FOR THE HOMEBREWER AND BEER LOVER

Zymurgy

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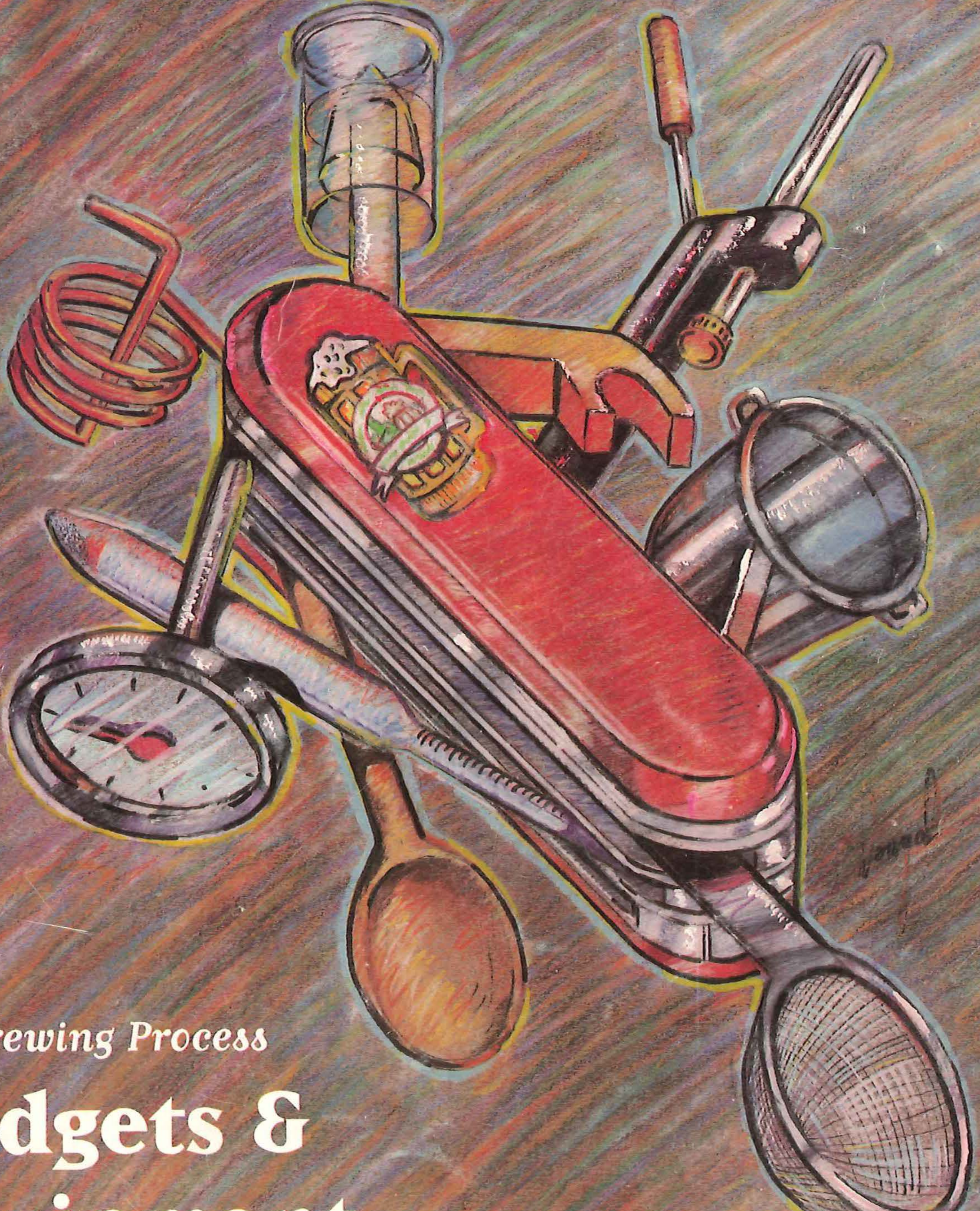
SPECIAL ISSUE



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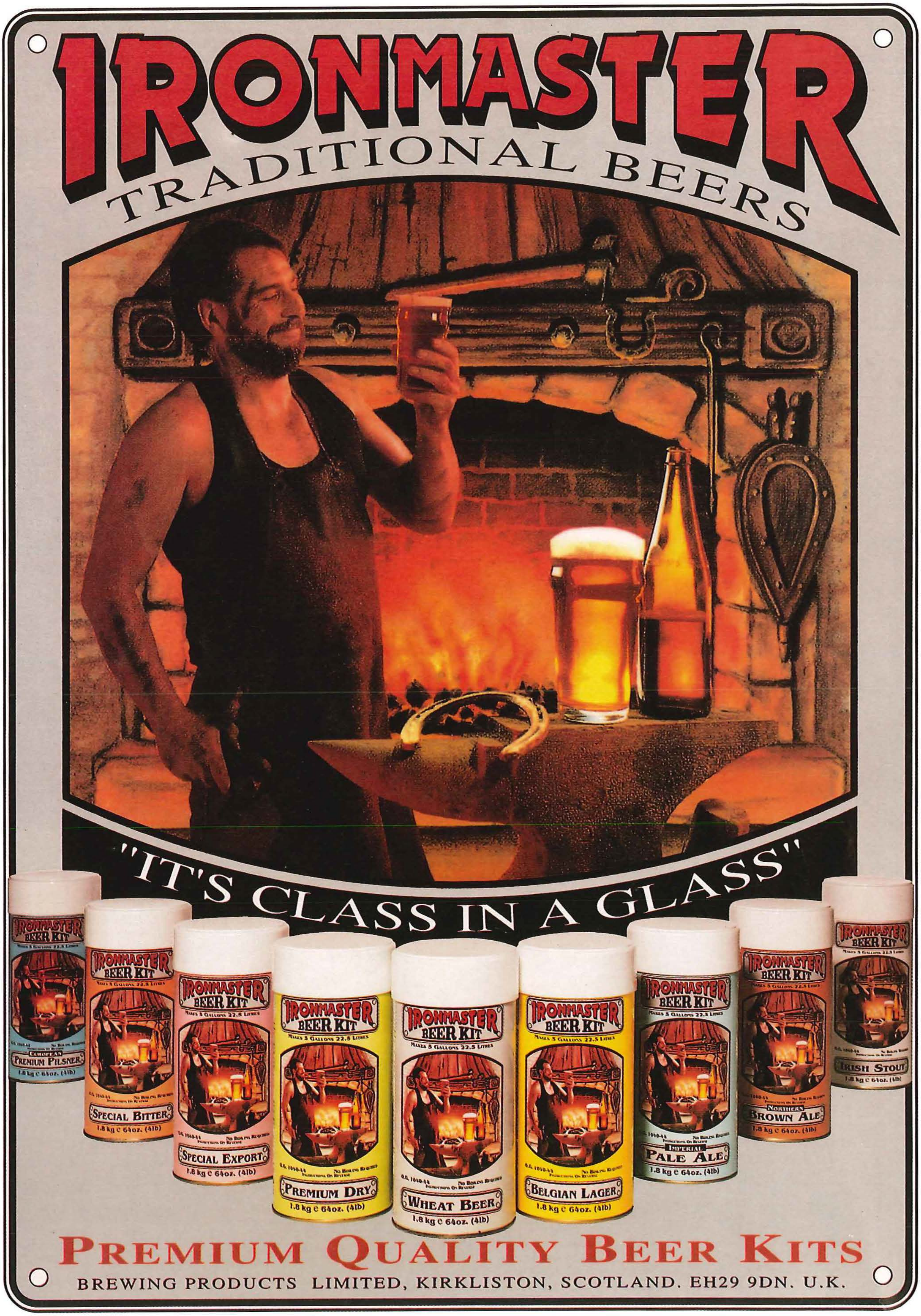
Gadgets & Equipment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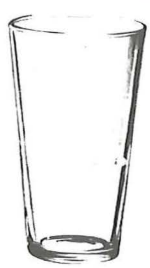

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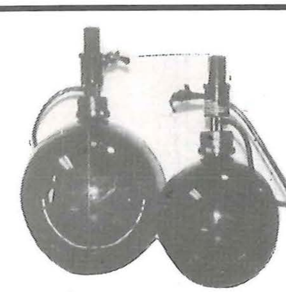

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THE AMERICAN HOMEBREWERS ASSOCIATION MISSION STATEMENT

To promote public awareness and appreciation of the quality and variety of beer through education, research and the collection and dissemination of information; to serve as a forum for the technological and cross-cultural aspects of the art of brewing; and to encourage responsible use of beer as an alcohol-containing beverage.

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CHARLIE PAPAZIAN

Theme and Variations

IT'S ABOUT GADGETS, kind of. But it's really about ingredients, brewing, fermenting, bottling, kegging, sanitizing, equipment; it's about the beermaking process. It's about simplicity and contrivance. It's about homebrewing. Great Caesar's ghost, it is about homebrewing!

Borrowing from Steve Cassleman's excellent article on "good stuff," I was thinking out loud, "Hey, this is good stuff. This is great stuff."

After clearing my boggled mind, this was my immediate reaction upon first reading the manuscripts submitted for this year's ***zymurgy*** Special Issue. "Great stuff." Elizabeth Gold, our editor-in-chief, smiled and calmly agreed (not hiding her excitement at all), "I know."

And something really crazy about these pages so crammed with innovative gadgets and creative processing is that we're only scratching the surface. That's right. I've been involved in this hobby too long to think for one moment that "Here it is folks, the state-of-the-art, be all, end all, for all time great stuff." No, for every ingenious idea presented in these pages there are a hundred more variations on a theme. That's one of the pleasures of homebrewing; knowing that the ideas and gadgets you contrive will be as valuable and innovative as any other homebrewers', be they beginner, intermediate or advanced.

This year's Special Issue deals with a few things. It's about great homebrew, of course. And improving it by examining how we use ingredients, fashion equipment, fool around with the process, ferment and package our homebrew. It's about extending our pleasure of brewing, be it simple or fantastic. And perhaps most important, this year's Special Issue is about having fun.

How many other hobbies present so many creative options? How many are so rewarding? How many inspire such comaraderie and sharing of knowledge and, of course, opinions?

I don't believe homebrewing in all its diversity has ever been presented by such a compendium of writers and diversity of experience. For almost a year, the American Homebrewers Association and ***zymurgy*** staff have been greatly anticipating what you now hold in your hands. ***zymurgy*** Editor-in-Chief Elizabeth Gold and Editorial Assistant Dena Nishek have somehow outdone themselves once again in managing to compile the thoughts of 30 writers and present them so succinctly in this Special Issue.

And, of course, a special thank you is deserved by all those homebrewers who have contributed ideas and writings. They are the heart and soul of this issue. I'll toast them with a great beer many times over as I engross myself in these special pages of ***zymurgy***. I hope they appreciate, as I do, how many great glasses of homebrew will spring forth from these pages. Thank you Maribeth, Sam, Phil, David, Ed, James, Dan, Rodney, Stephen, Kinney, Steve, Jim, Thom, Russ, Wayne, Randy, Byron, Chuck, Teri, George, Russ, Steve, Tom, Phil, Glen, Tom, Susanne, Larry, Paul and Jim.

Chapter 1

Equipment Utilization

RANDY MOSHER

Working with Brewery Materials

THERE COMES A time for many homebrewers when the basic starter equipment kit just doesn't make it any more.

The mysterious urgings of the brewer's art send many of us scurrying from junkyard to laboratory supply shops in search of pieces to build the perfect homebrewery—some dusty but beautiful stainless-steel vessels, bits of tubing, valves, screen and the like. At some point during this quest the aspiring brewery engineer is faced with the intimidating problem of how to put it all together.

Brew-friendly materials often are somewhat hostile to deal with. The ingredients that give stainless steel its impervious durability make it resistant to efforts to shape and join it. And what works for one material is often a disaster for another. In the case of brewery materials, a little knowledge and a few proper tools can mean the difference between a shiny new brewery and a pile of expensive junk on the basement floor.

So here's a summary of the most important knowledge I've gained in the construction of my stainless steel, electrically heated, stirred mash, vacuum-gauged lauter-tun, dual gas-fired kettle, parti-gyle brewing system. (Parti-gyle by the way, is beer that has the first, second and possibly third runnings boiled and brewed separately.)

Stainless Steel

This is the best material for almost everything. It is good for every stage of the brewing process from mashing to lagering. Stainless steel is resistant to all chemicals used in brewing and cleaning, with the caution that extended contact with chlorine-based cleaners will cause corrosion. Stainless steel is a poor but adequate heat conductor for most brewing purposes.

Unfortunately, stainless steel is very expensive when new, and it often is difficult to obtain exactly what you're looking for. This requires some ingenuity and perseverance on your part, but it's out there if you know where to look.

It's an unfriendly material for the craftsman. Without the proper tools and methods, attempting to work with stainless steel can be nothing less than a nightmare. But this need not be so.

Stainless steel is very hard stuff and when it gets hot it gets even harder. This is a key point and is the reason for the smoking drill bits and melting saber saw blades you may have encountered when trying to cut or drill the stuff. *Always wear safety goggles when working with stainless steel.*

For drilling holes the secret weapon is a cobalt drill bit. They cost more than regular bits, but they're virtually indestructible. Any large hardware store should have them. Carbide bits may be tempting, but generally don't have the proper sharpness or geometry to drill stainless steel. However, a tungsten carbide rotary file or burr is a useful tool to chuck into your drill to clean up rough-edged holes and saw cuts.

If you're tapping (threading) stainless, get the most expensive taps you can find—high-speed steel, at least—and be very careful. It's very easy to break off a small tap in the process of trying to thread a hole. A good lubricant is essential. It's also important to back the tap out frequently to keep the hole clear of chips. If you're doing a lot of tapping, it might be worth finding taps specially made to cope with stainless steel, but you won't find them at the hardware store.

With stainless-steel sheet metal, most pieces you need to work with are too tough to cut with tin snips and must be cut with a hacksaw or saber saw. Of course, this is true of beer kegs as well. Use a type of blade called a bimetal blade, which has

MATERIAL	ASPECT/STAGE OF BREWING PROCESS THE MATERIAL IS BEST SUITED FOR	RESISTANCE TO CLEANING MATERIALS; ESP. ALKALIES	COMMENTS AND CAUTIONS
Stainless Steel	all	no extended contact with chlorine-based chemicals	poor but adequate heat conductor; have fermentation vessel joints heliarc welded by a professional who can make sanitary welds
Copper	boiling kettle or other hot aspects of brewing process	easily damaged by alkaline materials (chlorine, lye)	excellent heat conductor; not a good material for cooling or fermenting; have joints brazed
Brass and Bronze	pipe or tube fittings and valves; screen and perforated sheets	easily damaged by alkaline materials (chlorine, lye), resists acid	alloys of copper: brass with zinc, bronze with tin and other materials; conducts heat well
Aluminum	heating water for strike and sparge	corrodes violently with alkalies; resistant to acids	excellent heat conductor
Iron and Steel	good for stands, carts, stove bases, etc.; avoid contact with wort or beer; unsuitable for brewing	n/a	sources of bad flavor; haze formers
Glass	ideal for fermentation; only laboratory glass is suitable for boiling vessels	limit soaking time in lye; resistant to cleaning and sterilizing materials	non-laboratory glass is thermally sensitive and not suitable for heating
Polyethylene	water treatment and storage; mashing; sparging and wort collection; not recommended for fermentation	resistant to cleaning and sterilizing materials but will develop scratches that can harbor bacteria	not heat resistant
Nylon	lautering, sparging; nylon fabric for grain or hop bags	impervious to most solvents and cleaners	does not glue well; safe for food
Plexiglas™	electronic equipment, panels, racks, etc.; not for brewing vessels per se	resistant to cleaning materials	glues well; somewhat brittle
PVC	any stage where hoses are handy	resistant to cleaning materials	*must* be food grade; softens when hot
Solder	avoid contact with wort or beer	n/a	a tin and lead mixture; toxic to yeast; haze former; avoid even lead-free solders

very hard cutting edges. A variable-speed saber or reciprocal saw is the best choice. Watch the speed carefully because the blade can get red hot trying to chew through the stuff and will dull or melt rapidly. Carbide grit blades work pretty well, too, and are the blade of choice with a single-speed saw.

Some people use a spray bottle filled with water to cool down the metal in front of the cut. This works well, but observe the normal precautions that apply whenever electricity and water are in danger of mixing.

Stainless steel requires an exotic and expensive welding process as well. Heliarc welding uses an inert gas to prevent oxidation of the weld. Before you take your job to the welder, make sure he or she has heliarc capability. If the fitting to be welded is for a fermenter, make sure the welder has adequate knowledge of sanitary welding and fabrication techniques or you could end up with welds that cannot be effectively cleaned. Do not be tempted to cut corners on fermenters.

Brazing uses special copper alloys as a kind of high-temperature solder, but is not as strong and corrosion-resistant as welding. It is suitable for affixing a pipe fitting to the bottom of your boiling kettle, which is the thing you'll be most likely to need. Brazing material can be obtained more readily, but make sure it is compatible with food and drink and doesn't contain any heavy metals.

There are two types of stainless steel commonly used for industrial process equipment, 304 and 316. The latter is the higher-grade material with extra manganese for better resistance to corrosion. Oddly enough, 304 actually has better (but not perfect) resistance to chlorine, but either type is perfectly fine for any imaginable homebrew purpose.

Copper

This is the traditional material for boiling kettle construction because of its excellent heat conduction. It is highly resistant to acids, but easily damaged by contact with alkaline materials such as chlorine cleaner and lye. Copper is suitable for anything on the hot side of the brewery, but is less serviceable for fermentation and cooling because it reacts with the common materials used in cleaning and sterilizing.

Copper is very easy to work with, and with the proper brazing material, may be brazed together. (Be careful with solder; it is harmful to yeast.)

Because of extremely good heat conduction, copper is a perfect material for heat exchangers and heat sinks. A thick strip attached to an electric element such as a Bruheat, can dissipate the heat and greatly reduce the amount of charring of mash that occurs with the bare element.

Brass and Bronze

These similar materials, brass and bronze, are alloys of copper, brass with zinc and bronze with tin or other materials. They are most often encountered as pipe and tube fittings, valves, etc. All the precautions about the corrodibility of copper apply to these metals, too.

Aluminum

Aluminum is cheap, available and an excellent conductor of heat. It might be passable as boiling kettle material, but is not recommended because of its reactivity. Aluminum corrodes violently on contact with alkalies such as chlorine cleaner and lye, but is resistant to acids. It is OK for heating water (for strike and sparge) but not really acceptable for any other use.

Solder

Watch out—solder is a mix of tin and lead, both toxic to yeast and powerful haze formers as well. Don't use tin or lead for anything that comes in contact with wort or beer. Lead-free solder is less toxic, but is mostly tin, which may be leached out by the acidic wort or beer. So-called "silver" solder is mostly tin, too. Avoid solder if you can.

Iron/Steel

These are sources of bad flavor and are significant haze formers. Don't allow iron or steel to come in contact with wort or beer. Enamel canning kettles are steel underneath, so if they're chipped they're capable of contaminating your beer.

Glass

Glass is inert and inexpensive; in many respects it's an ideal material for fermentation vessels such as carboys. It is resistant to all cleaning and sterilizing materials you would ever use. The one caution is that glass will become etched from long contact with strong caustic solutions (lye), so it's best to limit the soaking time if you're using that cleaning material. Thermal sensitivity makes glass boiling vessels out of the question. The exception is laboratory glassware, which is made from borosilicate glass (Pyrex, Kimax). This special glass is highly resistant to thermal shock and therefore suitable for contact with open flame, and is the kind used for laboratory vessels and cookware. Its extreme brittleness makes glass difficult to cut and drill. Special tungsten carbide drill bits are available that work pretty well, should you have some mysterious reason for needing a hole in a carboy or other glass item. Always wear safety glasses when working with glass. Also be aware that water cracks hot dry glass, even pyrex, and glass holds heat extremely well, so be careful when touching what appears to be a cool piece of glass—you can get burned.

Polyethylene and Other Plastics

Polyethylene is inexpensive and abundant. Of course, it is not at all heat resistant, but it's fine for water treatment and storage, mashing, sparging and wort-collection vessels. High density or linear is the premium grade—it's harder, tougher and stands up to heat better than the garden variety. Often used for primary fermenters, (never age your beer in this), polyethylene is highly resistant to all common cleaning and sterilizing materials. But after some use it will develop minute scratches that can provide a safe haven for contaminating microbes. White kitchen trash can bags fresh from the box are relatively sterile and may be used as liners for primary fermenters.

Other useful plastics include acrylic (Plexiglas), which is good for fabricating many useful brewery items. It is stiff but somewhat brittle, easily cut and can be glued together with special cement. Metal-cutting blades in a saber saw cut it well; special drill bits are advised to avoid cracking. Nylon often is used in industrial applications because it is stiff, machinable, safe for food and impervious to most solvents and cleaners. It comes in sheets of various thicknesses. Nylon does not glue well.

Flexible tubing is an essential brewery material. Most is PVC (polyvinyl chloride). It is very important for this to be food-grade material, which is more expensive and sometimes more difficult to find at the hardware store. Lower grades can leach toxic vinyl chloride into your beer, a very hazardous situation. If it is not specified as food grade, it probably isn't. Tubing of other materials such as polyethylene and silicone are useful as well and sometimes show up at the industrial surplus stores.

Pipe and Fittings

Now that you have lots of large, well-constructed vessels you'll need some way of connecting them. Most homebrewing connections can be made with one-quarter-inch or three-eighths-inch tubing or pipe. The quantities of liquid or gas involved don't really justify anything larger. Because the terminology can be confusing, I'll define the various systems in use:

NPT is the standard American rigid plumbing pipe and fitting. The threads are tapered so they tighten as they are screwed into one another. The size of these pipes and fittings is measured by the inside diameter of the pipe, so that:

NPT pipe	Inside diameter	Outside diameter
1/8 inch •	1/8 inch	3/8 inch
1/4 inch •	1/4 inch	1/2 inch
3/8 inch •	3/8 inch	5/8 inch
1/2 inch •	1/2 inch	3/4 inch
3/4 inch •	3/4 inch	1 inch

Iron and sometimes brass NPT pipe and fittings are available at hardware and plumbing supply shops. The iron ones are suitable only for tap water supplies because the more acidic wort or even treated water will leach away the iron and give your beer a metallic taste and possibly some haze. Brass fittings are quite acceptable because copper and zinc in small quantities actually are valuable yeast nutrients, as well as being acid-tolerant metals. Stainless-steel NPT fittings are available from industrial sources at five to 10 times the cost of the brass variety! Or from your local junkyard, if you're lucky enough to find what you need, for a buck a pound.

Most of the commonly available valves have NPT fittings, which makes NPT the valve of choice for the majority of homebrew tasks.

But because of the deep (and therefor uncleanable) threads on NPT fittings, they are not suitable for use on fermenting vessels or anything that comes in contact with chilled wort or fermenting beer.

Compression fittings and tubes have certain advantages over the NPT system. They have a threaded nut that tightens over a tapered ring which fits snugly over the tube, squeezing it tight and making a watertight seal as the nut is tightened down. They are much more practical for fittings that must be changed frequently, such as pump inputs and outputs, because they tighten with just a fraction of a turn past finger-tight.

Two formats are available: the garden-variety brass fittings from your local hardware store and the heavier-duty industrial ones from the usual expensive industrial sources or surplus outlets. Unfortunately, the two systems are not interchangeable. The industrial variety is available in stainless as well as brass. Because of the lack of internal threads, compression fittings are more suitable for items that may contact chilled wort or fermenting beer.

Flexible copper tubing works well with these fittings, as does stainless steel. You can mix and match.

Fittings that go from compression to NPT to compression are readily available, so you can use NPT valves with compression fittings.

Compression fittings are measured by the outside diameter of the tubing that they fit.

Quick-disconnect fittings are very useful for brewing setups, and are available in a variety of sizes and types. One of the most useful is the kind designed for garden hoses. These make it very simple to hook up your wort chillers and such items as carboy washers. The smaller-diameter kind normally used for compressed air also work well for transferring hot fluids from water tank to lauter-tun and similar purposes. There also is a type made for CO_2 systems to make it easy to hook up the gas to your draft system.

It is important to standardize as much of your brewing system with the same size and type of fitting as possible. This makes it easy to move hoses from vessel to vessel to pump to whatever, and to accommodate future changes and improvements to your brewery. I think three-eighths-inch compression fittings are the way to go, but if you stumble onto a mother lode of surplus stainless goodies of a different type, go for it.

Plumbing Parts

Valves come in many varieties, but the best all-around type is a ball valve. This has a ball in the middle with a hole drilled through it to which the valve-handle is connected. When the hole lines up with the pipe, liquid flows. When it doesn't, the flow is stopped. Just a quarter of a turn opens it all the way, making it very convenient to use. Hardware stores sell nice brass ones in a variety of sizes. Often they're nickel plated, so they may look like stainless at first. The ball inside usually is stainless. All-stainless steel ones go for $40 and up, unless you scrounge them, so it's easy to tell the difference. Regular faucet type valves work fine for most purposes, but are just a little less convenient than ball valves.

Hose barbs allow you to connect tubing to pipe fittings. They come in brass and plastic to fit various pipe and tubing sizes. With compression fittings you don't need hose barbs because the plastic hose can simply be clamped right over the copper or stainless tubing to serve that purpose.

Industrial Exotica

Since a homebrewery may be thought of as a tiny factory, parts that are used in big factories often work very well for our purposes. If you can find surplus sources there are many useful things out there. Filters, solenoid valves, float switches, flow meters, pumps, thermoregulators, heating elements, pressure regulators and more may often be had for a few cents on the dollar.

Note: Be extremely careful when working with electricity around the brewery; the combination with fluids can be deadly. Use the kind of electrical boxes meant for outdoor use and always be sure the equipment is grounded. The use of a GFCI-protected outlet or extension cord is essential; be sure to test it regularly. Always wear safety goggles when drilling or sawing metal, plastic and glass.

SAM WAMMACK

Available Store-Bought Equipment

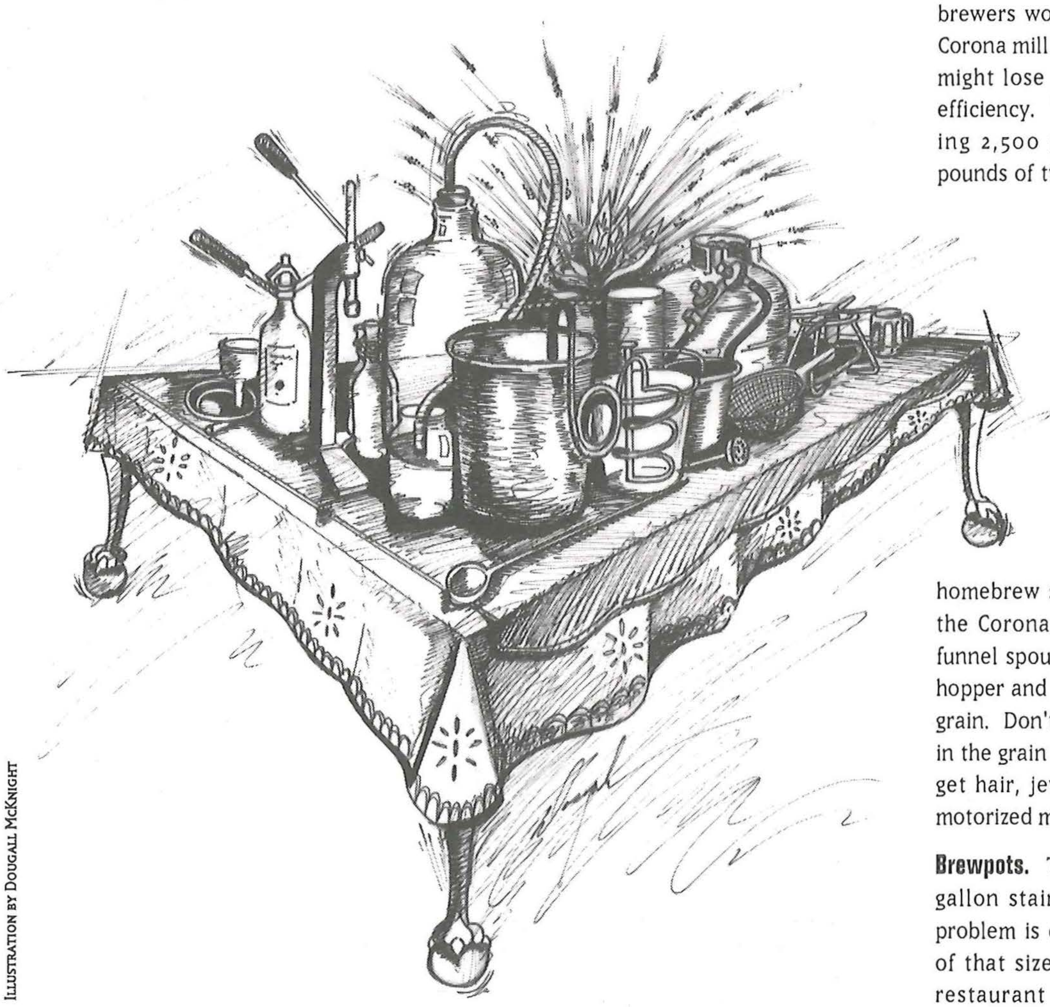


ILLUSTRATION BY DOUGALL MCKNIGHT

THE THING TO remember when you read this or any article on brewing equipment is there are lots of ways to malt a barley. Homebrewers are inventive and we all develop our favorite methods of brewing, fermenting and bottling (or kegging). These are some tips and opinions about how I use equipment, but good beer can be made in lots of different ways. To bring some order to the subject, I have organized all equipment into brewing, fermenting and bottling-kegging.

Brewing Equipment

Grain mills. The standard is the Corona, a hand-cranked mill made in Colombia and carried by most homebrew shops. All-grain brewers who want to crack each kernel without making flour can do it pretty well with the Corona, although a roller mill will do a better job. I think homebrewers worry about this too much. If a Corona mill fails to crack every kernel, you might lose 5 percent of your extraction efficiency. To a commercial brewer making 2,500 gallons of wort with 3,500 pounds of two-row, this means 175 pounds of malted barley. To a homebrewer making five gallons the loss is one-third pound. Just throw in the extra 25 cents worth of grain and don't worry about it.

The Corona mill can be motorized easily with a one-half horsepower electric motor and a couple of belts and pulleys. The standard 12-inch plastic funnel sold by homebrew shops fits just right on top of the Corona hopper. Cut off the narrow funnel spout, set the funnel on top of the hopper and the mill will hold 10 pounds of grain. Don't put anything other than grain in the grain mill and be very careful not to get hair, jewelry or clothing caught in a motorized mill.

Brewpots. The ideal is a seven- or eight-gallon stainless-steel brewpot, but the problem is expense. A new stainless pot of that size will cost close to $200 at a restaurant supply house. A two-quart stainless pot can be found for about $30 at many discount stores, but you can't boil five gallons in it. It's probably best to start with a seven- or eight-gallon porcelain-over-steel pot for about $35. It will get a few dings and the porcelain will chip, so keep looking for a big stainless pot at yard sales. I finally found a seven-gallon stainless pot with handles and a lid for $5.

Don't give in to temptation and invest in aluminum, which is cheap and available but causes a nasty metallic flavor in beer. And remember, five gallons of water weighs about 40 pounds so be careful when lifting.

Cookers. I don't like the electric beer cookers and mash tuns on the market. These are the plastic buckets with a thermostat on the outside and a heating ring on the inside. When used for extract brewing they take forever to come to a boil then caramelize malt extract on the heating ring. When mashing, the water is hot around the ring and progressively cooler toward the top. I have found no way to equalize the temperature for effective mashing.

I do like the outdoor propane cookers specially made for homebrewing. These must be used outdoors because toxic gases will build up indoors. I brew on a 50,000 b.t.u. cooker that brings five gallons of cold water to a boil in 12 minutes. If you can brew outdoors I heartily recommend these—not only for efficiency but for the sake of your kitchen stove. There is only one small drawback. Brewing on the grass last August in Missouri I had to name one batch "Grasshopper Ale." You can imagine why!

Sparge system. New to homebrewing is a simple piece of equipment made for mashing and sparging. It consists of two buckets, tubing, clamps, a rotating sparge sprinkler and a custom-made false bottom. I love this thing! It greatly simplifies all-grain brewing and helps me make great beer. With this system I can make an all-grain brew in about three hours including cleanup.

Scales. A scale is important for weighing specialty grains and hops. There is nothing special about the scales sold by homebrew supply shops—any good postage scale will do the job. Sometimes your other hobbies can help. I use an ammunition reloading scale that weighs powder in grains. At 7,000 grains to an ounce it makes for some mighty accurate hop measurements.

Spoons. You need a good long spoon for homebrewing. I use stainless steel, but there is nothing wrong with a wooden spoon if it is used only in the boil. Don't let a wooden spoon contact your wort after it has been cooled. Wood is porous and there is a good chance it will carry a bacterial infection to your beer.

Thermometers. I like the simple floating glass dairy thermometer, it's easy to read, floats and measures all the way to boiling. There are probe thermometers that read the temperature in seconds but I've never used one. A good thermometer is vital when mashing an all-grain brew, for knowing when to remove specialty grains, monitoring wort chilling and checking the temperature before pitching the yeast.

Grain bags. These little cheesecloth bags are great. They hold up to a pound of specialty grains and save straining the wort later. I use them like a big tea bag. They are good for leaf hops too. I use them about four times before they wear out.

Wort chillers. I feel strongly that there is no substitute for rapid and efficient wort chilling. When done right, this drops out protein trub (which causes chill haze) and minimizes the risk of contamination during the dangerous "lag time" before your yeast starts active fermentation. You really can't float the brewpot in cold water, pack it in ice or use any of the other makeshift cooling methods. To drop the temperature of boiling wort to about 75 degrees in 15 minutes you need a wort chiller.

There are two kinds of wort chillers. The counterflow type runs the hot wort through copper tubing that is surrounded with a hose carrying cold water in the other direction. The advantage is that it cools each individual drop of wort to pitching temperature in seconds The disadvantages are problems of sanitation and siphoning boiling liquid. Because the wort flows through the tubing you have to sanitize about 25 feet of tubing on the inside. Siphoning boiling liquid is destructive to plastic fittings and tubing. Beware of starting a siphon by sucking the hose.

The other kind of wort chiller is the immersion type. A coil of copper tubing is dropped into your boiling brewpot and cold water runs through the tubing while you stir with a thermometer. Sanitation is assured because only the outside of the chiller touches your wort, which is boiling at the start. Just rinse off the dust and spiders and drop it in, no problem. An immersion chiller will drop five gallons of boiling wort to pitching temperature in about 15 minutes. I prefer this type. Handle the hot wort chiller with care to avoid burns.

Wort Aeration. After chilling I use a small pump powered by an electric drill and a piece of three-eighths-inch tubing to blow air through the wort for a few minutes. Yeast needs lots of oxygen in the first stage and bubbling air through cooled wort gets your fermentation off to a good start. These pumps are sold at any hardware store.

Fermenting Equipment

Hydrometers. The standard is the glass triple-scale hydrometer; they are cheap and accurate. You will probably break one occasionally, but I believe they are more accurate than unbreakable plastic hydrometers.

Funnels. If you use a glass carboy as a primary fermenter you need a funnel to pour in the wort from the brewpot. If you didn't cool the wort first, add about two gallons of water to the glass carboy before pouring in the hot wort. The standard eight-inch funnel works well. It has a snap-in strainer that is handy if you have leaf hops or grains adrift in the wort. The 12-inch size works even better if you put the tip in boiling water to soften it then force it into the carboy neck. The plastic will conform and you won't need a second person to hold the funnel while you pour.

Fermenters. Plastic primaries and secondaries, glass primaries and secondaries in three different sizes, even stainless-steel kegs as secondaries—there are so many ways to do this stage. A food-grade plastic primary of either six- or seven-gallon capacity is common for five-gallon batches of beer. All the designs are fine, but make sure the plastic is food grade and the lid seals perfectly so you can use an airlock. The worst beer I ever "trouble shot" for a customer tasted like turpentine. It turned out that the customer had bought a new diaper pail for a primary fermenter. The plastic was not food grade and unknown petroleum compounds had leached into the beer.

It is best not to use plastic five-gallon water bottles. The plastic is porous and tends to harbor bacteria when the bottle is reused. By porous I don't mean it will leak, just that the plastic absorbs beer causing discoloration and odor. It is hard to clean and can be a source of infection. A stopper will not work on these—they take a fairly expensive rubber cap in order to attach an airlock.

I think glass carboys make the best fermenters. A 6 1/2- or seven-gallon carboy makes a great primary. Tape a piece of paper on the outside at the five-gallon mark. There is plenty of room for primary kraeusen (foam) without it going over the top. The five-gallon glass carboy is the standard secondary fermenter. A five-gallon carboy also can be used as a primary if you use the blowoff method. Beware of a foamy fermentation that causes your airlock to overflow. While the airlock is full of foam there is a continuous liquid path between the outside air and your beer and contamination will occur quickly. Three-gallon glass carboys are handy for making half batches (2 1/2 gallons) that will produce one case of beer.

I often use five-gallon stainless-steel soda syrup kegs as secondary fermenters. These are especially good for cold lagering because four of them will fit in my refrigerator. Just unscrew the outflow connection, remove the pickup tube and use fittings from the hardware store to attach a short piece of three-eighths-inch copper tubing. Plastic tubing and an airlock will fit on that.

Brushes and bottle washers. If you are using a carboy you need a carboy brush. This is long-handled brush made with a bend in the shaft to reach the bottom and under the shoulder. If you are reclaiming dirty beer bottles you need a bottle brush. If bottles are kept clean you can usually rely on soaking them and blasting them out with a spray-type bottle washer that attaches to a faucet.

Airlocks. Often called fermentation locks, airlocks are vital because there is no place in modern homebrewing for open fermentation. Several different airlock designs all do the same job. Like any plastic parts used in brewing, they should be replaced every so often. I usually fill airlocks with vodka instead of water because bacteria won't grow in vodka and if it burps backward into the beer it "enhances" my beer instead of contaminating it.

Racking tubes. I like the curved 30-inch kind with the removable tip. These are now available in clear plastic, which I like better because they are harder and less flexible than the white ones.

Carboy handles. These clamp on the neck of a glass carboy. Dropping a 50-pound bottle of liquid is scary and dangerous, not to mention expensive. For safety reasons never rely on these 100 percent—use them as an aid to lifting and carrying because they sometimes slip off.

Tubing. Three-eighths-inch plastic is standard. Be sure it is food grade, sanitized carefully and replaced frequently. Reused tubing is a common source of bacterial contamination.

Bottling-Kegging Equipment

Tubing clamp. This cheap little plastic clamp is handy. I use one just above my bottle filler that allows me to lay the bottle filler down without the beer leaking.

Bottle fillers. These are important when bottling because they fill the bottle from the bottom and help prevent oxidation. The common types are plastic with a spring-loaded valve on the bottom. The better and more expensive type is made of two machined pieces of brass tubing with no springs. I use the brass one and believe it does a better job. The brass filler displaces less liquid and leaves less head space.

Cappers. The model you should get depends on how much brewing you plan to do. An economy double-lever type is fine for the occasional brewer. If you are going to be capping a lot of bottles, the investment in a good bench capper will be worthwhile. Often a group of friends or a homebrew club will chip in and get a good bench capper to share. It does a uniformly good job and is easier.

Caps. Quit boiling those caps! A lot of homebrew articles say bottle caps should be boiled before use. That was great in the days of cork inserts (remember those?). With modern caps boiling will, as often as not, make the liners come out. I just soak caps in the standard sanitizing solution (one tablespoon of bleach to a gallon of water) and let them air dry.

Kegs. Some people won't agree with me, but the only kegging systems I like are based on five-gallon stainless-steel soda syrup kegs. I've never used new systems based on plastic "beer balls." In my experience the various systems involving plastic kegs and small pellet gun CO_2 cartridges produce poor results. [For information on beer ball tapping systems, see Reviews in *zymurgy* Fall 1991 (Vol. 14, No. 3).]

Bottle trees. There are two standard models holding 45 or 90 bottles each. These are easy to make. Just have a bunch of dowels sticking up out of something. Once your bottles are cleaned, sanitized and waiting to be filled they should be stacked upside down. It is a law of nature that bacteria-laden dust particles fall down rather than up.

Maybe some of these tips will help you develop your own system of brewing and using equipment. My procedure keeps evolving and I always like to learn new things that help me make good beer.

STEVE CASSELMAN

Getting the Equipment You Need:

How to Find Good Stuff

Comedian George Carlin has a bit where he states: "One person's stuff is another person's junk."

ILLUSTRATION BY MATT BROWNSON

Every homebrewer knows his or her stuff is stuff and every homebrewer's spouse knows it's just junk. This is an article on how to find good stuff.

First Some Definitions:

Stuff: Anything that can be used for homebrewing.

Junk: Everything else you thought could be used for homebrewing, but can't.

Free: The price you pay for someone else's junk (may include transportation costs such as truck rental and homebrew—ain't nothin' free).

Score: This is when a homebrewer's spouse pays you to take away the homebrew stuff (usually when the homebrewer is out of town).

Wholesale: The highest price some homebrewers will pay for anything.

Retail: The least-used word in a homebrewer's vocabulary.

Free labor: The number of homebrews it takes to get junk transformed into stuff.

Auctions are where I've found most of my really good stuff. With the way things are in the economy people are going out of business all over. You wouldn't believe how much stainless steel is used in a donut shop and how often those places go out of business. There are two types of auctions, closed and opened. A closed auction (otherwise known as a sealed bid auction) usually is held by a company trying to get rid of surplus equipment. Most of these auctions are held by government contractors. The items can be in good shape because the companies are selling off equipment that has gone through a tax depreciation cycle. This raises the overhead rates they can charge the government and therefore has nothing to do with the shape of the equipment. Look for these auctions in the Commerce Business Daily, found in most big libraries. But the best way is to pick up the phone book and look for General Dynamics or Hughes or any of the large government contractors spread across the country and call to ask if they have a surplus department and to be added to the list for surplus sales. In these auctions you walk around all the junk looking for stuff and when you find it, you write down a bid and place it in an envelope. A few days later they open all the bids and if you are the highest bidder you have new stuff!

By far the most exciting auctions are the open auctions. These are where you are given a paddle with a number on it and you actively bid against other people. You can find out about these auctions by looking in the classified section of your local paper. I have obtained things like glassware, a magnetic stir plate, pumps, test-tube holders, water deionizer, microscope and all sorts of stuff at about 10 cents on the dollar, which is about all you want to bid for most stuff. Don't get suckered in and buy something for 90 percent of the new price because at all auctions it is stated "as is, where is," meaning if it doesn't work, tough.

Some important hints to follow at auctions include:

If there is more than one item of what you want to bid on don't bid on the first, they almost always go for more. Bring a friend and when they get to the item you want to bid on have your friend yell out, "That thing is a piece of junk!" If you bring a friend don't bring beer—I still have a chicken cooker I bought when I thought I was bidding on something else.

Don't bid against yourself. This may sound stupid and it is, but it happens all the time.

And finally, only bid on stuff you want because if you don't want it and nobody bids after you, you got yourself some new junk.

Another great place to get equipment is at your local university—most have a place for used equipment. For example, I got a \$2,000 stainless-steel incubator for \$100. It was there because it was a CO_2 type that needs two regulators and one didn't work! I got the incubator and a working regulator for the price of the regulator! Sometimes labs just throw out equipment because it's not state-of-the-art. My future wife, who used to work at the University of California at Los Angeles, found a spectrophotometer in the trash. All that was wrong with it was a loose knob (the allen wrench to tighten it was under the thing). To find out about university surplus call your local university and ask for, what else, university surplus.

Surplus shops are all over and can be found in the Yellow Pages. Some are nice and organized and some look like junk-yards. The best values are in the junkyard type. I found 10 soda kegs for $10 each at a place called Apex Electronics. They had a pile 20 feet high and must have had 2,000 kegs.

Bribery, the sincerest form of flattery, also is known as the barter system. Homebrewed beers have an intrinsic price not often realized by the good-hearted homebrewer. Need some junk turned into stuff? People skilled in the art of metalworking often have an innate love of beer. I've seen plenty of fine work done on a 15-gallon keg turned brewpot that only cost a sixpack or two of homebrew.

Retail avoidance is one of the basic traits that drives a homebrewer to the craft in the first place. Usually a behavior of last resort, purchasing retail can be justified only if one has read enough catalogs to know that what you're buying is a good deal. Take pH meters, for example. I got mine from Cole-Parmer for about $55, it is temperature compensated and works like a champ. Following is a list of places you can call for free catalogs.

Free Information:

Abbott Laboratories, 1401 Sheridan Rd., North Chicago, IL 60064, (800) 323-9065.

Beckman Instruments Inc., 2500 Harbor Blvd., Fullerton, CA 92634, (800) 742-2345.

Cole-Parmer Instrument Co., 7425 N. Oak Park Ave., Chicago, IL 60648, (800) 323-4340.

Difco Laboratories, PO Box 1058, Detroit, MI 48232, (300) 521-0851.

Millpore Corp., 80 Ashby Rd., Bedford, MA 01730, (300) 225-1380.

The Perkin-Elmer Corp., 716 Main Ave., Norwalk, CT 06859, (300) 762-4000.

Sigma Chemical Co., PO Box 14508, St. Louis, MO 63178, (800) 325-3010.

Signet Laboratories Inc., 180 Rustcraft Rd., Dedham, MA 02026, (800) 223-0796.

Just one final word. An underground club has been formed as a sort of homebrewers science club, called the Chaotic Society. If you're interested send a letter to the Chaotic Society, 1604 W. Lunt, Chicago, IL 60626 and we will chaotically get back to you!

RANDY MOSHER

On the Surplus Trail

THERE IS A treasure-trove of high-tech goodies out there just waiting for you to discover.

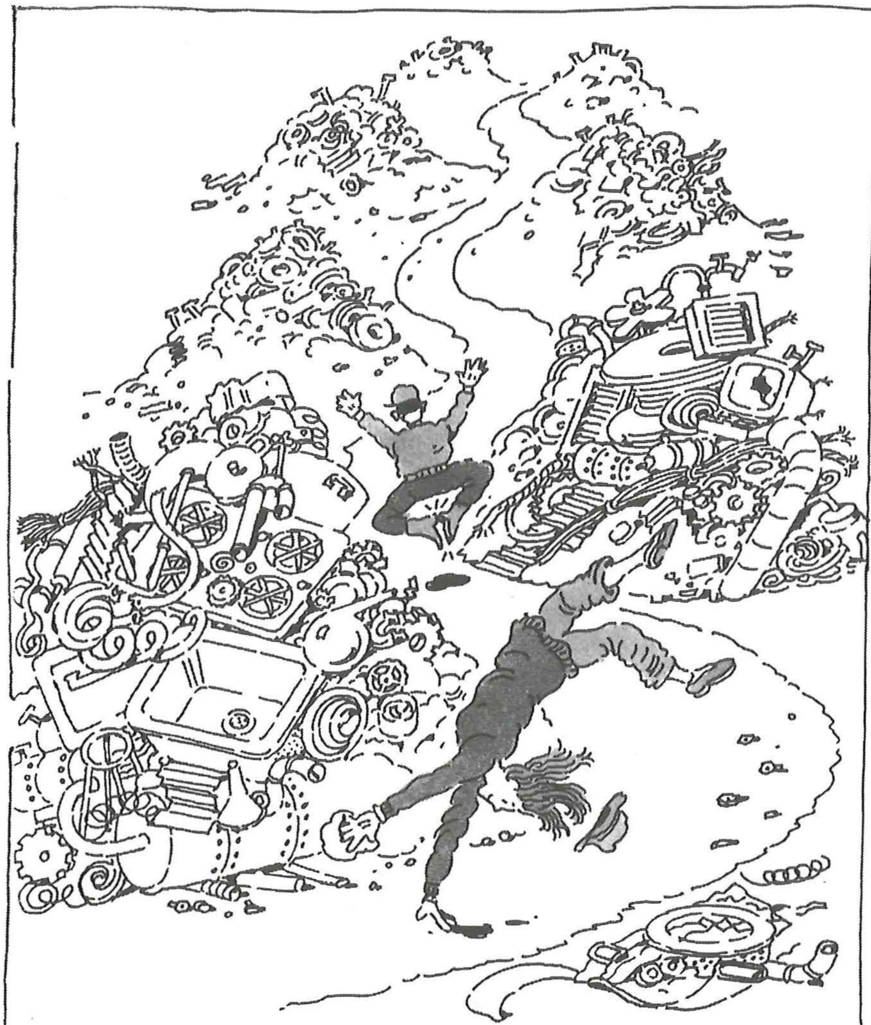


ILLUSTRATION BY BILL KASTAN / NO COAST GRAPHICS

As corporate America upgrades, shuts down, rebuilds and replaces, it tosses off vast quantities of used but otherwise perfectly fine parts and materials. Let's face it, folks, stainless steel is very durable stuff, it's not going to simply melt away.

Every city of any size will doubtless have one or more of these types of surplus equipment outlets available to you. The Yellow Pages are your best bet. Generally, the type of surplus available matches the industry in that area. If you're looking for junk near an aircraft plant, you're likely to find aerospace junk.

Most of this material is useful to the more advanced brewer who is scaling-up to a 10-gallon or larger system, but there are plenty of items useful to all serious brewers. Knowing what to look for is important, but the general rule is if it's cool, stainless steel and cheap, buy first and ask questions later.

Do be careful to avoid leaded metals and make sure whatever you scrounge is free of oil, grease and gasoline or can be thoroughly cleaned. It is a good idea to have any technical equipment safety checked.

The industrial surplus and salvage category is the first place to look. You'll always find things like motors, relays, electrical parts, nuts, bolts, casters, gears and other ubiquitous items. If you get lucky you might stumble on stainless-steel valves, pumps, filter housings and other invaluable components.

Electrical surplus may offer much more than just electrical parts. There is one in southern California that has a mountain of used Cornelius tanks, for example. And of course, what's a modern brewery without switches, motors, pumps and remote temperature measurement—all electrical parts. Look for them in both electronics and surplus categories of the Yellow Pages.

When searching scrapyards the important thing is to find one that has high-class stuff. Generally they list their specialties in Yellow Pages ads. What you want is one that specializes in non-ferrous metals and if you can find one that specializes in exotic metals, so much the better. If you're looking for castoffs from one particular factory, you can even call that plant and ask who buys their scrap.

Expect to find chunks, strips, bars, rod, sheet and tubing of various metals, at least. Sometimes you can find tanks and other vessels as well. Perforated sheet metal and screen wire can sometimes be found. I find it useful to take a set of tools with me—wrenches, pliers, screwdrivers, etc., to remove parts and fittings from big hunks of wreckage. Be sure to wear old clothes, sturdy shoes and carry a rag with you, as there is no dirt quite as filthy as junkyard dirt.

Check the university surplus outlets. Scientists like to have the very newest and best laboratory equipment, so there are a lot of perfectly workable, but not state-of-the-art, instruments that need to be disposed of. You can find pH measurement equipment, spectrophotometers, microscopes, incubators and a host of other lab equipment at these outlets. Check with the university for location and hours.

Corporate surplus outlets are the same idea as university outlets, but specialize according to the industry. Drug companies, for example, cast off very expensive pilot fermentation plants rather than do the extensive work required to recertify them to FDA standards.

You never know what will show up at flea and antique markets. I once turned down a whole box of specific ion probes for an ion meter at a giveaway price, thinking "Where on earth will I ever find an ion meter?" Later, of course, I found the meter for 20 bucks, but by then the probes were long gone. All kinds of useful lab stuff shows up and beverage-handling equipment is quite common. Old beer taps can be found at flea and antique markets, as can old grocery-store scales that are useful for weighing grains.

Used material shops are a step up from scrapyards. They have done the picking for you and generally offer neat pieces of sheet, tube, bar, plate, rod, perforated sheet metal and screen, plus other goodies like brass and stainless-steel nuts, bolts and more. They are sometimes listed under building material, used.

What do drug dealers use that homebrewers need? Scales! Police and sheriff's auctions of seized contraband usually are chockablock with expensive laboratory balances, perfect for weighing hops. You may have to buy a few at a time, so it's a good idea to get several people together before you go.

More than a few microbreweries have been started with tanks and other equipment from used process equipment dealers. Most of the equipment is a little large for homebrewers, but we can dream, can't we?

Stoves, sinks, pots, tanks, kettles and other useful items can be had for prices considerably lower than full retail from used restaurant equipment dealers.

Much of the stuff listed above has passed through an auction before you get to it. Check your local newspaper for current auction listings. Restaurants, dairies, laboratories, food-processing plants and other kinds of places are always biting the dirt and ending up in liquidation.

Many laboratory and science supply houses are for industrial customers only, but most cities have one that will sell over the counter. You'll pay full retail, which will be a shock if you've been shopping the surplus joints. Sometimes you just need that one little part to put something together and then it's worth it. Laboratory supply houses are a good source of chemical flasks, chemicals, filter paper, pipettes and other yeast-culturing supplies, all of which are reasonably priced in any event. Be sure whatever you buy is free of radioactivity, viruses or any other dangerous substances.

So there you have it. Combine this with the ability to put it all together and you can have a world-class brewery for $19.95, or slightly higher in some states, batteries not included.

BYRON BURCH

Stalking the Wild Cold Box

OVER THE YEARS, a lot of the advances in my own homebrewing have started with suggestions made by customers. Discussions over the counter have taught me everything from better methods of handling raw materials to clever little ways of saving a few minutes in the process.

One significant improvement originated a bit differently. A few years ago, a winemaking customer came in and asked if he could put up a note on our bulletin board. He had been cold-stabilizing wine in his home-built cold box for several years, but he had outgrown the box, built a bigger unit and wanted to sell the old one. He described it, and the price was reasonable, so we told him he couldn't put up his note. We wrote him a check for the box instead.

Prior to bottling, our wines and meads go through most of their processing in an uninsulated shed, and around Santa Rosa, Calif., that seems to cold-stabilize wine just fine in a normal year. I wanted the box for cold homebrew storage and had been thinking about building one for some time.

Summertime temperatures may be more than 100 degrees for several days in a row, and I've actually seen the 110 mark reached on rare occasions. The idea of standing over a brew kettle comes in a distant second to lounging in a pool. If you can arrange to do most of your brewing during the other three seasons of the year, your appreciation of the hobby's finer points tends to be maintained at a somewhat higher level.

The problem with confining your brewing to the three coolest seasons of the year, of course, is that the same warm temperatures that are hard on the brewer are murderously hard on beer in storage. Someone in the brewing industry once

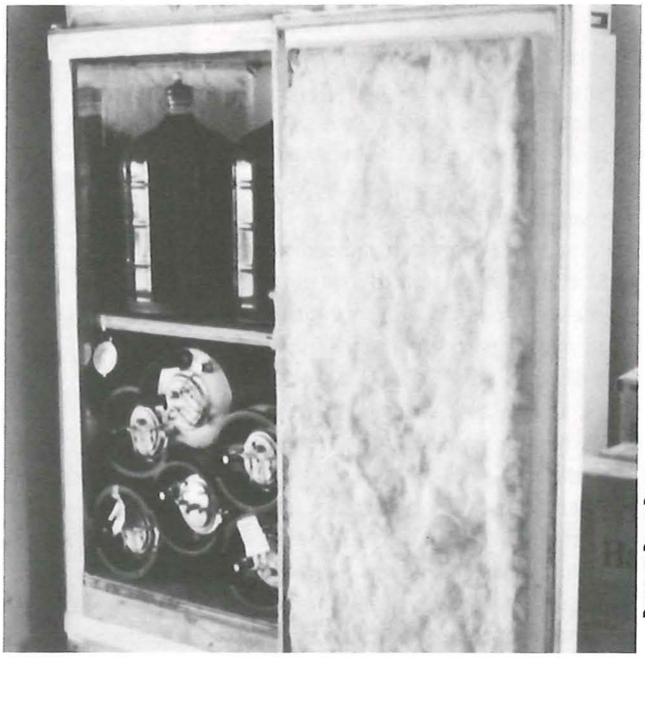


PHOTO BY BYRON BURCH

told me that in the beer's life cycle, a week of storage at room temperature of 70 degrees F (21 degrees C) is equal to eight weeks at 30 degrees F (−1 degree C). My own experience tends to back that up.

In Sonoma County, ice caves are conspicuous by their absence, so there really isn't much alternative to refrigeration. Old refrigerators may work wonders, but even though they may be able to hold a couple of carboys, that's not enough beer to last our family and friends till the cool weather hits in the fall. That's why we bought that home-built cold box.

Our cold box is really just an old square-back Admiral refrigerator that is "exploded" forward by attaching a box made of one-inch thick plywood 24 inches wide lined with a couple inches of rigid insulation. The box is attached to the refrigerator body with machine screws and the cracks are sealed with silicon caulking. The refrigerator door was taken off and reattached to the front end of the box. That meant the door could no longer operate magnetically, of course, so external latches had to be affixed at the top and bottom, so it would seal properly. The refrigerator section holds three five-gallon carboys, and the builder put a shelf 22 inches deep in the box addition, so four carboys can be stored at each level, for a total of 11 carboys. The front storage spaces are each 22 inches high, just big enough for a five-gallon carboy (fitted with a carboy cap, not a fermentation lock). A single plywood board was used to create a level "floor" all the way to the back of the refrigerator, roughly 42 inches from the door.

It works like a charm. I put a minimum/maximum thermometer near the door to keep track of the temperature, and my beer stays close to 30 or 32 degrees F (−1 or 0 degrees C) most of the time. Once or twice a year I have to empty out the box and defrost the refrigerator's freezing compartment. That takes the better part of a day, but I can usually get the beer back in the box before too much warming takes place.

I also discovered that each front section can take six soda kegs stacked on their sides like cordwood (instead of four carboys). Although I can then stand only two kegs or carboys behind them, that brings the total storage capacity up to a respectable 70 gallons. That goes a long way toward solving our warm weather storage problem.

If I did make changes in the design, I'd take the door off the end of the box and put it on the side. That would make it easier to get things in and out. As it is now, I have to move quite a few things to get a carboy or keg from the back. That's something to keep in mind if you plan to build one of these boxes.

When scouting for a suitable refrigerator, you should, first of all, be concerned with getting a good motor. Then be aware that a refrigerator with a squared-off shape and sharp corners will be much easier to adapt to a box than one with rounded "shoulders."

Make sure not to cover up the refrigerator's vent or include it inside the box. If you keep these simple things in mind, you should be able to construct a storage facility worthy of your finest brewing efforts.

CHUCK SKYPECK

Equipment For Beginners

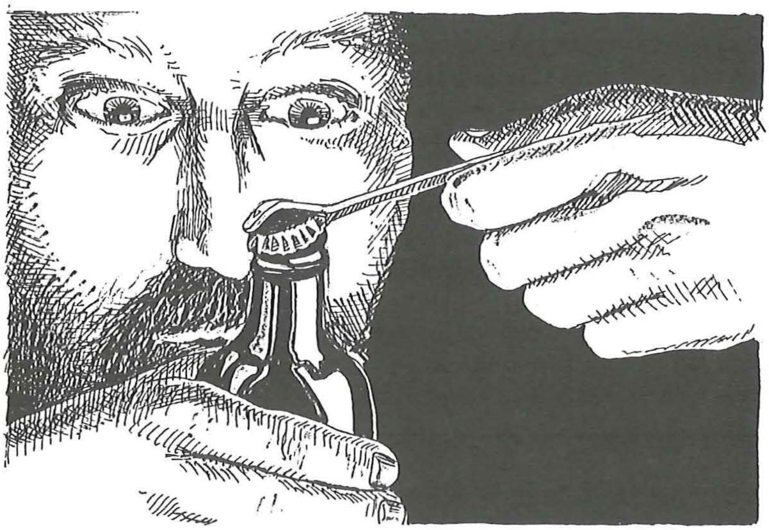


Illustration by Scott Knauer

AS A BEGINNING homebrewer, a few years ago I encountered a special issue of *zymurgy* that featured brewing gadgets.

Thumbing through the articles, I found myself full of fear and apprehension. Would I really have to build a wort reverse recirculating device, ferment upside down, then filter for 24 hours through diatomaceous earth to improve my beers? Was my love for homebrewing mismatched with my minimal tinkering skills?

Fortunately, I found out that homebrewing is a forgiving hobby. As my brewing skills and experience increased, I realized that there is room in homebrewing for both the consummate handyman, ready to meet every brewing challenge with a new and exciting device, and the simple brewer, ready to use existing techniques, ideas, equipment and gadgets to brew their beer. What a relief! I did not have to go back to school for a degree in chemical engineering in order to continue to brew excellent beer at home.

Tools do, however, play an important role in the beginning homebrewer's schemes. A large array of equipment and gadgets exists that serves the homebrewer by making the production of homemade beer a simpler task. In homebrewing, as in all other crafts, using the right tool for the right job makes the task easier, leaving more time for leisure and relaxation. In homebrewing, relaxing with friends and enjoying the fruits of one's labor is a requirement, the last step in the complete process. Beginning brewers who use the following simple gadgets and equipment in their homebrewing technique should find themselves with plenty of time for that important final step in the brewing process, enjoying their homebrewed beer.

Brewpots

Virtually every technique employed by a new brewer will require that a portion of the wort, i.e., the unfermented beer, be boiled. To achieve this, the new brewer will need a kettle or brewpot. Many will find a pot in their kitchen that will serve as a kettle. While kettles made from various materials will work, stainless-steel pots are considered the best choice. A stainless-steel kettle should be 18 gauge or heavier with a thick bottom that will distribute heat well. Increased volume during the boil has many advantages.

New brewers, however, are served well by a kettle with a volume of two gallons or more. This allows for at least a 1 1/2-gallon wort with plenty of space to contain the wort as it boils. If a stainless-steel pot is not available, porcelain or enamel-coated cookware will suffice. Do not use this type of kettle if the interior surface has been compromised by nicks, scrapes or rust. The wort is very acidic and will react with the metal underneath the coating, creating unwanted flavors in your beer. The same type of reactions occur when using aluminum cookware. For this reason, and because there are health concerns surrounding the use of aluminum cookware, it is not recommended.

Chiller

After the boil all brewers face the challenge of cooling the boiling wort to fermentation temperatures in a expeditious manner. The two most common types of wort chillers are the immersion chiller and the counterflow chiller. The immersion chiller, often only a copper coil through which cool water flows, is placed in the hot wort. The water flowing through the coil carries away the heat from the hot wort. This type of chiller is easy to clean and sanitize and can be used easily in most kitchens. The counterflow chiller is more efficient. The hot wort is circulated through a hose within a larger hose that contains cold water flowing in the opposite direction. Counterflow chillers require the hot wort to be siphoned or pumped through the chiller, which in my view is a dangerous task. Cleaning and sanitizing chores also are more complicated with this type of chiller.

New brewers, when boiling reduced volumes, can avoid the expense and headaches of wort chillers by employing the use of a common household item, the kitchen sink. By simply covering the wort and immersing the brewpot in a sink of cold water, the heat of the boil will be rapidly dispersed. The water in the sink may have to be changed once or twice as it absorbs the heat, but you will be amazed at how quickly this method chills the wort. Ice added to the water in the sink will, of course, decrease the chilling time.

Fermenters

Once the wort is chilled it is transferred to a fermentation vessel, a food-grade container that will hold the entire volume of your wort plus space for yeast activity during fermentation. The vessel also must be able to be fitted with an airlock, a device that allows the carbon dioxide produced during fermentation to escape but does not allow the outside air to enter the vessel. Homebrew supply shops sell food-grade plastic buckets and glass carboys to serve this purpose. Some homebrewers even modify stainless-steel containers to use as fermenters.

In the face of these options, I recommend glass containers. While the initial expense is higher than with plastic, the usable life of glass is much longer. Food-grade plastic does "breathe," and scores and scratches can harbor and transfer bacteria and off-flavors from batch to batch. Oversize six- or seven-gallon carboys can be found that will accommodate the foam produced by yeast activity during the primary fermentation of a five-gallon batch, the common recipe size. If only five-gallon carboys are available, a viable alternative is to ferment four of your five gallons and bring the beer up to complete volume during secondary fermentation or at bottling.

The necessary airlock is a simple device. The narrow base of the "bubbler" type fits into a drilled hole in the lid of a plastic fermentation bucket, or into a drilled rubber stopper that fits into the mouth of a carboy. A small chamber in the airlock is filled with water. The escaping gas bubbles through the chamber, which in turn excludes the outside air from the fermentation vessel. When fermenting in a carboy, a blowoff airlock often is employed. This device is simply a piece of plastic hose inserted into a drilled stopper that is then placed in the mouth of the carboy. The opposite end of the hose is placed in any container that will hold water. The escaping gas and any foam that may be pushed out during fermentation flow down the hose and bubble through the water in the container. This device often is replaced with a bubbler airlock once the initial surge of fermentation ends.

If a new brewer is fermenting in a glass carboy, a funnel will be needed when pouring the chilled wort into the carboy. Most people will have a funnel around the house, but funnels are available that are designed especially for the needs of homebrewers. These wide-mouthed funnels fit firmly in the mouth of a carboy, freeing both hands to hold the kettle while pouring. A small slot along the neck of the funnel allows the air displaced by the beer entering the carboy to escape without bubbling back through the incoming flow. These funnels are fitted with removable screens to filter out hops if they are used in the boil. If your funnel does not have a screen, a large strainer or a piece of cheesecloth placed in the mouth of the funnel will serve the same purpose. Look for these funnels wherever homebrew supplies are sold.

After fermentation, the beer will be transferred to a second container for secondary fermentation, aging or bottling. The best choice of equipment for secondary fermentation or aging is a second glass carboy. If beer is going to be aged for any length of time, I strongly recommend glass, not plastic. Plastic is appropriate to use as a holding vessel during bottling. Bottling buckets are available that are fitted with a spigot at the bottom allowing bottles to be filled without siphoning. The spigot should be fitted with a plastic hose that allows the bottles to be filled without splashing to avoid oxidation. The introduction of oxygen to fermented beer is something to avoid. Could this small act of altering a piece of equipment be the start of your homebrew tinkering career?

Siphoning

To transfer the beer from the primary fermentation vessel requires a siphoning system. Pouring the beer out of the primary vessel will stir up the sediment, which should be excluded during the transfer, and oxidize the beer. A long piece of plastic hose by itself will simply not do the job. A flexible hose will bend at the top of the container, restricting or stopping the flow. Also, the open end of the hose in the primary container will act just like a vacuum cleaner, sucking up the beer and sediment.

To get the desired results, a simple device called a racking tube should be used. The best racking tube will be a long rigid piece of plastic. The end of the racking tube, which is submersed in the beer, will have a plastic foot at the end that holds the opening above the top of the sediment and pulls the beer down into the opening. This avoids sucking up the sediment. The opposite end of the racking tube should be curved to allow the flow of the siphon to change direction without the constriction possible when a flexible tube crimps. A flexible hose is, however, attached to the racking tube to carry the beer into the receiving container. This flexible piece should be long enough to carry the beer all the way to the bottom of the receiving container to minimize splashing and oxidation.

Brewers who use their siphoning system to transfer the finished beer into bottles instead of using a bottling bucket with a spigot, have several tools and gadgets to choose from that can make the task easier. The simplest of these is a plastic tubing clamp, or siphon clip that fits around the end of the flexible hose and can shut off the flow of the siphon with one hand. Tubing valves are another easy-to-use piece of equipment. Spliced into a flexible hose, the flow can be turned on or off with a flick of the wrist.

Another group of more sophisticated but simple-to-use devices available to homebrewers are known as bottle fillers. Made from rigid plastic tubes, bottle fillers employ various types of valves that control the flow of the siphon. The most common of these use a spring-loaded valve that is opened by pressing the stem against the bottom of the bottle. The bottle is then filled to the very top. As the filler is removed along with the volume it displaced, the bottle is left with an appropriate amount of head space. (Note: most bottle fillers and racking tubes are made to work with three-eighths-inch inside diameter flexible tubing.)

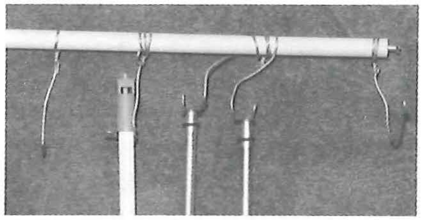
Capping

Most new homebrewers will put their beer in bottles that require a crown cap. Homebrewers can chose from several types of cappers. The most common is the double lever capper. This simple two-handled capper effectively crimps crown caps to most types of bottles with a minimum effort. The one disadvantage is that it takes both hands to operate the capper, leaving the bottle without support. A simple improvement is to install a magnet in the base of the capper to hold the crown cap in place as it is positioned over the mouth of the bottle.

Bench cappers, most often a single lever mounted on a stable base, can be operated with one hand, leaving the second hand free to hold the bottle steady as the cap is crimped on. Some bench cappers adjust to different size bottles by allowing the lever to be moved up or down to fit the bottle size. Other types have adjustable bases. If you encounter an old bench capper at a flea market or garage sale, buy it. The materials used in the construction of these older cappers often appear to be of higher quality than current models.

The most tiresome chore in homebrewing is cleaning. Bottles, carboys and siphon hose all must be both clean and sanitary. Tools and equipment exist that make these essential jobs easier for the homebrewer. Stiff bristle brushes in different sizes and shapes clean out beer bottles, carboys and even airlocks. Another very handy tool is a device that attaches to most faucets and directs a strong, controllable spray of water into the bottle. This device has a valve that closes off the water until a bottle pressed on. The valve opens and a strong stream is sprayed against the inside surfaces of the bottle. Easy-to-install adapters are available that allow this type of bottle washer to be used in most kitchen sinks.

These tools and equipment serve the new and experienced homebrewer by making the tasks surrounding the production of homemade beer easier. As an individual's homebrewing experience grows, these devices will continue to age in usefulness. Beginning brewers should not be intimidated like I was by the variety of new gadgets and equipment presented in this Special Issue of ***zymurgy.*** These unique homebrewers are our research scientists and design engineers who are finding ways to make the production of homemade beer easier, better and more exciting.



Photos by Jim Homer

Tool for Hanging Cleaned Equipment

Washer for Soda Kegs

Hop Back

USING A CHEST FREEZER FOR BEER STORAGE AND FERMENTATION

Here's a simple recommendation for anyone looking to buy an extra refrigerator for brewing needs—consider buying a chest freezer instead—it uses space much more efficiently and gives a wider temperature range to work within.

If you consider the dimensions of a standard refrigerator, you will notice that its base is one of its smallest areas. This leaves a very large airspace above anything you store in the refrigerator. On the other hand, a chest freezer has a base that is one of its largest areas and wastes little airspace above items stored in it.

I have a relatively small freezer (14 cubic feet) but it can easily store six Cornelius kegs and two cases of bottles. I can also remove three kegs and have room to place a seven-gallon carboy in the freezer for temperature-controlled lagering.

For temperature control, I use a thermostat available from William's Brewing (there are many others of this type advertised in ***zymurgy***). You can also build your own thermostat by following the instructions in Kurt Denke's article "Taming the Wild Fridge" in ***zymurgy*** Fall 1989 (Vol. 12, No. 3). These thermostats control temperature by cycling the power on and off according to the temperature. The unit from William's seems to be accurate to within two degrees.

To note one last benefit of a chest freezer, consider what happens when you open your fridge on a hot day. You probably notice a gush of cool air around your feet. This is because cold air is heavier than warm and opening the door pulls it out. A chest freezer will contain this cool air and you will not lose it when opening the door.

—David Coy, Northglenn, Colo.

TOOL FOR HANGING CLEANED EQUIPMENT

When brewing there is always the question of where to place some items after they have been sanitized. Tubes for soda kegs and bottle fillers tend to roll around when placed on dish-drying racks and it's also difficult to drain hoses after cleaning. I have created a device for hanging these items from the ceiling. Start with a one-half-inch wood dowel and wrap baling wire around it. Bend the wire to support the item you intend to hang. The dowel is hung from the ceiling with cup hooks for easy removal.

—Jim Homer, Boulder, Colo.

HOP BACK

This hop back has the advantages of being easy to sanitize and having an opening large enough to pour hot wort into easily. To make a hop back from a six-quart stainless-steel pan, punch a hole in the side for a coffee urn faucet. A stainless-steel wire mesh strainer in the pot filters out hops. Sanitize the hop back by boiling water in it while the wort is boiling. Place it over the fermenter (a soda keg) with another keg of the same height for support. A simple wooden frame to support the hop back also protects the plastic collars of both kegs from heat.

—Jim Homer, Boulder, Colo.

WASHER FOR SODA KEGS

This soda keg washer was inspired by clean-in-place systems that commercial breweries use. It produces a stream of high-pressure water to all the surfaces inside a soda keg. It does not replace scrubbing out stubborn stains, but the washer quickly cleans and rinses out a keg.

The soda keg washer is made from one-half-inch copper pipe. Three water outlets each consist of an end cap with a slit cut in it. The slit was cut with a Dremel® Cut Off Wheel No. 409 (a hacksaw also would work). The top outlet is 19 inches from the base and is at a 45 degree angle from the main pipe. The middle outlet is six inches from the top and is on a T connection to wash the side of the keg. The lowest outlet points down and is 11 inches below the top. By pointing down, the inside of the top of the keg is cleaned. This is particularly useful in cleaning the residue left from fermentation.

A simple wooden frame holds the copper pipe of the keg washer and a hose allows easy attachment to the kitchen faucet. The soda keg washer is used by placing the keg upside down over the washer and turning on the water. The keg is then turned to clean all parts of the inside.

—Jim Homer, Boulder, Colo.

CARBOY CARTS

The chemical company I worked for all my working life taught us to never, never, never carry an unprotected glass carboy, full or empty. There is always something around to trip over or bump into and cause a disaster.

Quilted jackets are available, but expensive. I built wooden cradles for all of my carboys. The dimensions fit a five-gallon carboy nicely, but are not critical and can be altered to fit three- to seven-gallon jugs. Any scrap wood will do. Add medium-duty casters to the bottom for a wheeled carboy cart.

—Paul F. Lewis, Columbia, Tenn.

INSULATED LAUTER-TUN

Recently I began making all-grain batches of homebrew. While gathering and assembling the equipment I found a very economical and easy way to make an insulated lauter-tun. If you purchase a 6 1/2-gallon glass carboy you will find that it comes encased in a Styrofoam™ container. The five-gallon food-grade plastic pail that just about everybody uses for a lauter-tun happens to fit quite nicely into the bottom section of this two-section container. All you need to do is drill a two-inch-diameter hole in the Styrofoam™ with a hole saw and electric drill to accommodate the spigot at the bottom of the lauter-tun.

—Jim Yuzwalk, Livonia, Mich.

REAL ALE AT HOME

So you've had "beer from the wood" and life will never be the same again. As a homebrewer you can make a reasonable facsimile without too much expense. You need a five-gallon stainless-steel soda keg, in and out quick-disconnects, a faucet head tap, a short piece of beer serving hose, a 12-inch section of a two-by-four, and a one-quarter-inch female flare by one-quarter-inch hose barb and your lid must have a safety pressure relief valve.

Rack your favorite beer from the primary fermentation vessel to the secondary fermentation vessel, which is a stainless-steel tank. In the stainless-steel keg dry hop with one ounce in a hop bag. Fermentation will continue inside the soda keg and the trapped CO_2 will be reabsorbed into solution rendering a low carbonation level consistent with cask-conditioned ale. Secure the hop bag with unwaxed dental floss so it rests in the beer and won't block the shorter tube on the dispensing in side when the keg is placed on its side at serving time.

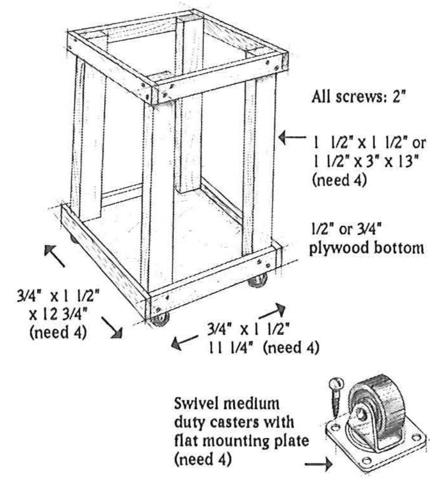
Let the beer condition in the keg for up to five days at 50 to 60 degrees F (10 to 15.5 degrees C). When it's time to serve, place the keg on its side with the in connection facing down and the out connection facing up. Put the two-by-four-inch block of wood underneath the in side of the keg so there is about a 15 to 30 degree angle between the table and the side of the keg. Construct your tap by attaching the faucet head tap to the short piece of hose and secure with a worm screw clamp. Connect that to a one-quarter-inch female flare by one-quarter-inch hose barb and screw that onto your in quick-disconnect. Attach your in quick-disconnect to the soda keg and pull off your first pint of real ale.

After pulling off a couple of pints, connect the out quick-disconnect to the keg, being sure to point the outlet away from your face. The out quick-disconnect will allow air to enter the keg and gravity to take over. To prevent oxidation of your favorite ale throw a party and drink it all up within two days.

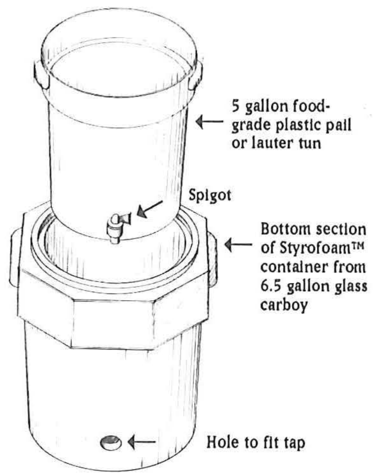
—Glen Falconer, Springfield, Ore.

SIPHON STARTER

The simplest and quickest method I've found for starting a siphon in a racking hose is to use an outboard motor remote fuel tank priming bulb. Simply slip the proper end into a three-eighths-inch racking hose and two squeezes will fill about five feet of hose with wort. A check valve

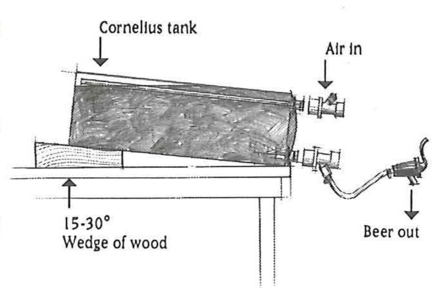


CARBOY CART

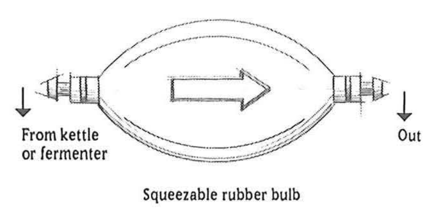


ILLUSTRATIONS BY RANDY MOSER

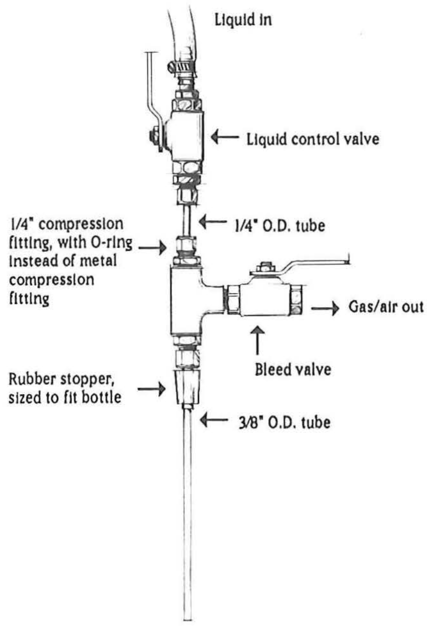
INSULATED LAUTER-TUN



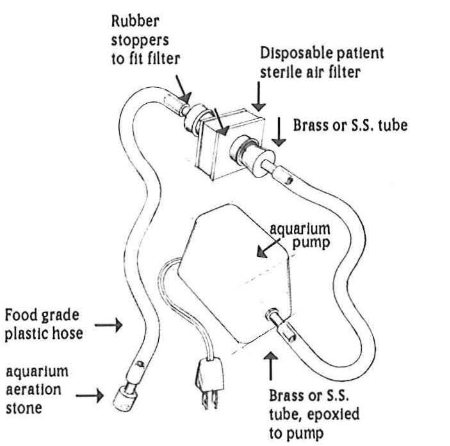
REAL ALE AT HOME



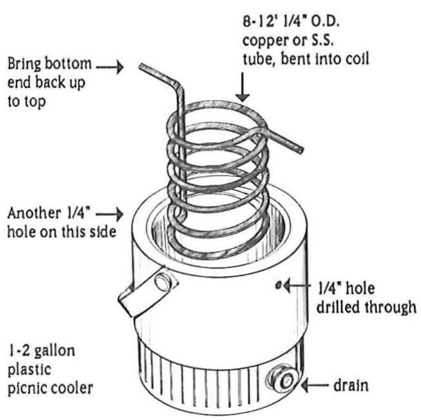
SIPHON STARTER



COUNTERPRESSURE TAP HEAD



WORT AERATOR PUMP



MINI-JOCKEY BOX

inside the bulb will prevent the wort or beer from running backward while you either pinch the hose off to hold the prime or aim the hose into your racking bottle or carboy. If you get a little overzealous in pumping and get some wort or beer in the bulb, just rinse it out with water to prevent it from sticking the valve open or closed. I purchased mine two years ago for about $5 or $10 from an Evinrude dealer and it still looks and works like new. The check valve will only keep the wort from running in the opposite direction of flow, which makes those little plastic hose clamps very handy. It sure has saved me a lot of hassle and worry about germs in my beer.

—Tom Hamilton, El Segundo, Calif.

COUNTERPRESSURE TAP HEAD

This is a simplified version of this increasingly popular device that allows you to fill a bottle or jug from your draft system to take to a party without losing too much fizz. The CO_2-purging part has been left out, which simplifies construction and use. And for short trips to parties, the air introduced is not noticeable. Follow the general method of construction outlined in **zymurgy** Spring 1990 (Vol. 13, No. 1). But instead of the two-way valve at the top for gas and liquid, install a simple ball valve, for liquid only. Everything else is the same. The advantage is a much quicker setup and use with no need to mess with your gas fittings. The disadvantage is slightly more introduced oxygen, but this will not cause a problem for at least a week when stored at cool or cold temperatures.

—Randy Mosher, Chicago, Ill.

WORT AERATOR PUMP

This is so cheap and easy and works so well that everyone should have one. Go down to the pet store and buy a cheap aquarium air pump, an aerating stone and about four feet of plastic tubing that fits both. Then purchase a disposable medical patient air filter from a surgical supply house. You may have to buy these in quantity so this would be an ideal club project.

The air filter has two openings about one inch in diameter. You will need two rubber stoppers to fit these holes, with holes in the stoppers suitable for inserting the aquarium tubing. Place the filter somewhere between the pump and the aerating stone. To use, sterilize the tubing and the stone and insert into the primary fermenter filled with chilled wort and the pitched yeast. Run the pump for half an hour or so, or until the wort foams up to the top of the fermenter, whichever comes first. You now have a well aerated wort.

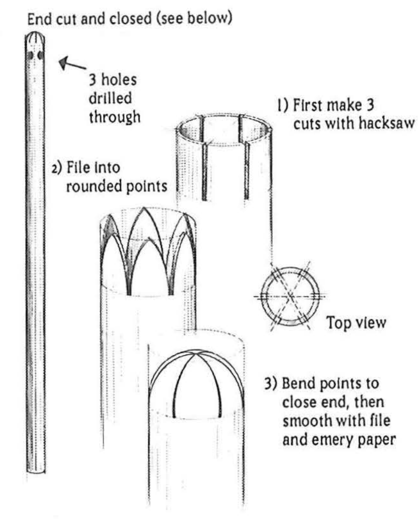
—Randy Mosher, Chicago, Ill.

MINI-JOCKEY BOX

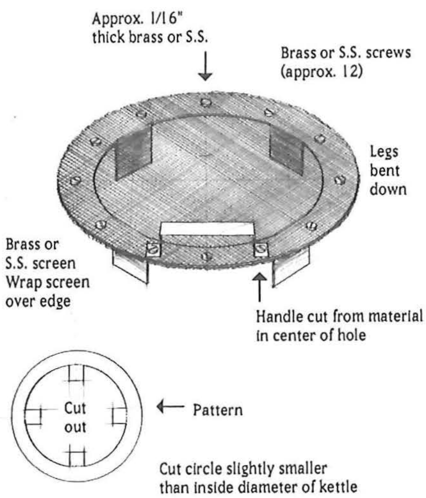
The mini-jockey box is a small unit that chills draft beer through a coil immersed in ice between the keg and the serving tap. To make one you need a small (four to eight quart) picnic cooler with a tight-fitting lid. The best ones are the small circular jugs with a spigot at the bottom. The other part is a 10-foot length of one-quarter-inch diameter copper tubing of the hardware store variety. Annealed stainless steel would be easier to clean, but is difficult to obtain in small quantities. To construct the jockey box, all you do is coil up the tubing into a springlike shape that fits into your cooler with at least one inch on all sides. If the cooler is round, just wrap the tubing around a cylinder of the appropriate diameter. If you have a rectangular cooler, bend the tubing to roughly match the shape of the space inside. It doesn't have to be pretty, but make sure there are no sharp kinks. Leave about four inches of extra tubing on one end of the coil and bring the other end of the tube back up the inside of the coil so both ends are at the top of the coil.

Drill two one-quarter-inch holes near the top of the cooler directly across from one another. Place the coil inside the cooler and feed the tubing ends through the cooler walls to the outside. The ends may be trimmed with a tubing cutter to the desired length, usually about 1 1/4 inch long. Seal the tubing in place with liberal gobs of silicone bathtub caulk and allow to cure overnight. Connect the jockey box to your serving line with hose clamps, fill with ice and you're ready to go. If you just need to chill the beer a little, fill the cooler halfway. Check periodically and replace ice as needed. Rinse the coil well with hot water after every use.

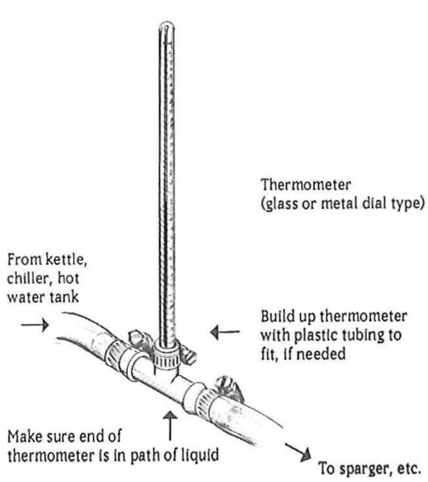
—Randy Mosher, Chicago, Ill.



WORT SPRAYER



BOILING KETTLE HOP SCREEN



THERMOMETER T

WORT SPRAYER

This extremely simple device helps aerate the wort before fermentation. It is simply a piece of three-eighths-inch diameter stainless-steel tubing modified to produce a shower effect as wort flows through it into the primary fermenter. It can be used as a sparge water sprayer because it will produce a spray about a foot in diameter, about right for most lauter setups.

Get a piece of three-eighths-inch diameter thinwall stainless-steel tubing about a foot long from your local hydraulics repair shop. With a hacksaw make three cuts crosswise about three-eighths-inch deep into one end of the tube. With a small triangular file, carve the bits remaining into six rounded points. You should end up with something that resembles a tiny crown. These points should be bent inward, using small needle-nose pliers until they all meet in the center. You may have to do some fine-tuning with the file to get them to fit tightly. It does not have to be an absolutely perfect fit.

With a three-thirty-seconds-inch drill bit, drill three holes through both sides of the tubing, about three-eighths-inch from the now-closed end. Use a larger drill or countersink to clean up the rough edges of the holes.

Chuck the whole affair in a drill with the closed end pointing out. Turn the drill on and use it like a lathe to file the closed end smooth. *Note: Wear safety glasses to protect eyes during the lathing process.* Follow the filing with finer and finer grades of emery cloth or wet-or-dry sandpaper until the whole end is polished and shiny.

Drill a small vent hole in a one-hole stopper for the carboy or fermenter or simply cut a small groove along one side of the stopper. You must vent the stopper or you'll find the wort flow stopping, or the whole affair blown out, spraying wort all over.

To use, insert the sterilized sprayer through the stopper, place in your carboy and connect to the output of your wort chiller. Do not use this device with hot wort because the wort will darken and oxidize quite badly. Make sure the spray end is above the maximum fill level of the fermenter—it will not work if immersed. This device also works well as a sparging spray, but do not use it to recirculate wort because the particles in that liquid will rapidly clog the holes.

—Randy Mosher, Chicago, Ill.

BOILING KETTLE HOP SCREEN

If you have a kettle with a spigot at the bottom it's a simple matter to make a screen that holds back hop cones and trub when the boil is done. You'll need a ring of stainless steel, brass or copper just big enough to fit inside the kettle. I cut mine out of the top of the cutoff end of the keg. You could also cut one from sheet metal. At any rate, you need a one-sixteenth-inch thick (or thicker if brass or copper) ring with about 1 1/2-inch of edge to it. The hole in the middle should be covered with stainless-steel or bronze screen material, about window-screen coarseness. Cut this into a circle and affix it to the ring with small brass or stainless-steel nuts and bolts at about a dozen points around the edge.

You also will need a handle for removing the ring. This can be made from a strip of material removed from the middle. Be sure the handle sticks up about three inches from the surface to get above the bed of hops. Depending on your kettle you may need to put the whole affair on legs to keep the strainer above the level where the drain hole is. These can be made from sheet metal, or simply from brass or stainless-steel bolts around the edge.

To use, all you do is put the thing in the kettle before filling with wort, and boil as usual. When the boil is done, allow the hops and trub to settle for 15 minutes or so before running through the chiller.

If you're using the wort sprayer you may want to make a secondary screen to keep hop debris from clogging up the holes. Just roll up a small tube of screen by folding one end over and stuff it into the kettle's outlet hole from the inside.

—Randy Mosher, Chicago, Ill.

THERMOMETER T FOR SPARGE WATER OR CHILLED WORT

The thermometer T is designed to hold a thermometer at any critical point in the brewing process. Sparge water and chilled wort temperature are critical and difficult to measure any other way. This is simply a T connection through which the liquid in question flows. One leg of the fitting holds the thermometer and allows constant monitoring of the actual liquid temperature. Either a glass or dial-type thermometer may be used. Simply attach the in and out flow to two legs of the T. The third leg can then be fitted with the thermometer. You will need to build up the thermometer with plastic tubing so it fits snugly into the T. If you're using a plastic T, fasten everything to it with hose clamps. Metal compression fittings also can be used. Choose the type that best fits your brewing equipment.

—Randy Mosher, Chicago, Ill.

INDESTRUCTIBLE RACKING TUBE

This one is so easy to make, all you have to do is call your local hydraulics repair and fabrication shop. Tell them you want a two-foot length of their least expensive stainless-steel tubing, three-eighths-inch outside diameter, with a 90-degree bend of unspecified radius two inches from one end. A stainless-steel replacement for those cheap plastic racking tubes solves the problem of melting while racking hot wort. The stainless-steel tubes may be sterilized with much more confidence than the plastic ones. All you have to do is pick it up when it's ready. Cost should be well under $20. Just take the plastic pickup end off your old siphon tube and attach the one you just bought.

—Randy Mosher, Chicago, Ill.

LAUTER-TUN JACKET

If you are using a keg, plastic food container or other non-insulated vessel for mashing and/or sparging, you can make a big improvement by insulating it. A good jacket of insulation can keep the temperature drop to just a couple of degrees an hour or less.

Polyisocyanurate building sheathing is the best material to use for this purpose. With any luck you'll never have to say this awful word—just ask for foil-faced building insulation. It is a dense tan foam with dull aluminum foil on either side.

It's soft and easily cut, but rigid and resistant to bending. The idea with round containers is to make V-shaped cuts or grooves out of one side of the board, about halfway through, which weakens it enough to bend. If the grooves are cut parallel to one another about two inches apart from top to bottom of the jacket, it will bend around the straight-sided vessel like barrel staves. Cut the foam to the proper height, then start making the cuts and bending the material until you get a piece long enough to go all the way around. If one piece won't do it, then attach a second piece with duct tape. When you've gotten all the way around trim it to the exact length.

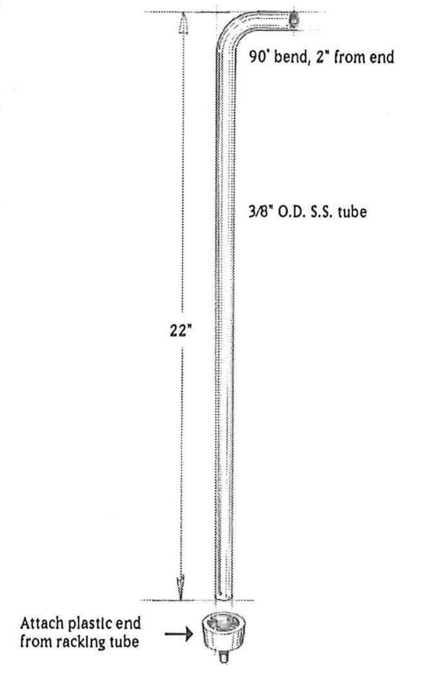
If you have a vessel that tapers, like a food container, the cuts will need to be tapered as well. Measure the diameter of the top, and then the diameter of the bottom. Divide the larger number by the smaller. This will give you the difference between the bottom and the top of each "stave." If the narrow, bottom end of the stave is two inches wide, then multiply two inches by the number you got by dividing the top and bottom circumferences. You'll get a number that is proportionally larger. This is the width of the staves at the top end. It will be best to cut these tapered staves in groups of three to five to avoid wasting too much board. It may be best to cut them somewhat long and trim them to fit once they're assembled.

Cover all exposed edges with a piece of duct tape folded over the cut sides. If you wish to make a closed bottom, cut a piece to fit and tape the jacket to it. If your vessel has a spigot at the bottom, have the two ends of the jacket meet there and cut away enough foam to clear the obstruction. If you have a closed bottom with spigots or other projections on the side, attach the bottom only three-fourths of the way around, leaving one-fourth free to swing out as a "door."

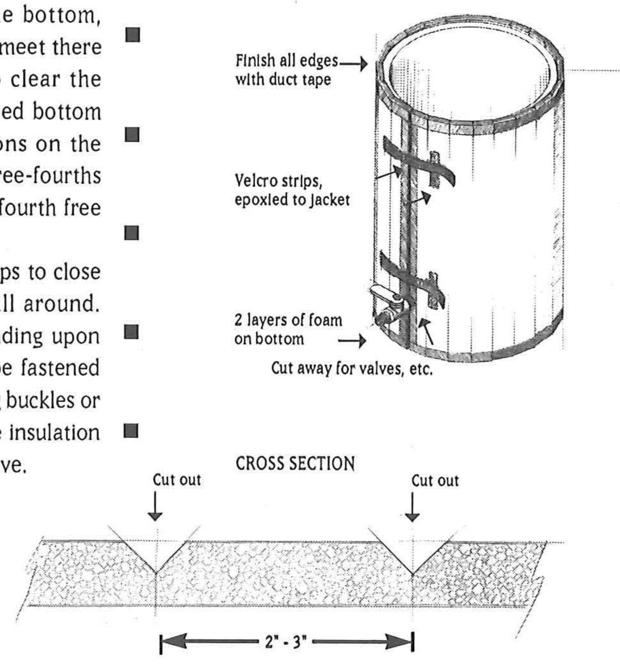
Finally, get some nylon straps to close the jacket as shown or to go all around. You'll need one or more depending upon the size of the tub. These can be fastened around the jacket like a belt using buckles or Velcro. You can glue them to the insulation with epoxy or other strong adhesive.

This insulation material will stand up to the heat of the mash tun but is not recommended for vessels that will be heated on an open flame.

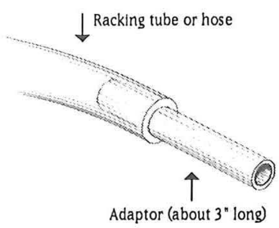
—Randy Mosher, Chicago, Ill.



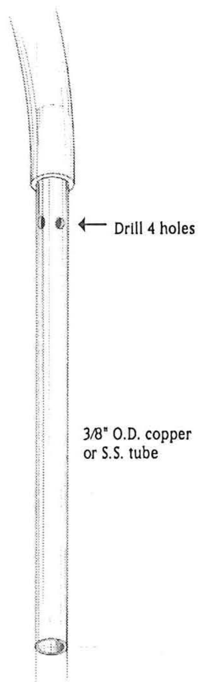
INDESTRUCTIBLE RACKING TUBE



LAUTER-TUN JACKET



RACKING TUBE ATTACHMENT



EASY WORT AERATION

A RACKING TUBE ATTACHMENT

As every dentist knows, the human mouth is a cesspool of bacteria, suggesting that the mouth should not be placed on the racking tube to start a siphon. So how do brewers get the siphon started without infecting the wort? They use a dental adapter: a short (three inches should do) tube just the right size to fit inside the racking tube end. One merely slips the dental adapter tube about three-eighths inch inside the rack tube and sanitizes the rack tube normally. To start the siphon, grab the end of the dental adapter with the teeth, wrap the lips around the end and suck. As soon as the liquid gets to the level of the hose clamp, close the clamp and grasp the adapter firmly with your teeth and pull until the adapter pops out. Now the end of the rack tube can be quickly dipped into an alcohol and water (70/30) blend to sanitize it in case the brewer accidently touched the end of the tube and the adapter can be spit out into the same fluid to keep one end of it sterile, too. If you have to restart the siphon, the rack tube and adapter still are sanitized. The brewer's mouth never touches the beer until it's time.

—Phil Fleming, Broomfield, Colo.

EASY WORT AERATION

To build a wort aerating device I used a six-inch length of three-eighths-inch outer diameter copper pipe that was surplus from constructing my wort chiller and racking tube. I drilled four one-sixteenth-inch holes around the circumference about one inch from one end. To use, I boil to sanitize, insert the short end into the outlet tube from my chiller (or racking hose) and rack away. The flow of wort will suck in a stream of air, and the outlet will be a frothy mix of wort and air bubbles. It sure beats picking up a full carboy and shaking to aerate!

This device is effective enough to fill the head space of a 6 1/2-gallon carboy with foam when chilling down a five-gallon batch of beer.

—Larry Barello, Bellevue, Wash

INSTANT NO FUSS WORK SPACE

I am still bottling my brew although it once made a sticky mess in my small kitchen. Then I discovered if I left the dishwasher door down it made a nice low shelf I could use to put my bottles on when filling. I get a strong siphon and extra space to work. The best part is I don't need to worry about spilling beer or cleaning up a mess. All I do is close the door and clean up with the next wash cycle!

—Steve Mechels, Topeka, Kan.

CARBOY CONDOMS

I brewed an Oktoberfest last fall that went into high gear at one point during fermentation and blew the top off my plastic bucket. Half-fermented wort went everywhere and the cleanup involved moving two large appliances and scrubbing walls. My wife, a long-suffering but accommodating spouse of a homebrewer, let me know that future fermentations in the laundry room would require the use of protective devices. Yes, I had to practice "safe fermentation."

The answer was, of course, a carboy condom: a plastic trash bag placed over the top of the fermenter, which sits either in a large laundry sink or shallow tub. Now I can ferment without fear of the consequences. I'm safe, my family and home are safe and my yeast can respirate to their little hearts' content. Sure, there may be some who feel as though a carboy condom takes some of the fun out of homebrewing, but I say safe fermentation is better than no fermentation.

—Tom Lyons, Winter Haven, Fla.

KETTLE-CLEANING SPRAY

This easy-to-make sprayer makes cleaning carboys and other brewing vessels much easier than holding them in the sink or the shower. It's simply a length of washing machine supply hose with a garden hose pistol spray on one end and the other end attached to your kitchen faucet. The garden pistol will provide a stronger spray than ordinary kitchen sprayers and make cleanups easier.

For most kitchen sinks you may need to get an adaptor that fits the fine threads of the faucet to the coarse ones of the hose. Be sure to get the plastic-covered type of pistol spray, as the bare metal ones get too hot to handle with hot tap water. Garden-hose quick-disconnects make the whole thing a lot easier to hook up and remove.

—Randy Mosher, Chicago, Ill.

THE ALCOHOL SWAB

At one of many talks given about improving beer I learned a simple, easy, cheap step to keep it clean during the racking process. Let's say your fermenter has been sitting in the cellar, fermenting away until it is time to rack the beer. You have sanitized all of the pertinent equipment and are ready to begin racking. Before sticking that rack tube into the fermenter, swab around the fermentation lock cork and vessel lip with a cotton-tipped swab dipped into an alcohol (ethyl, grain or 100-proof vodka) and water blend (70/30, the same as 150-proof vodka). Then, while still wet, remove the cork and quickly torch the alcohol with a butane lighter or torch. This should kill any bugs that have been gathering around the edge of the cork and on the lip of the vessel. It may sound like an unnecessary step, but who can say what the Homebrewer of the Year ribbon is really worth?

—Phil Fleming, Broomfield, Colo.

Chapter 3

Sanitation

SUSANNE PRICE

Keeping It Clean

Sterilization is practically impossible for the homebrewer. The best we can do is clean out all visible particles then sanitize equipment by either boiling or heating, by using high-proof alcohol or, most commonly, by soaking in a chemical sanitizing solution. If your water is fit to drink, rinse with it. If not, consider sanitizing with iodine-based sanitizers such as iodophors that don't necessarily require a rinse.

Cleaning is not sanitizing or sterilizing. An effective cleaner should remove all organic compounds but leave the container or implement (glass, steel, wood, plastic) unscratched and unpitted. Immersion of equipment in sanitizing solutions will kill the vast majority of micro-critters, but it will not kill everything. Rapid chilling of wort and high pitching rates will make sure the yeast outproduce any competition.

ILLUSTRATION BY SCOTT KNAUER

As a homebrewer you might as well give up the idea of complete sterilization of anything, especially wood or plastic. Some people successfully ferment in wooden kegs or plastic buckets, but there are just as many who end up with infected beer. The cleaner your equipment and all that touches your beer, and the more attention you pay to sanitation, the closer you will be to sterile conditions when bottling or kegging. I know of homebrewers who close all the doors and windows once the wort is chilling, keep their houses ridiculously clean and even clean their fingernails before they brew. The bottom line is you can't control everything. You must decide what level of cleanliness and sanitation helps you make good beer.

The Initial Rinse

Using a strong stream of water, clean your brewpot, wort chiller, carboy or keg, turkey baster or wine thief (for samples), siphon tubes and bottle capper. It's easy to forget to wash your bottle capper. Wash all other utensils such as spoons and funnels in water. Normal wort residue that can't be removed should just be soaked. If you don't have a long bottle brush to get inside your carboy, tie a long piece of string tightly to a sponge or plastic scrubber that is fastened to the end of a long thin stick or wire hanger. If you hang the string out of the carboy, you won't lose the scrubber at the bottom.

Using soap or detergent for cleaning equipment usually is unnecessary. The residues they might leave behind will do nothing to improve your beer. However, if after rinsing there is still visible organic matter on your equipment, use a detergent like trisodium phosphate to remove it. Baking soda or vinegar leave less residue and odor and can be used for cleaning if rinsing is thorough. Getting out grease is another thing. I once brewed a chocolate porter with baking chocolate. It was just about impossible to clean the greasy cocoa butter film out of the siphon tubes, brewpot and off the wort chiller. When adding ingredients like chocolate, or essences like spruce, sassafras, root beer—anything strong—use an older siphon hose that you can afford to toss. Otherwise, use soap sparingly and rinse with plenty of hot water.

Chlorine

The most common, least expensive and possibly easiest-to-use sanitizer is the chlorine bleach solution. One-third to 1 1/2 teaspoons of household bleach per five gallons of water is adequate. This gives 5 to 25 ppm. An extra few teaspoons won't hurt, especially if your water contains nitrogen or organic matter. Again, you'll want to rinse thoroughly. Do not leave chlorine solutions in contact with stainless steel for longer than 20 minutes, or in contact with plastic for longer than 30 to 45 minutes. Stainless steel will corrode, and chlorine can stay behind in the fine scratches that all plastic develops, no matter how careful you are not to scratch it.

The major drawback to using chlorine is that it must be rinsed well to prevent the formation of chlorophenols, which are easily detectable in beer in concentrations of just 2 to 5 ppb. Even if you avoid using chlorine, most cities add it to their water. Normally these additions are unnoticeable, but in Colorado during the spring runoff, for example, the larger amounts added are noticeable the moment you turn on the faucet. Contact your city water department for information on chlorine levels in your tap water. The levels of chlorine in city water will not adequately sanitize your equipment, only contribute to chlorephenol formation.

Never mix chlorine with detergent or other household chemicals, as the chlorine gas that may be given off is poisonous.

Boiling & Heating

Besides boiling your wort, it makes sense to boil either your bottle caps or the CO_2 fittings of your keg. Some brewers like to choose one chemical sanitizer and stick with it for all their equipment, yet the smallest pieces are the hardest to rinse completely. This is also true to some extent for blowoff tubes, rubber stoppers, metal mesh scrubbers, metal strainers and nylon hop bags. Boiling may be the best option for those tools. If immersed in a strong chlorine solution or boiled in plain water, siphon tubes will turn cloudy, so it's best to sanitize them using other methods. It won't matter much if blowoff tubes are cloudy, so these can be boiled.

An interesting method of sanitizing bottles is to put them through the drying cycle of a dishwasher. The heat produced is high enough to kill bacteria and most other microorganisms.

Isopropyl Alcohol, Vodka & Grain Alcohol

Many homebrewers have used 80 proof or stronger alcohol as an effective germicide. It can be applied to any gadget or device by immersing or with a spray bottle. Alcohol is a good choice when you are concerned about soaking plastic, rubber, aluminum or stainless steel in chemical solutions, or when you just plain forgot to sanitize the siphon tube and a cloud of voracious bacteria threatens your just-primed-and-ready-to-bottle-now Pilsener.

One well-known trick to sanitize the rim of a carboy or bottle is to swab it with alcohol then flame it all around the edge. Try this technique when pitching your yeast starter. While isopropyl alcohol is reasonably cheap, it is toxic and contains wood alcohol. For safety reasons use grain or methyl alcohol or 150 proof vodka. The basic disadvantage to using vodka or grain alcohol to sanitize all your gadgets is the comparative cost. On the other hand, they are easy to use, quick and accessible.

Trisodium Phosphate (TSP)

Ask your homebrew supply shop or restaurant supply store for chlorinated trisodium phosphate if you want a good detergent-sanitizer combination. Trisodium phosphate itself is more a cleaner than a sanitizer, because its antiseptic properties are limited. It removes dirt, grime and oil films effectively, making it useful for bottles and brewpots. The disadvantage is that it requires thorough rinsing, because even small residual amounts will kill a foamy head. Use in a 2 percent solution.

Iodophors

The word is spreading about iodophors, which are very effective sanitizers and cleaning agents containing iodine and phosphoric acid. At concentrations of 12.5 ppm (one-half fluid ounce or one tablespoon per five gallons) iodophors not only kill bacteria and perform well as surfactants, but they also dissolve and remove mineral deposits from hard water. At this concentration, iodophors are non-corrosive, non-staining and don't even need to be rinsed off. If you add more than one ounce per five gallons you'll need to rinse. At 15 ppm, aroma and taste become apparent if the glassware is not dried or rinsed. The effective pH range is from 2.5 to 3.5, and equipment should be soaked for 20 to 30 minutes in very cold water of 32 to 50 degrees F (0 to 10 degrees C). Iodophors should not be used with water hotter than 120 degrees F (49 degrees C) because they stain above this temperature. Their effectiveness also decreases as pH increases. Iodophors can be found at many homebrew supply shops.

Quaternary Ammonium Compounds & Sodium Hydroxide

In *The New Complete Joy of Home Brewing*, Charlie Papazian recommends that homebrewers never use quaternary ammonium compounds, or quats. Quats and sodium hydroxide are used extensively in the brewing and soft-drink industries because of their excellent sterilizing and organic dissolving powers. Both quats and sodium hydroxide (caustic soda) are highly toxic, notoriously difficult to work with and require prodigious amounts of rinse water. Sodium hydroxide has a pH of 14, and even the commercial half-strength solutions are strongly alkaline. Contact with eyes or skin can cause severe burns if not immediately rinsed with copious amounts of water followed by a weak acid such as vinegar. Beware!

Conclusion

Household chlorine bleach has long been the mainstay of homebrewers when it comes to cleaning and sanitizing equipment. However, those who are concerned about the effects of chemical residues in their beer (and in their bodies) can choose to boil or heat some equipment, or to use high-proof alcohols. To avoid the chlorophenol blues, one alternative is TSP. And homebrewers who hate all the rinsing involved can use iodophors at low concentrations to sanitize. Many other compounds are available for sanitizing, although most are only practical and safe to use in a commercial setting.

Resources

Information on sanitation was provided by Brad Fournier in *Malting and Brewing Science, Vol. 2; The Practical Brewer; Beer Packaging: A Manual for the Brewing and Beverage Industry*, Dave Suda, Rodney Morris; *The Complete Joy of Home Brewing* by Charlie Papazian and from personal experience.

Chapter 4

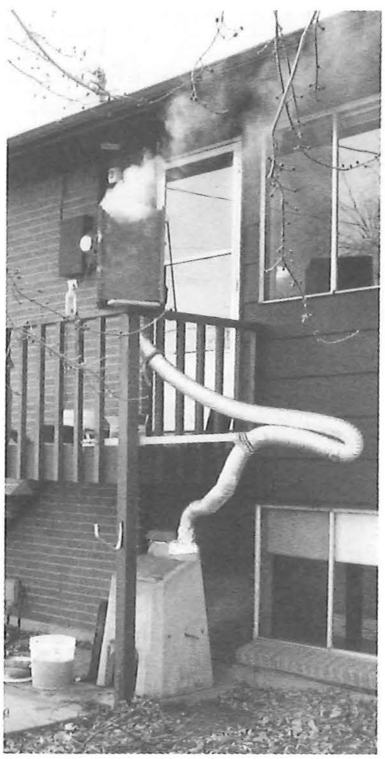
Ingredients

JIM HOMER & THOM TOMLINSON

Sky Kennel Malt Smoker

ALASKA, WONDERFULLY HUGE Alaska, land of the Eskimo, the midnight sun, salmon and most important, land of Alaskan Brewing and Bottling Co. and their Alaskan Smoked Porter.

What a heavenly brew, especially when accompanied by smoked salmon, cheese or chicken. Last fall we watched as Geoff Larson served up the last of his keg of Alaskan Smoked Porter at the 1991 Great American Beer Festival. It was truly a sad moment. We knew that we could not wait for next year's festival to taste another smoked porter.



What could two homebrewers do to satisfy the craving? The drive from Colorado to Alaska is no short road trip, so we decided to build a grain smoker and smoke our own. We had discussed malt smoking with Geoff and Marcy Larson late one evening at the 1990 Great American Beer Festival. Marcy smokes already malted grains using humid smoke. Since that time we have talked with many other brewers and beer lovers who shared their grain-smoking secrets. After much consideration we decided to smoke the malt using cold, humid smoke.

Smoking malted grains at home differs from the traditional process used in

PHOTOS BY JIM HOMER

Bamberg, Germany. The grains that make up classic rauchbiers go through a special dry smoking process. The wet, germinated grains, or "green malt," are dry smoked at the end of the malting process. Like most homebrewers we purchased our grain after the malting process. Because the malted grain is dry compared to "green malt," we accepted the recommendation to smoke with humid smoke. Recognizing that using humid smoke runs counter to traditional dry smoking procedures, we moved ahead with construction of the Sky Kennel Malt Smoker.

Construction

An old wooden sky kennel (bought at a yard sale) provided an excellent body for the smoker. Metal shelving brackets, cut to fit vertically along the left and right inside walls of the box, provided shelf support. Strips of pine, assembled with the aid of a picture frame vice or a miter clamp, served as low-cost shelf frames. A bronze screen was stapled to each frame resulting in a shelf of screen with a three-quarter-inch deep frame around the outside edge.

A concrete trash incinerator, no longer in use, needed no alterations to hold an adequate fire. You might find an old incinerator at a junk yard but a large grill or anything that will hold a fire will work. A wire grill, used to support hot charcoal, was positioned in the bottom of the incinerator supported by two bricks. A chimney made from 16 feet of aluminum dryer duct connected the incinerator to the Sky Kennel Smoker. A test run indicated the smoke needed to move through 16 feet of aluminum duct to cool down before reaching the smoke box. We secured the smoke box to the handrails of a deck nine feet above the incinerator. Even if you do not attach your incinerator or smoker to your house, constant supervision of the fire is a practical precaution.

Procedures

We placed one-half pound of American two-row malt on each of the 189.5-square-inch shelves and misted it with water. After returning the shelves to the smoker, we placed hot charcoal on the grill in the incinerator. With great care we sprinkled layers of wet alder wood chips on the hot charcoal. We soaked the small chips in water for 24 hours before the smoking began. A continuous supply of hot charcoal was maintained in a separate grill.

Hot charcoal was moved from the grill onto the grate in the bottom of the incinerator. A layer of wood chips was spread on top of the charcoal. As the chips heated, they produced an aromatic, humid smoke, which traveled through the dryer duct to the smoker. Periodically we added more charcoal and wood chips in an attempt to maintain a constant smoke source. A three-hour smoking session used 2 1/2 pounds of alder wood chips and 10 to 20 pounds of charcoal.

We learned a few lessons using the sky kennel malt smoker that will lead to procedural changes in the future. The misting of the malt prior to smoking resulted in damp grain that had to be dried in the oven. The next time we will not spray the malt, but will count on the humid smoke generated by the hot, wet wood to provide the needed moisture. The first time we used the smoker we were not sure we had enough wood to properly smoke the grains. Our first three-hour smoking session yielded grain with a very smoky aroma. A final lesson, Marcy and Geoff were right when they said that smoking malt is more an art than a science.

Recipes for Smoked Porter

Kachemak Bay Smoked Porter

Jim Homer

Ingredients for five gallons

3/4 pound 90 °L crystal malt
3/4 pound chocolate malt
1/4 pound roasted barley
2 pounds British two-row malt
above grains smoked for three hours, crushed and mashed for one hour at 153 degrees F (67 degrees C)
6 pounds Munton & Fison light dry malt extract
1/4 pound maltodextrin
1/2 ounce Chinook hops (12 percent alpha acid)—60 minutes
1 ounce Kent Golding hops (alpha acid unknown)—30 minutes
Wyeast No. 1028 London ale yeast
chipotle chilies

- OG: 1.060
- FG: 1.018

This is a full-bodied beer with smooth, smoky flavor and aroma. The crystal malt provides residual sweetness that balances the smoked malt flavor. Future attempts will include more crystal malt, probably 1 1/2 pounds instead of 3/4 pound. After fermentation the above beer was split equally between two kegs.

One of the above kegs was primed with a solution containing two chipotle (smoked dried jalapeño) chilies crushed and boiled with the priming malt and called Smoke on the Water, Fire in the Beer. This mix proved too hot for all but the most asbestos of palates. The next batch will include only one chipotle.

Kachemak Bay Smoked Porter recipe won third place in Specialty Beers Category in the First Rocky Mountain Homebrew Shootout competition sponsored by the Unfermentables homebrew club in Denver, Colo., May 9, 1992.

Chester's Smoked Porter

Thom and Diane Tomlinson

Ingredients for five gallons

7 pounds 9 ounces Briess two-row malt
2 pounds Briess two-row malt smoked three hours
14 ounces crystal malt (20 °L)
12 ounces chocolate malt
8 ounces black patent malt
2 ounces red roast malt
1 ounce rolled barley
1 1/2 ounces Galena hops (13.6 percent alpha acid)—60 minutes
7 grams Mount Hood hops (alpha acid unknown)—60 minutes
7 grams Nugget hops (13.4 percent alpha acid)—60 minutes
1 ounce Cascade hops (6.7 percent alpha acid)—30 minutes
14 grams Willamette hops (alpha acid unknown)—30 minutes
3/4 ounce Cascade hops (6.7 percent alpha acid)—five minutes

Infusion mash: 4 gallons mash water, mash at 159 degrees F (70.5 degrees C) for 20 minutes, drop the temperature to 154 degrees F (68 degrees C) over a 10-minute period, then finish mash for an additional 25 minutes at 154 degrees F (68 degrees C). Five gallons sparge at 170 degrees F (76.5 degrees C). Eight ounces ale yeast slurry courtesy of the Walnut Brewery, Boulder, Colo. Primary fermentation in glass for six days at 63 degrees F (17 degrees C). Secondary fermentation in glass for 14 days at 64 degrees F (18 degrees C).

- OG: 1.054
- FG: 1.020

Chester's Smoked Porter is a medium to full bodied porter with a smoky and Cascade hop aroma. A strong smoky flavor dominates with hop flavor evident. This porter finishes dry and is wonderful with cheese and barbecued chicken.

Thanks to Geoff and Marcy Larson for their smoked salmon and hints on malt smoking. Thanks to Diane Tomlinson, Thom's brewing partner, for her contributions to the grain smoking process and to Chester's Smoked Porter.

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150 Paularino Ave., Suite 190, Costa Mesa, CA 92626

WAYNE GREENWAY & RUSS WIGGLESWORTH

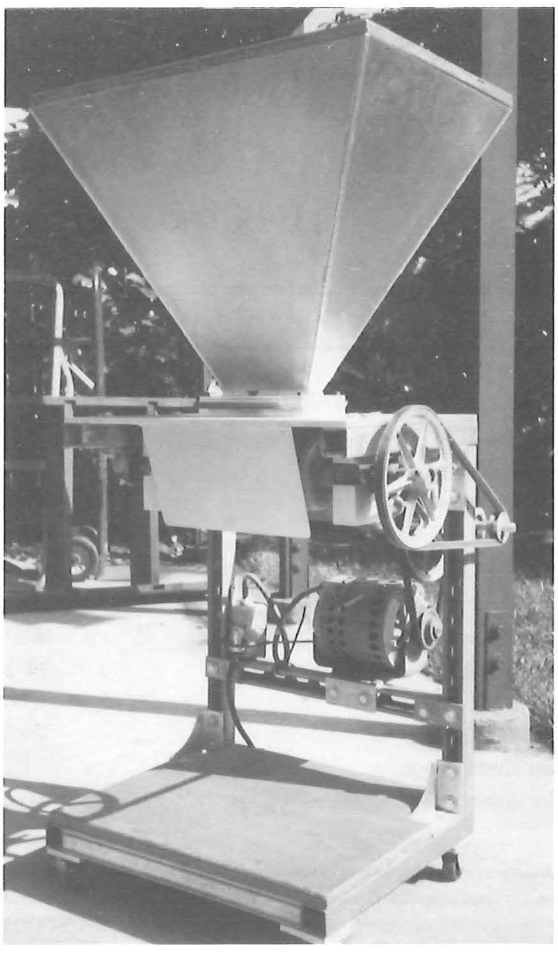
Building a Roller Grain Mill

AS AN ALL-GRAIN brewer you like the economy of purchasing grains in bulk, and the fact that you have the space to store them doesn't hurt.

A side benefit of bulk purchases is the freedom to brew much more spontaneously. No more trips to the brew shop or placement of mail orders well in advance of your brewing sessions. Now when you have a sudden free day you can brew if you want to (provided you have some yeast on hand).

The only real problem is how to crack the grain. The Corona mill does a fair job, but it requires constant attention. It doesn't have the capacity nor is it self-powered. You may have attached your variable speed drill to the Corona so you have enough muscle left to mash-in, but it still seems to be a compromise. Cracking 20 to 30 pounds of grain for those 10-gallon (or larger) batches is a chore you'd rather avoid. There's no question that a roller mill is the answer.

A roller mill has at least one pair of rollers mounted opposite each other in the same plane with a narrow gap between them. One of the rollers is rotated either by crank or motor. The grains are passed through the gap between the rollers. With the gap properly set the husk is split just enough to expose the starchy material within. Roller mills have several advantages. They crack grain much more evenly than the sliding plates of the Corona mill and they can increase your yield and make for much easier sparging. While it's not mandatory, most roller mills are powered by electricity that increases the speed of the crack (and saves your arms).



PHOTOS BY RUSS WIGGLESWORTH

The chief disadvantage of the roller mill is expense. You don't come across many roller mills at garage sales, and commercial models are priced way above the means of most homebrewers. You could have grain cracked at your local brew shop or friendly brewpub, however this offsets the spontaneity you have gained and may cost you time and money. At the very least it isn't very convenient.

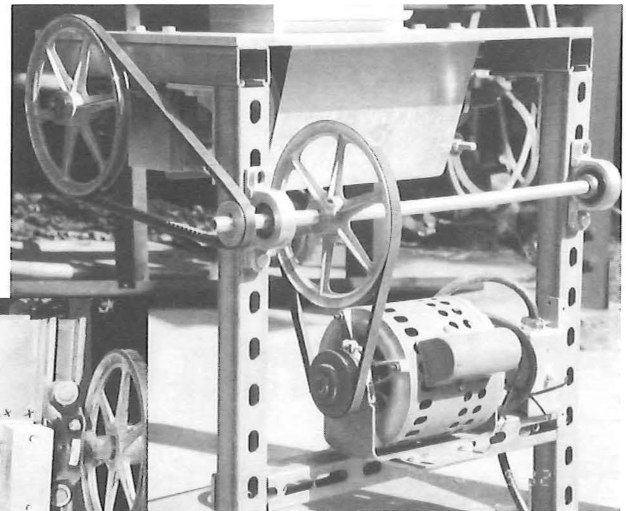
One solution is to build your own. If you have any mechanical ability this is a real possibility. If you have a modicum of resourcefulness you can build one for $150 or less. The remainder of this article explains how just such a mill can be built.

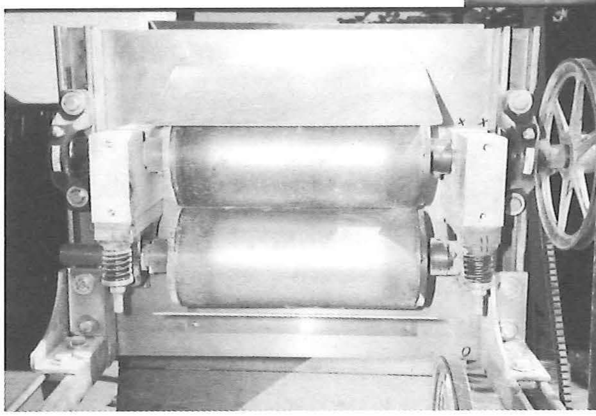
The mill pictured is built on a frame made of Unistrut™. If you are not familiar with this material you are really missing something. Unistrut™ is a metal frame system made up of standardized channels that bolt together using special nuts and brackets. It is an extremely strong and versatile system used for a variety of tasks in the construction trades. Considering the flexibility and strength of this product it isn't expensive, either. If you have to purchase all the Unistrut™ materials pictured here you might spend about $35. If you choose to use some other material to build the base, keep in mind there is a lot of vibration created during cracking, and the base needs to stand up to it.

The base of the frame rests on four casters so you can move the mill easily. This facilitates cleaning and allows you to roll the mill away from your brewing area to minimize infection problems caused by airborne dust generated during cracking.

The top of this mill is a piece of one-half-inch aluminum plate. A piece of three-quarters-inch plywood also would work. This plate supports the hopper and holds parts of the roller assemblies in place. The hopper here also is all aluminum but any of a variety of materials can be used. The key is to make the hopper large enough to hold a fair amount of grain without being unwieldy or making the mill top heavy. The sides should be smooth and well-sloped to allow a good flow of grain into the rollers. This one holds 60 pounds of grain and has 60-degree sides. It has an opening above the rollers that is one inch wide by six inches long. A piece of one-sixteenth-inch stainless steel slides into a slot at the base of the hopper, parallel to the bottom slot. This slide can be used to control the flow of grain or shut it off completely if necessary. This piece could be eliminated if you only crack as much grain as you can collect in one bucket at one pass.

The motor was salvaged from a washing machine. It is one-third horsepower that turns at 1,725 rpm and runs on 110 volts. It is fitted with an adjustable-diameter pulley. A one-half-inch axle is mounted on two pillow block bearing assemblies above the motor. An eight-inch pulley and a two-inch pulley are mounted to the axle. One final eight-inch pulley is mounted to the one-inch shaft of the driven roller. Belts go between the eight-inch and two-inch pulleys to transfer the drive to the roller and reduce the speed from 1,725 rpm to about 100 rpm. The adjustable pulley on the motor can be used to fine tune the speed.





The rollers are two 10-inch pieces of one-quarter-inch-wall black iron pipe. An end plate needs to be made and welded into each end of the pipes. This plate will have a one-inch hole in its center to accept the roller shaft. The shaft can be welded to the end piece or round key stock can be used with set screws. This mill uses the key stock to make the 4 1/2-inch diameter rollers more adjustable. Larger diameter rollers will work better because the channel (nip) between them narrows more gradually and draws the harder grains, like wheat and CaraPils, into the roller gap better. Use six- or eight-inch pipe if you can.

The rollers are held in place with four one-inch pillow block bearing assemblies. The driven roller blocks are mounted to the Unistrut™ below the top plate. The shaft for this roller extends beyond the right side of the top plate to allow room to attach the eight-inch pulley. The non-drive or slave roller is suspended from the top plate via two aluminum blocks and the two remaining pillow blocks. The aluminum blocks are machined with a channel so they can straddle the driven shaft. The pillow blocks are mounted to the aluminum blocks and spring loaded using valve springs from an old Chevy. The springs allow the roller gap to open in case any hard foreign object should find its way into the mill. If you are sure your grain is free of rocks and similar items the springs can be eliminated. In fact, the slave pillow blocks can be mounted on the same piece of Unistrut™ as the driven roller's blocks if you use large enough rollers.

The positioning and alignment of the rollers is fairly critical. They must be level and parallel within the same plane. This ensures the gap will be uniform along its entire length. The gap should be centered below the bottom opening of the hopper and as close to the base of the hopper as possible. A gap of about 0.030 inch works well for most grains but you will adjust yours for optimum cracking. To adjust the gap move the pillow blocks for the driven roller on the Unistrut™. Take up the slack in the pulley belts by also moving the one-half-inch pillow blocks and the motor mount. Unless you plan to crack single-type adjunct grains by themselves (i.e., just wheat, CaraPils, crystal or dark grains not mixed with pale malt) you should be able to set the gap once and leave it alone.

The outside edges of the rollers are shielded by two sheet metal deflector plates. These plates help guide stray grains into the collection bucket. The plates are the same width as the rollers and extend two or three inches below them, narrowing as they descend.

Obviously this mill isn't designed to be run unattended. There are plenty of places for fingers and clothing, beards and what not to get caught. Use common sense and take the proper safety precautions when operating it.

With any luck this article has provided you with the basis for designing and building your own mill. Even if you have to pay to have the rollers and the slave blocks fabricated, you should be able to build a very cost-effective machine. And don't be afraid to tinker — there is always room for improvement!

PHIL FLEMING

Water Filters for Beginners

PHOTO BY PHIL FLEMING

I USED TO spend a lot of time boiling the water I used in making beer to drive off the chlorine and prevent off-flavors. After building a simple series of water filters, I no longer have to boil all of the water just for chlorine removal.

I wanted to get a deionizing system similar to ones used in chemistry labs, but they were too expensive. An article in ***zymurgy*** Summer 1989 (Vol. 12, No. 2) on building a reverse osmosis filter looked like too much work and sounded like a waste of water. I decided on a Teledyne Water Pik filtration system because I could buy the filters at local discount stores. I believe the company is fairly stable and the filters will continue to be available so my investment in filter housings will not become obsolete.

My Teledyne Instapure water filtration system consists of two filters. The first is the "whole house" filter that removes big chunks like sand and rust. The second is an activated charcoal filter that does the important work. All of the necessary parts and instructions for connecting the filters are included and don't require a plumbing expert. The filters should last for 30,000 gallons. I figure I'll replace them every year even if I don't run thousands of gallons through them.

I was not sure just where to install the filter because I expected to move the brewery around and did not want a permanent installation. What I did was to take all of the parts provided and attach them to a piece of scrap plywood. Instead of permanently attaching the filters to the pipes as instructed, I changed the input and output fittings (available from suppliers for beverage dispensing equipment) to accept a three-eighths-inch hose barb. Then I attached a dishwasher quick-disconnect fitting to the input side and a long hose to the output. This allows me to store the filter system under the sink. When I brew or need filtered water, I just drag out the hoses, connect them and instantly have chlorine-free water.

I purchased a chlorine test kit used for aquariums to check the system's effectiveness. The unfiltered water was somewhere around 0.25 to 0.5 ppm chlorine and the filtered water tested at no chlorine. The filtered water has no chlorine aroma so I believe it works quite effectively.

I'm debating the convenience of a built-in faucet just for the filtered water. Other than the problem of installation, it would make access to the filtered water easier when not brewing. If all this sounds like too much for you, there are several other filters available from Omni, Foxx, Rapids and your local hardware store that are suitable for homebrewers.

Chapter 5

Mashing

DAVID COY

Brewing in a Bucket

I AM A strong believer in the importance of a full wort boil. Not only because I am an all-grain brewer, but also because I believe a full boil improves the quality of beer and utilizes hops more efficiently.

However, trying to boil six to seven gallons of wort on a stove is a difficult and time-consuming process. It didn't take me long to decide my electric stove just couldn't keep up with my brewing needs. With that in mind I began looking for an alternative brewing system. What I decided on is what a friend calls "brewing in a bucket."

ILLUSTRATION BY MATT BROWNSON

I started using the Bruheat Boiler (available from BrewCo) about four years ago while living in an apartment. Space was limited so I wanted something versatile. I now use the Bruheat for heating sparge water, containing the mash and boiling the collected wort.

For those of you who aren't familiar with the Bruheat, it is a large (7 1/2 gallon) plastic bucket with a 220 volt heating element near the bottom. The Bruheat does have some limitations, but if you keep in mind what it does well (boil liquid) it can be a very handy and efficient piece of equipment.

The manufacturer of the Bruheat claims it can hold mash temperature within 2 degrees. However, I found that my mash tended to have hot spots and that temperatures tended to creep up if I didn't stir constantly. I also found that too much heat was lost from the sides of the plastic bucket.

To remedy this, I insulated the Bruheat by cutting an old foam camping mat to fit around the bucket with openings for the drain spout and the heating controls. This not only increased the speed at which liquid comes to a boil by minimizing heat loss from the sides of the bucket, but also allowed me to hold a constant mash temperature without further heating. The foam mat works well, but if I were to start over I probably would use strips of Styrofoam™ insulation. This would provide better insulation and be easier to fit around the bucket.

A second limitation I found with the Bruheat is that it is difficult to get a clear runoff when sparging. As the manufacturer recommends, I use a grain bag with the boiler, but I found that it did not provide a stable enough grain bed to get a clear sparge (even with gallons and gallons of recirculating). Therefore I use a standard picnic cooler lauter-tun fitted with copper piping for sparging. The *zymurgy* 1985 All-Grain Special Issue (Vol. 8, No. 4) gives instructions on how to build one.

This next step might seem like extra work, but actually provides a very clear runoff and allows me to raise to mash-out temperature without scorching the grain. I do this by recirculating my mash liquid through the grain bed and back into the Bruheat for heating. By setting the Bruheat on a table and the cooler-lauter-tun on a chair, I can set up a gravity feed system that collects in two pitchers which I alternate for pouring the liquid back into the Bruheat. I like to think of this as my manual recirculating infusion mash system.

To show how all of this fits together, here is what I have found to be the most efficient brewing sequence using the Bruheat.

Begin by bringing six to 6 1/2 gallons of water to a boil. Once boiling, draw off slightly more than four gallons of water and place this water in an insulated box. This water will be the sparge water. Then add between two and three gallons of water to the boiling water in the Bruheat. With practice, I can come pretty close to my mash-in temperature when adding this water. Then dough-in the grains, cover the Bruheat with an insulated lid and wait for starch conversion. I usually check temperatures every 15 minutes and have found that the insulation provides a very stable temperature.

Once starch conversion is complete, transfer the grain and liquid to the picnic cooler lauter-tun and begin recirculating the wort. As the wort is clearing, heat it in the Bruheat to reach mash-out temperature.

Once I am satisfied with the clarity and temperature of the wort, I allow the Bruheat to drain completely into the picnic cooler, then fill it with the previously boiled sparge water reserved in the insulated box. The pot I store the sparge water in is then used to collect the cleared wort while I drain the sparge water into the cooler.

When all the sparge water is drained into the cooler, I pour the collected wort into the Bruheat and begin heating to a boil. I usually have my wort up to a boil shortly after all of my sparge water has circulated through.

I find this system very efficient and particularly like the minimal amount of equipment needed.

STEPHEN FOSTER

Get Into Grain Brewing

THE MOMENT YOU decide to deviate from a standard extract brew and venture into the realm of creating your own personalized beer, you will be tempted and challenged by the use of grains.

How much and when to use grains could be the subject of an entire *zymurgy* Special Issue, but for now let's focus on how to get them in and, more importantly, out of the brewing process in the cleanest and most stress-free ways. This is a problem for everyone from the extract brewer to full-mash breweries, and can be solved with a little ingenuity and maybe a little cash.

Full-Extract Brews

A few ounces of crystal or chocolate malt added to a full liquid or dried extract brew can add depth, character and freshness. Two types of grains can be used in the brewing process: those such as pale ale malt that have enzyme activity and grains that do not, such as crystal and chocolate malt. For full-extract brews use these latter non-enzyme grains that don't require mashing.

It is important to note that the cracking, or grinding, is one of the most important steps in the use of grain. Grain should be cracked to open the kernel to the wort but must not be ground to a powder. Cracking can be done with a rolling pin (in a bag is much cleaner), a clean, oil-

Table 1

Sieve Sizes with Corresponding Uses

Sieve Size	Micrometers	Inches	Uses in the Brewing Process
#200	75	0.0029	A bag with this mesh is very fine and will clog if used with grain. Use in boil with hops in the bag.
#60	250	0.0098	A bag with a fine mesh that will not clog as easily. The mesh size of nylon stocking, use it in the boil with hops inside.
#30	500	0.0197	A fine-mesh bag that will work with grains. However, it is better when used with smaller quantities of grain that do not develop a good grain bed.
#20	850	0.0337	A bag of this mesh provides a good grain filter bag.
#10	2000 (2 mm)	0.0787	A large-mesh grain bag that is best used with larger quantities of grain where a good bed can develop.

free coffee grinder or a grain mill. Do not add the grains to the boiling wort because this will impart a husky or bitter flavor to the beer. I have seen some recipes call for this practice.

If the grains are to be steeped, then they should first be cracked, placed in the warm or hot water and steeped before being removed. Use about one quart of water per pound of grain. The preferred method of extraction is to add grain to the water at a temperature of 140 to 158 degrees F (60 to 70 degrees C) and steep for 15 to 30 minutes. The grains should be strained, and the extract added to the wort before boiling. To remove the grains use a fine mesh household sieve. If the mesh allows too many of the husks to come through, line the sieve with linen, cotton, a mesh bag or a pair of prewashed nylon tights. In fact, this item of clothing is very versatile, with the feet making an excellent in-the-boil bag and the rest making a great grain filter. Grain bags can, of course, be purchased in various mesh sizes (holes to the inch). A table of mesh sizes (with corresponding sieve number) is shown in Table 1 with some guidance on where they can be used in the brewing process.

Adding grains to an extract brew is a chemist's equivalent of "bumping grains." If you boil with grains they provide a focal point for water vapor bubbles to form and rise to the surface fast. It's very easy for the wort to boil over, so use a large pan and/or stir the wort as it is coming to a boil.

Half Extract, Half Grain

When graduating from extract brewing to mashing (using grains with enzyme activity to produce sweet wort), it is useful to undertake the process on a smaller scale at least once to understand the potential pitfalls, mess points (where you can have a very sticky problem) and points where you need three hands. The type of strainer used will be proportional to the amount of grains used. If only a few ounces of grain are used they can be mashed in a stove-top saucepan, the wort can be collected by pouring the mash into a colander lined with a fine mesh grain bag, nylon (tights) or gauze. A bowl or bucket can be used to collect the wort.

Don't Oversparge

The first run of the wort, when you stir it, probably will be cloudy with spent grains and other debris. This material should be removed by carefully pouring it back through the spent grains before sparging. It is easy to oversparge small quantities of grain. You should only use about 1 1/2 times the volume of mash water for sparging.

For small batches I have found this step is best done in the sink or the bathtub, then when I spill, it's easy to clean up. Always have a towel handy.

When the volume of grain increases to more than four pounds, it is difficult to work with household utensils, but it is possible. Larger equipment may need to be made or purchased. What you use depends on your pocketbook and ingenuity. One of the cheapest grain filters for stove-top mashed grains is a plain square of gauze or nylon suspended over a plastic bucket and clipped firmly in place with eight to 12 spring-type clothespins. A better variation has a tap at the base of the bucket so you can easily remove and refilter the initial cloudy wort.

Close the Tap

Remember to close the tap and have someone hold a towel opposite you when you pour the grains into the suspended grain bag. It can splash and leave sticky spots all over the kitchen.

A grain bag is always useful for sparging and can be purchased at a brewing supply store.

Another system that is cheaper than a tap and works well is one that needs only a hole in the bucket, a tubing connector, some tubing and a clamp (see Figure 2). By running some tubing from the lauter-tun to the brew kettle or collection pan the mess is controlled.

However, unlike a tap, it's only held in by the force you apply. If it falls out before you're done you have an uncontrolled stream of warm wort to deal with fast. With the simple addition of a copper rivet on the inside of the bucket, through the tubing connector, against the bucket, the problem is solved.

With all of these systems, check them with water before you pour your valuable mash into them.

Photos by Stephen Foster

Figure 1

All Grain

If you buy or make a grain bag large enough to hold eight to 12 pounds of malt you can make most five-gallon styles of beer. However, with larger quantities a grain bag should not be used because pockets of unsparged wort can develop, leading to low extraction rates. There are many ways to do this. One of the cheapest is shown in Figure 1. All you need is a plastic bucket, a grain bag or some gauze,

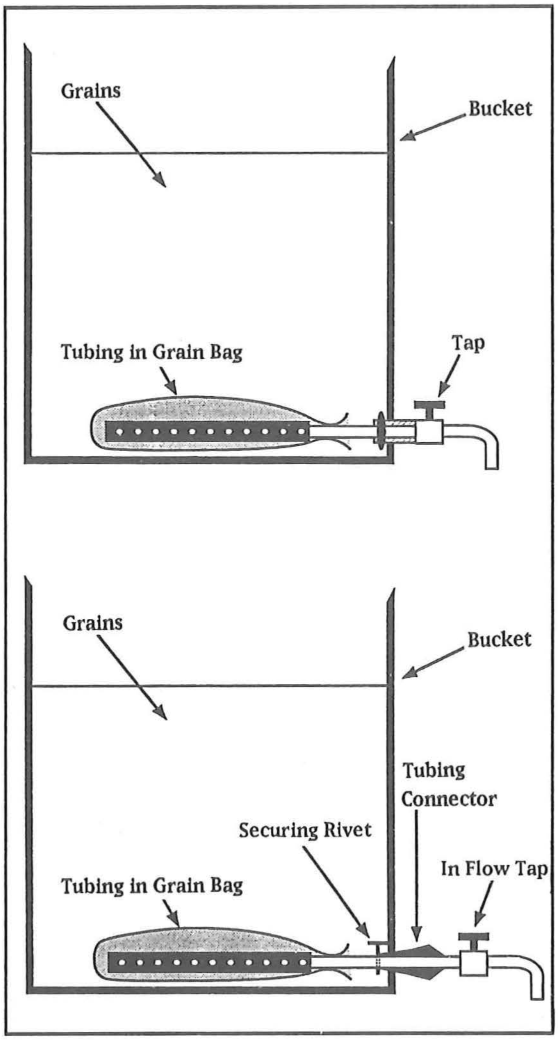


Figure 2 - A Simple Grain Lauter-Tun

Tygon (polyethylene) tubing, a tubing connector and a hose clamp. In this case a tap would be better as it gives you more control over the flow of wort. Simply cut holes in the tubing, put it in the bag and tie the bag with the end of the tubing sticking out. Then connect this end to the inside of the tap.

From here you can move into many different systems such as a false bottom lauter-tun. There are some good systems available commercially for this. The Zapap system provides two interlocking buckets, one with a perforated bottom for straining the wort. You can make this system with two buckets, one fitting inside the other, with an electric drill. If you are going to make a lauter system it can be done in combination with an insulated mashing system for convenience. Using this system, you never have to physically move the mash, only the sweet wort.

One of the simplest designs is to use a cooler and build a system of polyvinyl chloride tubes with holes drilled in the base. This system can be constructed for less than $25. When the polyvinyl chloride is covered with a grain bag, this system is perfect for infusion mashing and can be used for decoction mashing when done near the stove. A more elaborate false bottom system is shown in Figure 3. This system is more expensive, but the investment is only done once and the system will last a lifetime.

Coupling a tap and tube to the bucket or cooler outlet helps prevent spills and reduces the stress of handling hot sticky wort, particularly around other family members who may not appreciate it.

Whether you brew with extracts or are a full-mash brewer, whether you like to build things or not, grains can transform a simple extract brew or can produce the whole beer. Either way, it's fun!

Figure 3

RODNEY MORRIS

Recirculating Infusion Mash System Revisited

I DEVELOPED THE recirculating infusion mash system (RIMS) because I was dissatisfied with the traditional "pot on a stove."

It was developed to have the following features:

(1) Precise temperature control to within 0.1 degree to give repeatable mashing conditions from batch to batch. If a particular beer was a bit too dry, I could adjust precisely the mash temperature a few degrees on the next batch to change the ratio of fermentable to non-fermentable carbohydrates.

(2) Uniform temperature throughout the mash. The old system heated the malt in the pot in a non-uniform manner and precise temperature control was difficult.

(3) Reduction of labor. There is no need to stir the pot during a temperature boost.

(4) Faster mashing.

(5) Recirculation of wort in the new method produces a brilliantly clear liquid by the end of the final temperature rest. Formerly, it was necessary to transfer the mash to a lauter vessel, then drain and recycle some of the wort repeatedly until the wort ran clear.

(6) Mashing and sparging are done in one vessel.

Items Required

Igloo Legend 36-quart cooler, or a 48-quart cooler if you mash eight- to 10-gallon batches.

A stainless-steel open-bottomed box that just fits in the cooler. I bought a sheet of 20 gauge stainless steel, nine inches wide and long enough to bend into the box shape for $12 from a local sheet metal supplier. A flange three-eighths-inch wide was bent inward on the bottom of the box to support an 18-mesh stainless-steel screen held in place by pop rivets. Two five-sixteenths-inch diameter rods were run lengthwise in the box below the screen and welded to the bottom of the box to hold it just above the cooler surface.

The bolting grade type 304 stainless-steel screen has 70 percent open area, allowing a very fast recirculation of the wort. If you use any other type of mash support, be certain it allows rapid recirculation. (The screening is available from McMaster-Carr in three- or four-foot-wide rolls sold in linear feet, Catalog No. 9230T72, around $5 per foot. Ask for their catalog of industrial products that has many items useful for microbrewery construction.)

A small magnetic drive pump with heat resistant housing was used to recirculate the wort. Check surplus dealers for such pumps. The selection criteria are:

(1) Magnetic drive, no shaft to leak wort into the motor.

(2) Pump housing connections for 1/2-inch diameter hose.

(3) Pump capacity of four to eight gallons per minute at a one-foot head.

(4) Universal-type motor capable of being speed controlled by a triac motor controller. All pumps I have examined can be speed controlled.

(5) Motor power of 1/50 to 1/20 horse power, with 1,500 to 3,000 rpm.

(6) Shut off pressure of pumping at six to 20 feet of head.

(7) Heat resistant pump head.

Companies that make suitable pumps include March Manufacturing Co., Milton Roy and Little Giant. I found a low-cost surplus pump available from H&R Corp. but it had sold out. The company does get additional surplus pumps from time to time, so you might request a catalog listing their pumps. Two companies that routinely carry pumps, but not at surplus prices are Cole-Parmer Instrument Co. and W.W. Grainger.

If you mash eight- to 10-gallon batches in a 48-quart cooler, use the Cole-Parmer higher capacity MDX-3 pump, Catalog No. N-07004-30 about $115. W.W. Grainger sells pumps and many industrial items at wholesale prices from more than 225 branches nationwide. The catalog has many items of use to microbreweries. They sell the March MDX pump, Catalog No. 1P676 for around $60, and the MDX-3 pump, Catalog No. 1P677 for around $70.

The mash heating element, R5 in the circuit diagram, is a nickel alloy low density 240 volt, 4,500 watt heating element for electric water heaters. It is run at 120 volts, giving 1,100 watts of heat. Use only this type of heater, with a 15-inch long element, with the loop folded back most of its length to have a low heat density. Tin plated copper heating elements are not recommended because of the high heat density that can scorch the wort on the heating element. I purchased the heating element from a local building supply/hardware store for $11.78. Use the screw-in type. If you mash eight- to 10-gallon batches of beer, use a 5,500-watt heater with a March MDX-3 pump and a 48-quart cooler.

Use a 1 1/2-inch diameter by 15 1/2-inch long copper plumbing pipe to hold the heater. The ends of the pipe are closed with copper pipe caps. One cap has a one-inch hole to admit the heating element. A one-inch copper threaded coupling is mounted on this end to accept the screw-in heating element. At one end, a copper one-half-inch T is attached to receive the wort from the pump. The other end has a one-half-inch elbow attached at the top to carry the heated wort back to the top of the grain in the cooler. The copper parts cost me a total of $12. Some lumber suppliers quoted a much higher price. See Figures 3 and 4 for construction details of the heater tube. Do not use a larger diameter tube, because it would result in the wort flowing more slowly past the heater element and being overheated.

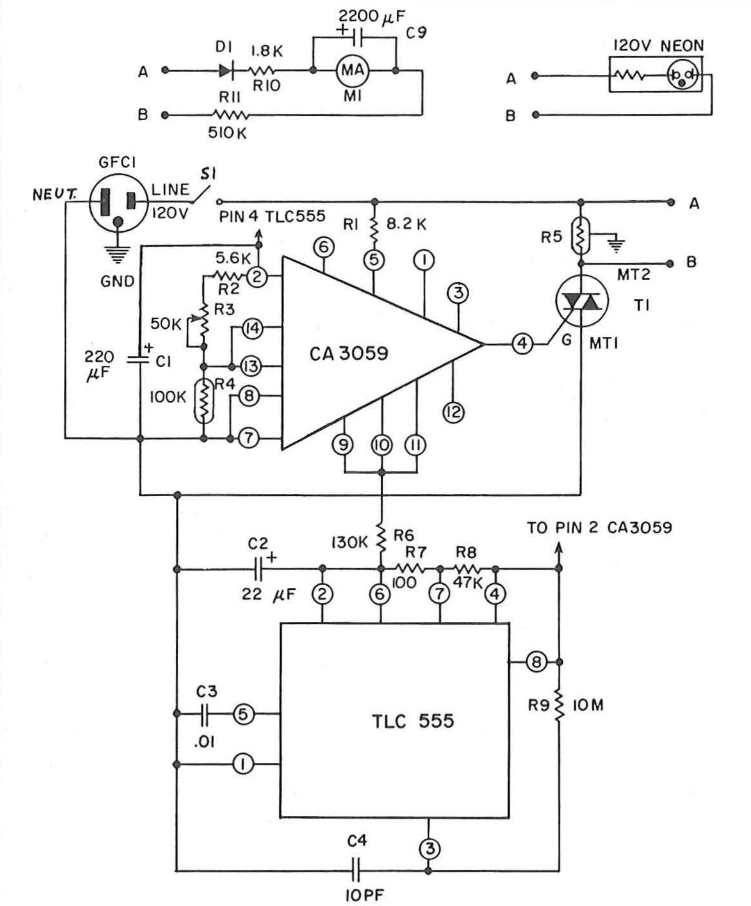


Figure 1. Temperature controller.

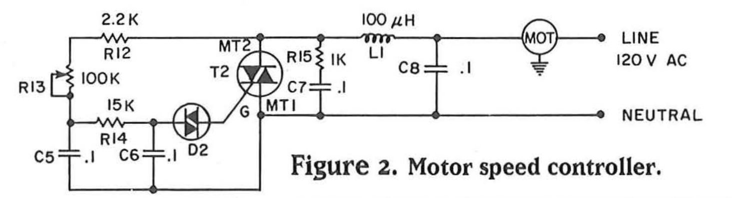


Figure 2. Motor speed controller.

Figure 1 is a circuit diagram of the temperature controller. At points A and B you may connect either of the two power indicator circuits shown at the top. The meter circuit will show the average power being used to heat the mash. H&R Corp. sells surplus meters for about $5. If you use this meter power circuit, the scale must be recalibrated to show the average power accurately. The motor speed controller circuit shown in Figure 2 may be constructed using the components shown or a similar controller may be purchased from H&R Corp. for about $4. Do not use a light dimmer because the inductive load may cause it to fail. You can convert a light dimmer to a motor speed controller by connecting a snubber consisting of R15 and C7 across the triac. Use only a low power CMOS type 555 timer in the circuit, because the current available from the CA3059 is insufficient to power a conventional 555 timer. The TLC 555 CMOS timer is available from Radio Shack as is the 120 volt neon indicator. Most of the components are available from Digi-Key Corp.

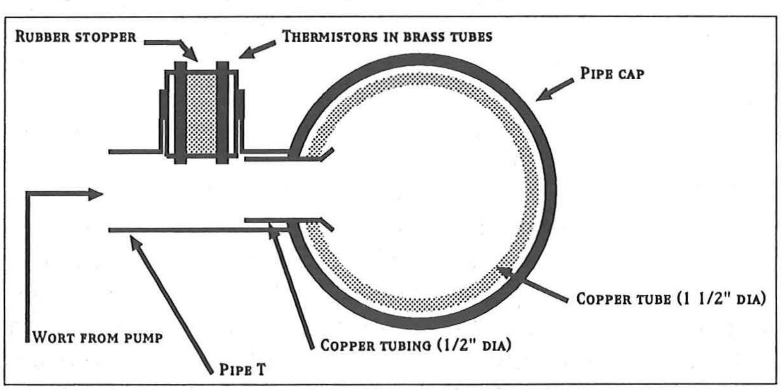


Figure 3. End view of heater tube (wort inlet).

GFCI is a 15-ampere ground fault circuit interrupter wall outlet which I obtained from a local hardware store for $8. Do not pay more than $20 for this item.

R3 may be a single turn potentiometer (Radio Shack) or a 10-turn precision potentiometer and counter knob from a surplus dealer (about $5 each). The 10-turn potentiometer allows one to precisely set the desired temperature, but is expensive unless purchased from a surplus dealer. R4 is the thermistor that allows the CA 3059 to control the temperature of the wort. Use a small size (0.1-inch diameter) bead type thermistor available from Digi-Key. Solder the leads of the thermistor to two small wires. Coat the thermistor and bare leads with a thin layer of epoxy cement.

When the epoxy has hardened, insert the thermistor into a short piece of thin-wall brass tubing that is slightly larger in diameter than the thermistor bead. The brass tubing is filled with epoxy and allowed to harden. Use only brass tubing that is slightly larger than the thermistor bead so rapid response to temperature changes in the wort is possible. The wire is inserted into the tubing and held in place by the epoxy. This must be done very carefully because if the wires touch the tubing, the system won't work and it'll short out. Make certain that the wire leads of the thermistor are not shorted to the brass tubing. A convenient source of small-size brass tubing is ballpoint pens. The thermistor is inserted through a small hole in a rubber stopper at the inlet to the heater.

An accurate digital temperature display was available from Radio Shack for about $13 but is now discontinued. This same digital thermometer is available from Edmund Scientific for about $20 (Catalog No. R36677). Remove the circuit board from the case and unsolder the tiny thermistor bead located underneath the slots in the front panel of the unit. Mount this thermistor in another tiny piece of brass tubing as was done with the other thermistor. Mount this thermistor in another hole in the rubber stopper. Run the wire leads back to the thermometer board and solder the ends to the location from which you removed the thermistor. This thermometer will display Celsius or Fahrenheit. It also will show the time with a push of a button. My unit has an error of 0.3 degrees. There is no temperature calibration adjustment in this unit. The maximum temperature displayed is 158 degrees F (70 degrees C). A larger digital thermometer with a remote probe included is also available from Edmund Scientific for about $30 (Catalog No. R34005). This unit reads to 199.9 degrees (Fahrenheit only) and has a temperature calibration potentiometer on the circuit board.

Parts List

All resistors are one-quarter watt, 10 percent unless indicated otherwise.

- R1 8.2 K, 2 watt film type
- R2 5.6 K
- R3 50 K linear potentiometer, single or 10 turn
- R4 100 K NTC thermistor, Digi-Key Catalog No. KC009N-ND, about $2
- R5 4500 watts, 240 volt nickel alloy (Incoloy) low heat density hot water heater element
- R6 130 K
- R7 100 ohm
- R8 47 K
- R9 10 M ohm
- R10 1.8 K
- R11 510 K, adjust for full scale on meter at maximum heating
- R12 2.2 K, one-half watt
- R13 100 K linear potentiometer
- R14 15 K
- R15 1 K, one-half watt

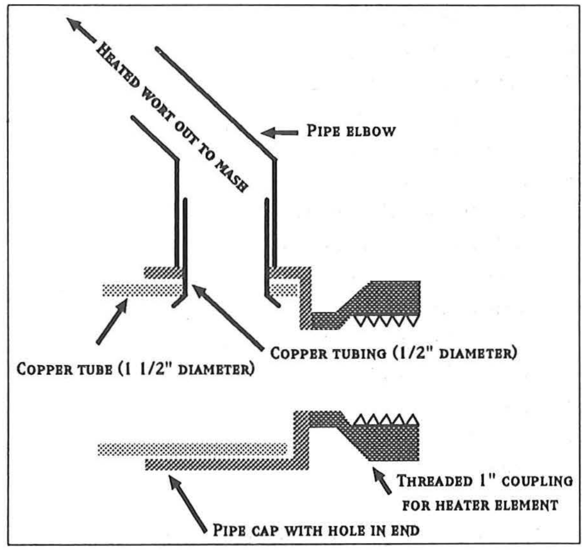


Figure 4. Side view of heater tube (wort outlet).

- C1 220 µF, 16 volt electrolytic
- C2 22 µF, 16 volt low leakage electrolytic or tantalum type
- C3 0.01 µF, 50 volt ceramic
- C4 10 pF, 50 volt ceramic
- C5 0.1 µF, 200 volt Mylar
- C6 0.1 µF, 100 volt Mylar
- C7 0.1 µF, 250 volt Mylar

C8 0.1 μF, 250 volt Mylar
C9 2,200 μF, 6 volt electrolytic
D1 1 amp, 600 volt rectifier
D2 Diac trigger for triac, or use a triac with a built in diac (quadrac)
S1 15 amp SPST switch
T1 15 amp, 400 volt triac with an isolated tab, Digi-Key Catalog No. Q4015L5, about $3
T2 4 amp, 400 volt triac or quadrac, Digi-Key Catalog No. Q4004LT, about $2
M1 100 μA DC meter
MOT pump motor
L1 100 μH choke (200 turns of 20 gauge wire wound on 1 1/2 inch by one-half-inch ferrite rod)
Neon 120 volt panel mount neon indicator with built-in resistor
GFCI 15 amp Ground Fault Circuit Interrupter Outlet
CA 3059 Temperature controller, Digi-Key Catalog No. CA3059, about $2
TLC 555 CMOS type 555 timer, Radio Shack Catalog No. 276-1723, about $2

Mount the T1 triac on a two-inch by four-inch finned aluminum heat sink with thermal compound between the triac and the heat sink because it dissipates considerable heat. Use an isolated tab-type triac so that the heat sink does not become electrically live.

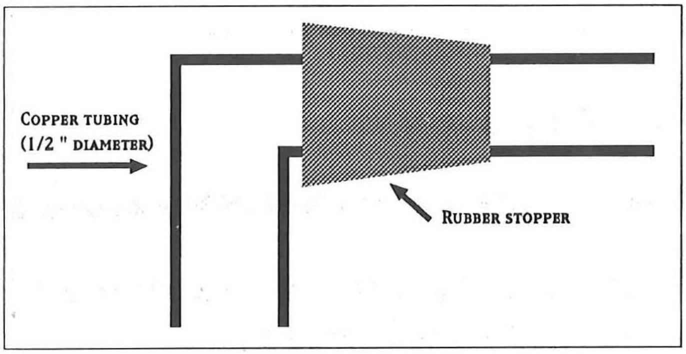


Figure 6. Connector for collar drain hole.

The CA 3059 temperature controller uses zero voltage switching to eliminate radio frequency interference. It operates directly off the 120 volt AC line with no transformer power supply needed. The temperature controller circuit uses proportional control to hold the wort temperature within 0.1 degrees, actually better than is necessary. The controller anticipates the set point temperature when you boost it after a mash rest, and automatically starts to reduce the heating power at 1.5 degrees before the set point, preventing overshooting the desired wort temperature. At the set point, the average power needed to maintain temperature is about 60 watts. The wort should be recirculated at least 2 1/2 gallons per minute during maximum heating in the temperature boost periods. The temperature differential between the input and output of the heater should be 2 degrees or less with maximum power. Recirculation may be slowed during the rest periods. A sheet of one-eighths-inch thick styrene plastic with 250 one-eighths-inch holes drilled in it is cut to fit the box and is laid on top of the mash. This prevents the stream of wort from the heater from stirring up the mash.

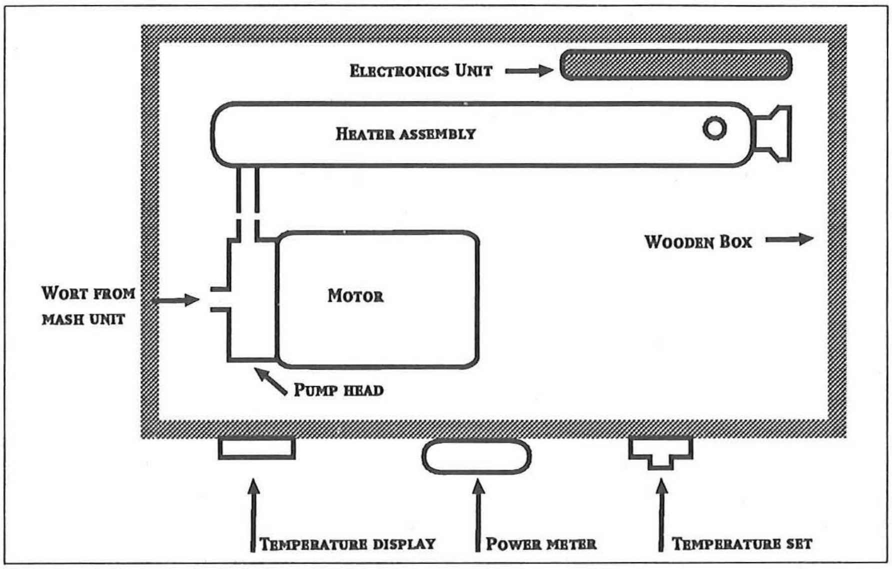


Figure 5. Layout of RIMS components.

Figure 6 shows the connector made from copper tubing to replace the plastic spigot that comes with the cooler.

Safety Considerations

Use this RIMS unit only on three wire grounded circuits. The unit must have wire attached to the heater tube and the case of the pump motor. The ground will protect against shorts in the equipment. Use a ground fault circuit interruptor-type outlet because it will trip at about five milliamperes, unlike a conventional circuit breaker. If a GFCI is not used, touching a 120 volt wire in the RIMS unit may allow enough current to flow through your body to the ground to kill you without tripping a conventional circuit breaker or fuse.

Assemble the copper tubes with only lead-free solder. Kmart sells small spools of lead free 96 percent tin/4 percent silver or 95 percent tin/5 percent antimony solder.

More on RIMS

(1) The circuit diagram for the system is accurate. Various homebrewers have constructed the device and found it to work. Check your circuit board carefully for wiring errors before turning it on and doing a smoke test.

(2) Use a ground fault circuit interruptor (GFCI) type outlet for safety because an electrical hazard will result if you spill wort onto the electronic components, etc. A GFCI outlet sells for less than $10 at hardware stores, so safety is not expensive.

(3) Cheap recirculating pumps are not readily available. Do not substitute a pump with a slow flow rate for the suggested types, even if they are cheap (for example, a pump used in evaporative coolers for homes). Check industrial surplus stores for good, inexpensive pumps.

C&H Sales Co. sells a pump that will work when modified. This magnetic drive pump has a brass heat-resistant head that pumps at 2.3 GPM, a little slow. You can use an auto transformer to increase the flow rate sufficiently for use with the RIMS system. Buy a small 120 to 12 volt center tapped transformer rated at 2 amperes on the low voltage side. Connect the 12 volt windings in series with the 120 volt windings. Wire the transformer with the line voltage connected to the 120 volt terminals and connect the pump to the series connected windings through a switch to select 120 volts, 126 volts or 132 volts as needed to control the speed of the pump motor. Do not use the electronic speed controller with this setup.

(4) Add about 1.3 quarts of water per pound of grain to the cooler and heat to about 6 degrees above the desired strike point. When you have reached the desired temperature turn off the heater then add the grain while pumping. Continue to pump for about 10 minutes, whereupon the grain will pack down and the flow rate will decrease. Stir up the grain bed with a large spoon, continue pumping for about two minutes then turn the heater back on. I do not need to stir up the grain bed more than twice during a mashing session to keep a high flow rate through the grain bed. Mash out about 10 to 20 minutes after the starch particles have digested and the recirculating liquid is clear.

(5) If the barley was ground too fine, the result will be a "set mash," which is a mash in which the lauter runoff is slow or stopped. When crushing grain, do not grind too finely.

(6) If a large, strong suction pump is used without a box to hold the grain, it can cause the grain bed to be compacted, reducing the flow rate excessively. Also, if the pump is too far below the grain bed, it may result in a strong hydrostatic head suction that compacts the grain bed and reduces the flow of wort through the grain. The inlet of my pump is two inches above the bottom of the screen. I designed the RIMS unit so the box has a small gap between the box and the walls of the cooler. The maximum hydrostatic head is limited by the depth of the grain bed, never more than nine inches. The wort flows through the grain without suction into the bottom of the cooler to a depth of about one to two inches, where it is drawn into the pump.

(7) If a box is not used to hold the grain in the insulated cooler, you can limit the hydrostatic head to the depth of the grain bed by vertically securing a piece of 1 1/2-inch diameter by one-foot long piece of PVC sink tailpiece to the false bottom screen with wire to exclude grain inside the tube. If the pump runs too fast, air will be drawn into the pump, but the grain bed should not be compacted.

(8) Use sufficient water for mashing. Various technical homebrewing books by Gregory Noonan, Dave Miller and George Fix recommend a ratio of 1.25 to 1.5 quarts of water per pound of grain as typical for mashes. The RIMS unit works well with about 1.25 to 1.33 quarts of water per pound of grain. Miller considers 1.22 quarts per pound of grain in his step infusions to be a "stiff" mash.

(9) Do not have the grain bed more than one foot deep. Commercial brewers may have deeper beds during the lauter period, but they continually stir the top of the mash beds during the lauter operation to keep the liquid flowing fast enough.

(10) I have some heat-resistant polypropylene screening of the type used by commercial brewers for their lauter tuns that has a rapid flow rate suitable for the RIMS unit. Installation of this screening is different from that used for the stainless-steel screen, which is considerably more expensive.

(A) The RIMS stainless-steel open-bottom box should have a 3/8-inch strip of metal bent inward on the box bottom for securing the screen. Cut additional stainless-steel sheeting into 3/8-inch wide strips to the same lengths as the flanges on the bottom of the box. Drill one-eighths-inch holes through both the box flanges and the additional metal strips every three inches.

(B) Weld two five-sixteenths-inch diameter stainless-steel rods to the two shorter three-eighths-inch wide metal strips, evenly spacing them. These rods will run lengthwise along the bottom of the box and help support the screening to keep it off the bottom of the cooler.

(C) Cut the screening to size, a little bigger than the box dimensions, and lay it over the flange on the inverted box. Place the metal strips over the screen, aligned with the box flanges. Pour about one gallon of boiling water over the screen to soften it and allow it to be stretched better.

(D) Pull the screen tight, melt holes through the screen with a soldering iron tip where the holes drilled in the flanges and metal strips are located. Secure the screen in place with stainless-steel screws and nuts. The three-eighths-inch wide metal strips help to clamp the screen in place and prevent stretching. Trim off the excess screen with a scissors and use the soldering iron to fuse the edges of the cut screen to prevent fraying.

(E) Cut several pieces of one-eighths-inch diameter stainless-steel welding rod to the same length as the narrow dimension of the box and slide each one between the screen and the two five-sixteenths-inch rods. Space the one-eighths-inch rods about three inches apart to give additional support to the screening. The one-eighths-inch diameter rods are held in place by friction and do not need to be glued.

(F) Use large plastic or wooden spoons to stir the mash in the box, not sharp-edged metal spoons.

Where to buy:

Screening:

McMaster-Carr (main office), PO Box 4355, Chicago, IL 60680-4355, Orders: (312) 833-0300, Los Angeles, Calif., office sales: (213) 692-5911, Dayton, N.J., office sales: (201) 329-3200.

Pumps:

H&R Corp., 401 E. Erie Ave., Philadelphia, PA 19134, Orders: (214) 425-8870.

Cole-Parmer Instrument Co., 7425 N. Oak Park Ave., Chicago, IL 60648, Orders: (800) 323-4340.

W.W. Grainger, 5959 W. Howard St., Chicago, IL 60648, (800) 323-0620.

C&H Sales Co., 2176 E. Colorado Blvd,. Pasadena, CA 91107, (800) 325-9465.

Electrical Components:

Radio Shack, (check your Yellow Pages).

Digi-Key Corp., 701 Brooks Ave. South, PO Box 677, Thief River Falls, MN 56701-0677, (800) 344-4539.

Edmund Scientific, 101 E. Gloucester Pike, Barrington, NJ 08007-1380, (609) 573-6259.

Tips for a Better Beer

Now that you can have precise temperature control for mashing, here are some suggestions for improving your beers.

The ratio of water to grain in your mash will affect the mash enzymes. Measure the water and weigh the grain to produce the style of beer you like. Check and adjust the pH of the mash, as the pH level will affect the enzymatic reactions. I recommend the plastic "colorpHast" strips sold in most brewing supply stores. (Use Catalog No. 9582, pH range of 4.0 to 7.0.) The indicator dye does not wash out of the test strips. With weakly buffered solutions such as wort, immerse the test strip for one minute before reading. You can also buy boxes of 100 test strips from scientific supply houses for about $8.

The salts in your mash and sparge water also will affect the type of beer you make. Adjust the sparge water to the same range as wort (around pH 5 to 5.5) with phosphoric or lactic acid to reduce the amount of tannins leached from the barley husks during runoff.

Do not grind the grain too finely in a hand mill. Excess flour slows the recirculation rate too much, resulting in scorching of the wort on the heater.

I monitor the mash development with a hand-held refractometer to determine when to cease and start sparging. The refractometer is faster and more convenient than a hydrometer. Unfortunately, refractometers are expensive, with a price around $175. A refractometer is unsuitable for determining the gravity of a fermented beer, because of the dramatic effect the alcohol has on the refractive index. I use this effect to measure a fermented beer with a refractometer and hydrometer to determine the residual gravity, original gravity, alcohol content and final gravity.

Do not exceed 167 degrees F (75 degrees C) with the sparge water because very hot water may warp the plastic of the cooler and gelatinize remaining starch, which could then clog the wort runoff. A decoction mash has little problem with hot 176 degrees F (80 degrees C) sparging because portions of the mash are boiled and little starch remains at the end of mashing. I use a one kilowatt stainless-steel heater unit that hangs on the rim of my sparge water pot and has a thermostatic probe to maintain the sparge water at 161.5 to 167 degrees F (72 to 75 degrees C). I bought this heater from H&R Corp. for about $10.

Leave the hot break trub and cold break behind when you fill the fermenter.

Aerate (rouse) the cold wort so the yeast fermentation will get a fast start. Use a clean, vigorous yeast starter and do not ferment at too high a temperature.

GEORGE MONCURE

Whale of a Homebrewery

BREWING IS NOT only an art, it's a science. I started homebrewing the hard way and continued for a long time until I got tired of difficult labor, burned fingers and a messy kitchen.

Finally I decided to bring home science, in the form of home technology, to my homebrewing. It was never that difficult, but I was interested in simplifying the mechanics of brewing and improving precision and reproducibility. This interest showed in two areas: controlling the flow of mash and sparge liquids and regulating temperature. Two components of a prototype system are presented here that significantly reduce fluid handling and temperature concerns. A system flow diagram is shown in Figure 1.

The system uses a cylindrical cooler mash/lauter-tun with a perforated stainless-steel false bottom. A bottom-mounted drain reduces the dead volume and the drain valve allows extract to flow into a small pump that drives the circulation system. The circulation system serves three functions: maintain temperature, set the grain bed (filter medium) and pump extract into the boiler pot during sparging.

The design of such a system is limited only by imagination, time and funds. My prototype system was designed around the parts on hand. While specific parts or electrical skills may be in short supply, the design serves my needs and can easily be modified yet still adhere to the principle.

The plumbing system is designed around a common pump found in recreational vehicles. The Superline 99 Whale Pump operates on 12 volts DC and can move more than 12 quarts per minute. However, it requires a control unit to allow a range of pumping rates and currents up to 2.8 amps. A simpler pumping system like a drill-powered peristaltic pump can be used instead. The Whale system offers relatively quiet and powerful operation with dedicated controls.

Parts List for Pump Control

R1 1.5k
R2 100k
R3 180k
R4 47k
R5 470k
R6 47k

P1 10k Linear Taper
P2 100k

IC-1 Voltage Regulator: 15-V, 5-A (use heat sink)
IC-2 NE555N Timer

Q1 0.5-A, 40-V, NPN Transistor
Q2 NPN Darlington Amplifier: 15-20-A (Use heat sink)

D1 Bridge Rectifier: 25-A, 100-PIV
D2,
D3 50-PIV, 1-A Silicon Diode (1N4148)

C1 500µF, 25-VDC Electrolytic
C2 100µF, 25-VDC Electrolytic
C3 0.047µF, 50 to 100-VDC film, 10 percent
C4 0.1µF, 50 to 100-VDC film, 10 percent

The control unit is based on similar power applications for model railroading. The control unit (Figure 2) provides a range of 0 to 12 volts for variable pump rates. The potentiometer (P1), mounted on the control panel, varies the voltage at the base of low power transistor (Q1). Q1

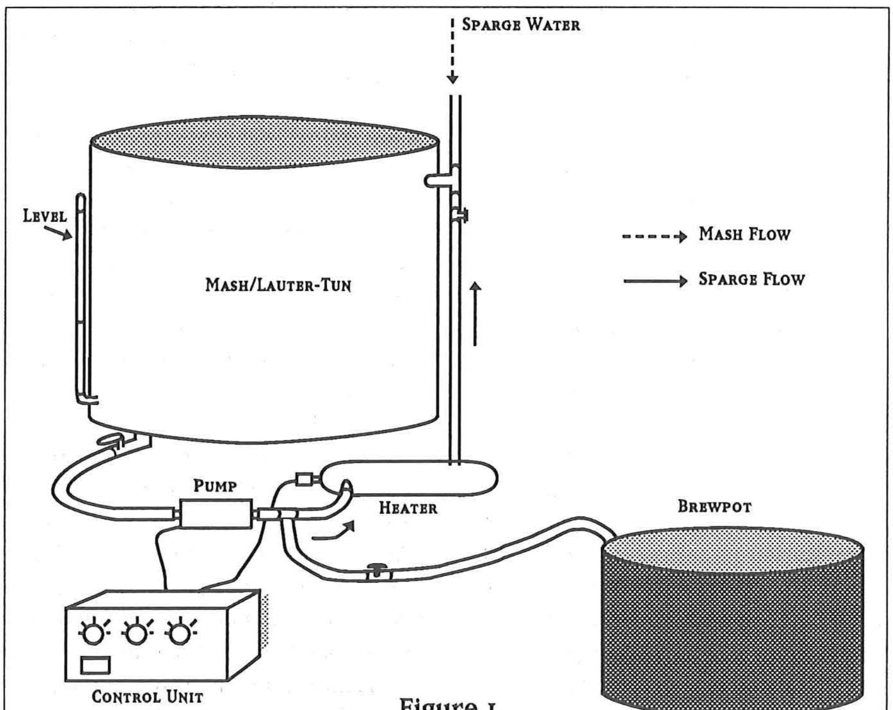


Figure 1

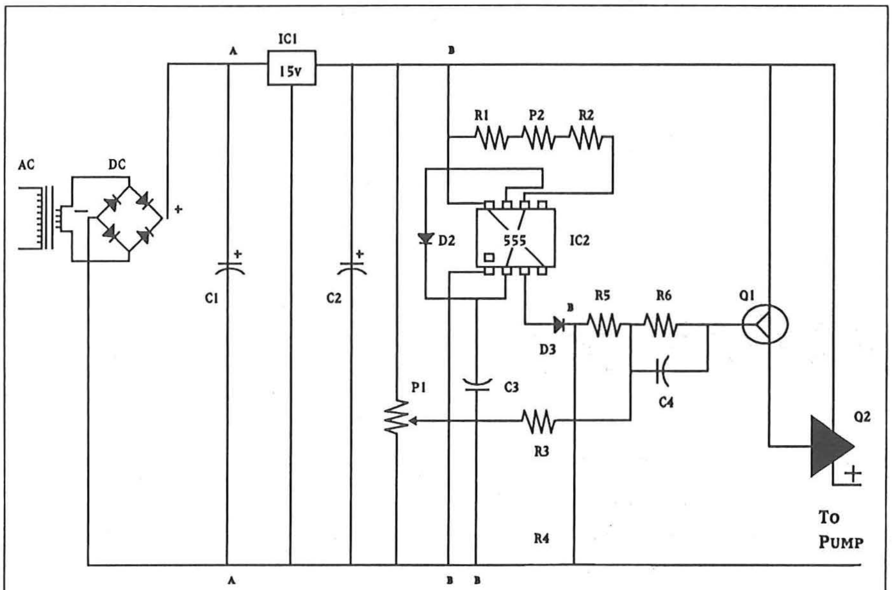


Figure 2

in turn controls the base of a power Darlington transistor (Q2) that can allow up to 3 amps of current to the pump.

An added level of sophistication is the pulse generator connected at diagram points marked "b." The pulse generator provides mechanically quiet and efficient pump motor operation at low speeds. The 555 timer chip and components produce a 150 Hz square pulse with a duty cycle of 2 to 50 percent controlled by potentiometer (P2). Narrow pulses can be used for high-quality pumps and wide pulses for cheaper pumps.

The power supply requires a transformer with 12.6 to 16 volt secondary poles. Filter capacitors provide a root-mean-square voltage sufficient to operate the 15 volt regulator. An automobile battery charger can substitute for the hard-to-find and expensive transformer at points marked "a" on Figure 2.

Because this equipment is powered from 120 volts AC line current, a three-wire grounded circuit must be used with it. Connect the ground wire to the case of the 500 watt wort heater and the chassis of the power supply. Do not depend on the home circuit breakers to provide electrical shock protection. You should plug the power cord into a ground fault circuit interrupter socket (GFCI). If you are not familiar with electrical wiring, ask the assistance of someone who is experienced.

There are numerous ways to obtain and maintain the temperatures desired for extraction. The design presented here assumes that heating large quantities of water is best accomplished in a boiling pot using traditional kitchen or laboratory-style heat sources. A valve welded to the bottom of the pot allows controlled gravity drainage of hot water into the tun at the start of mashing and during sparging. High power immersion heating elements placed into the mash can be very efficient but require care to avoid burning the mash.

Again, this design used parts on hand and emphasized simplicity and use of the circulation system. A 110-volt AC, 500-watt, hand-held stainless-steel restive heating rod, normally used for laboratory applications, was configured for inline flow with external power regulation (Figure 1), while 1 1/4-inch diameter copper pipe, T-sections, and caps form the housing for the heater. Pieces were epoxy-joined and coated to eliminate undesired heavy metals. Constant circulation of extract past the heating element results in a very short contact time and eliminates risk of overheating the liquid.

Heater power control is accomplished by standard duty cycle regulation using an easy-to-make silicon-controlled rectifier (SCR) circuit. Those interested should not have difficulty finding applicable circuit diagrams. Otherwise, a light dimmer found in hardware stores can be used.

Temperature monitoring can be achieved by a port in the bottom side of the tun. My system uses an inexpensive Cole-Parmer model 90201-00 digital temperature probe for temperature measurement (again, equipment on hand). The probe is tightly fitted through a rubber stopper that seals a port into the dead space at the base of the tun (Figure 1). However, I am designing a dual thermistor (temperature varying resistor) stainless-steel probe for permanent application.

The diagram in Figure 1 illustrates the plumbing concept. As you can see, the only real brewing labor comes in grinding the grain, filling the tun and managing mash and sparge water temperatures. Several other features are worthy of attention. A glass tube sight gauge is fixed to the bottom side of the tun. This simple device, functioning like the level gauge on a coffee pot, allows monitoring equal sparge filling and tun draining rates. A similar sight tube is placed in the return line to the top of the tun. This tube allows visual inspection of extract clarity.

I use a vacuum pump (more equipment on hand) to drop pressure inside the fermenter jar which, in turn, sucks wort from the brewpot through the chiller. This handy feature eliminates the hassle of siphoning and reduces contamination potential.

Sparging is accomplished by a single offset perforated one-half-inch PVC tube. The tube is removable through a port in the top side of the tun.

The plumbing system is a two-step operation. Extractant is circulated from the bottom of the tun through the heater and sprinkled onto the mash at the top of the tun. The duration of this circulation stage is as long as the brewer feels necessary. The clarity tube helps determine duration.

Following circulation, simultaneous purging and sparging is accomplished by opening a valve to the brewpot and closing the return flow valve at the top of the tun. Hot sparge water drained by valve from the bottom of a stove pot enters the sprinkler tube. The rate of sparging and draining is controlled by valves and pump rate and is monitored by the sight tube.

Safety note: Observe the necessary precautions when electricity and water are in danger of mixing.

KINNEY BAUGHMAN

Hopping Up Homebrew with a Hop Back

***WHAT HOMEBREWER HASN'T** taken a sip of Sierra Nevada's Pale Ale or Hart's Snow Cap or Pyramid Ale and wished his or her homebrew had that same wonderful hop nose?*

For years I tried to capture the hop character so typical of these extraordinary beers. I finish hopped until I was blue in the face and never did the hop aroma of the finished beer match my expectations. If only the wonderful smell of hops that wafted from the kettle would carry over to my beer. But of course, that's the problem! If you smell the hop aroma when adding the hops, you've lost all hope of it entering your brew.

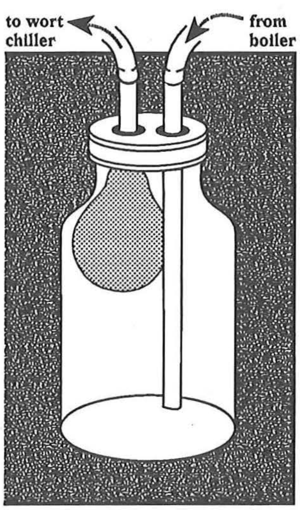


Figure 1

So what's the secret behind the marvelous hop aroma in the beers of Sierra Nevada and the Hart Brewing Co.?

The hop back.

A hop back is a tank that is between a brewery's boiling kettle and fermentation room. While the primary purpose of the hop back is to filter the beer from the kettle on its way to the fermenter, brewers discovered that if they put fresh hops in with the boiled hops the beer would pick up some aromatics on the way. This is what both Sierra Nevada and Hart do. In effect, the hop back allows the brewer to add finishing hops without losing the volatile hop aromatics to the atmosphere.

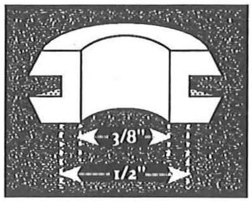


Figure 2

In order to use a hop back in your system you need an inline counterflow wort chiller like most commercial breweries use.

The idea is to stuff about 3/4 ounce of hops with high oil content into a jar and siphon through it on the way to your inline wort chiller, (Figure 1). The hot wort picks up the aromatics from the hops. But because the wort immediately enters the wort chiller, none of the aromatics are lost. Instead, they go straight into the chilled wort where they belong and have the best chance of emerging in the nose of a freshly poured homebrew.

Building a Hop Back

Get a quart canning jar (a wide mouth is best but a narrow-mouth jar works too), about a foot of three-eighths-inch copper tubing, two rubber grommets for the tubing, a three-quarters-inch copper cap, two wound copper pot scrubbers (check your local grocery store), two 10-inch squares of mosquito netting or two fine-mesh hop bags, two four-inch lengths of copper wire and some lead-free solder.

Drill two holes in the jar lid with a seven-sixteenths-inch drill bit. A plastic lid drills best but the metal lids can be used too. Extra care must be taken drilling a metal lid because it is so soft. Start with two lids—you'll probably need to practice on one to get the drilling procedure down. Remove any metal burrs with sandpaper, a sharp knife or a cone-shaped grinding stone available in hardware stores.

The concern here is to drill holes in the jar lid that are slightly smaller than the one-half-inch outside diameter of the grommet body, (Figure 2). This will ensure an airtight seal when inserting the grommet into the drilled hole. Insert the grommets into the prepared holes.

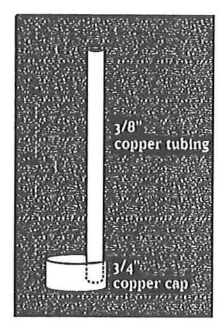


Figure 3

Make a miniature pick-up tube. Cut a four-inch section of copper tubing and solder an inverted three-quarters-inch copper cap to the bottom of the tubing, (Figure 3). After cleaning and sterilizing the miniature pick-up tube, wrap the pot scrubber around the three-quarters-inch cap, wrap the mosquito netting around the scrubber and secure them both to the tubing with the copper wire (Figure 1). A similar scrubber and mesh arrangement on the pick-up tube in the boiler is recommended as well.

Insert the pick-up tube and the eight-inch copper tubing into the grommets as in Figure 1. The tubing must fit tightly in the grommets. If there are any air leaks whatsoever, you'll lose the siphon once the wort transfer is initiated.

Stuff about three-quarters ounce of the gummiest, high-aroma hop cones you can find into the canning jar. I've used Chinooks to good effect. I have not been pleased with Cascades and other lower alpha hops they just didn't impart the aromatics I was looking for. But this could be because I used Cascade hops that weren't as fresh as they might have been. The hops are purely a matter of preference. Screw the lid onto the jar and connect it between your boiler and wort chiller with the pick-up tube connected to the hose going to the chiller and the eight-inch copper tubing connected to the hose to the boiler (Figure 1).

Warm the jar to reduce the risk of cracking it when the wort goes through. Start the siphon. The hot wort will enter the jar, pick up the aromatic oils from the hops, strain through the mesh scrubber filter and into the wort chiller where it is immediately cooled.

The mesh can become clogged with hop particles, especially toward the end of the siphon. The source of the problem will most likely be the mesh/scrubber in the boiler. The first suggestion is to use fresh hop cones instead of hop pellets in the boil and keep the lower end of the pick-up tube suspended above the trub layer in the kettle. Two other remedies to try are removing the mesh from the scrubber on the pick-up tube in the boiler or extending the vertical distance between the boiler and the fermenter to increase the force of the siphon.

I have been extremely pleased with the hop character of my beers using this contraption. The hop back can give your beers a character reminiscent of dry hopping without the muss and fuss of adding hops to the secondary fermenter, making it troublesome to clean up and siphon into bottles and kegs.

PHIL RAHN

Boiling Wort Using The Slotted T Drain

PHOTO BY PHIL RAHN

Have you been boiling more wort lately and enjoying it less? Well, I have been boiling wort for 17 years and have always hated what we had to do after the boil. Which, of course, is to cool the hot wort and then figure out how to get it into a carboy, leaving the hops behind, without spilling, splashing or otherwise messing up the kitchen floor.

My brewing system can produce 10 gallons of all-grain beer in about five hours with minimal effort. An integral part of my system is the slotted T drain that filters out the spent hops and hot break material.

I brew all-grain beers, believe in the full wort boil (for 90 minutes) and use a homemade three-level, gravity-flow system set up in my garage-turned-brewery. On the top level I use a cut down half-barrel beer keg with its own burner to hold sparge water. The next level down is the mash tun, which is a 10-gallon stainless-steel kettle fitted with slotted copper tubes in the bottom. The sweet wort is drawn out the bottom through a stainless-steel pipe welded in the side near the bottom. The boiler sits on a burner on the floor. After the boil, an immersion wort chiller (50 feet of five-eighths-inch outside diameter copper) is used for cooling (30 minutes for 10 gallons). After cooling, the kettle is raised to the second level to fill the carboys and is where the slotted T drain system does the filtering.

I have two sizes of boilers fitted with the slotted T drain system. For five-gallon batches I use a 10-gallon stainless-steel kettle with an aluminum-clad bottom, which I like because it spreads the heat and helps prevent scorching. This kettle is used as the mash tun when I make 10-gallon batches. It is too large for the average kitchen stove, so I use a propane burner for boiling. I don't believe this kettle is worth the $250+ cost for the average homebrewer.

For 10-gallon batches (my preferred system), I boil in a cut down, half-barrel stainless beer keg. I had a professional welder cut the top off two inches below the ring, which, by the way, was too far. If you do it, have the top cut out from just inside the ring. I had to have handles welded onto the sides which added to the cost. If the ring is left on, handles can be cut out of the side of the ring. This kettle can boil about 12 gallons without any problems if you can avoid a boil over in the

Figure 1

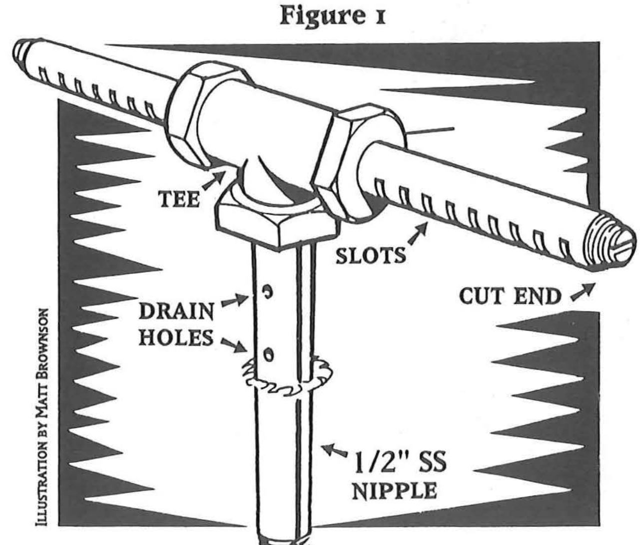


ILLUSTRATION BY MATT BROWNSON

beginning. It also sits nicely on my "Superb" propane burner and the dished bottom makes for nice circulation during the boil.

While at the welding shop I had the kettles drilled and fitted with six-inch pieces of one-half-inch stainless-steel pipe, threaded on both ends. The pipe needs to be welded to the kettle wall on both sides as close to the bottom as possible. The outer end of the pipe is fitted with ball valve, which is removed and cleaned after each batch. The slotted T is assembled on the inner end of the pipe. It is composed of the following pieces (see Figure 1), all one-half-inch stainless-steel pipe: one T and two four-inch nipples threaded on both ends. Get a good hacksaw blade (with fine teeth), clamp a four-inch nipple in a heavy vice and cut slots about half way through spaced one quarter inch apart. Now reclamp the pipe so one end is up and cut three or four V-shaped notches, three quarters of an inch deep down the axis (into the end) of the pipe. Now you can use a heavy hammer and beat that end shut. This is better than buying end caps. Do the same thing to the other pipe, then deburr and clean all the pieces.

To assemble, fit the T on the inner end of the threaded pipe that was welded to the kettle, then screw in one of the slotted pipes, rotate the T so the other slotted pipe can be put in. Align the slots so they are at the bottom. Don't forget to assemble the slotted T before filling the kettle. Without this device, you will have a heck of a time getting the wort out of the kettle.

Fit a copper fitting (one-half-inch pipe to one-half-inch female sweat fitting) into the ball valve. The female sweat fitting will accept your siphon hose (five-sixteenths-inch inside diameter), and works to pipe the wort into the carboy. Now when you finish boiling, just cool the wort right in the kettle (be sure to boil the immersion cooler for 15 minutes), and then open the ball valve and let the clear wort run. I tip the kettle quite a bit to allow nearly all of the wort to run out and rinse the hops with preboiled water to make up the volume to what is desired. For more complete drainage, drill two three-sixteenth-inch holes in the top of the nipple that is welded to the kettle. Now you can be a cool brewer and save some pain.

PHIL FLEMING

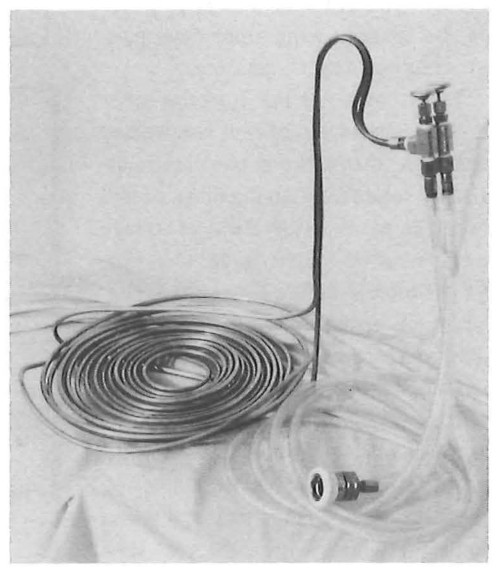
Immersion-Style Wort Chiller

I BEGIN TO be concerned for my brew during that scariest moment when the steamy hot wort is slowly cooling in the brewing kettle preparing to become the most fertile substance for the invasion of those nasty little bugs found everywhere. After the temperature drops below 140 degrees F (60 degrees C) and before the yeast is pitched is the most likely period for infection.

So what does a brewer do when a 15-gallon batch of lactobacillus medium (a.k.a. homebrew) is at 200 degrees F (93.5 degrees C) and the yeast wants it to be at 70 degrees F (21 degrees C)? Some people just put the wort in a fermenter and wait for the temperature to drop, sometimes overnight. This seemed too scary so I "invented" my wort chiller. This is a nifty little device similar to the ones my fellow brewers use.

You probably have seen them. They look like a long copper tube that has been wrapped around a soda keg to create a vertically oriented cylindrical coil with garden hose fittings attached to the ends. The user attaches a garden hose to each end, places the chiller into the boiling wort just before the boil is finished to sanitize it and then, when the boil is over, proceeds to pass cold water into the chiller. The flowing water picks up the heat from the wort via conduction and eventually the wort cools to the water temperature. To speed up the chilling process, the user must stir the wort as it cools because the fastest cooling occurs where the wort is in contact with the chiller.

Well, I did not like removing the lid from the hot wort and sticking a spoon in and splashing the sterile wort around. That seemed to increase the risk of getting some of those nasty little beggars that are just floating around, waiting for the opportunity to jump into a bonanza of beer food and make it a "dumper" brew. So after thinking about how to minimize this risk, I came up with an improved chiller.



PHOTOS BY PHIL FLEMING

My version is still a long copper tube, but instead of being vertically wound it is horizontally wound like a spiral. This creates a horizontal plane of cooling that can be moved up and down through the wort, contacting the whole batch without having to remove the lid and stick a spoon in. Both ends are brought over to one side of the kettle so they exit over the top edge, leaving only about one-half inch of the wort exposed to air, water splashes and other accidents waiting to happen. The incoming end is directed down the side of the kettle, across the bottom and into the decreasing spiral with the coils soldered with lead-free solder to the tube across the bottom to give the whole thing some rigidity. By placing a small upward bend in the opposite side of the first, outermost coil, an additional handle has been created. The outgoing end passes beside the incoming end and creates, with a tight bend at the top, the handle used to raise and lower the chiller. Use a thick potholder when grabbing the handle as its temperature varies the heat transfer.

If you have ever worked with water pipes, you know it is very difficult to maintain a permanent hose attachment that does not leak. So to prevent water from dropping into the kettle, I added another "S" bend to the ends of the tubes immediately after they snaked over the top edge of the kettle and attached the hose fittings there. Now when the hoses leak, the

PHOTO BY PHIL FLEMING

water falls harmlessly (well, almost) onto the floor.

The unique part of this creative design is the two thermometers attached in the middle of the hose fittings. I wish I had thought of this first but I got the idea from "Mr. Wizard" who uses it in his ice bucket prechiller. All I did was adapt it to measure the incoming water temperature that will dictate the final chilling temperature, but also to give an indication of how efficient the process will be. For example, the wort cools much faster in the winter when the water temperature is 50 degrees F (10 degrees C) than in the summer when it is 75 degrees F (24 degrees C).

The chiller can also measure the outgoing water temperature. Yep, you guessed it. It starts at about 210 degrees F (99 degrees C) and quickly goes down to about 190 degrees F (88 degrees C) within the first couple of minutes. After about another eight minutes the temperature has dropped to around 100 degrees F (38 degrees C). Here the process slows down. When it finally gets to between 80 and 85 degrees F (26.5 to 29.5 degrees C) I prepare the fermenter. The whole process takes about 20 minutes to cool a five-gallon batch of beer during the summer to a pitching temperature of 70 degrees F (21 degrees C).

For future projects, I want to add a stainless-steel screen to the top of the spiral tube to increase its efficiency in trapping hops. When the chilling is done and the chiller is removed, I have discovered it also drags along about 30 percent of the leaf hops that have become trapped on top of the coils. Also, I would like to try a three-eighths-inch copper tube to see if that shortens chilling time. I expect the loss of surface area is more than made up for by the increased water flow rate.

RUSS KLISCH

How To Oxygenate Your Wort—Cheaply

PUT OXYGEN IN my wort?

This will eventually give my beer a stale flavor, won't it? How can it be that sometimes you want to put oxygen in your wort and other times you do everything possible to prevent it? Oxygen in wort is one of brewing's paradoxes. Sometimes it's good and sometimes it's bad. Knowing the difference is critical to making good beer.

Oxygen is needed right after the wort has been cooled to pitching temperature and has just entered the fermenter. At this time the yeast is in an aerobic stage. Early in life yeast needs oxygen, an essential ingredient in the cell membrane and for its sex life. Without oxygen, yeast will not reproduce as quickly, and there will be a higher percentage of dead yeast cells, which have a marked effect on flavor. Knowing this, it's hard to deny yeast the proper amount of oxygen needed to carry on a decent sex life. Rapid yeast growth is one of the best methods of fighting off contamination. Another way of thinking about this is that yeast is doing its beer-obics at this stage and needs oxygen.

After the first few hours of yeast growth, oxygen should never be introduced into the wort.

But how do you get oxygen into the wort? For those who don't have any equipment, take a few gallons of cold wort and slowly pour from one container into another. This is normally done with the yeast in the wort.

There are two things to remember when doing this. First, the cooler the wort the more air it will absorb. Second, the more small bubbles you create, the greater the surface area that will absorb oxygen. When pouring the wort, the object is to create a slow steady stream that trickles into the other container and causes a lot of splashing and small bubbles. Wort in the two containers should be poured back and forth at least 10 times. This pitching of the wort and yeast is how the term "pitching yeast" came about. The great fear of doing this is that airborne bacteria will get into the wort. This should be a concern, but until a year ago this is how the wort was aerated at my brewery, Lakefront, with no contamination problems.

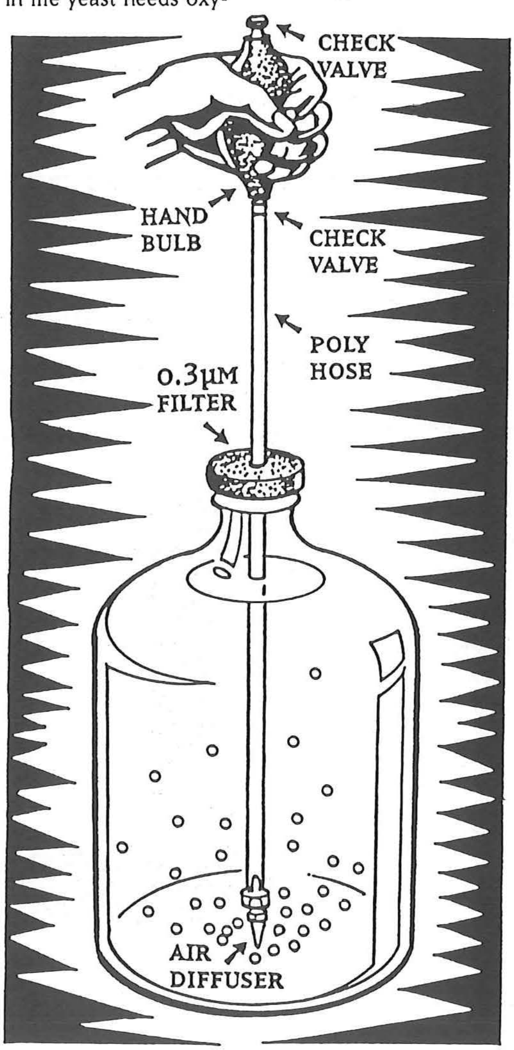


ILLUSTRATION BY MATT BROWNSON

Anyone who has tried this method knows it can be very tiring and messy. An easier method is to use a wort aeration device that is nothing more than a squeeze bulb with two check valves on both sides, food-grade tubing, a bacterial air vent and a cindered air muffler with hose barb at the end. This will allow you to pump small bubbles of sanitized air into your wort with great ease. The parts you need for the aerator are listed below.

Part/Example	Source	Estimated Cost
Air muffler/Parker EM 25	Pneumatic fittings outlet	$7.00
Female hose barb/ Parker 126 HBL-6-4	Hardware store	$1.50
Bulb with check valves/S73125	Sargent-Welch	$6.50
Food-grade tubing/ five feet of three-eighths inch	Homebrew supply store	$3.00
Bacterial Filter/ L-29701-00 Vacu-Gurad	Cole-Parmer	$5.70*
	Total Cost	**$23.70**

*The filters are only available in packages of 10. Cole-Parmer sells filters that will filter 0.3 µm or less but are more expensive.

You can probably substitute some equivalent items you already have. Some suppliers may only sell wholesale, so find out what items are available at retail.

The aerator can be sanitized with a chlorine solution and washed by rinsing hot water through the muffler. Chlorine is a very corrosive chemical, and the cindered muffler should not sit in the solution for more than a few minutes or the brass will start to corrode. The cindered air muffler will create the smallest bubbles when a slow steady stream of air is passed through it. Do not pump high air pressure though the aerator because it may damage the filter membrane. Try to pass air through the wort for at least five minutes. Make sure the carboy is not too full because the wort will foam a lot. If the filter is not abused, it should last for at least 10 batches before needing replacement.

All of the "wizards" out there probably know that because of Henry's Law, wort saturated with air cannot contain any more than the 21 percent oxygen that air contains (20 percent is optimum). To increase the amount of saturated oxygen in your wort you must use pure oxygen. You can do this by replacing the squeeze bulb with an oxygen cylinder and regulator. This will take the strain off your hand and free it up for a homebrew.

Unfortunately this also becomes more expensive for most homebrewers. The smallest cylinder you can buy is an R size and, with regulator, will cost about $185 at a welding supply store. The good thing about buying oxygen is that a cylinder will last a long time and it is relatively inexpensive—a refill costs about $9.

One important thing to know when buying oxygen is that there are different grades. The top grade is medical and to get it legally you must have a prescription. The next grade is industrial and anyone can purchase it at a welding supply store. Technically there is no difference between the medical and industrial oxygen, and both tanks are filled from the same line. The reason for the different grades is that medical oxygen can only be put into a cylinder that has been cleaned and has never been used industrially. If you buy a new tank and only use it for aeration, using industrial gas would be fine. I would not recommend using an old industrial cylinder because acetylene or some other gas could have back flowed into the tank and will contaminate the beer. If you use pure oxygen, beware, because excessive fermentation will result if the wort is fully saturated. Before we were able to determine the correct dosage at Lakefront, the blob that came out of the fermenter looked like something out of a sci-fi movie.

The methods mentioned here are only a few ways a homebrewer can aerate wort. Another method is to use a clean aquarium pump with a bacteriological filter, such as cotton. Other types of filters, air pumps or bellows are within the reach of homebrewers and can be put to proper use with a little ingenuity.

Chapter 7

TERI FAHRENDORF

Closed System Pressurized Fermentation

THE BEST HOMEBREWING system is the simplest to use. The less complicated your technique, the more you can concentrate on the joy and art of homebrewing. Many homebrewers spend more time brewing one batch of beer than a professional microbrewer would per batch. And they worry about their beer more (when they should be relaxing) because their equipment is jerry-rigged, not designed to be sanitary or is hard to work with.

After I began brewing professionally in 1989, I thought about how some of the fermentation techniques of a microbrewery could be adapted for homebrewing. Among the most wonderful pieces of brewpub equipment are the pressurized fermentation tanks. Once fermentation has begun, the system is "closed" and from that point onward the beer is never exposed to the air until it is poured into your glass. The tank can be kept under pressure, so the beer is naturally carbonated from the primary fermentation.

The advantages to this system are that you no longer need to prime, rack, bottle or clean bottles, and the beer is ready to drink sooner.

Fermentation at Steelhead Brewery

The wort from our kettle is chilled and transferred to a fermenter where the yeast is pitched. As fermentation begins, the CO_2 created is allowed to escape out of a hose attached to the top of the fermenter with the other end in a bucket of bleach water. This is essentially an airlock. (A fermenting beer creates much more CO_2 than needed to carbonate the beer.) As the beer ferments, the gravity is falling in direct proportion to the amount of alcohol being produced. When the gravity has fallen almost all the way to the beer's predicted final gravity (usually two to three days after pitching), the hose is removed, then a pressure-relief device and a pounds-per-square-inch gauge are attached instead. The CO_2 produced by any further fermentation is trapped and becomes the natural carbonation and head on the beer. The pressure will build to about 15 to 18 psi. No need to prime the beer with more wort or corn sugar, and the beer remains sealed in a closed system.

Because we have no secondary fermenters or conditioning tanks, the beer is conditioned in the fermenters for another week or two, then is chilled to near freezing, forcing most of the yeast to fall or flocculate out. After being chilled for one to two days, the beer is filtered and transferred (still under pressure) to a serving vessel where it is tapped. This transfer is done via closed system and the beer is not exposed to the atmosphere. The total elapsed time from brew day to drinking day is about 10 to 14 days. Darker and more alcoholic beers may take three to four weeks total.

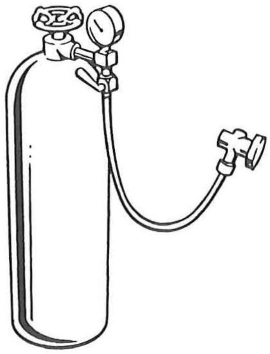
Special Equipment Needed

- 2 five-gallon Cornelius containers, either pin (Coke) or ball-lock (Pepsi)
- 1 CO_2 tank, filled
- 12 feet of one-quarter-inch inside diameter FDA food-grade vinyl hose
- 3 "in" connects or gas Cornelius quick-disconnects (preferably one-quarter-inch male flare fitting instead of hose barb fitting—then you can swap out parts easier.)
- 3 "out" connects or liquid Cornelius quick-disconnects (also one-quarter-inch male flare)
- 6 one-quarter-inch female flare by one-quarter-inch hose barb
- 1 single gauge regulator with on-off toggle. (You can use twin gauge but single is cheaper.)
- 1 0 to 30 psi gauge (can be small size)
- 1 one-quarter-inch female pipe thread by one-quarter-inch hose barb
- 1 one-quarter-inch male pipe thread by one-quarter-inch hose barb
- 1 one-quarter-inch hose barb T
- 1 one-quarter-inch mini ball valve
- 1 cobra head tap or other tapping device for serving
- 11 small worm screw clamps (optional)
- 1 roll of one-half-inch Teflon plumber's pipe tape

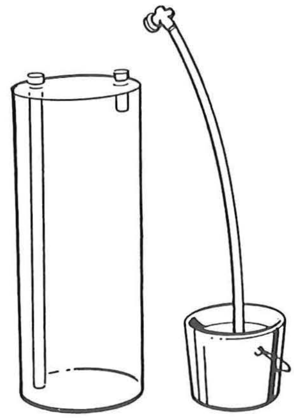
Other Equipment Needed

- hacksaw
- small dowel (optional)

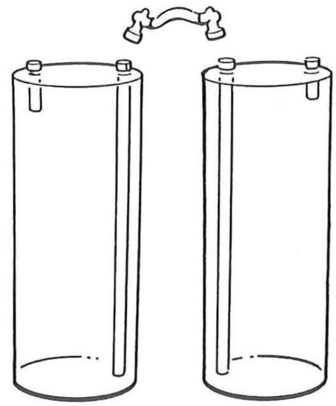
CO_2 Tank and Regulator



Fermentation Blowoff Tube



Fermenter to Server Transfer Hose



ILLUSTRATIONS BY MATT BROWNSON

SCREWDRIVER OR NUTDRIVER
HOT WATER
MEDIUM AND LARGE CRESCENT WRENCHES

Building the System CO_2 Tank and Regulator

Cut two feet of vinyl hose. The regulator should have a hose barb attachment beneath it. If not, you probably will need another one-quarter-inch female pipe thread by one-quarter-inch hose barb that you will connect to the regulator with Teflon tape. Take one Cornelius "in" quick-disconnect. Wrap some Teflon tape around the male flare fitting, taking care not to cover the flared part or the hole. Attach one one-quarter-inch female flare fitting by one-quarter-inch hose barb and tighten with wrenches. Dip one end of the vinyl hose in hot water and push firmly onto the regulator hose barb as far as it will go. Slip two worm clamps onto the hose. Dip the other end of the vinyl hose in hot water. Push onto the "in" quick-disconnect. Clamp the hose over the hose barbs by tightening the worm screw clamps with the screwdriver or nutdriver.

The Cornelius Canisters

If the Corneliuses are old, take them apart and clean them. Don't forget the long tube goes in the "out." If these Corneliuses have not yet been pressure tested, close the lid and attach regulator "in" quick-disconnect. Turn CO_2 pressure to 30 psi and open the regulator toggle. If the Cornelius leaks, disconnect the CO_2, bleed off pressure (either through a pressure relief valve in the center of the lid or with an unattached "in" quick-disconnect). Try reseating the lid. If you can't get the Cornelius to stop leaking, it is probably very old. Get one that doesn't leak.

After pressure testing, remove the long "out" tube from the Cornelius that will be your fermenter. Carefully cut about two inches off the bottom of this tube with a hacksaw. To avoid squashing the tube while cutting it, stick the dowel in the end to support it. The other Cornelius will be your serving tank.

Fermentation Blowoff Tube

Cut three feet of vinyl hose. Take a Cornelius "in" quick-disconnect. Wrap some Teflon tape around the male flare fitting as described above, taking care not to cover the flared part or the hole. Attach a one-quarter-inch female flare by one-quarter-inch hose barb and tighten with wrenches. Dip one end of the vinyl hose in hot water and push firmly onto the hose barb. No need to use a worm clamp on this one because the hose will never be under pressure.

Pressure Gauge and Bleedoff

Cut three pieces of vinyl hose in the following lengths: three inches, three inches and one foot. Take a Cornelius "in" quick-disconnect, wrap with some Teflon tape and attach a one-quarter-inch female flare by one-quarter-inch-hose barb. Take the 0 to 30 psi gauge and wrap it with some Teflon tape. Attach the one-quarter-inch female pipe thread by one-quarter-inch hose barb. Take the one-quarter-inch male pipe thread by one-quarter-inch hose barb and wrap with Teflon tape. Attach the mini ball valve.

Take a three-inch piece of vinyl hose and dip one end in hot water. Push onto the Cornelius "in" quick-disconnect. Slip two worm clamps on the hose. Dip the other end of the hose in hot water and push onto one arm of the hose barb T.

Take the other three-inch piece of hose and dip it in hot water. Push it onto the stem of the hose barb T. Slip two worm clamps on the hose. Dip the other end in hot water and push it onto the mini ball valve hose barb.

Take the foot-long vinyl hose and dip one end in hot water. Push onto the other arm of the hose barb T. Slip two worm clamps on the hose. Dip the other end of the hose in hot water and push onto the other arm of the hose barb T. Slip two worm clamps on the hose. Dip the other end of the hose in hot water and push onto the 0 to 30 psi gauge hose barb.

Attach the Cornelius "in" quick-disconnect to the Cornelius cannister. Twist the hoses of the apparatus if necessary to point the mini ball valve down and the face of the gauge up or to the side. Tighten all worm clamps.

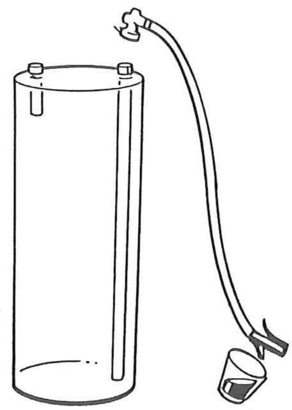
Fermenter to Server Transfer Hose

Cut 1 1/2 feet of vinyl hose. Take two Cornelius "out" quick-disconnects. Wrap some Teflon tape around the male flare fittings on each as described above. Attach a one-quarter-inch female flare by one-quarter-inch hose barb fitting to each and tighten. Dip one end of the vinyl hose in hot water and push it onto one hose barb. Slip two worm clamps onto the hose. Dip the other end of the vinyl hose in hot water an push onto the other hose barb. Tighten the worm clamps.

Serving Tap Hose

Cut three feet of vinyl hose. Take a Cornelius "out" quick-disconnect. Wrap the male flare fitting with Teflon and attach a one-quarter-inch female flare by one-quarter-inch hose barb and tighten. Dip one end of the vinyl hose in hot water and push it firmly onto the hose barb. Slip one worm clamp on the hose. Dip the other end of the hose in hot water and push onto the faucet head. Tighten the worm clamp around the Cornelius "out" hose barb.

Serving Tap Hose



Closed System Pressurized Fermentation

Note: Follow these directions carefully. You run the risk of death by an exploding Cornelius if adequate blowoff time is not allowed. Even a mild explosion could cause a fitting to be a lethal flying object.

I no longer brew at home, so I enlisted one of our chefs, Chris Rossi, to test this method. He had never homebrewed before, but seems to enjoy this method's simplicity and speed of conditioning.

Sanitize the Cornelius that has the shorter "out" stem. This is your fermenter. If boiling the whole quantity of wort, start at about 5 1/2 gallons instead of six and boil down to about 4 1/2 to 4 3/4. After brewing your beer, chill it to yeast-pitching temperature. You could chill the wort by putting the Cornelius into a clean garbage pail or bathtub filled with ice water and then transferring the hot wort. Fill the Cornelius to about three to four inches from the top. Pitch your yeast when the wort is cooled. If you have a wort chiller (lucky you), pitch the yeast directly into the sanitized Cornelius and siphon the cooled wort right over the yeast. Splash the wort down the sides of the Cornelius to aerate it, filling to three to four inches from the top. If you end up with too little wort, add some preboiled water. (It always is best to add preboiled water to top up, for sanitation reasons and for best flavor.)

Attach the Cornelius lid tightly and attach the fermentation blowoff tube to the "in" connection. Put the other end of the hose into a small bucket filled with water and a splash of bleach. If the beer is in a place where you can't get the floor dirty, put the small bucket inside a five-gallon pail because it could overflow with foam and scum. *Note: Allow it to blow off* *for a few days. If you close up the Cornelius with nothing attached to release pressure, the pressure will build rapidly and the keg could explode.*

With any luck, within 24 hours (and hopefully within 12) you should see bubble action in the bucket. Approximately 36 hours after pitching the yeast the bubble action should be slowing down a bit. Detach the blowoff tube and attach the pressure gauge and bleedoff hose. (We call this "capping the beer.") Note: If you cap the beer too soon, pressure may continue to build beyond safe levels. Make sure the mini ball valve is closed. If you want to dry hop the beer, now is the time. Open the Cornelius lid before you cap the beer and add your hops. Close the lid and "cap the beer" as described above. Clean the fermentation blowoff tube.

Within 24 hours you should notice a pressure reading on the psi gauge. Cornelius canisters can take up to 130 psi, so unless you capped the beer too early you should never get close to this amount of pressure in the fermenter. The pressure should eventually reach 15 to 18 psi. It can get up to 20 psi and still be OK. If it never gets to 15 psi you will want to top it off with some CO_2 from your tank so it can carbonate properly. If it is above 18 psi it could become overcarbonated and fizzy. Just open the mini ball valve a crack and bleed off the excess pressure. Lift the gauge higher than the ball valve when you do this so that foam does not get up into your 0 to 30 psi gauge. Note: Monitor the pressure gauge once or twice daily. Do not allow pressure to build to over 20 psi.

The beer is done fermenting in about seven days but you can leave it another week to condition and settle if you want. After seven days or so you could chill it if you have a refrigerator. Chill standing up, not on its side.

Closed System Transfer

Sanitize the Cornelius with the longer "out" stem. This is your serving tank. Attach the lid tightly and pressurize with your CO_2 tank. Bleed off some of the air either through the pressure relief valve in the center of the lid, or disconnect your CO_2 tank, let the CO_2 settle a little (CO_2 is heavier than air), and bleed off some air with your fermentation blowoff tube. Pressurize the serving Cornelius to the same pressure as that showing on the fermenting Cornelius gauge. Disconnect the CO_2. Bleed off just a little pressure from the serving Cornelius. Sanitize and connect the fermenter to server transfer hose from "out" to "out". The pressure on the fermenter should now read about 15 psi. If it is higher than that, use the blowoff tube to bleed a little pressure from the server. This will allow some of the beer to be transferred over and will relieve the pressure in the fermenter.

Set the regulator pressure on the CO_2 tank to 20 psi. The CO_2 tank should be about five pounds higher than the pressure in the fermenter. Disconnect the pressure gauge and bleedoff apparatus. Open the toggle below the regulator before attaching to the "in" on the fermenter. Bleed off pressure from the server a little at a time using either the pressure relief valve in the center of the lid or your fermentation blowoff tube. Keep bleeding off the server slowly until you see gas in the fermenter to server transfer hose.

Disconnect the fermenter blowoff hose from the server if you were using it to bleed pressure. Disconnect the transfer hose. Disconnect the CO_2 tank and turn it off. Note: Bleed off all the pressure from your fermenter before taking the lid off for cleaning. Do not inhale the CO_2 still inside.

If the beer is not cold, chill it. If it is cold and you are thirsty, attach the serving tap hose and pour yourself a beer. The first beer may be a little fizzy. Once you have poured a couple of beers and the beer is pouring slower, set your CO_2 regulator to 15 psi, open the toggle, attach to the serving Cornelius and congratulate yourself on your closed system pressurized fermentation and serving system. Now we're having some fun!

Of course the best part is the beer, but if the system is easy to use, you'll have more time to sit around and enjoy it. No (nerve) racking, no priming, no bottle washing or filling. Simple, easy to use and fun too.

MARIBETH RAINES, PH.D.

Chemicals for Preserving and Freezing Yeast

FRUGAL HOMEBREWERS ARE always looking for ways to recycle their yeast.

ILLUSTRATION BY JOHN MARTIN

Many have been hesitant to repitch because they do not know how to store it. With the help of a few simple inexpensive chemicals, you can prolong the shelf life of your yeast.

The best way to store yeast is frozen. This technique called cryopreservation is used to preserve organisms from bacteria to human cells (that's how they do it at the sperm bank). Yeast stored in the frozen state is less susceptible to genetic mutation and can be easily revived. However, several factors such as the age of the cells, storage temperature and the chemicals used to protect yeast during freezing determine how well your yeast will be preserved.

In general, actively growing cells from a yeast starter will freeze much better than yeast taken from a fermenter. The greater number of cells obtained from your fermenter, however, help make this a feasible alternative for yeast storage. I prefer freezing yeast taken from a yeast starter because it is less likely to be contaminated with bacteria.

Although the best temperature for the indefinite storage of yeast is -256 degrees F (-160 degrees C), a freezer that maintains a constant temperature of -4 degrees F (-20 degrees C) also will keep yeast for shorter periods of time, approximately one to two years. If you have a frost-free freezer don't bother freezing your yeast; the warming and cooling that takes place in a frost-free freezer is deadly to yeast stocks. Alternatively, you can keep yeast in a 45 degree F (7 degrees C) refrigerator. If you use one of the chemical agents described below you can still store it for about six months this way. This is perhaps the easiest way to keep yeast for repitching.

Chemical agents are needed to protect yeast from lysing (rupturing) during freezing. As the yeast freezes, water crystallizes first and forms high concentrations of salts that damage the yeast. The addition of glycerol or sucrose to the yeast prior to freezing promotes uniform solidification thereby preventing the formation of high salt concentrations. Glycerol or glycerin is an alcohol that is commonly used for cryopreservation. You can pick some up at your local drugstore. To prepare glycerol for freezing dilute one-third cup of glycerol into two-thirds cup of water, i.e., one part glycerol to two parts water. Sterilize it by boiling for 15 minutes. You'll find that glycerol is very viscous and is much easier to measure if warmed up first. Sucrose or cane sugar that is not readily metabolized at low temperatures is sometimes used to preserve cells. To prepare sucrose for freezing, dissolve three-eighths cup of cane sugar in one cup of water and boil for 15 minutes to sterilize. Remember to cool these before you add them to your yeast.

To freeze your yeast just mix an equal volume of either the glycerol or sucrose solution with your yeast suspension. For example, mix one ounce sterile glycerol with one ounce of yeast starter, place in a sterile container and freeze. The freezing container should be something that seals tightly such as Tupperware® or sealable bags.

When you are ready to revive your frozen yeast (or yeastsicle), remove it from the freezer and quickly thaw it by immersing in warm water. The faster it thaws the better. Although you can pitch this directly into your fermenter, there may be a considerable delay before your yeast will start growing. It is best to make a yeast starter or at least feed your yeast some sterile wort a day or two before pitching. If you're going to use a yeast starter you don't really need to thaw all of your yeast. Merely scoop out a tablespoon of frozen yeast directly into your yeast starter. Within two days the yeast starter should be ready to pitch.

The volume of yeast that you freeze really depends on you. If you're like many homebrewers, freezer space is more precious than refrigerator space so you can't be storing large volumes of yeast in the freezer, but you don't really need large volumes of frozen yeast if you use yeast starters. Once you have a yeast starter you can always use it to regenerate your frozen stock. On the other hand, if you plan to use the same yeast within the next few months you can save the yeast from your primary fermenter and store it with an equal volume of sucrose (it's cheaper than glycerol) in the refrigerator.

Great care should be taken to make sure that the originating yeast stock, be it from a starter or fermenter, is free of bacterial contamination. Preserving your yeast by freezing will also preserve any bacteria that when revived could potentially infect your next brew. But that's the chance that you always take if you repitch your yeast. Be sure to use sterile utensils and solutions when working with yeast.

A final note to those yeast culturing aficionados who may not be interested in recycling their yeast. Remember that freezing your yeast stocks is a great way of backing up your yeast slants. Frozen stocks will keep longer without any worry of mutation and really is the method of choice for preserving the genetic stability of yeast.

So put your freezer to work and start your own collection of yeastsicles. It's an easy, inexpensive way to store your yeast for extended periods of time without all the manipulations of yeast culturing.

DAN FINK

Fermentation Temperature Control

TEMPERATURE CONTROL DURING fermentation always has been a problem for brewers. Before the advent of refrigeration, beer production often would cease during the summer. Some brewers resorted to fermenting in caves to regulate temperature.

Homebrewers today have similar problems. Yeast produces the best beer flavor with constant cool temperatures. Most quality liquid and dry ale yeasts prefer temperatures from 55 to 65 degrees F (13 to 18.5 degrees C), while most liquid lager yeasts are at their best from 35 to 45 degrees F (1.5 to 7 degrees C). Fermentation temperatures of more than 70 degrees F (21 degrees C) can cause higher amounts of estery phenolic, medicinal off-flavors with most beer yeasts.

Commercial brewers circulate glycol coolant around jacketed fermenting tanks. This is impossibly expensive for homebrewers, but there are many other inexpensive possibilities for regulating temperature at home.

Temperature problems fall into two categories: brewers in hot climates who always need to cool their fermenters and those in colder climates who must cool in the summer and heat in the winter.

Solutions for cooling problems

If you have a minor temperature problem—say the room temperature is 75 degrees F (24 degrees C) and you wish to ferment at 60 degrees F (15.5 degrees C)—one simple method is to use evaporative cooling. Place the fermenter in a shallow tub of cold water and drape towels around it and into the water. This method can lower the temperature by a surprising degree, but its efficiency will vary with your water temperature and relative humidity.

If the temperature still is too high, try placing a fan to blow directly on the covered fermenter, or keep a trickle of cold water running through the tub and into the floor drain of a laundry room.

An immersion wort chiller can be drafted into service as a fermentation cooler, though it would only work in a wide-mouthed soda keg or plastic fermenter. Sterilize it by boiling before use and keep only a trickle of cold water flowing through it. You'll need to experiment to get a flow rate that maintains the right temperature and doesn't waste water. The colder your tap water, the less you'll use to maintain temperature. If your area is drought-stricken, you might try recirculating your cooling water with a pump through a radiator—but that's getting way out of the realm of a simple solution.

Surprisingly, ice blocks can be very effective for cooling beer. The key, however, is insulation. One Colorado brewer uses a basement shower stall lined with six-inch-thick Styrofoam™ to lager beer in the summer. He went through lots of ice for the first week, but after that needed only a couple five-pound blocks per week to maintain 45 degrees F (7 degrees C). The shower holds four 15-gallon fermenters, more if they're stacked.

Treat a superinsulated fermentation chamber the same way you'd treat a refrigerator. Getting trapped inside can cause suffocation and death.

Simply digging in the dirt can help in certain climates. My cabin's root cellar maintains a relatively constant 50 degrees F (10 degrees C) in the heat of summer, and near 40 degrees F (4.5 degrees C) in the winter. The key, once again, is to super-insulate a small area to reduce heat transfer.

The best cooling solution, though, is an old refrigerator with an external temperature controller. Most refrigerators can't keep a constant temperature with their internal thermostats and none can come close to ale temperatures (with good reason—your food would rot at 60 degrees). A beer faucet is easily mounted through the door of the fridge, giving you cool beer on draft, too.

A controller like the model detailed in "Taming the Wild Fridge," ***zymurgy*** Fall 1989 (Vol. 12, No. 3), can be set at any temperature, and will maintain it within 3 degrees. They cost around $40, and old refrigerators can be found for under $50.

ILLUSTRATION BY JOHN MARTIN

My lagering fridge holds four five-gallon soda kegs. An old chest freezer is even better—many models will hold up to eight kegs or carboys. This relatively inexpensive and nearly maintenance-free system makes lagering a breeze. You can start fermenting at 50 degrees F (10 degrees C), reduce to 45 degrees F (7 degrees C) for the primary then crank all the way down to 33 degrees F (10.5 degrees C) for clarification in the secondary.

Air conditioners and walk-in coolers are only for the very rich—or those who own a refrigeration company. But one clever mountain brewer installed the guts of a refrigeration system in a small trailer. For a party, he simply loads up some kegs and plugs in the trailer when he arrives! The beer dispenses through faucets on the back of the trailer.

Heating Solutions

Because my cabin is 8,400 feet above sea level, I let nature keep it cool for much of the year. But in the dead of winter, even a superinsulated fermentation area gets too cold.

One solution employs the same lagering fridge controller I use during the summer months. Simply swapping terminals on the controller converts it for heating applications and it still maintains temperature within 3 degrees. I use a tiny, 1,500 watt ceramic disk heater, but any small electric space heater will work. Just be sure to insulate the fermentation room heavily. If the heater has to turn on too frequently, hot spots will develop where the hot air blows past your fermenting tanks.

My fermentation room is a highly insulated room built into the back of a small insulated outbuilding. Another Colorado brewer built a fermentation cabinet (he calls it a "Gerüngenschrank") out of plywood and Styrofoam™ and placed it in the garage. During the winter it keeps the temperature perfect for ales.

Small, submersible heaters with thermostats are available through some homebrew supply shops. They fit right through the carboy stopper next to the fermentation lock. Check the delta (how many degrees of variation the thermostat allows) before purchasing, though. It's best to keep the temperature constant to within 5 degrees. And think about how many batches you're likely to have going at once. If it's more than one or two, it would be more economical to heat a small, insulated space with one space heater than to purchase multiple submersible heaters. Follow the directions carefully—electrical tools and liquids don't mix.

The best temperature-control solution for you will depend on your climate, how severe the problem is and how much money you're willing to spend. But with a little ingenuity and some serious scrounging, the cure to temperature troubles can be simple and inexpensive.

Chapter 8

EDMUND J. BUSCH

Building a Diatomaceous Earth Filter

DIATOMACEOUS EARTH (DE), Kielselguhr, filter aid and Featherstone are all words used to describe the fossilized remains of aquatic plants, or diatoms, that have the capability of forming a very porous silica structure. Most diatomaceous earth is mined from the American West. Industrial grades of DE, after processing, have pores ranging from about 60 to less than one micron in size, with most of the pores in a definable and controllable range. It is in the control of the porosity that DE manufacturers separate the many grades of DE.

There are three main types of filter aid quality DE available from two different types of ore. The first is natural DE, mined and dried. Second is calcined DE, processed through a kiln at high temperatures with the addition of a fluxing agent, such as soda ash. The fluxing agent helps bind DE particles together to form a larger and more porous particle.

Natural DE: This is the tightest filter aid, capable of removing particles up to about one micron. It has a grey or dark grey appearance right out of the bag.

Calcined DE: This is coarser than natural DE and allows faster flow rate but passes particles up to about seven or eight microns. It is pink or tan.

Flux-calcined DE: This will include the coarsest DE grades, allowing the fastest flow rates but passing particles as large as 30 microns. It is white.

(In the calcined and flux-calcined categories, many grades are included, too many to detail here. I will refer to commonly used grades later in this article.)

Ore sources: DE ore is available from marine and fresh-water diatoms. Each has qualities best suited to certain applications and equipment. In general, marine diatomite is best for beer filtration using the pressure filters common to that industry.

Grades: The grades used in 98 percent of beer filtration are Celite 512, Hyflo SuperCel and Standard SuperCel. There are lots of other grades but they are not suitable for beer filtration.

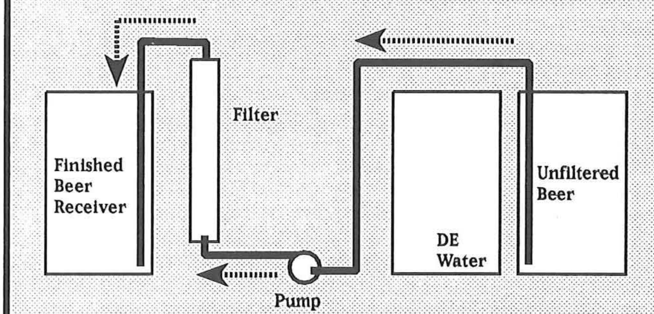
A question I am often asked by people who find out I sell DE is "Oh, you sell swimming pool powder?" Yes I do, but swimming pool powder is far coarser than anything used in beer filtration and will not do a good job on homebrew or any type of fermented beverage. Yeast cells will pass through the DE bed, so forget about using DE from a pool supply store.

About Filters

There is one basic concept of how a filter works. Once you know that, you will understand how most of the filters on the market operate.

It's simple. Consider your coffee maker. Water mixes with coffee. Call this the mash, just for fun. You separate the solids from the liquids by pressing the mash against a filter medium, in this case the paper coffee filter. The most important thing to remember is that you are filtering through a filter medium with the pressure on one side being greater than on the other side.

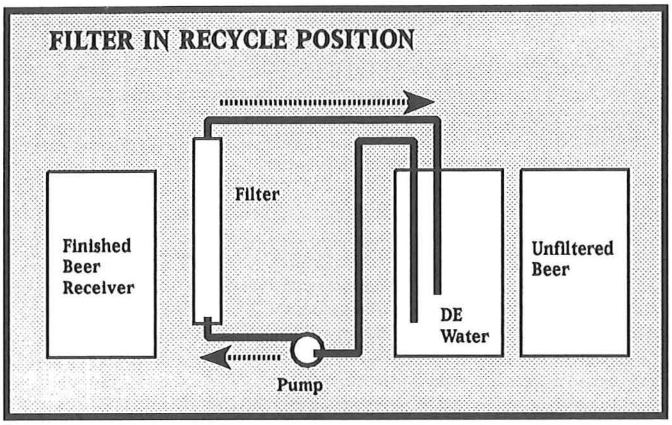
FILTER IN PRODUCTION POSITION
(Note: You can move the outlet tubing, but the inlet tubing should be valved.)



You doubt that? You're not pressing the mash against the coffee filter? Yes you are, only you're letting gravity do the job for you. The difference in pressure isn't great, but it's there.

DE is used in pressure filters in two ways. First, you precoat the filter by applying a thin layer of DE on the filter medium. This will allow you to take a filter with a coarse filter medium and change it to a superfine filter medium. The DE can increase the number of filter channels a thousand fold, and remove particles one-thousandth the size of an unprecoated filter. Second, addition of DE during the filtration cycle allows you to filter and main-

Bottling & Kegging



tain a porous filter cake while filtering something that might otherwise quickly plug up the filter medium.

Here's where you might have questions about DE filtration, especially if you've used cartridge filters before. Cartridge filters can remove particles smaller than DE filters can, and without the use of a filter aid, too. So, why use DE?

The stuff left in your homebrew is mostly yeast and some leftover trub. It's slimy. It will plug up the pores in cartridge filters and stop the filtration quickly. To successfully use cartridge filters you have to have more surface area than will be plugged up by the yeast. If you're only going to filter a five-gallon batch of brew, a cartridge filter probably is good enough. If your brew is very cloudy, or if you want to filter sake, it's probably not good enough.

Why can't you just put some DE in the filter and use CO_2 to push it onto the filter element? Because DE contains very small particles that will pass through the filter element on its first pass. Recycling the liquid to build up a precoat bed passes the same DE around until it locks together to form a firm precoat bed.

By the way, you can use DE with a cartridge filter if you like. It's perfectly acceptable, but use a pleated filter cartridge, not a string-wound one. Just read further to understand completely the use of DE in the filter.

How to use DE in filters: Using water, add enough DE to your filter to cover the surface with about one-sixteenth of an inch of DE. The rule of thumb is at least 15 pounds of DE for every 100 square feet of filter surface. If your filter has one square foot of surface area, use 2 1/2 ounces of DE for precoat. When in doubt, add a bit more.

Very important: Add water to the filter system using a pump. Recycle the water around the filter system and add DE while the water is going in that loop. The pump should be at least capable of one gallon per minute per square foot of surface area. Keep the pump going at all times. If you stop the pressure for even a second, you risk breaking the precoat and getting DE particles into your homebrew. (Not dangerous, just unsightly.) The filter system should be designed so you can switch from the recycle loop to final product filtration without disturbing the precoat bed.

Body feed: This refers to adding a measured amount of DE to the product to be filtered in order to maintain a porous filter cake. In large breweries this is done inline just before the filters. For small filter operations, it's possible to add the body feed DE to the batch of brew to be filtered.

Stop here for a second. DE is very porous. When it's dry, the pores contain air. Adding dry DE to beer can introduce oxygen. If you want to minimize the oxygen, add the DE to boiled water first and allow it to saturate. Remove excess water and add the wet DE to the beer. The extra water is negligible.

We've come all this way and I haven't even talked about making a filter!

It's impossible to give detailed instructions here on making a filter, but I can give you the main ideas. If you don't have some simple workshop equipment for handling plastic and metal, then you should use a cartridge filter.

I used the following parts to make my two-gallon filter. Keep in mind that everything is flexible and you are not locked into these materials and sizes, (and don't buy the parts until you understand the method).

Materials

- end plates: one-half-inch acrylic plastic, four inches by four inches
- main housing: two-inch diameter acrylic plastic tube, 10 inches long
- end support piece: one-half-inch acrylic, cut to fit tube
- gaskets: white rubber with center hole, cut to fit tube
- barbed nipples: brass from hardware store, threaded
- threaded rods: from hardware store, with wing nuts, cut to fit, about 12 inches
- screws: stainless steel, from hardware store
- pump: model 1A-MD-1, March Mfg., Glenview, Ill.
- tubing: three-eighth-inch vinyl tubing
- filter element: (see next paragraph)

For the filter element I used a plastic screen for a core with nylon cloth over the screen. You could also use well screen from a plumbing supplier and cover it with cloth, or go to a swimming pool dealer and get one filter element for a DE filter. It should be either plastic or stainless steel covered with cloth. You can attach it to the end plate with epoxy or with a brass connector from a hardware store. Stainless-steel screen wrapped in a tubular shape also will work well.

You should begin by getting an idea of what size filter you want in terms of surface area of the filter medium. Everything else is a function of this decision. If you can expect a filtration rate of 10 gallons per hour per square foot, a one-tenth square foot filter would pass a five-gallon batch in about five hours. Then decide on what type of filter you want. All filters need pressure to operate. It's the way you apply that pressure that makes different filters. Your choices are candle type, flat leaf and plate and frame.

Candle filter: The filter surface is cylindrical and each filter element is about one inch in diameter. They resemble candles, hence the name. Each filter can have many candles housed in a large container kept under pressure by pumping liquid into it. This makes it a pressure filter, too.

Pressure-leaf filter: Instead of a cylinder, this type of filter uses a flat surface, either round or rectangular. The leaves are mounted inside a pressure vessel and function similar to the candle filter. The flat surfaces make the mathematics of the filter easier to handle as well as easier to clean.

Plate and frame filter: This filter is a flat square plate with grooves in the surface and cloth draped over each side of the plate. A square open frame abuts the cloth-covered plate and is held there by pressure from bolts on each side of the filter. Liquid is pumped into the frame chamber and filtration is through the cloth, into the grooves that channel to a common drainage port. This is the oldest design for a pressure filter and it works very well. The drawback is that for industrial applications it is very labor intensive to clean the filter between cycles. From the drawing in the ad, it looks like the Marcon filter advertised in *zymurgy* is a plate and frame filter.

I chose the candle type only because it was the easiest to build. I would prefer the flat leaf type.

Materials and Design

I used acrylic plastic for most of the filter because I can see what's going on in the filter as it is running.

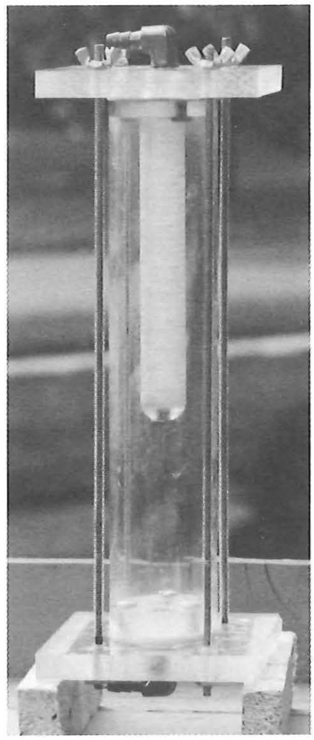


PHOTO BY ED BUSCH

The design is deceptively simple and I credit a colleague, George Christofferson, with the design. Two flat plastic plates hold a large plastic tube. The tube edges are sealed by holding gaskets between it and the flat plastic plates. One plastic plate has the filter element attached to it over a hole in the plate. The other has a simple hole in the middle. This is the feed end.

The whole thing is held together by threaded rods with wing nuts on one end. The filter can be broken down for cleaning or repair very easily.

The barbed nipples hold regular tubing. The tubing for the feed end comes from a magnetic pump (a peristaltic pump might be preferable). In order to run the pump in recycle, simply put the feed end tubing in the same beaker or jar as the exit tubing.

With the filter in recycle position and water running through it, add the precoat DE to the beaker. It will precoat the filter element. It might take 10 to 20 minutes, so patience is a virtue. Wait until the recycle water is completely clear.

When you're ready to feed flat beer to the unit, remove the exit tubing and let the water start going into another bucket of some sort. Start feeding beer to the beaker. If you've used clear acrylic plastic for your filter housing, you will see the color change as you feed the beer. When you see the liquid in the exit tube change color, move the tubing to the clear beer receptacle, possibly a Cornelius keg.

Add a small amount of wet DE to the beaker on a regular basis. This will act as body feed. Or, you can add the whole amount to the flat beer, so long as you can keep it in suspension. A magnetic stir device is helpful here.

Continue to filter until the feed beer is completely filtered. If your filter becomes plugged, don't panic. Remove the exit tubing from the receptacle and put it back into the recycle position. Stop the pump. Let the precoat fall off the filter element then start the pump again. The precoat will reform, hopefully with the DE moved around enough so you can filter. The filtrate will be cloudy. Let it run in recycle until you get clear beer. Then move the exit tubing and start filtering beer again.

Doses, math and stuff like that: Large breweries use about one-third to one half pound of DE per barrel of beer for filtration. Assume that your operation isn't as efficient so you decide to use one pound per barrel. For a five-gallon batch you need 2 1/2 ounces of DE for body feed.

- DE typical density: 22 pounds per cubic foot
- typical precoat amount: 15 pounds per 100 square feet
- expected filtration rate: 0.2 gallons per minute per square foot (This is actually lower than commercial production, just to be on the conservative side.)

Other information you should get:

- filter element surface area: (3.14) X diameter X length
- filter element volume: (3.14) X radius cubed X length
- housing volume: (3.14) X inside radius cubed X element length
- DE for precoat: 15 pounds per 100 X filter element area in square feet

Let's look at the filter I built. The element has a three-quarter-inch diameter and is five inches long. It has almost 12 square inches of surface area and has almost six cubic inches of volume.

How quickly will this filter do its job? At 0.2 gallons per minute per square foot, 12 square inches will filter about one gallon per hour.

The housing is two inches in diameter. Assuming the wall is about one-sixteenth inch thick, this means the internal volume of the housing along the length of the element is more than 14 cubic inches. Because the element volume takes up six cubic inches, that means that we have eight cubic inches to work with.

DE is 22 pounds per cubic foot. Adding the amount of DE to precoat to the amount needed to body feed shows that we plan to add 2.8 ounces of DE to our filter system. Will the filter hold that much? No, it will filter at best half the amount necessary. But then I didn't intend this filter to filter every batch of beer I made, only occasional batches. By splitting the five-gallon batch into two cycles, this filter is adequate.

Not satisfied? Want to do it all in one pass? Then increase the diameter of your housing to three inches. This will give you the volume you need to handle the whole five gallons. Want to do it faster? Increase the surface area of the element. Want to do even more beer? Plan to open a brewpub and filter 10 barrels at a time? Call your friendly DE sales rep and let him or her size the filter for you.

Final Notes

So far I haven't once mentioned flavor: If you are a large brewer who bottles for sale in retail outlets, you should filter your beer. Filtration is forced aging and removes organic matter that might otherwise lead to off-flavors. Filtration lengthens shelf life. It also produces a clear beer for those who desire it.

But how about homebrewers? I had a unique opportunity on a trip with the Homebrewers of Philadelphia and Suburbs (HOPS) a couple years ago. At the Stoudt Brewery in Adamstown, Pa., I tasted the same beer filtered and unfiltered. Let me be clear on this. I don't mean just the same recipe, I mean the same fermenter on the same batch sampled before and after filtration. I preferred the unfiltered beer. It had a better mouthfeel and a better balance. I prefer "real homebrew," which is unfiltered beer. But that's just my opinion.

DAN FINK

Counterpressure Bottling

WHY BOTHER TO counterpressure bottle? It takes twice as long as regular bottling, it's a touchy operation that takes practice to become consistent and it requires special equipment.

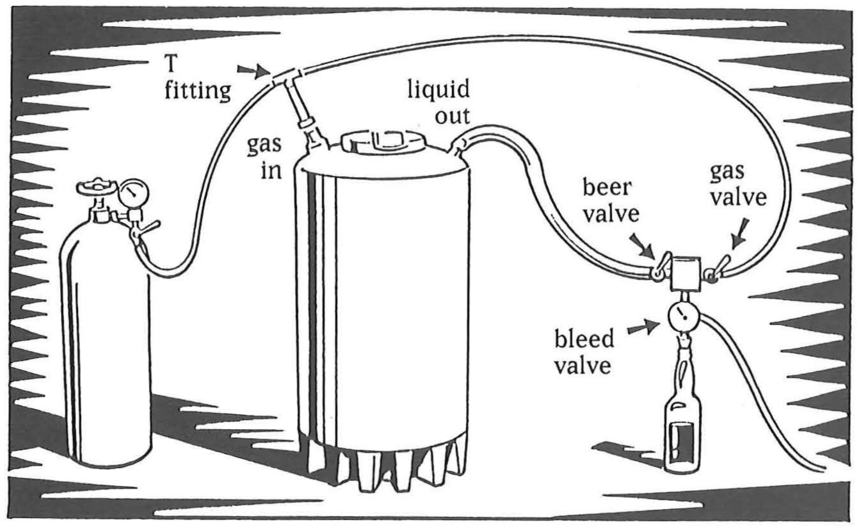


Figure 1

Among the many good reasons to put up with the hassle is that it's the only way to consistently bottle finished, carbonated beer from a keg. And because there is no secondary fermentation to produce carbonation after bottling, no sediment layer forms on the bottom of the bottle. If you want to bottle a six-pack to ship to a distant friend or homebrew competition, the beer will arrive ready to drink—they won't have to wait for the sediment to settle before tasting or judging.

Many homebrewers simply draw beer from the keg right into a bottle to take to a club meeting. Many brewpubs fit a rubber hose around the beer faucet to fill jugs for takeout. The problems are that much carbonation is lost, it's hard to prevent foaming and the beer spoils through oxidation within a day or two. A sample bottled and sent to a distant competition could spoil by judging time.

Theory

Check with your homebrew club or retail supply shop for recommendations on which of the many available varieties would be best for you. *zymurgy* Spring 1990 (Vol. 13, No.1) contains detailed instructions for building a filler on your own.

A basic counterpressure bottler consists of three valves, a stem that seals inside the rim of the bottle and a collar around the stem to release pressure. The collar connects to the bleed valve and the gas and beer valves are both connected through the stem. The gas valve and the beer keg each are connected to the CO_2 tank via a Y in the gas line (see Figure 1).

The bottle is first pressurized with CO_2, and the air is expelled under pressure through the bleed valve. The bottle then returns to the same pressure as the kegged beer. The beer valve is then turned on and the gas valve off, but no beer flows into the bottle. The two are at equal pressures because the filler and keg are connected to the CO_2 tank through the Y.

When the bleed valve is cracked open slowly the CO_2 in the bottle comes out the bleed valve and beer from the keg flows in to replace it. There's no possibility of oxidation because the beer is flowing into a CO_2 environment in the bottle.

When the bottle is full, the beer valve is turned off and excess pressure is released through the bleed valve (otherwise, you'll get a face full of foam when you remove the filler from the bottle!). The filler is removed and the bottle must be immediately capped to avoid oxidation and loss of carbonation.

Practice

Before you start your filling session, chill the beer as cold as you can get it—32 degrees F (0 degrees C) is about right. This will help prevent the biggest problem homebrewers have with counterpressure bottling—excess foam.

Line up your bottles and hook up the sanitized equipment. Be sure to connect a Y (or use a dual-outlet regulator) so the keg and filler unit are both connected to the CO_2 tank. Set the regulator about five psi higher than the natural keg pressure. This usually is around 15 to 20 psi. If you're not sure, don't worry—15 psi will usually work just fine. Then for each bottle use the following sequence:

1. Insert filler into bottle neck
2. Open gas valve
3. Briefly open and then close bleed valve (to expel air)
4. Allow bottle to repressurize (about five seconds)
5. Close gas valve
6. Open beer valve
7. Slowly open the bleed valve (control speed of flow with bleed valve)
8. When bottle is full, close bleed valve
9. Close beer valve
10. Open bleed valve (to release pressure)
11. Remove filler
12. Cap immediately

That's it (whew!). You can see why counterpressure filling takes longer than the regular method.

Problems

The biggest problem most homebrewers have with counterpressure filling is foam. The beer foams as it goes into the bottle and much foam is lost out the bleed valve while waiting for the liquid level in the bottle to rise to the top.

The best cure is to chill everything before bottling—including the beer, bottles, hoses and the filler itself. The colder everything is, the less foam you'll have. Keeping the flow rate slow (using the bleed valve, not the beer valve) can help, as will a filler tube that reaches right to the bottom of the bottle. Also, avoid any obstructions or kinks that could cause turbulence and foam in the beer line. That's the reason to control the flow rate with the bleed valve instead of the beer valve.

The regulator setting can sometimes cause some foaming, carbonation loss or carbonation gain problems, too. The exact setting will depend on the beer's temperature and carbonation level. You'll have to experiment to find the setting that keeps the carbonation level consistent and works for your system. Five psi over natural beer pressure or 15 psi are both good starting points.

There will be some loss of carbonation between the time when you remove the filler and cap the bottle. If you have trouble with too little carbonation in the bottle from a keg that was carbonated perfectly, try increasing the number of volumes of CO_2 you put into your beer. An increase of only 0.2 to 0.5 volumes usually will do the trick.

Finally, be extremely careful with sanitation when counterpressure filling. Even small commercial breweries sometimes have problems with infected batches coming out of the filler. And because your beer is unpasteurized, wait until all primary and secondary fermentation is complete in the keg before trying to fill bottles—any further fermentation or wild yeast infection will cause overcarbonation, a yeast sediment or even exploding bottles because the beer already contains ample carbonation.

DAN FINK

Kegging Basics and a Buyer's Guide to Kegging Equipment

I HATE WASHING bottles so rather than quit brewing I started kegging. Besides cutting down on cleaning time, kegging allows the pleasure of drawing a frothy pint right out of a brass faucet, cuts down on beer oxidation problems, is great for parties and is a whole lot of fun.

Think of a keg simply as a giant bottle that holds your entire batch. When you draw off a pint, something has to replace it inside the keg. Your two options are air and carbon dioxide. Air is commonly used but it will eventually oxidize and spoil your beer. Any brew dispensed with air pressure must be consumed within about 24 hours of tapping or it will go flat, spoil and taste bad.

Carbon dioxide is the ideal dispensing method, but it costs money to set up. You'll need a tank (about $60), a regulator (about $30) and hoses and fittings (about $15). It is worth the money, however; a beer dispensed with CO_2 will taste fresh for two or three months after tapping. The tank and regulator can often be found used at homebrew or welding supply stores, and sometimes even at flea markets. I've seen regulators for $20 and tanks for $30, which puts CO_2 tapping systems within almost everyone's reach.

Cleaning

When cleaning any keg system, disassemble it completely to make sure even the smallest parts get clean. When the parts and keg are physically clean, sanitize either with boiling water (in the case of metal kegs), or a bleach and cold water solution (one ounce bleach to five gallons of water) when using either metal or plastic kegs. Don't leave a bleach solution in contact with stainless steel for more than a couple hours because it can pit the metal. Rinse out the bleach solution thoroughly.

Carbonation

There are two choices for carbonating your beer. The best one for you will depend on the kegging system you choose. One method is to prime with corn sugar or malt extract, just like when bottling. The other is to inject carbonation from a CO_2 tank.

For sugar priming use about half the amount of sugar you've used for bottling a same-sized batch in the past—that's about one-fourth to one-half cup corn sugar in one cup of water to five gallons of beer. Add the boiled sugar water when you rack the beer into the keg. Seal the keg, wait about a week and the beer will be carbonated. If you made a lager that has aged in a carboy for a long time, just as in bottling you may have to add live yeast (a packet of dry yeast or, preferably, a prestarted liquid yeast pouch) to the keg during racking to start the secondary fermentation that produces carbonation.

The disadvantages of sugar priming are the sediment that's left on the bottom of the keg and the waiting time before the beer is carbonated. Most of the sediment will be dispensed with the first pint of beer. The remainder of the keg will be crystal clear unless you shake or pick the keg up to see how much beer remains. After moving a keg with sediment you'll have to wait a day or two for the sediment to drop out again. An option to prevent this is to transfer the carbonated beer off the sediment by CO_2 pressure into another clean keg before moving. This procedure, counterpressure transfer, is covered in the *zymurgy* Summer 1991 (Vol. 14, No. 2) article, "Counterpressure Transfer—Rack Your Beer Without Losing the Fizz."

An alternate method of sugar priming is to keg the beer while it is still fermenting. This requires a sugar test kit like the ones used by diabetics. This method is covered in "Bottling Beer? Test Your Sugar" in *zymurgy* Spring 1989 (Vol. 12, No. 1).

Injected Carbonation

A rumor that persists in some homebrewing circles is that injecting carbonation produces "bigger bubbles" or a "harsher mouthfeel" than sugar priming. This is pure bunk! I and others have done side-by-side comparisons of split batches carbonated both ways. You might detect a very slight taste difference from the secondary fermentation in a sugar-primed beer, but I challenge anyone to pick which method was used in a blind test. Injection is used by many homebrewers and fine craft breweries. The advantages of injection are a short waiting time, precise control of carbonation levels and best of all, no sediment.

The amount of carbonation you inject depends on the beer style and your personal tastes. A good rule of thumb is to use 2.0 or fewer volumes of CO_2 for low-carbonation British-style ales, 2.0 to 2.5 volumes for most brews and 2.5 to 3.0 volumes for high-carbonation wheat beers and American-style brews.

The volume of CO_2 in your brew depends on both CO_2 pressure and the beer's temperature. Find the beer's temperature on the chart and trace to the pressure column. To find the correct volume of CO_2 for your beer, use the CO_2 volume chart (Table 1). That's where you need to set the regulator on your tank to carbonate the beer properly. Those numbers are correct only when the beer has reached equilibrium, that is when it has absorbed all the CO_2 it can at that temperature.

The easiest way to carbonate and bring the beer to equilibrium is to simply keep it hooked up to the CO_2 tank at the proper pressure and constant temperature for three or four days. If you're in a hurry, you can rock the keg briskly back and forth while it's hooked up to the CO_2 tank. When gas stops flowing through the regulator (usually after about 150 shakes), let the keg rest overnight at the same temperature, still hooked to the tank. That will produce equilibrium.

Even in case of emergency (you forgot about the party you were throwing tonight), there's hope. If the beer is 55 to 60 degrees F (12.5 to 15.5 degrees C) or so, set the regulator at 30 psi. Shake vigorously 200 times. Unhook the keg from the gas and let sit one hour. With a little luck the beer will be at about 2.5 volumes in about one hour. This sometimes works because even though you used double the normal pressure you didn't inject all the CO_2 the beer could hold.

If your beer is too flat after injection simply increase the pressure and inject more CO_2. If the beer's too fizzy, release pressure from the keg every so often until the proper level is reached.

TABLE 1
Volumes of Carbon Dioxide (CO_2)

Pounds per square inch (psi)

Degrees Fahrenheit

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
30	1.82	1.92	2.03	2.14	2.23	2.36	2.48	2.60	2.70	2.82	2.93	3.02																		
31	1.78	1.88	2.00	2.10	2.20	2.31	2.42	2.54	2.65	2.76	2.86	2.96																		
32	1.75	1.85	1.95	2.05	2.16	2.27	2.38	2.48	2.59	2.70	2.80	2.90	3.01																	
33		1.81	1.91	2.01	2.12	2.23	2.33	2.43	2.53	2.63	2.74	2.84	2.96																	
34		1.78	1.86	1.97	2.07	2.18	2.28	2.38	2.48	2.58	2.68	2.79	2.89	3.00																
35			1.83	1.93	2.03	2.14	2.24	2.34	2.43	2.52	2.62	2.73	2.83	2.93	3.02															
36			1.79	1.88	1.99	2.09	2.20	2.29	2.39	2.47	2.57	2.67	2.77	2.86	2.96															
37				1.84	1.94	2.04	2.15	2.24	2.34	2.42	2.52	2.62	2.72	2.80	2.90	3.00														
38				1.80	1.90	2.00	2.10	2.20	2.29	2.38	2.47	2.57	2.67	2.75	2.85	2.94														
39					1.86	1.96	2.05	2.15	2.25	2.34	2.43	2.52	2.61	2.70	2.80	2.89	2.98													
40					1.82	1.92	2.01	2.10	2.20	2.30	2.39	2.47	2.56	2.65	2.75	2.84	2.93	3.01												
41						1.87	1.97	2.06	2.16	2.25	2.35	2.43	2.52	2.60	2.70	2.79	2.87	2.96												
42						1.83	1.93	2.02	2.12	2.21	2.30	2.39	2.47	2.56	2.65	2.74	2.82	2.91	3.00											
43						1.80	1.90	1.99	2.08	2.17	2.25	2.34	2.43	2.52	2.60	2.69	2.78	2.86	2.95											
44							1.86	1.95	2.04	2.13	2.21	2.30	2.39	2.47	2.56	2.64	2.73	2.81	2.90	2.99										
45							1.82	1.91	2.00	2.08	2.17	2.26	2.34	2.42	2.51	2.60	2.68	2.77	2.85	2.94	3.02									
46								1.88	1.96	2.40	2.13	2.22	2.30	2.38	2.47	2.55	2.63	2.72	2.80	2.89	2.98									
47								1.84	1.92	2.00	2.09	2.18	2.25	2.34	2.42	2.50	2.59	2.67	2.75	2.84	2.93	3.02								
48								1.80	1.88	1.96	2.05	2.14	2.21	2.30	2.38	2.46	2.55	2.62	2.70	2.79	2.87	2.96								
49									1.85	1.93	2.01	2.10	2.18	2.25	2.34	2.42	2.50	2.58	2.66	2.75	2.83	2.91	2.99							
50									1.82	1.90	1.98	2.06	2.14	2.21	2.30	2.38	2.45	2.54	2.62	2.70	2.78	2.86	2.94	3.02						
51										1.87	1.95	2.02	2.10	2.18	2.25	2.34	2.41	2.49	2.57	2.65	2.73	2.81	2.89	2.97						
52										1.84	1.91	1.99	2.06	2.14	2.22	2.30	2.37	2.45	2.54	2.61	2.69	2.76	2.84	2.93	3.00					
53										1.80	1.88	1.96	2.03	2.10	2.18	2.26	2.33	2.41	2.48	2.57	2.64	2.72	2.80	2.88	2.95	3.03				
54											1.85	1.93	2.00	2.07	2.15	2.22	2.29	2.37	2.44	2.52	2.60	2.67	2.75	2.83	2.90	2.98				
55											1.82	1.89	1.97	2.04	2.11	2.19	2.25	2.33	2.40	2.47	2.55	2.63	2.70	2.78	2.85	2.93	3.01			
56												1.86	1.93	2.00	2.07	2.15	2.21	2.29	2.36	2.43	2.50	2.58	2.65	2.73	2.80	2.88	2.96			
57												1.83	1.90	1.97	2.04	2.11	2.18	2.25	2.33	2.40	2.47	2.54	2.61	2.69	2.76	2.84	2.91	2.99		
58												1.80	1.86	1.94	2.00	2.07	2.14	2.21	2.29	2.36	2.43	2.50	2.57	2.64	2.72	2.80	2.86	2.94	3.01	
59													1.83	1.90	1.97	2.04	2.11	2.18	2.25	2.32	2.39	2.46	2.53	2.60	2.67	2.75	2.81	2.89	2.96	3.03
60													1.80	1.87	1.94	2.01	2.08	2.14	2.21	2.28	2.35	2.42	2.49	2.56	2.63	2.70	2.77	2.84	2.91	2.98

Draw a line straight across from the temperature of the beer to the desired volumes of CO_2 then straight up to find the correct psi of your regulator. For example: Beer at 40 degrees F (4.5 degrees C) with 2.84 volumes of CO_2 will require 16 psi.

Dispensing

There are many methods for dispensing kegged beer, but the simplest is a plastic hose and faucet coming from the keg. A classier system might have four faucets mounted through a refrigerator door. Parts are available for any conceivable setup through advertisements in ***zymurgy***. In one setup, I drilled through a cabin floor so the kegs could sit in the root cellar, which stays at 45 degrees F (7 degrees C). The beer is dispensed through a brass faucet in the kitchen. The cabin has no running water, but who needs it if you have running beer!

The biggest problem most brewers have with dispensing is excess foam. There are many causes, but here are a few guidelines to avoid foaming:

- Avoid any constrictions of the beer line that could cause turbulent flow.
- Keep the lines as cold as possible—use beer line insulation if you must run the line outside the cooled keg area.
- Experiment to find the correct serving pressure for your system—8 to 10 psi is about normal, but that can vary greatly from system to system because of line length, temperature, brand of hose and the beer carbonation level.

The aforementioned cabin system requires 15 to 18 psi, while my home system is happy at about 8 psi. With low-carbonation British-style ales, 8 psi would slowly start to overcarbonate the beer in the keg. In this case, turn the gas on right before you draw your pint and shut it off right after.

Which System to Buy?

The various kegging systems on the market are described in the following pages. The right one for you will depend on your finances, refrigerator space, batch size and the availability of components. But one thing's for sure—whatever you buy, you'll never have to wash case after case of bottles again.

A BUYER'S GUIDE TO KEGGING SYSTEMS

Commercial Beer Kegs

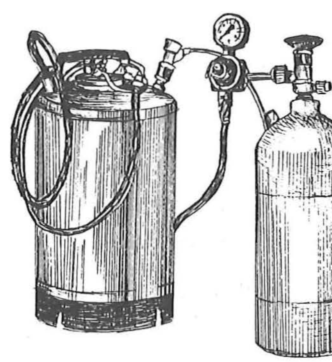
Illustrations by Vicki Hopewell

Cost: to purchase: \$50 to \$100
to rent: price of deposit, usually \$15
Capacity: 7 3/4 and 15 1/2 gallons
Material: Stainless steel or coated aluminum
Availability: Buy from local breweries or at auction, rent from liquor store
Dispense: Air or CO_2
Cost of fittings: Taps cost \$15 to \$30, or rent from liquor store. Add cost of hand pump (\$20 to buy, \$10 to rent) or CO_2 tank and regulator.
Advantages: Sturdy, reliable, large capacity, won't leak
Disadvantages: Heavy, bulky, hard to clean, odd batch size needed

Commercial kegs are used often by homebrewers, but the sizes available make for strange-sized batches. The easiest kinds to use are the Hoff-Stevens and Golden Gate kegs, which have wooden bungs. To fill and clean, remove the bung with a hammer and screwdriver and pound in a new one after filling. Bungs are available at most homebrew shops. (Note: Wear safety glasses when removing bung. Drill a hole through the bung first to relieve any, potentially massive, pressure. A flying bung is like a wooden cannonball and can seriously injure.) Be sure to clean rented kegs, taps and pumps very thoroughly before using them with your homebrew. You wouldn't believe the layers of green scum that build up in rental units.

Sankey kegs (they have a single ball valve on top and no bung) can be used for homebrew, but are very difficult to fill and clean. The entire valve assembly must be removed after releasing all keg pressure through the ball valve. Pry out the lock ring with a screwdriver and gently twist it out with Vise-Grips. If you mess up you're stuck because replacement parts are not available to homebrewers. It's best to avoid this keg style because of this and if you can't legally buy one, "playing around" with brewery-owned kegs is illegal and sets you up for liabilities you don't want. Stick with wooden-bunged commercial kegs.

Cornelius or Soda Kegs

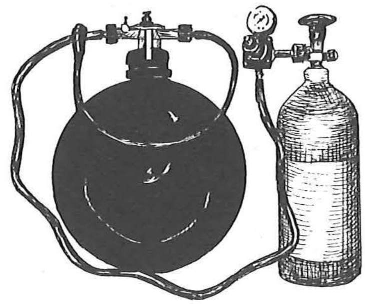


Cost: \$80 to \$110 new, \$10 and up used
Capacity: three, five and 10 gallons
Material: Stainless steel
Availability: Soda suppliers (new), auctions and local homebrew shops (used) or scrounge kegs by talking to restaurant owners
Dispense: CO_2
Cost of fittings: Fittings, called disconnects, cost about \$6 per set. Add cost of CO_2 tank and regulator.
Advantages: Sturdy, reliable, won't leak, widely available, batch size perfect for most brewers, easy to clean, most common homebrew kegging setup
Disadvantages: May be hard to find used kegs locally, expensive to buy new

These make about the best all-around system, especially if your local homebrew shop has a source of used kegs. Soda kegs come in two styles, ball lock (Pepsi) and pin lock (Coke). Neither works better than the other and the two are not compatible. Stick with one style, or put flare fittings on all your hoses instead of hose barbs—that way you can quickly change fittings to the right style.

The top "race track" or oval lid is held on by internal pressure. To remove it, you must first release pressure through the gas fitting, not the liquid fitting unless you want a soda pop shower. To remove the valves for cleaning, try a thirteen-sixteenths-inch end wrench for most kegs. If the big rubber gasket smells like soda, you must replace it. Washing won't help and your entire next batch could come out smelling like Dr Pepper®. After filling the keg with flat, primed beer you may have to inject 5 psi of CO_2 pressure to seal the lid on top.

Beer Balls

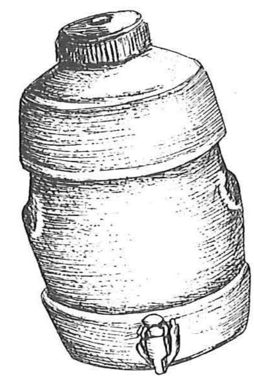


Cost: $5 to $6 (new) or free for the scrounging after parties (used)
Capacity: 2 1/2 and five gallons
Material: PET plastic
Availability: Mail order through ***zymurgy***, some local stores
Dispense: Air or CO_2
Cost of fittings: "Batch-Latch," required to tap the balls, costs $30. Add cost of hand pump tap or CO_2 tap ($15), CO_2 tank and regulator and non-reusable rubber seals (about $1 each).
Advantages: Won't leak, inexpensive, batch size perfect for most brewers, smaller size fits all refrigerators, even those containing food.
Disadvantages: Somewhat fragile, hard to clean, not widely available locally (easy to get through mail order, though).

This system was reviewed in depth in ***zymurgy*** Fall 1991 (Vol. 14, No. 3). The balls cannot be cleaned with boiling water and the five-gallon size cannot be filled full of bleach solution and drained—it will collapse upon draining. To sanitize, pour in a quart of bleach solution and slosh around for a few minutes. Rinse with hot water from a bottle washer.

The rubber seal caps worked quite well but are not reusable. After tapping, the beer must be finished before untapping—that makes it hard to transport a tapped ball. This system is new on the market, but seems to work reliably and without leakage. A tapper that uses tiny, expensive CO_2 cartridges is available, but not recommended because of price and leakage problems.

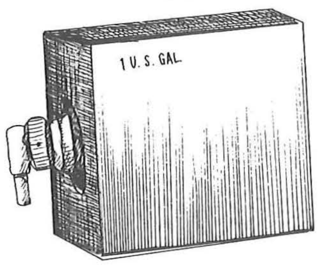
Plastic Homebrew Kegs



Cost: $40 to $80 (new)
Capacity: 2 1/2 and five gallons
Material: plastic
Availability: Local homebrew shops, mail order through ***zymurgy***
Dispense: Air or CO_2
Cost of fittings: Included
Advantages: Inexpensive, light, some designed to fit in refrigerator
Disadvantages: Very leaky, cannot hook up to regular CO_2 tank, uses tiny and very expensive CO_2 cartridges, cannot inject carbonation, cannot hook to regular beer or soda fittings for transfer or counterpressure bottling

These systems may save money in the short run but end up costing plenty in the long run. The tiny, low-capacity CO_2 cartridges are notoriously leaky and very frustrating. You cannot inject carbonation, counterpressure bottle or counterpressure transfer with them. They will not attach to beer or soda fittings, and cannot be adapted for bulk CO_2. With time, the plastic will let in air that causes oxidation. Before investing in one of these kegs, carefully consider the cost. You may be much better off obtaining used bulk CO_2 equipment.

Polypins

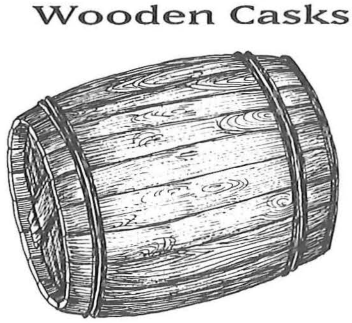


Cost: $2 to $5 (new), free (used)
Capacity: one, 2 1/2 and five gallons
Material: plastic
Availability: Scientific suppliers, local brewpubs
Dispense: Gravity
Cost of fittings: Included
Advantages: Downright cheap, light, fit in refrigerator, good for parties.
Disadvantages: Air dispense only—must consume beer in 24 hours, cannot inject CO_2 and can be used for low-carbonation ales only.

Polypins (a.k.a. beer boxes) are fun for parties but a hassle for everyday beer dispensing. They rely on gravity for dispensing—the plastic collapses as the beer level drops and oxidation occurs within 24 hours of tapping. This makes the boxes perfect for parties where the beer will be consumed in one night. The plastic is oxygen permeable, so rack into the polypin just before priming. Prime only with tiny amounts of sugar—one-quarter cup to five gallons is the maximum.

You still may have to vent excess carbon dioxide out once or twice during conditioning—do so if the beer box starts to bulge ominously. Be sure to keep the plastic bag inside the cardboard box it came in! The cardboard actually contains the pressure, so the plastic could rupture if you remove it from the cardboard.

Wooden Casks



Cost: $60 to $80 (new), do not buy used casks
Capacity: one, three, five, 10 and 15 gallons
Material: Oak
Availability: Special order through local homebrew shop from homebrew wholesalers, coopers; fittings very hard to find, some must be ordered from England.
Dispense: Gravity, hand pump
Cost of fittings: Very high—total of $100. Hand pump could cost more than $300 plus overseas shipping.
Advantages: Authentic, beer has distinctive British flavor and conditioning, fun to look at and show off.
Disadvantages: Extremely expensive, hard to clean, hard to find, beer must be drunk quickly, fittings hard to find, casks very difficult to maintain.

You're not really serious about wanting ale from the wood, are you? No, I didn't think so. But if you're a die-hard, fanatical CAMRA-member, Anglophile lottery winner, refer to Terry Foster's book *Pale Ale* (Brewers Publications, 1990) and "Beer in the Wood" in **zymurgy** Fall 1984 (Vol. 7, No. 3) for detailed instructions.

Only coated oak casks will work for beer—the coating process is called pitching, and can be done by some coopers. Coated barrels are available from a U.S. homebrew wholesaler—ask your local shop to special order for you. Never buy a used cask—it might have contained vinegar or pickles. Barrels must be kept full of sanitizer and water when not in use, otherwise they'll dry up and be ruined. The surest way to clean casks is with steam.

The basic procedure: Rack the flat beer into the clean cask. Prime with a very small amount of sugar (maybe one-quarter cup to five gallons). Pound in a hard spile and wait until the barrel carbonates. Pound the hard spile through, pound in soft spile. Broach cask by pounding in tap. Attach to beer engine, enjoy all of the hand-pulled beer within three days of tapping. But is it worth the hassle? Visit Yorkshire and compare for yourself!

CA
Fun Fermentation
1800 950-WINE

IDAHO
Brewers Connection
1800-955-BREW

Biographies

Larry Barello

of Seattle, Wash., has been homebrewing off and on for 14 years. A former techno-weenie, Larry is now a "daddy supreme" and spends most of his time taking care of his children. In his spare time he reverts to technical projects like brewing, working on brewing gadgets and other home projects.

Kinney Baughman

is owner of BrewCo, the U.S. distributor of the Bruheat and manufacturer of the BrewCap and BrewChiller. He is a charter member of Long Necks, the Tall Brewers of America, and lives in Boone, N.C.

Byron Burch

is an internationally recognized expert in homebrewing and winemaking and has been teaching the arts since 1972. Byron owns Great Fermentations of Santa Rosa, Calif., a supply company for homebrewers and winemakers. He is a member of the seven-time national champion Sonoma Beerocrats. Byron has won several brewing awards at the national level and is the 1986 Homebrewer of the Year and 1992 Meadmaker of the Year. He is writing a book on wine- and meadmaking.

Edmund J. Busch,

a homebrewer since 1984, is president of the Mid-Atlantic Sudsers & Hoppers (MASH) of New Jersey and is a BJCP Certified Beer Judge. A member of the AHA Board of Advisers, Edmund has a bachelor's degree in chemistry and a master's in marketing. He sold diatomaceous earth filters from 1976 to 1984, and diatomaceous earth since 1984.

Steven Casselman,

an AHA Board of Adviser Member, has been brewing beer for somewhere around 10 years. The past president of the Maltose Falcons has furnished a two-barrel back yard brewery using the methods outlined in his article, "How to Find Good Stuff."

David Coy

is from Iowa, where he earned his secondary teaching degree in mathematics from Iowa State University. He and his wife Cherri of Northglenn, Colo., have been brewing for seven years and, with the help of daughter Allison, recently began perfecting an Oktoberfest recipe. David is secretary of Hop Barley & The Ale'rs, the Boulder County, Colo., homebrew club.

Teri Fahrendorf,

who was educated at the University of Wisconsin, Eau Claire, and the Siebel Institute for Brewing Technology in Chicago, began her brewing career at Siebens River North Brewpub in Chicago as an unpaid intern. Since then she has worked as brewmaster at the Golden Gate Brewpub and head brewer at Triple Rock Brewpub, both in Berkeley, Calif. She is now brewmaster at Steelhead Brewery & Cafe in Eugene, Ore. Two of Teri's beers won gold medals at the 1991 Great American Beer Festival. She is a member of the Master Brewers Association of the Americas and is a BJCP Certified Beer Judge.

Glen Falconer

started homebrewing five years ago in Atlanta, Ga., where it is still illegal. After moving to Eugene, Ore., in 1988 he started all-grain brewing. Glen works at Steelhead Brewery where he designed a cask-conditioning ale system for the bar. A self-professed brewing maniac, Glen still brews at home on the anniversary of his brewing beginnings, Labor Day.

Dan Fink

has been brewing beers and meads for seven years. The former Brew News editor of *zymurgy*, Dan is planning to open a homebrew supply shop in Boulder, Colo. He specializes in all-grain brewing and kegging techniques.

Phil Fleming

of Broomfield, Colo., has been homebrewing since 1982 when he took a class from Charlie Papazian at the Boulder Free University. To provide financial support for his brewing he is an electronic engineer involved in instrumentation design. "I guess that makes me the perfect example of the techno-geek who takes up homebrewing," Phil said. "I even have facial hair."

Stephen Foster

of Fort Collins, Colo., has been brewing since age 16 and more seriously for the past 12 years. He writes on the brewing process for the Rocky Mountain Brews and has contributed several articles to *zymurgy*. He is an environmental consultant with a doctorate degree in organic chemistry, which only sometimes helps when it comes time to brew.

Wayne Greenway

of Oakland, Calif., is a mechanical technologist at the Lawrence Berkeley Lab and is studying mechanical engineering. He made his first homebrew with his father 20 years ago and finally started brewing on his own six years ago when mortgage payments lowered the quality of beer he could afford. Wayne enjoys "wrenching" on his brewery system almost as much as brewing. He is designing and building a 50-gallon, stainless-steel, all-grain system.

Tom Hamilton,

a full-time machinist and part-time student at the University of Southern California, has been brewing for three years. He keeps up with Homebrew Digest via electronic mail and is a member of the Maltose Falcons. Tom's beers are extract-adjunct ales but he plans to move into all-grain brewing as soon as he gets his wort chiller built. With his fridge hooked up to a Hunter Airstat, he's ready to brew lager beers, too.

Jim Homer

took Charlie Papazian's homebrewing class in 1980, joined the AHA as member No. 763, and has been co-director of the Beer Judge Certification Program since 1985. He has been on the Great American Beer Festival staff and was director of the Professional Panel Blind Tasting between 1987 and 1990. In 1991 Jim judged for the Great American Beer Festival and best of show in the AHA National Competition. Jim is an active member of Hop Barley & The Ale'rs. When he's not brewing or judging he is an electrical engineer for AT&T.

Russell J. Klisch

started his homebrew career shortly after graduating in chemistry from the University of Wisconsin, Eau Claire, in 1981. After homebrewing for several years, Russ turned professional in 1987 and helped found, and is current president of, Lakefront Brewery, Milwaukee, Wis. Although Russ receives most of his notoriety from running the brewery, he receives most of his money from Johnson Controls, where he works as a process engineer. He hopes to expand the brewery within the next year and work full time along with the brewery's other two full-time employees.

Paul Lewis

of Columbia, Tenn., is a retired employee relations manager with a chemistry degree from Oklahoma State University. A member of the AHA, Paul has been homebrewing since 1985. He enjoys woodworking, homebrewing and, of course, relaxing.

Tom Lyons,

president of Tampa Bay BEERS homebrewing club in Florida, has been brewing since 1989. He makes mostly ales and does partial mashes in his RIMS unit. He is active on the CompuServe Beer and Wine Forum (ID number 76474,2350). Tom is married, has two sons and is vice president of operations for a large distribution firm.

Steve Mechels,

originally from Montana, is a helicopter pilot in Kansas. He has been a homebrewer for one year and is seeking work in a brewpub or microbrewery. When not flying, he enjoys making (and drinking) weizens and pale ales.

George Moncure

is a ground-water scientist in Fort Collins, Colo. When not fishing for parts to build some contraption, he teaches his 2 1/2-year-old daughter Alex how to spread spent barley on the garden. His next project is electro-malting.

Rodney Morris

is a doctoral degree candidate in microbiology at Texas A&M University. Although he is studying organisms unrelated to beer, he has an avid interest in brewing as a hobby. Rodney brews regularly, maintains a large collection of cultured yeasts and is a member of the MaltHoppers homebrew club, College Station, Texas. He has been homebrewing for 16 years.

Randy Mosher

began homebrewing in 1983. The creator of Doctor Bob Technical's Amazing Wheel of Beer, he has just finished work on a serious reference for homebrewers, *The Brewer's Companion*, to be published this fall by Alephenalia Publications, Seattle, Wash. The inveterate tinkerer's 15-gallon all-grain system includes an electrically heated, motor-stirred, electronically timed and temperature-regulated mash tun, one step in his quest for "... total brewhouse automation for a buck a pound." Profession-ally, he runs his own graphic design and new product development company in Chicago, Ill., and is a trainer on Macintosh graphic design systems.

Susanne Price's

first fermentation experiment, at age 12, included such necessary adjuncts as apple cider, hot dogs, Band-Aids, Elmer's glue and Old Milwaukee, and successfully produced the full range in taste as well as infection. Years later, after receiving a bachelor's degree in geology and Russian from the University of Colorado at Boulder, she went on to produce several award-winning beers and meads. Susanne continues to concoct brews like pomegranate-passion fruit weizen and vanilla bean mead.

Phil Rahn

of Cordova, Tenn., is president of the Bluff City Brewers homebrew club in Memphis. He started brewing in 1975 and has been brewing all-grain beers for 14 years. A BJCP Certified Beer Judge, Phil is partial to ales. He is a product development representative for the Agricultural Group of Monsanto, St. Louis, Mo.

Maribeth (M.B.) Raines

received her doctorate degree in biochemistry from Michigan State University in 1987. She is a research associate at Memorial Sloan-Kettering Cancer Center in New York City and will be setting up her own research lab this fall at University of California, Los Angeles. Her research interests are cancer and the human immune system. She cultures everything from bacteria and human cells to viruses and, of course, yeast. A loyal Maltose Falcon, she also serves as a consultant for Brewers Resource, a mail-order business, and has developed a yeast culturing kit for homebrewers.

Chuck Skypeck,

operations manager for Squash Blossom Markets, two whole-food grocery stores, considers homebrewed beer to be a wholesome and nutritious addition to any diet. An active member of the Bluff City Brewers, Memphis, Tenn., Chuck is a BJCP National Beer Judge and has been homebrewing for seven years. He has taught beer brewing and judging classes for four years, helping to spread the good word about homebrewed and commercial beer.

Thom Tomlinson

holds a doctorate degree in psychology, manages the Great American Beer Festival's Professional Panel Blind Tasting and is president of the Boulder County, Colo., homebrew club, Hop Barley & The Ale'rs. With wife Diane and a Siamese cat named Samantha, he conjures up award-winning stouts. When not involved in brewing he teaches and conducts research in psychology at the University of Colorado at Boulder.

Sam Wammack

of Ozark, Mo., is owner of The Home Brewery, a homebrew supplier with shops in California, Nevada, Missouri and New Jersey. Sam has been brewing for about 15 years. For 20 years he worked for the San Bernardino County, Calif., marshal's office rising to the rank of division commander. In 1990 he took an early retirement from law enforcement to work in the homebrew supply business full time and says homebrewing is a lot more fun. A BJCP Certified Beer Judge, Sam is founder of the more than 500-member Inland Empire homebrew club.

Russ Wigglesworth

is an all-around homebrewing nut (just ask his family). A very active member of the San Andreas Malts, Russ involves himself with all aspects of homebrewing. He has invented gadgets, run major competitions, written articles and still finds time to actually brew his own beer. Someday Russ hopes to earn his living from beer and brewing, but he's not holding his breath. He can be reached via the CompuServe Beer Forum or the Home Brew Digest on Internet.

Jim Yuzwalk

is a Canadian citizen who has lived in Michigan for more than 30 years. He is a senior engineer in charge of testing electronic components and modules for Chrysler vehicles. Jim's degree in electrical and electronic engineering from Wayne State University was partly responsible for his taking up the homebrewing hobby in 1982. His wife of five years dislikes commercial beers but enjoys his all-malt Pilsener homebrew. Besides homebrewing, Jim enjoys fishing, computer hacking, making videos and building and flying remote control airplanes.

JAMES SPENCE

Winners Circle

1992 Brewing Champions

THE 1992 NATIONAL COMPETITION JUDGED 2,399 ENTRIES FROM ALL OVER THE WORLD, A 47 PERCENT INCREASE FROM LAST YEAR'S NATIONAL COMPETITION.

First-round entries were judged in San Francisco, Boulder, Chicago, Boston and Portland. Second-round and best-of-show judging took place in June at the 1992 AHA National Conference in Milwaukee, Wis.

Homebrewer of the Year Stu Tallman won a trip to the 1992 Great American Beer Festival in Denver, Colo., on Oct. 2 and 3 with a Munich Dunkel. Strangely enough, last year's best-of-show brew also was a Munich Dunkel-style lager. The Ninkasi Award, given to the brewer who wins the most points in the competition (three points for first place, two for second and one for third), was won by Steven and Christina Daniel of League City, Texas, who also have the distinction of winning first and second in the American Light Lager category—that's great brewing. Byron Burch of Santa Rosa, Calif., won Meadmaker of the Year. Burch was also the 1986 Homebrewer of the Year. Cidermaker of the Year went to Charles Castellow of Edmonds, Wash. Tina Long of Sacramento, Calif., won Sakemaker of the Year.

For the seventh consecutive year the Sonoma Beerocrats of California won the Club High-Point Trophy, edging out the Boston Wort Processors by only one point, 26 to 25. Colorado's Hop Barley & The Ale'rs took third. The award is given to the homebrew club whose members earn the most points in the competition. Three points are given for first place, two points for second and one point for third.

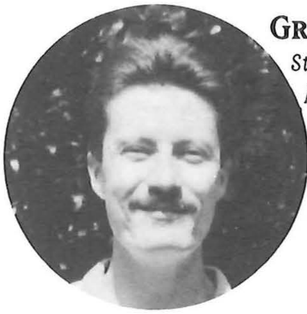
The most popular category this year was stout with 205 entries, making Dick Van Dyke's first place in the category a remarkable homebrewing achievement. English-style pale ale drew the next highest number of entries with 168. Sake, in the first year of competition, drew 12 entries making it the smallest category.

Here they are! The finest recipes from the world's largest homebrew competition. Try 'em, you'll like 'em.

BARLEY WINE

Category award sponsored by EDME Ltd., England

F I R S T   P L A C E



GREG LEAS
St. Charles, Missouri

"FOGHORN LEGHORN BARLEYWINE"

Ingredients for 5 gallons

10 pounds two-row malt
4 pounds pale malt
1 pound 40 °L crystal malt
1 pound CaraPils malt
3.3 pounds Northwestern malt extract
4 pounds Alexander malt extract
3 ounces Centennial hops, 9.1 percent alpha acid (60 minutes)
1 ounce Northern Brewer hops, 6.7 percent alpha acid (60 minutes)
1 ounce EKG hops, alpha acid 5.3 percent (one minute)
Wyeast No. 1056 liquid yeast

- Original specific gravity: 1.096
- Final specific gravity: 1.025
- Boiling time: 60 minutes
- Primary fermentation: 14 days at 70 degrees F (21 degrees C) in glass
- Secondary fermentation: 14 days at 70 degrees F (21 degrees C) in glass
- Age when judged (since bottling): 12 months

Brewer's specifics

Mashed all grains for 90 minutes at 153 degrees F (67 degrees C) until conversion.

Judges' comments

"A nice brew. Malty, hop bitterness appropriate. Alcohol evident. Color at light end of spectrum."

"Nice hop-malt balance."

"Very good barley wine. Very sweet, malty nose. Spicy aroma. Not enough fruitiness—perhaps try a different yeast. Nice job."

"Great beer, clean, well-made."

BELGIAN-STYLE SPECIALTY

Category award sponsored by Manneken-Brussel Imports, Austin, Texas

F I R S T   P L A C E

MARK RICHMOND
Springfield, Ohio

"HOE GARDEN — MOW LAWN"

Subcategory: White

Ingredients for 5 gallons

5 pounds Klages two-row malt
1/2 pound oats
4 1/2 pounds wheat malt
1 ounce Hallertauer hops, 4.4 percent alpha acid (60 minutes)
1/2 ounce Tettnanger hops, 4.5 percent alpha acid (20 minutes)
1 ounce Hallertauer hops, 4.4 percent alpha acid (10 minutes)
1 ounce Saaz hops, 3.1 percent alpha acid (finish)
1 ounce crushed coriander (60 minutes in boil)
1/2 ounce orange peel (10 minutes in boil)
1 ounce coriander seed (dry "hop")
1/2 ounce orange peel (dry "hop")
Wyeast No. 1028 liquid yeast in a 1-quart starter
3/4 cup corn sugar to prime

- Original specific gravity: 1.046
- Final specific gravity: not taken
- Boiling time: 90 minutes
- Primary fermentation: 33 days at 65 degrees F (18 degrees C) in glass
- Age when judged (since bottling): five months

Brewer's specifics

Sour mash technique. Dough-in at 160 degrees F (72 degrees C), gradually dropping to 122 degrees F (50 degrees C) over a 24-hour period. Sparge with 165 degree F (74 degrees C) water. Dry "hopped" with 1 ounce coriander seed and one-half ounce orange peel.

Judges' comments

"Clean, sharp flavor. Very drinkable."

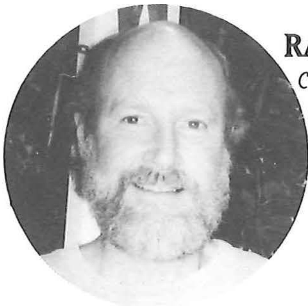
"Very good white. Spices come through with crispness."

"Great refreshing beer. True to style. With a little less spice and more tartness, it would be unbeatable."

BROWN ALE

Category award sponsored by Premier Malt Products, Grosse Pointe, Michigan

F I R S T   P L A C E



RANDY GREMP
Calistoga, California

BEER UNNAMED

Subcategory: American Brown Ale

Ingredients for 10 gallons

- 20 POUNDS KLAGES MALT
- 4 POUNDS 20 °L CRYSTAL MALT
- 1/2 POUND BLACK PATENT MALT
- 1/2 POUND CHOCOLATE MALT
- 1/2 POUND ROAST BARLEY
- 1 OUNCE CHINOOK HOPS, 11.8 PERCENT ALPHA ACID (60 MINUTES)
- 1 OUNCE PERLE HOPS, 6.8 PERCENT ALPHA ACID (15 MINUTES)
- 1 OUNCE CASCADE HOPS, 5.2 PERCENT ALPHA ACID (15 MINUTES)
- 2 2/3 OUNCE CASCADE HOPS, 5.2 PERCENT ALPHA ACID (FINISH)
- WYEAST NO. 1056 LIQUID YEAST 500 mL
- 1 TEASPOON GYPSUM
- 1 1/2 CUPS CORN SUGAR TO PRIME

- Original specific gravity: 1.060
- Final specific gravity: 1.024
- Boiling time: (60 minutes)
- Primary fermentation: seven days at 60 degrees F (16 degrees C) in glass
- Secondary fermentation: nine days at 58 degrees F (15 degrees C) in glass
- Age when judged (since bottling): five months

Brewer's specifics

Mashed all grains for 60 minutes at 158 degrees F (70 degrees C). Raise to 170 degrees F (77 degrees C) for 15 minutes. Sparge with 12 gallons water at 170 degrees F (77 degrees C).

Judges' comments

"Nice full balance of dark malt and lively hops."

"Great hop character—complex citrus and floral—spicy! Clean aftertaste. Excellent effort."

"Pleasant nicely balanced beer. Could be a little heavier in bittering. Some sour notes are the only defect."

"Some sourness. Too much black malt in flavor. Good finish except for excess black malt. Nice drinking beer. One sip calls for another."

ENGLISH-STYLE PALE ALE

Category award sponsored by Wynkoop Brewing Co., Denver, Colorado

F I R S T   P L A C E

KEVIN JOHNSON
Pacifica, California

"SALUTATION NO. 4"

Subcategory: Classic English Pale Ale

Ingredients for 6 gallons

- 2 POUNDS ENGLISH PALE MALT
- 2 POUNDS ENGLISH MILD MALT
- 3 POUNDS AMERICAN PALE MALT
- 1/2 POUND ENGLISH CRYSTAL MALT
- 1/2 POUND AMERICAN 40 °L CRYSTAL MALT
- 1/2 POUND MUNICH MALT
- 1/2 POUND AMERICAN 10 °L MALT
- 1 2/3 POUNDS JOHN BULL LIGHT UNHOPPED MALT EXTRACT
- 1 OUNCE EROICA HOPS, 11.4 PERCENT ALPHA ACID (75 MINUTES)
- 1/2 OUNCE CASCADE HOPS, 6.1 PERCENT ALPHA ACID (75 MINUTES)
- 1/4 OUNCE EROICA HOPS, 11.4 PERCENT ALPHA ACID (30 MINUTES)
- 3/4 OUNCE CASCADE HOPS, 6.1 PERCENT ALPHA ACID (30 MINUTES)
- 2 OUNCES CASCADE HOPS, 5.5 PERCENT ALPHA ACID (FINISH)
- 3/4 TEASPOON GYPSUM (HALF IN MASH, HALF IN SPARGE)
- WYEAST NO. 1056 LIQUID YEAST
- 63 GRAMS CORN SUGAR FOR PRIMING

- Original specific gravity: 1.053
- Final specific gravity: 1.015
- Primary fermentation: 19 days at 62 degrees F (16 degrees C) in glass

Brewer's specifics

Mash all grains for 75 minutes at 153 degrees F (67 degrees C).

Judges' comments

"Overall a really nice beer. The aftertaste could be improved a little. Slightly astringent. Keep up the good work."

"Great job, a good drinking beer."

"Good beer. Could use some more bittering hops."

"High bitterness level. Nice, long-lasting aftertaste. A very good beer."

AMERICAN-STYLE PALE ALE

Category award sponsored by Northwestern Extract Co., Brookfield, Wisconsin

F I R S T   P L A C E

Bill Draths
Chicago, Illinois

"Dan Ale"

Subcategory: American Pale Ale

Ingredients for 5 gallons

- 10 pounds American two-row malt
- 1/2 pound American 60 °L crystal malt
- 1/4 ounce Northern Brewer hops, 8 percent alpha acid (60 minutes)
- 1/3 ounce Chinook hops, 10.8 percent alpha acid (50 minutes)
- 1 ounce Willamette hops, 3.2 percent alpha acid (one minute)
- 1 ounce Cascade hops, 5.9 percent alpha acid (dry hopped four weeks)
- Wyeast No. 1056 liquid yeast
- 1/8 teaspoon citric acid
- 1 teaspoon gypsum
- 1 teaspoon Irish moss in kettle
- 3/4 cup corn sugar to prime

- Original specific gravity: 1.055
- Final specific gravity: 1.012
- Boiling time: 60 minutes
- Primary fermentation: 11 days at 68 degrees F (20 degrees C) in glass
- Secondary fermentation: 28 days at 58 to 60 degrees F (15 to 16 degrees C) in glass
- Age when judged (since bottling): four months

Brewer's specifics

Mash all grains for 75 minutes at 153 degrees F (67 degrees C).

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

ENGLISH BITTER & SCOTTISH ALE

Category award sponsored by Jasper's Home Brew Supply, Litchfield, New Hampshire

F I R S T   P L A C E

John Arends
Calistoga, California

"Caroline's Mild"

Subcategory: English Ordinary

Ingredients for 10 gallons

- 15 1/2 pounds Klages malt
- 1 pound 40 °L crystal malt
- 3/4 pound 90 °L crystal malt
- 1/2 pound wheat malt
- 1/2 pound CaraPils malt
- 1 1/3 ounces Kent Golding hops, 4.9 percent alpha acid (60 minutes)
- 1 1/2 ounces Kent Golding hops, 4.9 percent alpha acid (30 minutes)
- 1 1/10 ounces Kent Golding hops, 4.9 percent alpha acid (two minutes)
- 1/2 teaspoon gypsum
- 1/2 teaspoon chalk
- 1/4 teaspoon salt
- Wyeast No. 1028 liquid yeast
- 1 1/2 cups corn sugar to prime

- Original specific gravity: 1.038
- Final specific gravity: 1.011
- Boiling time: 60 minutes
- Primary fermentation: nine days at 68 degrees F (20 degrees C) in glass
- Secondary fermentation: 13 days at 68 degrees F (20 degrees C) in glass
- Age when judged (since bottling): three months

Brewer's specifics

Mash all grains for 75 minutes at 156 degrees F (69 degrees C). Sparge with 175-degree-F (79-degrees-C) water.

Judges' comments

"Touch of hops and malt—very nice. Subtle. Very good for an ordinary bitter. I wish I'd brewed this—wonderful job! Thanks!"

"Almost the perfect beer. Could perhaps use a bit more hop bitterness."

"This is no ordinary beer. Excellent. Would be hard to improve."

"Malty, some caramel, good hop balance. Clean finish, nice conditioning. A little bold for an Ordinary Bitter. Might fit Special Bitter better."

PORTER

Category award sponsored by The Cellar, Seattle, Washington

FIRST PLACE

DENNIS KINVIG
Toronto, Ontario

"COAL PORTER"

Subcategory: Brown Porter

Ingredients for 5 gallons

- 3 1/3 pounds Brewmaker Mild hopped extract
- 3 1/3 pounds Munton and Fison amber extract
- 1 pound 9 ounces caramel malt
- 5 ounces chocolate malt
- 1/2 ounce Northern Brewer hops, 8 percent alpha acid (35 minutes)
- 1/4 ounce Northern Brewer hops, 8 percent alpha acid (two minutes)
- 1/4 ounce Cascade hops (dry)
- 1/2 ounce Hallertauer hops (dry)
- 6 ounces barley syrup
- Wyeast No. 1084 liquid yeast
- 1/2 teaspoon non-iodized salt
- 3 3/4 ounces dextrose to prime

- Primary fermentation: 12 days at 65 degrees F (18 degrees C) in plastic
- Age when judged (since bottling): four months

Brewer's specifics

Grains steeped until boil then removed.

Judges' comments

"Slight burnt malt aroma. Smooth flavor, slight burnt malt flavor. Clean. Good example of brown porter."

"A touch smoky-phenolic, otherwise sweet and inviting. Very clean, almost lagerlike. Good creamy head."

"Lovely rich brown color. A bit "husky" but I get no diacetyl. Good rich taste for style, but a bit too bitter. A proud entry."

"Really well-balanced ale. Body just a little over medium."

ENGLISH & SCOTTISH STRONG ALE

Category award sponsored by Wine & Hop Shop, Denver, Colorado

F I R S T   P L A C E

JIM CAMPBELL
San Jose, California

"A PEEK UNDER THE KILT ALE"

Subcategory: Strong "Scotch" Ale

Ingredients for 5 gallons

- 3 1/3 POUNDS AMBER EXTRACT SYRUP
- 6 POUNDS CALIFORNIA LIGHT EXTRACT SYRUP
- 1 POUND AUSTRALIAN LIGHT DRY EXTRACT
- 2 POUNDS CRYSTAL MALT
- 1/2 POUND MUNICH MALT
- 1/2 POUND FLAKED BARLEY
- 1/2 POUND WHEAT MALT
- 1/2 CUP ROASTED BARLEY
- 3/4 OUNCE CHINOOK HOPS (75 MINUTES)
- 1 OUNCE HALLERTAUER HOPS (75 MINUTES)
- 1 OUNCE CASCADE HOPS (30 MINUTES)
- 1 OUNCE KENT GOLDINGS HOPS (10 MINUTES)
- 1 OUNCE CASCADE HOPS (FIVE MINUTES)
- 1/2 TEASPOON GYPSUM
- 1/2 TEASPOON SALT
- 1/2 TEASPOON IRISH MOSS
- 1/2 TEASPOON ASCORBIC ACID
- SIERRA NEVADA CELEBRATION ALE YEAST CULTURE
- 3/4 CUP CORN SUGAR TO PRIME

- Original specific gravity: 1.074
- Final specific gravity: 1.018
- Boiling time: 75 minutes
- Primary fermentation: 38 days at 65 degrees F (18 degrees C) in glass
- Age when judged (since bottling): 12 months

Brewer's specifics

All grains steeped.

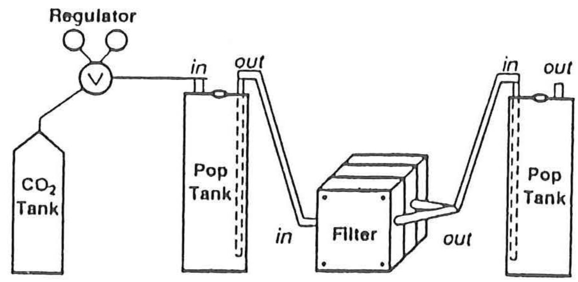
Judges' comments

"Good, well-made beer, but aggressive hopping isn't appropriate for style. Nice smokiness."

"Enjoyable, smooth beer. Huge flavor. Hoppiness perhaps too much for style."

"Malty aroma follows through to palate. Slightly smoky finish lends interest and complexity. A well-made beer."

"Overall a very nice effort, but hop could be too much for style."



STOUT

Category award sponsored by BME Extract Co., Staten Island, New York

F I R S T P L A C E

DICK VAN DYKE
Park Forest, Illinois

"ROSE'S RUSSIAN IMPERIAL STOUT WITH MAYO"

Subcategory: Imperial Stout

Ingredients for 5 gallons

- 5 pounds six-row English malt
- 6 2/3 pounds Northwestern dark malt extract
- 2 pounds 90 °L crystal malt
- 1 pound black patent malt
- 1 pound chocolate malt
- 1 pound Munich malt
- 1/4 pound wheat malt
- 1 ounce Chinook hops, 11.3 percent alpha acid (60 minutes)
- 5 1/2 ounces Eroica hops, 10.6 percent alpha acid (60 minutes)
- 1 ounce Kent Goldings hops, 4.7 percent alpha acid (45 minutes)
- 1 ounce Cascade hops, 4.9 percent alpha acid (45 minutes)
- 1 ounce Fuggles hops, 4.5 percent alpha acid (45 minutes)
- 1 ounce Chinook hops, 10.8 percent alpha acid (45 minutes)
- 1 ounce Kent Goldings hops, 4.7 percent alpha acid (30 minutes)
- 3/4 ounce Cascade hops, 4.9 percent alpha acid (30 minutes)
- 1 ounce Kent Goldings hops, 4.7 percent alpha acid (10 minutes)
- 1 ounce Fuggles hops, 3.4 percent alpha acid (10 minutes)
- 1 cup molasses
- 1 inch licorice stick
- 2 packages Red Star Champagne yeast
- 2/3 cup corn sugar to prime

- Original specific gravity: 1.107
- Final specific gravity: 1.047
- Boiling time: 60 minutes
- Primary fermentation: three days at 65 degrees F (18 degrees C) in plastic
- Secondary fermentation: six days at 63 degrees F (17 degrees C) in glass
- Tertiary fermentation: 28 days at 63 degrees F (17 degrees C) in glass
- Age when judged (since bottling): six months

Brewer's specifics

All grains mashed for 30 minutes at 130 degrees F (54 degrees C). Temperature raised to 150 degrees F (65 degrees C) for 60 minutes. Temperature raised to 156 degrees F (69 degrees C) for 30 minutes.

Judges' comments

"Very good beer. Almost too much roasted flavor. Overcarbonated. Watch boiled grains for astringency. Very, very good."

"Molasses, licorice, roasted malt. Very nice beer. Well-made Imperial Stout."

"Rich, malty, fruity aroma. Alcohol evident in aroma. Thick, tight, compacted head. Good color and clarity. Very warming. Very smooth, drinkable beer. It leaves a warm feeling in my stomach."

BOCK

Category award sponsored by Yakima Valley Hop Growers, Yakima, Washington

F I R S T P L A C E

STEVE DEMPSEY
Fort Collins, Colorado

"SCINTILLATOR"
Subcategory: Doppelbock

Ingredients for 5 gallons

- 7 pounds Munich malt
- 2 pounds 20 °L crystal malt
- 3 1/3 pounds BME Munich Gold extract
- 1 pound light dry extract
- 1 1/4 ounces Hallertauer hops, 4.1 percent alpha acid
- 1 ounce Tettnanger hops, 3.8 percent alpha acid
- 1/2 teaspoon salt
- 1/3 teaspoon gypsum
- 1 2/3 teaspoon chalk
- 1/3 teaspoon Epsom salts
- Wyeast No. 2308 liquid yeast

- Original specific gravity: 1.080
- Final specific gravity: 1.028
- Primary fermentation: one day at 65 degrees F (18 degrees C) in glass
- Secondary fermentation: 21 days at 47 degrees F (8 degrees C) in glass
- Tertiary fermentation: 21 days at 38 degrees F (3 degrees C) in stainless steel
- Age when judged (since bottling): 15 months

Brewer's specifics

All grains mashed at 156 degrees F (69 degrees C) for 120 minutes. Beer was force carbonated in keg.

Judges' comments

"This beer has a lot of unfermented dextrines.

"I wish this beer had been better conditioned. It could have been excellent."

"I taste the malt and hop but believe a yeasty off-flavor effects the aftertaste."

" Good beer."

"Nice malty flavor - excellent. Some spiciness in finish, alcohol just noticable - very nice."

" Nice beer, needs to get better carbonation and head retention - change mash temperature to give more body.

"Great job. Real malty. Outstanding smoothness. Subordination of hops might be too much."

BAVARIAN DARK

Category award sponsored by Crosby & Baker, Westport, Massachusetts. Homebrewer of the Year award sponsored by Munton and Fison, England.

F I R S T P L A C E

STU TALLMAN
Rochester, Massachusetts

1992 HOMEBREWER OF THE YEAR BEST OF SHOW

"STU BREW"

Subcategory: Munich Dunkel

Ingredients for 10 gallons

15 POUNDS PALE MALT
4 POUNDS MUNICH MALT
4 POUNDS 40 °L CRYSTAL MALT
2 1/2 OUNCES SAAZ HOPS (90 MINUTES)
WYEAST NO. 2026 LIQUID YEAST

- Original specific gravity: 1.060
- Final specific gravity: 1.018
- Boiling time: 90 minutes
- Primary fermentation: 21 days at 50 degrees F (10 degrees C) in glass
- Secondary fermentation: 21 days at 37 degrees F (3 degrees C) in glass
- Age when judged (since bottling): four months

Brewer's specifics

Three-step upward infusion mash.

Judges' comments

"Slightly bitter start. Malty flavor. Sweet caramel finish. Very nice. Good balance. Clean."

"Very nice! Smooth malty taste. True to style and perfectly clean."

"Nice malty character. Smooth, little sweet and caramelly. Good. Hops are good. Sulfury flavors come out when warming."

AMERICAN DARK

Category award sponsored by Briess Malting Co., Chilton, Wisconsin

F I R S T P L A C E

CRAIG BEIFUS
Milford, New Jersey

"FRANKIE DARK"

Ingredients for 5 gallons

8 POUNDS KLAGES MALT
2 POUNDS DARK CRYSTAL MALT
1 POUND CARAPILS MALT
1/4 POUND VICTORY MALT
1/4 OUNCE CHINOOK HOPS, 12.5 PERCENT ALPHA ACID (80 MINUTES)
1/2 OUNCE HALLERTAUER HOPS, 5.0 PERCENT ALPHA ACID (30 MINUTES)
1/8 OUNCE CASCADE HOPS, 6.7 PERCENT ALPHA ACID (30 MINUTES)
1/2 OUNCE HALLERTAUER HOPS, 5.0 PERCENT ALPHA ACID (FOUR MINUTES)
1/8 OUNCE TETTNANGER HOPS, 5.0 PERCENT ALPHA ACID (FOUR MINUTES)
WYEAST NO. 2305 LIQUID YEAST

- Original specific gravity: 1.040
- Final specific gravity: 1.014
- Boiling time: 80 minutes
- Primary fermentation: seven days at 50 degrees F (10 degrees C) in plastic
- Secondary fermentation: 14 days at 50 degrees F (10 degrees C) in glass
- Age when judged (since bottling): four months

Brewer's specifics

All grains mashed for one hour 45 minutes at 153 degrees F (67 degrees C).

Judges' comments

"A good, clean example of the style. Body may be a little too full."

"Malty, corniness fades quickly to dry clean aftertaste."

"Close to style with fairly delicate hop-malt balance. Slight astringency in finish—be careful with sparging technique."

"Drinkable; astringent aftertaste lingers—detracts from this beer's enjoyability."

DORTMUND/EXPORT

Category award sponsored by DeFalco's Wine & House Beer, Dallas, Texas

F I R S T   P L A C E

NORMAN DICKENSON

Santa Rosa, California

"GRAIN-N-BEERIT"

Ingredients for 10 gallons

- 17 POUNDS TWO-ROW PALE MALT
- 2 POUNDS MUNICH MALT
- 1 POUND VIENNA MALT
- 1 POUND DEXTRIN MALT
- 1 OUNCE PERLE HOPS, 7.6 PERCENT ALPHA ACID (60 MINUTES)
- 1 1/4 OUNCE SAAZ HOPS, 2.8 PERCENT ALPHA ACID (60 MINUTES)
- 2 OUNCES TETTNANGER HOPS, 3.2 PERCENT ALPHA ACID (30 MINUTES)
- 1/2 OUNCE PERLE HOPS, 7.6 PERCENT ALPHA ACID (10 MINUTES)
- WYEAST NO. 2206 LIQUID YEAST
- 1 1/2 CUPS CORN SUGAR TO PRIME

- Original specific gravity: 1.050
- Final specific gravity: not taken
- Boiling time: 60 minutes
- Primary fermentation: 10 days at 52 degrees F (11 degrees C) in glass
- Age when judged (since bottling): four months

Brewer's specifics

All grains mashed at 149 degrees F (65 degrees C) for 50 minutes. Raise temperature to 168 degrees F (75 degrees C) for 10 minutes.

Judges' comments

"Good balancing act sustained from entry to finish. Malt character a bit milky; hops could be more assertive. Good job, though!"

"Some sweetness but seems nicely balanced. A little overcarbonated."

"I like this from the nose all the way to the aftertaste. I think it is a little overcarbonated and fruity for the style. Could use more hardness. Overall a very good beer."

"Good malt flavor. Nice balance. Slightly overcarbonated. Good clean finish. Maybe just a touch sweet for style."

MUNICH HELLES

Category award sponsored by Wines Inc., Akron, Ohio

FIRST PLACE

BRIAN AND LINDA NORTH
Franklin, Wisconsin

"MELTDOWN LAGER"

Ingredients for 5 1/2 gallons

- 5 1/2 pounds Munton and Fison pale dry extract
- 1/2 pound crystal malt
- 1/2 pound dextrin malt
- 1/2 ounce Hallertauer hops, 3.4 percent alpha acid (60 minutes)
- 1/2 ounce Hallertauer hops, 3.4 percent alpha acid (30 minutes)
- 1 ounce Saaz hops, 3.0 percent alpha acid (two minutes)
- 3/8 teaspoon gypsum
- Wyeast No. 2124 liquid yeast

- Original specific gravity: 1.045
- Final specific gravity: unknown
- Boiling time: 60 minutes
- Primary fermentation: four days at 45 degrees F (7 degrees C) in glass
- Secondary fermentation: 28 days at 35 degrees F (2 degrees C) in stainless steel
- Age when judged (since bottling): six months

Judges' comments

"Fine example of Munich Helles. Could be higher in body and less carbonated. But not bad."

"Good beer. Cooler fermentation would help."

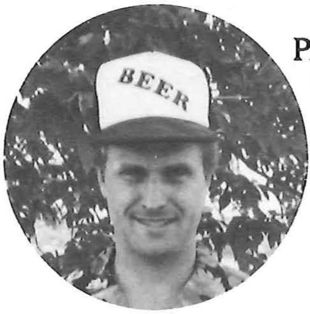
"Very fine effort. No real flaws. Good job."

"Very well-brewed beer. In category and noticeably better than others I have tasted."

CLASSIC PILSENER

Category award sponsored by California Concentrates, Acampo, California

F I R S T   P L A C E



PATRICK DRIGANS
Buffalo, Minnesota

"DISTINCTLY DEUTSCH PILSNER"

Subcategory: German Pilsener

Ingredients for 5 gallons

- 10 pounds German Pilsener malt
- 1 pound CaraPils malt
- 1 ounce Saaz hops, 3.6 percent alpha acid (60 minutes)
- 1 ounce Saaz hops, 3.6 percent alpha acid (35 minutes)
- 1 ounce Saaz hops, 3.6 percent alpha acid (20 minutes)
- 2 teaspoons yeast nutrient (20 minutes)
- 1 teaspoon Irish moss (20 minutes)
- 1 ounce Saaz hops, 3.6 percent alpha acid (two minutes)
- 1 ounce Saaz hops, 3.2 percent alpha acid (dry)
- Wyeast No. 2035 liquid yeast
- 3/4 cup corn sugar to prime
- 1 teaspoon ascorbic acid (in solution)

- Original specific gravity: 1.045
- Final specific gravity: 1.013
- Boiling time: 90 minutes
- Primary fermentation: 13 days at 68 degrees F (20 degrees C) in glass
- Secondary fermentation: 14 days at 35 degrees F (2 degrees C) in glass
- Age when judged (since bottling): six months

Brewer's specifics

Step infusion mash; 20 minutes at 113 degrees F (45 degrees C); 15 minutes at 140 degrees F (60 degrees C). Hold at 154 degrees F (68 degrees C) until conversion. Raise to 168 degrees F (75 degrees C) for 10 minutes. Sparge with 6 gallons 170-degree-F (77-degrees-C) water. Gelatin finings added in secondary. One teaspoon ascorbic acid added at bottling.

Judges' comments

"Hopping right at the top end of range, malt needs to be up there, too. Clean fermentation."

"A good drinkable brew but a little heavy on the hops and could use more malt."

"The beer is not fully rounded, though it is well-made and has Pilsener attributes. A nice beer. A bit more malt and malt complexity would be nice."

"Balance toward hops. Very good beer."

AMERICAN LIGHT LAGER

Category award sponsored by Coors Brewing Co., Golden, Colorado

F I R S T   P L A C E

STEVEN AND CHRISTINA DANIEL
League City, Texas

"BUTT-SCRATCHER"

Subcategory: American Premium

Ingredients for 5 gallons

- 3 pounds six-row malt
- 4 pounds two-row malt
- 1 pound rice
- 18 total IBUs
  - 1/2 ounce Hallertauer, 4 percent alpha acid
  - 1/2 ounce Cascade, 6 percent alpha acid
  - Wyeast No. 2308 liquid yeast

- Original specific gravity: 1.049
- Final specific gravity: unknown
- Boiling time: 60 minutes
- Primary fermentation: 21 days at 50 degrees F (10 degrees C) in stainless steel
- Secondary fermentation: 30 days at 32 degrees F (0 degrees C) in stainless steel

Brewers' specifics

Rice precooked prior to mash. Mash all grains at 151 degrees F (66 degrees C) for 60 minutes.

Judges' comments

"Somewhat oxidized—chalky in aftertaste. Watch oxygen pickup. Otherwise nice, clean, balanced taste."

"A good beer slightly marred by oxidation."

"Very smooth, nice maltiness (a bit too much, but still fine). Very slight tang."

"This is a fine beer overall. Has a nice warm alcohol presence. I like this one!"

VIENNA/ OKTOBERFEST/ MÄRZEN

Category award sponsored by F.H. Steinbart Co., Portland, Oregon

FIRST PLACE

KEITH WEERTS
Windsor, California

"VIENNA LAGER"

Subcategory: Vienna

Ingredients for 5 gallons

4 pounds light malt extract
3 pounds Munich malt
2 pounds Vienna malt
1 1/2 pounds Klages malt
1/2 pound dextrin malt
2 ounces chocolate malt
1/2 ounce Saaz hops, 2.8 percent alpha acid (60 minutes)
1 1/2 ounce Saaz hops, 2.8 percent alpha acid (30 minutes)
1/2 ounce Saaz hops, 2.8 percent alpha acid (finish)
Wyeast No. 2206 liquid yeast

- Original specific gravity: 1.052
- Final specific gravity: 1.012
- Boiling time: 60 minutes
- Primary fermentation: 11 days at 50 degrees F (10 degrees C) in plastic
- Secondary fermentation: 10 days at 40 degrees F (4 degrees C) in glass
- Tertiary fermentation: 20 days at 32 degrees F (0 degrees C) in glass
- Age when judged (since bottling): nine months

Brewer's specifics

All grains mashed at 152 degrees F (66 degrees C) for 60 minutes.

Judges' comments

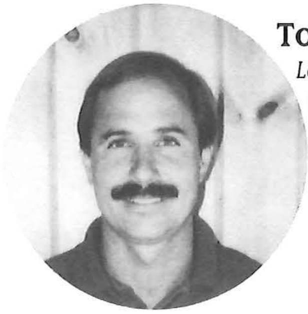
"Wonderful beer. A little malt heavy for Vienna. Cut the malt about 10 percent and you have a winner."

"Good maltiness, very clean. Overall this is a bigger beer than expected—it's pushing the upper end of Vienna in all characteristics. Really excellent."

GERMAN-STYLE ALE

Category award sponsored by Great Fermentations of Santa Rosa, California

FIRST PLACE



TOM YOUNG
Loyalton, California

"FAT HORSE"

Subcategory: Düsseldorf-Style Altbier

Ingredients for 5 gallons

- 7 pounds Klages malt
- 3 pounds Munich malt
- 3/4 pound 60 °L crystal malt
- 1 ounce black patent malt
- 1 ounce Galena hops (60 minutes)
- 1/2 ounce Northern Brewer hops (60 minutes)
- 1/2 ounce Saaz hops (30 minutes)
- 1/2 ounce Saaz hops (finish)
- Sierra Nevada yeast culture

- Original specific gravity: 1.050
- Final specific gravity: 1.016
- Boiling time: 60 minutes
- Primary fermentation: eight days at 60 degrees F (15 degrees C) in glass
- Secondary fermentation: 30 days at 35 degrees F (2 degrees C) in glass
- Age when judged (since bottling): four months

Brewer's specifics

Black patent malt steeped for 10 minutes at 190 degrees F (88 degrees C). All other grains mashed for 45 minutes at 152 degrees F (67 degrees C).

Judges' comments

"Very good clean, smooth beer. Reduce original gravity a bit. Malty aroma is great but doesn't fit style. What yeast did you use? I want more."

"Overall a very good beer but could use a bit more lagering (too much malt fruitiness)."

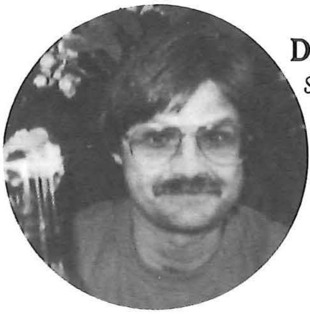
"Close to being over the hill. Slight oxidation beginning to show."

"The Munich or other dark malt flavor is a little too strong for this style."

FRUIT BEER

Category award sponsored by The Purple Foot, Milwaukee, Wisconsin

FIRST PLACE



DAN ROBISON
Salt Lake City, Utah

"LEFTOVER STRAWBERRY ALE"

Subcategory: Fruit Beer

Ingredients for 4 1/2 gallons

- 7 pounds two-row Klages malt
- 1 pound dextrin malt
- 9 pounds frozen strawberries
- 1/2 ounce Chinook hops (90 minutes)
- 1 ounce Cascade hops (finish)
- Wyeast No. 1056 liquid yeast

- Original specific gravity: 1.050
- Final specific gravity: 1.011
- Boiling time: 90 minutes
- Primary fermentation: seven days at 65 degrees F (18 degrees C) in stainless steel
- Secondary fermentation: seven days at 65 degrees F (18 degrees C) in stainless steel
- Age when judged (since bottling): seven months

Brewer's specifics

Mash all grains at 158 degrees F (70 degrees C) for 90 minutes. Add frozen strawberries to primary fermenter.

Judges' comments

"Thirst quenching. May want just a little more malt or a yeast that is not so attenuative to provide a little sweetness for balance. Very impressive."

"Nice effort. Strawberry evident!"

"Tartness of fruit is evident and nicely balanced by beer maltiness. Very nice."

"Good tasting fruit beer. Good job. Well done."

HERB BEER

Category award sponsored by Marin Brewing Co., Larkspur, California

FIRST PLACE

ERIC McCLARY
Carson City, Nevada

"CHILE GARDEN PILS"

Subcategory: Herb Beer

Ingredients for 5 gallons

- 9 pounds Klages malt
- 1 pound toasted Klages malt
- 2 ounces Saaz hops (60 minutes)
- 1 1/4 ounces Saaz hops (10 minutes)
- 3/4 ounce Saaz hops (steeped 15 minutes after boil)
- 6 deseeded Fresno chilies (steeped 15 minutes after boil)
- Wyeast No. 2206 liquid yeast
- 3/4 cup dextrose to prime

- Original specific gravity: 1.051
- Final specific gravity: 1.008
- Boiling time: 60 minutes
- Primary fermentation: seven days at 55 degrees F (13 degrees C) in glass
- Secondary fermentation: 50 days at 38 degrees F (3 degrees C) in glass
- Age when judged (since bottling): seven months

Brewer's specifics

One pound Klages toasted for 10 minutes at 300 degrees F (150 degrees C). Mash all grains at 128 degrees F (54 degrees C) for 45 minutes. Raise temperature to 154 degrees F (68 degrees C) for 90 minutes. Chilies and aroma hops steeped at end of boil.

Judges' comments

"Good chili flavor without burning your mouth out. Very creamy. Good balance. Pleasantly subtle."

"The peppers are added in just the right amount, they augment the flavor, but don't overpower it."

"Fascinating. Not what I expected. Pepper flavor definitely there."

"Surprisingly tasty and easy to drink. Fresh chili pepper flavor shines through. This could grow on you."

SPECIALTY BEER

Category award sponsored by Beer and Wine Hobby, Woburn, Massachusetts

FIRST PLACE

BOB BARSON
Chicago, Illinois

"1991 CHRISTMAS ALE"

Subcategory: Specialty Beer

Ingredients for 5 gallons

- 6 2/3 pounds Northwestern Gold extract
- 2 pounds Munton and Fison dark dry extract
- 1 1/2 pounds Munich malt
- 1 1/2 pounds Vienna malt
- 1 pound 90 °L crystal malt
- 6 ounces dextrin powder
- 1/2 ounce Cascade hops, 4.9 percent alpha acid (90 minutes)
- 1/2 ounce Kent Goldings hops, 5.9 percent alpha acid (90 minutes)
- 1/2 ounce Willamette hops, 4.5 percent alpha acid (30 minutes)
- 1/2 ounce Willamette hops, 4.5 percent alpha acid (two minutes)
- 1 1/2 ounce Cascade hops, 4.9 percent alpha acid (dry)
- 1 ounce Kent Goldings hops, 5.5 percent alpha acid (dry)
- 8 whole cloves (dry)
- 1 1/2 pounds Sioux Bee Clover Honey (90 minutes)
- 3/4 pound Grandma's Robust Style Molasses (90 minutes)
- 750 mL Le Roux Triple Sec (aged 5 1/2 weeks with 3 whole cloves)
- 3 teaspoons pumpkin pie spice
- 4 teaspoons dried orange peel
- 1 ounce pure almond extract
- Whitbread Ale yeast
- 8 teaspoons calcium sulfate
- 1 teaspoon salt
- 1 teaspoon Irish moss

- Original specific gravity: 1.090
- Final specific gravity: 1.020
- Boiling time: 90 minutes
- Primary fermentation: five days at 60 degrees F (15 degrees C) in plastic
- Secondary fermentation: 35 days at 60 degrees F (15 degrees C) in glass
- Age when judged (since bottling): seven months

Brewer's specifics

Mash all grains for 45 minutes at 150 degrees F (65 degrees C). Primed with LeRoux Triple Sec liqueur, pumpkin pie spice, dried orange peel and pure almond extract.

Judges' comments

"Very nice effort. I'd like one of these at a Christmas party. A bit dry in body but still excellent."

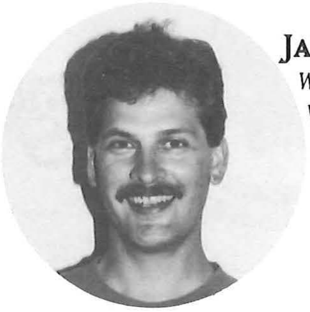
"Wow! The whole kitchen is here. Good!"

"I couldn't drink more than one of these at a sitting, but I still like it. Ambitious beer. Well-brewed."

SMOKED BEER

Category award sponsored by Jim's Homebrew Supply, Spokane, Washington

F I R S T   P L A C E



JAMES CANNON
Williamsburg, Virginia

"BEECH BEER"

Subcategory: Bamberg-Style Rauchbier

Ingredients for 5 gallons

- 2 1/2 pounds smoked Klages malt
- 2 1/4 pounds Munich malt
- 1 pound Vienna malt
- 4 1/2 pounds Klages malt
- 1/2 pound 40 °L crystal malt
- 1 ounce Hallertauer hops (105 minutes)
- 1/2 ounce Hallertauer hops (15 minutes)
- 1/4 ounce Hallertauer hops (two minutes)
- 1/4 ounce Saaz hops (dry)
- Wyeast No. 2206 liquid yeast
- 2/3 cup dextrose to prime

- Original specific gravity: 1.054
- Final specific gravity: 1.013
- Boiling time: 105 minutes
- Primary fermentation: 28 days at 50 degrees F (10 degrees C) in glass
- Secondary fermentation: 28 days at 35 degrees F (2 degrees C) in glass
- Age when judged (since bottling): three months

Brewer's specifics

Two and one-half pounds Klages malt smoked on a grill over smoldering local beechwood for 30 minutes. Two-decoction mash. Mash all grains at 105 degrees F (41 degrees C) for 20 minutes. First decoction to 125 degrees F (52 degrees C) for 10 minutes. Second decoction to 149 degrees F (65 degrees C). Cooled to 144 degrees F (62 degrees C) over 30-minute period. Raised temperature to 154 degrees F (68 degrees C) for 30 minutes. Raise again to 168 degrees F (75 degrees C). Sparged with 6 gallons 168-degree-F (75-degrees-C) water.

Judges' comments

"Very good, delicate smoke but good balance."

"Good malt and smoke synergy. Some DMS problems—some vegetable overtones."

"Very nice smoke flavor. Decent body. Good clean, smoke finish. Maybe just a little thin."

"Very good, but has some warm ferment characters. Otherwise a well wrought, beautifully smoked beer."

CALIFORNIA COMMON BEER

Category award sponsored by Anchor Brewing Co., San Francisco, California

F I R S T   P L A C E

PHIL RAHN
Cordova, Tennessee

"MEMPHIS STEAMER"

Ingredients for 10 gallons

- 16 1/2 pounds Klages malt
- 2 1/2 pounds crystal malt
- 3 1/4 ounces Northern Brewer hops, 6.5 percent alpha acid (60 minutes)
- 3/4 ounce Cascade hops (60 minutes)
- 1 1/2 ounces Cascade hops (40 minutes)
- 1 ounce Centennial hops (finish)
- 1 ounce Cascade hops (dry)
- Wyeast No. 2206 liquid yeast

- Original specific gravity: 1.049
- Final specific gravity: 1.013
- Boiling time: 60 minutes
- Primary fermentation: 12 days at 68 degrees F (20 degrees C) in glass
- Secondary fermentation: 10 days at 68 degrees F (20 degrees C) in glass
- Age when judged (since bottling): eight months

Brewer's specifics

All grains mashed at 155 degrees F (68 degrees C) for 90 minutes.

Judges' comments

"An excellent beer, but hop character overwhelms somewhat."

"Nice beer, just needs more hop bitterness for style."

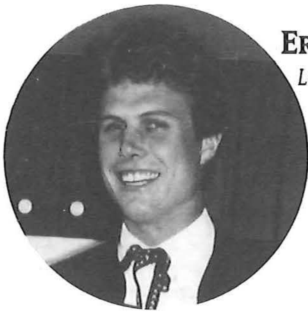
"Good beer. Nice malt flavor and hop flavor. Good balance. Nice hops."

"Lots of hops. Malt most apparent in finish. A touch of astringency. Tasty!"

WHEAT BEER (ALE)

Category award sponsored by the American Homebrewers Association, Boulder, Colorado

F I R S T   P L A C E



ERIC WARNER
Lafayette, Colorado

"SUPAI'S WEISSBIER"

Subcategory: German-Style Weizen/Weissbier

Ingredients for 10 gallons

- 10 1/3 POUNDS WHEAT MALT
- 7 POUNDS PALE BARLEY MALT
- 1/3 OUNCE NORTHERN BREWER HOPS, 8.0 PERCENT ALPHA ACID (105 MINUTES)
- 1/4 OUNCE HALLERTAUER HOPS, 4.5 PERCENT ALPHA ACID (45 MINUTES)
- 1/4 OUNCE HALLERTAUER HOPS, 4.5 PERCENT ALPHA ACID (15 MINUTES)
- YEAST CULTURE FROM BOTTLE OF GERMAN MOY WEISSBIER

- Water treatment: NSA activated charcoal water filter
- Original specific gravity: 1.050
- Final specific gravity: 1.012
- Boiling time: 105 minutes
- Primary fermentation: 10 days at 61 degrees F (16 degrees C) in open aluminum
- Secondary fermentation: Seven days at 59 to 61 degrees F (15 to 16 degrees C) in bottle, 39 degrees F (4 degrees C) thereafter
- Age when judged (since bottling): three months

Brewer's specifics

Single-decoction mash.

Judges' comments

"Soft, delicate cloviness and malt. Bitterness perfect. This is why I love wheat beers. Extraordinarily good."

"Nice effort. I like the fruitiness and clove combined with the carbonation."

"Good, biting clove taste. Banana still hangs over the flavor profile, but this is only marginally detracting. A great drinking beer finishes clean but fruity. Could be more tart."

"Very nice flavor. Strong wheat flavor. Some vanilla. Could be more tart."

CIDER

Cidermaker of the Year award sponsored by Mayer's Cider Mill, Webster, New York

F I R S T P L A C E

CHARLES CASTELLOW
Edmonds, Washington

1992 CIDERMAKER OF THE YEAR
BEST OF SHOW

"HARD CORE XXX CIDER"

Sparkling Cider

Ingredients for 3 gallons

- 3 GALLONS APPLE CIDER
- VINTNERS' CHOICE PASTEUR CHAMPAGNE YEAST
- 3 OUNCES LACTOSE
- 28 OUNCES FROZEN APPLE JUICE CONCENTRATE

- Original specific gravity: unknown
- Final specific gravity: 1.004
- Primary fermentation: 21 days at 68 degrees F (20 degrees C) in glass
- Age when judged (since bottling): three months

Brewer's specifics

Lactose and apple juice concentrate added after kegging.

Judges' comments

"Very pretty, appley, light aroma. A little too sweet in the balance, but very drinkable."

"Smooth, soft, banana flavors. Low acid and tannins. Nice."
"Lovely brilliant yellowy orange. Creamy and well balanced. A touch sweet but well balanced."

TRADITIONAL MEAD

Category award sponsored by Havill's Mazer Mead Co., New Zealand. Meadmaker of the Year award sponsored by the Home Wine and Beer Association.

F I R S T P L A C E

BYRON BURCH
Santa Rosa, California

1992 MEADMAKER OF THE YEAR
BEST OF SHOW

"ALBERTA FROST"

Subcategory: Sparkling Mead

Ingredients for 5 gallons

- 12 POUNDS MEADMAKERS MAGIC™ CANADIAN CLOVER HONEY
- 4 OUNCES TARTARIC ACID
- 2 OUNCES THE BEVERAGE PEOPLE™ YEAST NUTRIENT FOR MEADS
- 1/4 TEASPOON THE BEVERAGE PEOPLE™ IRISH MOSS
- 20 GRAMS THE BEVERAGE PEOPLE™ PRISE DE MOUSSE WINE YEAST
- THE BEVERAGE PEOPLE™ LIQUID OAK EXTRACT TO TASTE (APPROXIMATELY 25 ML)

- Original specific gravity: 1.080
- Final specific gravity: 1.010
- Primary fermentation: seven days at 80 degrees F (27 degrees C) in glass
- Secondary fermentation: 21 days at 80 degrees F (27 degrees C) in glass
- Age when judged (since bottling): nine months

Judges' comments

"Slightly sweet flavor and good fizz. Finishes with nice citrus balance, sweet and tart."

"Nice."

"No obvious problems. Balanced by slight acid in finish."

"Robust complex flavor, tart and sweet, melonlike in the middle. Nice mouthfeel."

MELOMEL, CYSER, PYMENT, METHEGLIN

Category award sponsored by the American Mead Association, Ostrander, Ohio

FIRST PLACE

VERN AND DARLENE WOLFF

Esparto, California

"FORBIDDEN BUT PLUM GOOD"

Subcategory: Sparkling Melomel

Ingredients for 5 1/2 gallons

- 8 pounds Star Thistle honey
- 10 pounds Santa Rosa plums
- 2 Campden tablets
- Red Star Epernay yeast
- 1/2 pint apple juice
- 5 teaspoons pectic enzyme
- 5 teaspoons yeast nutrient
- 10 teaspoons acid blend
- 1/2 cup dextrose to prime

- Original specific gravity: 1.095
- Final specific gravity: 1.008
- Primary fermentation: 31 days at 75+ degrees F (24+ degrees C) in glass
- Age when judged (since bottling): 10 months

Brewers' specifics

Boil honey and 3 1/2 gallons of water to sanitize. Crushed fruit sanitized with two Campden tablets and allowed to sit 24 hours to allow SO_2 to dissipate prior to fermentation.

Judges' comments

"Hello plums! Fruit dominates over honey. A bit tart (acid) understated expression of honey, sweetness OK. I would have preferred a little more residual honey flavor and better clarity otherwise, a very nice effort."

Good fruit character, lacks a definite honey profile. Alcohol well done. A little on the dry side. Nice job. Good job with fruit. Would like a little more honey character to balance fruit."

Very sweet with dry astringency noticeable. Plums come through nicely. A different yeast might ferment a little further giving a dryer finish.

★ ★ ★ ★

★ ★ ★ ★

SAKE

Sakemaker of the Year award sponsored by Hakusan Sake, Napa, California

F I R S T   P L A C E

TINA LONG

Sacramento, California

1992 SAKEMAKER OF THE YEAR

BEST OF SHOW

"SAKE LITE"

Japanese rice beer

Ingredients for 3 gallons

- 10 POUNDS SHORT-GRAIN RICE
- 2 1/2 POUNDS RICE KOJI
- 2 GALLONS 20 OUNCES WATER
- 3/5 TEASPOON WINE YEAST NUTRIENT
- 1 1/4 TEASPOON MORTON SALT SUBSTITUTE
- 1 PACKAGE RED STAR SHERRY YEAST
- 1 PACKAGE FININGS

Brewer's specifics

This recipe is by Fred Eckhardt. Eckhardt uses three steps: moto (yeast mash), moromi (main ferment) and yodan (stabilizing step). In the moto step, a "yeast starter" is made and gradually built up during the moromi step with three additions of rice, water and koji over a four-day period. Yodan is a final addition of water that adjusts the alcohol content of the sake. A secondary ferment is used to mature the final product. For specific sake brewing techniques, refer to ***zymurgy*** Fall 1982 (Vol. 5, No. 3). A sake newsletter published by Eckhardt is available from The Sake Connection, PO Box 546, Portland, OR 97207.

Judges' comments

"Very good."

"No real off-flavors."

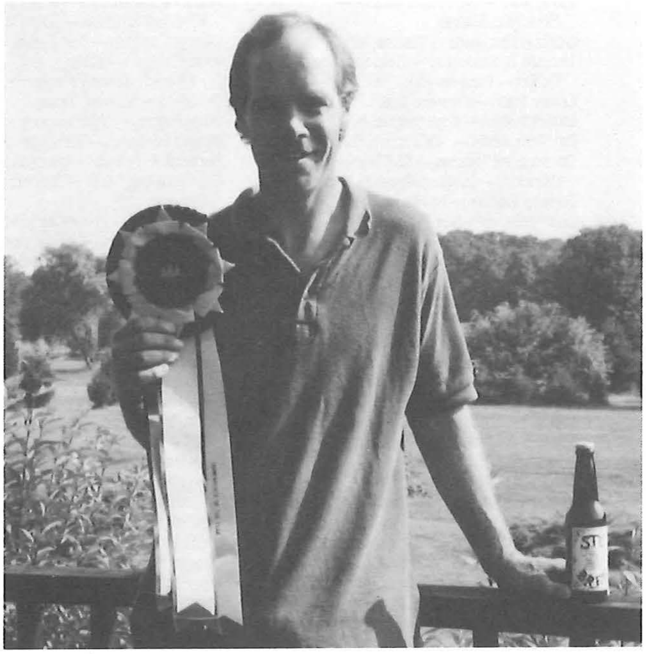
"Good body."

"Give me a liter and some sushi and I'll be happy all night. Excellent."

"Polishing rice is best. Good sake."

1992 Homebrewer of the Year

JAMES SPENCE



Stu Tallman

Stu Tallman's first homebrew, a stout, won best of show in the first homebrew competition he ever entered. He has 25-foot hop vines growing on the 10th hole at the Rochester (Mass.) Golf Club, where he is superintendent. All of his beers are called "Stu Brew."

"On New Year's Eve in 1987, a friend of mine brought over a six-pack of homebrew," Tallman says, "I thought it was really good—full of flavor." He started brewing with his friend, and 11 months later won the 1988 New England Spring Regional Competition with his stout. Now homebrewing has become a way of life for Tallman and his success in competitions proves it. He has won awards in nine major competitions since he started brewing, including a second place in the 1991 National Competition's Dortmund/Export category.

Not a beer connoisseur before taking up homebrewing, Tallman says homebrewing introduced him to the wide range of commercial beer. "I really didn't know what to drink before I homebrewed; now my favorite is Samuel Adams Ale." Most of his early beers were ale styles, but now he prefers brewing European lagers. "That's the flavor I really love," he says.

Tallman uses a 10-gallon Gott water cooler as a mash tun. A one-eighths-inch thick stainless-steel plate with one-half-inch holes combined with stainless-steel mesh provide a false bottom. His brew kettle is a 15-gallon keg with the top cut out. A propane cooker and wort chiller complete the setup.

Tallman attributes his success to cleanliness. "I keep everything really clean, and since I mash in my basement and boil in my garage, I don't have as many sources of bacteria as someone who brews in their kitchen." Tallman uses a couple of tablespoons of bleach in five gallons as a sanitizer and doesn't rinse—just lets equipment drip dry. His best-of-show Munich Dunkel lagered for four months before the 1992 National Competition. "I saved a couple of six-packs for competition and drank the rest," Tallman says. "As soon as I found out I had won, I brewed another batch."

Tallman develops the recipes himself. "I look at four to five different sources, and then modify the recipes to suit myself. The AHA National Competition Style Definitions Chart helps a lot—I keep a copy taped to my wall." Tallman also believes religiously in liquid yeast and building up a strong yeast culture with starters. "I used my first package of dry yeast just a few months ago and I could tell the difference."

After switching to all-grain brewing, Tallman had to tinker with the equipment before his brews were to his liking. "I threw out 40 gallons of my first all-grain brews. They were terrible." Tallman's advice to homebrewers is to read a lot. "I read Fred Eckhardt, zymurgy Winners Circle, Greg Noonan, Byron Burch and anything else I can find." Asking questions helped and Tallman says Charlie Olchowski of The Frozen Wort in Greenfield also was very helpful.

Becoming a Beer Judge Certification Program judge in March 1990 was an important improvement in Tallman's homebrewing life. "You get to taste winning beers and learn what to look for in your own beers," he says. He holds the rank of Certified Beer Judge.

Tallman lives in Rochester, Mass., with his wife and two teen-age children. He has been a member of the Boston Wort Processors for more than a year.

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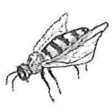
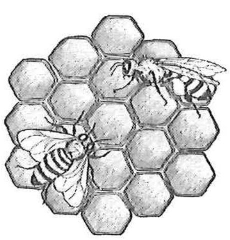
1992 Meadmaker of the Year

JAMES SPENCE

Byron Burch





Byron Burch of Santa Rosa, Calif., won this year's Meadmaker of the Year award. "Alberta Frost" was his first batch of traditional mead, although he has brewed about 25 batches of herb and fruit mead in the last three years. "This batch was part of an experiment with this particular honey, which I split into three different batches and made three different versions of mead." Burch used Canadian clover honey from Alberta, Canada, in his winning batch.

Burch, the 1986 Homebrewer of the Year, is no novice homebrewer. He is an internationally recognized expert on homebrewing and has written two homebrewing books that have sold more than 150,000 copies. He owns and operates Great Fermentations of Santa Rosa, a supply company for homebrewers and winemakers. He has served on the Beer Judge Certification Committee for several years.

One of Burch's first experiences with mead was a taste of Charlie Papazian's mead in the late 1980s—a taste that didn't impress him. "We were enjoying some very good homemade Chenin Blanc, and I don't think the context of our tasting was really appropriate for the mead. It was very dry and the wine had some residual sweetness, so I don't think the mead performed well against the wine."

It took Burch another two years to get seriously interested in meadmaking. "I'm an old literature student, and I was reading up on mead and became really interested in its history and tradition. I became obsessed with the idea of making a mead with a good, light honey and apricots. I don't know why, but that particular combination fascinated me." He tried brewing a batch and loved it. "It was really good, very dry."

Burch warms his jars of honey to make them pour easily, then adds the honey to warm water. He boils the must for only 10 to 15 minutes and uses a skimmer to remove proteins. Various nutrients and enzymes go into the kettle depending on the style being made, and a standard wort chiller cools the must to pitching temperature. "I use Sparkolloid to fine—you can almost stand there and watch the mead clear from the top down," Burch says.

Burch believes that mead has tremendous potential for homebrewers as an untapped area of craft brewing. "One of the things I believe will be valuable to prospective meadmakers is knowledge of standard winemaking procedures. I have been making my own wine since 1970, and I think I had good perspectives on the similarities between wine and mead brewing that might not occur to the home beer maker." Meadmakers often use enzymes, multiple rackings, acid treatments and special yeast procedures much like winemakers do.

With all of his experience and experimentation, Burch had an inkling that his mead was a champion. "It had a very delicate character and was very Champagnelike," he says. Burch doesn't enter local and state competitions regularly so he can take the opportunity to judge the meads in those competitions. "I would encourage meadmakers to start judging meads. I try to judge meads often, and I think the judging experience has helped me improve my own recipes."

That first taste of Papazian's mead has little bearing on Burch's feelings about the beverage now. When he accepted his Meadmaker of the Year award at the 1992 National Conference in Milwaukee in June, he announced to the audience, "Charlie tried to get me interested in mead several years ago. I wasn't interested at that point. He was right. I was wrong."

1992 Cidermaker of the Year

JAMES SPENCE

Charles Castellow

This year marked the first time a cider category was included in the AHA National Competition. The category, sponsored by Mayer's Cider Mill of Webster, N.Y., included four subcategories of American-style ciders: still, sparkling, New England and specialty.

Charles Castellow of Edmonds, Wash., won the award with a sparkling cider, only the second batch of cider he had made. Castellow does not consider himself an accomplished cidermaker. "I've learned more since I won the national award, mainly from ***zymurgy*** Summer 1992 (Vol. 15, No. 2). Before that, I didn't even know you could add sugar to cider. Sugar added to beer gives cidery flavors, which is a defect. But it's just what you want in hard cider."

To make his first batch of cider, Castellow picked up a one-page information sheet from his local homebrew supply shop. His recipe uses apple juice and apple juice concentrate. "I think many people are overwhelmed by hard cidermaking because they think they need a big apple press and all kinds of fancy equipment. Making cider with apple juice is really just like making beer with extracts."

Castellow stopped at a roadside stand on his way back from a ski trip and bought the apple juice used in his winning batch. The juice came from John and Gold apples, a hybrid of Jonathan and Golden Delicious apples. He believes being able to tinker with the recipes is one of the most attractive and important elements of cidermaking. "Once you know what you want your final product to taste like, you can steer the recipe toward that end," Castellow says.

He tinkered with Hard Core XXX Cider several times before he was satisfied. After fermenting for three weeks, it came out too dry. He added some lactose for sweetness and apple juice concentrate to increase the apple character.

Castellow thinks cidermaking is a bit easier than beermaking. "Just get some juice and dump it in the carboy, there's no boiling or mashing to do." As in beermaking, sanitation is important, and Castellow is a self-described "Clorox freak." He is fond of the cider he tasted from taps in England. "I don't think the Washington apples I used were particularly suited for cidermaking. They don't have a lot of flavor. A tarter apple like they use in England might be better." Castellow's present cider batch uses juice from Red Delicious and Granny Smith apples.

Beer is still Castellow's main homebrew product. He uses a Bruheat in his backyard and ferments in his garage during the summer and his recreation room in the winter. His winning cider was force carbonated and bottled from the keg with a counterpressure filler. He makes mostly ale styles but reading ***zymurgy*** got him interested in fruit beers as well. In addition to ***zymurgy***, he reads all the books in the Brewers Publications Classic Beer Styles Series and is reading George Fix's Principles of Brewing Science (Brewers Publications, 1989).

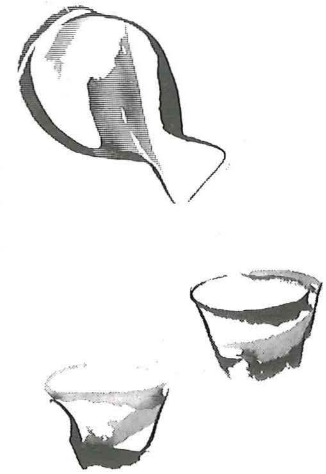
The Cidermaker of the Year is Castellow's first homebrewing award. "I don't want to sound too cocky, but I expected to do well with this cider. I knew it was good," says Castellow. His cider took best of show of 36 entries, and, yes, he plans to enter a cider in next year's National Competition.

Castellow is a software consultant, a member of the Brewfish Homebrew Club, an avid skier and the father of 2 1/2-year-old twin girls.

ILLUSTRATION BY AMBER SKY ILLUSTRATORS

1992 Sakemaker of the Year

JAMES SPENCE



Tina Long

Tina Long of Sacramento, Calif., didn't set out to brew the AHA National Competition's first championship sake. Her husband, Jim Long, was experimenting with several different batches of sake, and Tina volunteered to help by brewing a batch herself. Using sake guru Fred Eckhardt's original recipe, she carried out the day-to-day procedures involved in brewing sake.

"One good thing about sake is that time commitment is spread out over a few days. With a family, you sort of have to schedule a whole day to brew a batch of beer and send the kids to their grandparents' house or something. With sake you can get it done in just a few minutes each day," Tina says.

Although she hasn't done a lot of solo brewing, Tina often assists her husband in homebrewing. "I proved that I can do it by myself–winning gave me a lot more confidence in my abilities as a homebrewer." Tina hopes to progress upward from her novice brewing and brew more batches independently.

Sake is one of the brewing world's most unusual beverages. Because it is made with cereal grain (rice), it is technically a beer. The unique rice koji, the yeastlike fungus (*Aspergillus oryzae*) used to make sake, acts to convert the rice starch into sugar, while at the same time fermenting the sugar into alcohol. Sake is essentially mashing and fermenting at the same time and involves several additions of water, rice and koji over a period of several days.

The alcohol content of sake can range from 14 to 17 percent by volume. Contrary to popular custom, sake does not have to be served warm and can be served at room temperature or with ice, depending on the style of sake and the occasion.

Tina has visited a couple of different commercial sakemakers and enjoys the change of pace from beer. "Sake has a very different taste," she says. "I pretty much have to be in the mood for it–I can't drink it all the time. I also prefer the lighter flavored sakes." Tina prefers lighter flavored beers too, especially wheat and fruit beers.

One of the ways she helps her husband brew is through her knowledge of botany from her job in a retail nursery. "The first homebrew Jim made was a spruce beer, and I helped him by finding the young spruce tips he needed. I also know when certain berries and fruits are ripe and ready for using in beer." Each works full time, so they don't brew as often as they would like. The Longs enjoy outdoor activities and have 15-foot hop vines growing in their large backyard in Sacramento, Calif., where Tina was born and raised. They have a 5-year-old son and a 3-year-old daughter.

Because this was the first AHA National Competition that included a sake category, the judges were specially trained to evaluate the 12 entries that were received in Portland, Ore.

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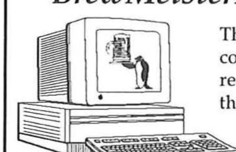

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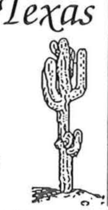

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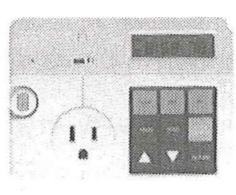

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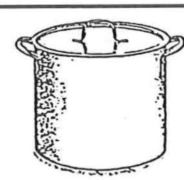

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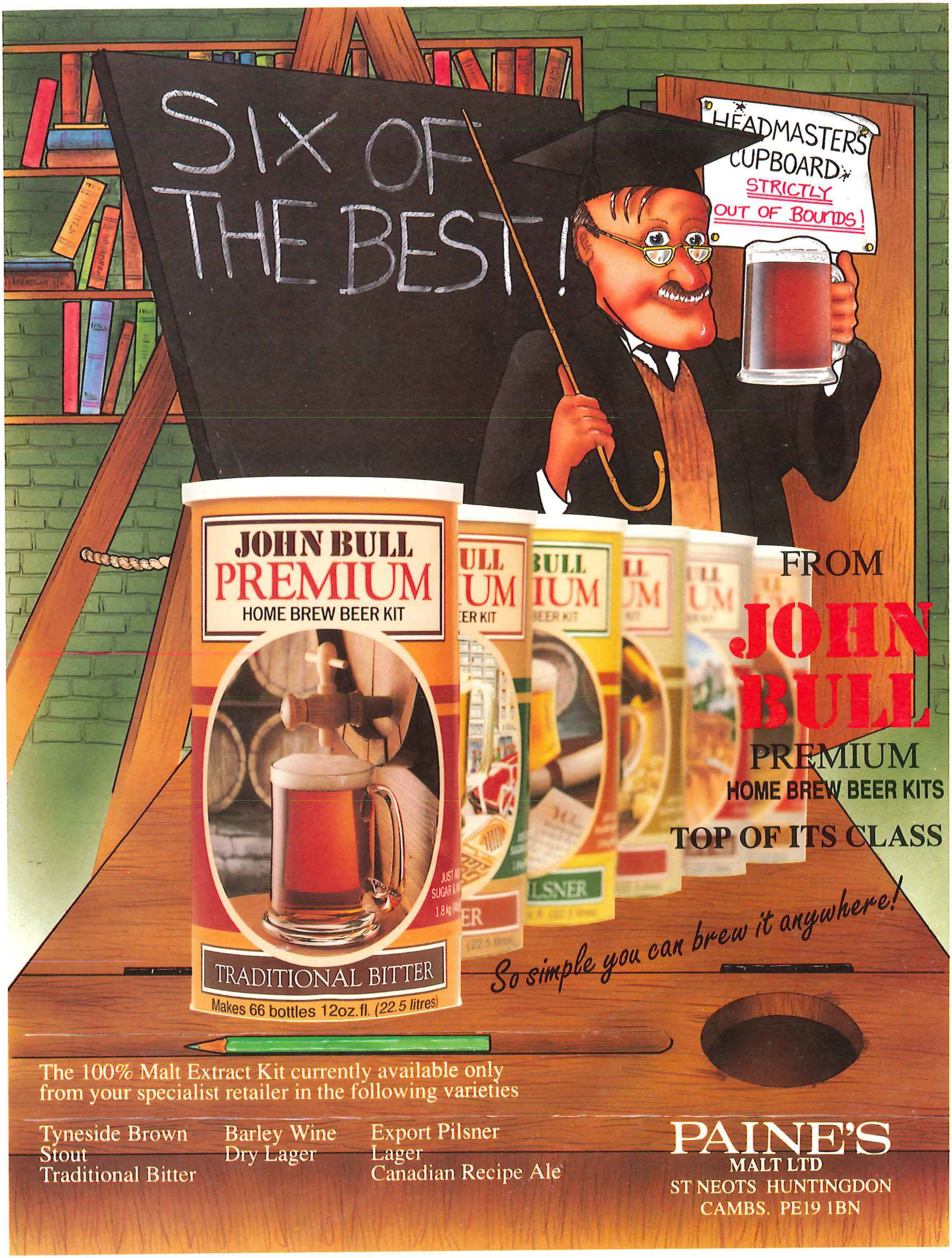
15-4



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