort being pumped in to flow all the way to the bottom with minimal splashing. The kettle has a close-fitting lid and a fitting to accept a spray ball for cleaning in place.

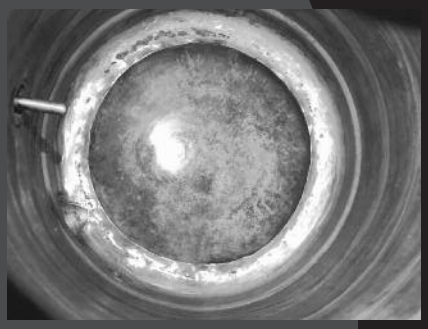
The kettle is fired by a custom stove built around a wok burner. Twelve of the 20 burner jets (like little torches) were removed and reconfigured so that three pairs of burners are controlled by one valve, and a single pair on another.

Float switch connects to the grant, turns on pump when level rises.

This aerospace-grade solid titanium filter probably came off of a B-52. It hasn't yet found a place in my brewery but it's just too cool to get rid of.

pennies on the dollar. Most cities of any size have an industrial surplus outlet and these are well worth searching out. Many of these operations now have a presence on the Web, and of course eBay has become a tremendous source for just about anything you need to put a really crazy, wonderful brewery together.

Randy Mosher is a veteran homebrewer and equipment builder. He is the author of *The Brewers Companion* and creator of "Dr. Bob Technical's Amazing Wheels"—circular calculators for brewing recipe formulation. The Buckapound Brewery resides in his basement in the Roger's Park neighborhood of Chicago.



COPPER BREW KETTLE

Work has begun on a traditional style copper domed brew kettle.

CLEANING UNIT

A very dedicated cleaning unit was fabricated from a half-barrel and a powerful gear pump. Three-way valves allow fresh water in, recirculation and waste water pumped to drain. Water sprays up through the center. A timer allows vessels to be cleaned for up to 15 minutes with automatic shutoff. Cone in center holds carboys and other narrow-necked vessels, but removes easily to allow cornies to fit comfortably. A hose can be connected to the sprayer to clean-in-place vessels too large to invert. A filter just ahead of the pump keeps chunks out of the works.

HOP BACK

Made from a soda carbonator tank, and completely lined with a fine perforated screen, the hop back can be charged with hops or simply used to filter hops and trub from the brew. A ball-lock fitting allows a vent line to be attached, which prevents gurgling.

AERATOR/ OXYGENATOR

An inline wort aerator/oxygenator was built from sanitary fittings plus a sintered stainless airstone.

CONE-BOTTOM FERMENTER

Cone-bottom fermenter was made from a stainless milk can, with additional sheet metal added to increase the height. A corny hatch on top provides access for cleaning. Sanitary fittings are used for the drain as well as the pressure gauge.

SAMPLE CHILLER

This industrial sample chiller contains 50 feet of stainless tubing and is very efficient!