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NOVEMBER 2001, VOL.7, NO.9

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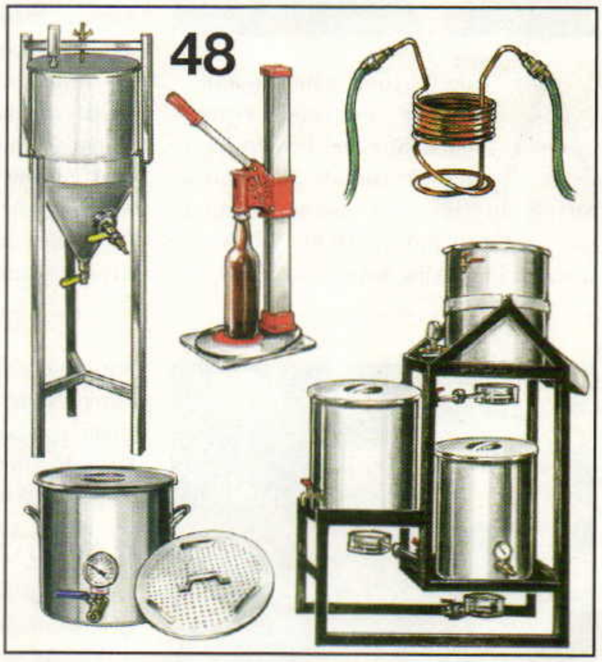

Where to find it

Contributors

BYO's "Projects" author, Thom Cannell, sold his first story in 1976. Since then his articles have appeared in every major U.S. automotive enthusiast publication. He also has been a photographer for "every automotive manufacturer from Audi to Yugo." When not behind the wheel, you will find him working at his "if I ever retire" career as an aerobics instructor and personal fitness trainer.

Thom began homebrewing "three or four years ago" at the prodding of his best friend, Mike Allen, an assistant automotive editor at *Popular Mechanics*. "Mike kept hounding me — and astonishing me with the great beers he was making at home. So I started lurking on the Compuserve online wine and beer forum. I soon discovered that homebrewing wasn't much more difficult than making my own barbecue sauce."

Thom's first article for *BYO,* "Build Your Own Mash Tun," appeared in the September 1999 issue. Since then Thom has been playing with adjuncts, mini-mashes and small all-grain brews before eventually tackling five to 15-gallon batches. Thom lives in Lansing, Michigan. He belongs to the Red Ledges Homebrew Club and is past president of Lansing's Mid-Michigan Maltmeisters Home Brew Club.

Anne Whyte is a new member of our editorial review board. She and her husband own Vermont Homebrew Supply in Winooski, Vermont. Anne started brewing in 1990, when an interest in making food from "scratch" eventually led her to a weekend course in homebrewing.

These days Anne doesn't buy a lot of beer because she likes her own so much. She brews twice a month, mostly five-gallon, all-grain batches. She uses her kitchen stove and a fairly simple equipment set-up. She doesn't even need a refrigerator, since she has a nice chilly basement and usually brews as the temperature dictates.

Anne enters a few competitions each year and has won her share of ribbons. She also will be sending an entry to the Masters Championship of Amateur Brewing (MCAB) next year (her third try). Her local club is the Green Mountain Mashers. They get together monthly and sponsor a competition in May. She is a certified beer judge, which signifies that she "knows enough to know that she doesn't know everything." She loves to try brewing new styles for the first time and enjoys figuring out ways to do things better. Her favorite tried-and-true styles are American pre-Prohibition lagers and rauchbiers. The more she brews, the more she learns.

In the mid 1990s, Anne and her husband Matt bought Vermont Homebrew Supply, the largest homebrew store in Vermont. They strive to give good advice and supply everything a homebrewer needs. "It's a real labor of love," says Anne.

A picture can be worth a thousand words, whether it is used to illustrate a procedure or to show a specific piece of equipment. Contributing artist Don Martin's accurate and colorful illustrations appear frequently in *Brew Your Own*. His detailed renderings are done in pen and ink or with colored pencils.

Born and raised in Wilmington, Delaware, Don graduated from the University of Delaware as a commercial art major. He moved to Vermont in 1977. As a freelance illustrator, Don has drawn everything from architectural renderings to maple-syrup labels to children's books. He also used to do illustrations for *Rod and Reel* (now called *Fly Rod and Reel*).

Don's beverage of choice happens to be beer. He prefers microbrewed ales like Otter Creek and also enjoys English ales, especially Newcastle and Guinness. Don has even tried his hand at brewing his own. "A long time ago, I brewed a batch of bitter from a kit I brought home from England and it was really good." He brewed just one more kit batch from England, then temporarily abandoned the hobby until *BYO* came calling.

Don is perhaps best known for his Hawaiian shirts and his ability to go shoeless from May to October. He lives in Middletown Springs, Vermont, with his wife and two daughters. ■

Brew YOUR OWN

EDITOR
Kathleen James Ring

MANAGING EDITOR
Betsy Shaw

ART DIRECTOR
Coleen Jewett Heingartner

TECHNICAL EDITOR
Ashton Lewis

CONTRIBUTING WRITERS
Thom Cannell, Chris Colby,
Horst Dornbusch,
Joe and Dennis Fisher,
Thomas Miller,
Steve Parkes, Scott Russell,
Dawnell Smith,
Tess and Mark Szamatulski

CONTRIBUTING ARTISTS
Don Martin, Ian Mackenzie,
Shawn Turner, Jim Woodward

CONTRIBUTING PHOTOGRAPHER
Charles A. Parker

PUBLISHER
Brad Ring

ADVERTISING DIRECTOR
Kiev Rattee

ADVERTISING MANAGER
Michael Pollio

NEWSSTAND DIRECTOR
Carl Kopf

How To Reach Us

Editorial and Advertising Office
Brew Your Own
5053 Main Street, Suite A
Manchester Center, VT 05255

Tel: (802) 362-3981
Fax: (802) 362-2377
E-Mail: BYO@byo.com

Advertising Contact
Kiev Rattee
kiev@byo.com

Editorial Contact
Kathleen James Ring
kath@byo.com

Subscriptions Only
Brew Your Own
P.O. Box 469121
Escondido, CA 92046

Tel: (800) 900-7594
M-F 8:30-5:00 PST
E-mail: byo@pcspublink.com
Fax: (760) 738-4805

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MaiL

Belgian Dark Ale

Your recipe for Belgian Strong Ale in the Summer 2001 issue says to pitch yeast three days before bottling. I was wondering if it is safe to pitch the yeast if the wort is in a five-gallon carboy with just an airlock, or should I attach a blowoff tube or rack to a bigger carboy? Will I be safe bottling in 12-ounce bottles or should I use something bigger and stronger? I was also wondering about the merits of dried malt extract (DME) versus liquid malt syrup. I have been advised by some to stay away from DME and go with the syrup, but I am seeing a lot of recipes using DME. Are the weights equivalent or is one going to yield more than the other? I can see that working with DME might be less messy and easier to use. What's your opinion on this?

Keith Larson
Irene, South Dakota

"Style" authors Tess and Mark Szamatulski respond: "Pitch the yeast directly into the same five-gallon carboy and re-attach the stopper and airlock. Be sure to sanitize the neck, lip, stopper, yeast pack and scissors before pitching the yeast. If the beer hasn't finished fermenting, the new yeast will give it the kick it needs to finish. If it has finished, the new yeast will help carbonate a high-gravity beer. Regular beer bottles are fine since the yeast is pitched three days in advance and will not overcarbonate the bottles.

As for dried malt extract, we find that DME is easier to use and the color is more accurate. DME is 98 percent malt and liquid malt extract is 80 percent malt. The specific gravity of DME is approximately 1.044 and the SG of liquid is approximately 1.037. This means you should use approximately 19 percent more liquid syrup than DME in any given recipe. Cheers!"

Happy Reader

Having just read the September issue cover-to-cover, I was compelled to write and express my appreciation. This is one of the most informative magazines I have read in recent memory. I found the excellent sidebars by Horst Dornbusch and Ashton Lewis in the "Homebrew University" feature package to be very much of interest. I also found the article by Steve Parkes on enzymes very helpful and I look forward to hearing more from him. The scientific details explained by these three writers are in tune with my interests, as are the regular contributions of "Mr. Wizard." Chris Colby did an excellent job with his series of "Hombrew U" articles, and I enjoyed the closing piece on the "Quiet Side of Homebrewing" by Sam Piper. The September issue will be a tough act to follow.

David Towson
Bel Air, Maryland

Volume Confusion

In looking over issues from last spring, I noticed that every recipe in your "Replicator" column indicates you should sparge to collect 5.5 gallons of wort. This does not seem to be sufficient for what I consider to be a 5-gallon batch. I collect 6.5 gallons, assuming 15 percent boiloff, and rack 5.5 gallons to the primary, which gives me some leeway to fill an entire 5-gallon carboy for secondary. I have always assumed a 5-gallon batch to be the ending volume, not the starting volume. Did Dawnell Smith expect the brewer to top up or was she expecting the batch to yield less than 5 gallons?

Paul Erbe
via e-mail

Technical editor Ashton Lewis responds: "The topic of batch size can get a bit dicey, because not all brewers use the term the same way. In the commercial arena, batch size often refers to the volume of wort at 'knock-out' from the kettle. Knock-out refers to transferring the hot wort out of the kettle. This seems simple, but hot wort contracts when cooled and some brewers multiply the hot wort volume at knock-out by 0.96 to account for this cooling contraction. Other commercial brewers refer to the volume of wort they actually collect in the fermenter. And finally, there are brewers who refer to the amount of beer in the keg as their batch size. The first two uses of the term are very common, while the third definition is infrequently used.

Evaporation rate during the boil is another topic with no right or wrong answer. Ten percent evaporation is a frequently cited figure for a good boil. The Replicator recipes that began with 5.5 gallons of wort were based on a 10 percent evaporation rate. If you get 15 percent evaporation during a boil, then you can simply collect more wort before boiling or add water to adjust the specific gravity after the boil."

By the way, we have a new Replicator columnist, Steve Bader. He always recommends topping up to 5.5 gallons in the fermenter, which better agrees with your comments.

Keg Tip: Cut the Tube

I'd like to add one tip to Thom Cannell's "Save a Keg" article *(September 2001)*. The short "gas-in" dip tube extends about an inch or so into the keg. This can cause a problem if your keg is really full. If you hook up a CO_2 line and the keg pressure is higher than that in the line, you will get beer backflowing into the line. Not good! An easy way to reduce this possibility is to cut the dip tube so that the end is just flush with the top of the keg.

Tony Verhulst
Tewksbury, Massachusetts

100 Degrees Too Low. Oh, No!

In the September 2001 issue, on page 32, the temperature for steeping the specialty grains in the "Getting the Most (and Best) Out of Your Steeping Grain" sidebar should read 170° to 180° F rather than 70° to 80° F.

John Stika
Dickinson, North Dakota

Oops! Hey, where were you when we were proofreading that page?

Yeast Starter

In "Homebrew University" on page 33 *(September 2001)*, the author suggests using a two-liter yeast starter for a five-gallon batch. Is this correct?

Jerry Jenkins
Fontana, California

Techniques author Chris Colby responds: "A rule-of-thumb for pitching rates of ale yeast is to pitch enough yeast so that they only have to divide three times to reach fermentation density. If you use a yeast-starter wort that is the same SG as your main wort and 1/8th the volume of your main wort, it should contain this amount of yeast at high krauesen. (Upon pitching to the main wort, the first yeast division will result in twice as many yeast cells. This will be enough to ferment 1/4th of your batch. The second yeast division will quadruple the original amount of yeast, enough for half your batch. The third yeast division will provide enough for your entire batch.)

Two liters of yeast starter is roughly 1/10th the volume of a five-gallon batch of beer. This is a little smaller than the optimal 1/8, but not by much.

Most homebrewers pitch far less than the optimal amount of yeast and could benefit by elevating pitching rates. Using two liters as roughly the volume that results in three yeast divisions, you can see that a one-liter starter would mean that the yeast would have to divide four times. A 500mL starter would mean the yeast had to divide five times, and so on. This assumes your starter wort is the same as your main wort. If your starter wort is treated differently (higher gravity or aerated with more oxygen than your main wort), you may not need such a large volume."

Early Irish Moss Addition

In the September issue of *BYO*, the Replicator's recipe for Harpoon IPA called for the addition of Irish moss at the beginning of the boil. I have never seen a recipe that called for Irish moss to be added so early. A more typical time is to add it with twenty minutes left in the boil. Why the 60 minutes?

Bruce Murray
Bear Branch, Indiana

Steve Bader, the most honorable Replicator, replies: "I suggest adding the moss at the beginning of the boil, at the same time as the first hop addition, for simplicity. While 60 minutes may be more time than is needed to make Irish moss work, I do not know of any problems with adding it at this time."

Praise for the New Look

It's obvious you folks didn't spend your summer vacation lounging by the pool. You were hard at work fine-tuning the appearance of the magazine and the Website. Your new look is clean and attractive and makes the publication even more enjoyable. ■

Michael A. Salerno
Mahopac, New York

brewer profile

Hobby Overboard • David Houseman • Chester Springs, Pennsylvania


PHOTO COURTESY OF DAVID HOUSEMAN

Homebrewer Dave pulls himself a fresh pint from his built-in tap.

While brewing my first batch of beer in 1991, I made the same mistake that probably every neophyte has made: I poured liquid malt extract into a pot of boiling water only to have it stick and burn to the bottom of the pot. Like many homebrewers, I got my start at the kitchen stove. After a year of cleaning up the gummy mess that lurked under the largest burner, I decided to move to a propane burner in our garage. But I still brewed with extract, kits and specialty grains.

I made the leap to all-grain after apprenticing with an experienced brewer buddy. This enlightening session took away all the mystery and fear of all-grain brewing. Hey, this was easy! As an engineer and technologist for a major computer services company, I quickly came to understand the technical side of brewing. Like the American Homebrew Association (AHA) says, "It's not rocket science unless you want it to be." I got into the technical aspects of brewing in a big way. I like the way that brewing can satisfy both my technical side and my artistic side.

One can go overboard with a hobby, and I'm pretty much out there at the moment. I've gone from making extract brews on the kitchen stove to having enough equipment to take up half of the garage, part of the pantry, one bathroom and a good portion of the basement. My brewing set-up at this time consists of a modified Sankey keg as a kettle, Gott coolers for a mash-lauter tun and hot liquor tanks, and two propane burners, one for the kettle and one to heat hot water and to do cereal mashes and decoctions. I do use a RIMS, but not for every batch. I've made a brewing platform on wheels to allow me to store it out of the way. I also have two beer-dedicated refrigerators, a temperature-controlled chest freezer and a beermeister.

I brew once a month on average. Between brew sessions I'm involved with judging, grading or proctoring Beer Judge Certification Program (BJCP) exams, participating as a member of the AHA's board of advisors and reading and contributing to various on-line forums. I actually brew more than we can drink, so I enter various competitions as well.

Brewing is challenging. Even if you don't compete, there's always that self-imposed competition to make the next batch even better. Brewing complex lambics has proved to be challenging and rewarding, but I must admit I enjoy brewing lighter session beers, such as dry stouts, on a regular basis. I really love to nail a style and brew a beer that stands up to the best commercial examples. I often brew on a moment's notice. Other times I plan in advance and invite new brewers. They help me brew and learn about the all-grain brewing process in return. I am truly glad I got involved in homebrewing.

reader recipe

Hoppin' Mad Wheat Ale

(5 gallons, all grain)

OG = 1.055 FG = 1.012 IBU = 38

I find most summer wheat beers bland and uninspiring. So I set out to brew a wheat beer that combined my love of hoppy pale ales with the crisp spiciness of wheat. This one was a winner — easy to make, quick to ferment and tasty.

Christopher Jon Poel
Numazu, Japan

Ingredients

5.5 lbs. lager malt
5.5 lbs. wheat malt
10 oz. crystal malt (10° Lovibond)
3 AAU Tettnanger hops
(0.75 oz. of 4% alpha acid)
4.25 AAU Cascade hops
(0.75 oz. of 5.7% alpha acid)
2.7 AAU Saaz hops
(0.75 oz. of 3.6% alpha acid)
2.7 AAU Saaz
(0.75 oz. of 3.6% alpha acid)
Starter of British ale yeast
(Wyeast 1098)
1-1/4 cups (average carbonation) or
1-1/2 cups (strong carbonation)
dry malt extract for priming

Step by Step

Start with thick mash (1 qt/gal). Do a protein rest at 122° F for 30 min. Raise temperature to 150° to 154° F for 45-min. rest. Sparge with 168° to 172° F water to collect 6 to 7 gallons. Total boil is 90 min. Add Tettnanger and Cascade bittering hops at first boil.

Boil for 80 min. and add first addition of Saaz hops. At end of boil, add second addition of Saaz hops. Cool to 68° F to pitch yeast starter. Ferment at 64° to 68° F until done (4 to 5 days). Rack to secondary for a few days to condition and clear. Prime and bottle.

homebrew club

Dunedin Brewers Guild • Dunedin, Florida

PHOTO BY CATHY SCHULZ

The members of the Dunedin Brewer's Guild lift a cup to celebrate the hobby.

The Dunedin Brewers Guild held its first meeting in November 1997. It began with a few dedicated homebrewers, including Dave Morgan (the current DBG president), Michael and Kandi Bryant, the owners of Dunedin Brewery, and a few others with a vision of promoting homebrewing around the central-west coast of Florida.

DBG started with fifteen members and now has almost 80 members. Our group includes pilots, sea captains, professional brewers, writers and musicians. One of our most recently celebrated members, Virgil Walker, won a gold medal in the 2001 National Homebrew Competition for his Blond Ale. The city of Dunedin has a Scottish heritage and its sister city is Sterling, Scotland. As a result, the DBG has a definite Scottish theme. Many of our members have kilts and have been known to bring bagpipes to beer festivals. (We don't dare ask what they wear under their kilts.)

The ultimate goal of the DBG is to educate the public about the benefits of the responsible consumption of fresh home- and craft-brewed beers. Since we have such great weather here in Florida we can host many outdoor festivals and events. We often put on homebrewing demonstrations at these events. During American Beer Month, for example, we organized an extract homebrewing exhibition in the parking lot of the Dunedin Brewery and signed up four new members as a result.

We also participate in fundraising events for local nonprofits and try to stay involved with area politics concerning beer laws. We recently joined forces with other homebrew clubs throughout the state and formed a grassroots campaign to persuade the state of Florida to approve a law allowing beer to be sold in "off-size containers." Prior to this, beer could only be sold in 8, 12, 16 and 32 ounces, which limited the sale of many out-of-state microbrews and various imports.

We also make time to have fun with many outside activities including bicycle pub crawls, canoe trips, theme parties and festival hopping. We co-host the State Fair homebrew competition, one of the state's largest competitions, where we won the trophy for the Best Homebrew Club in Florida in 2000. We hope to win it back in 2002. ■

—Rich Curtin

reader tip

Most brewing instructions for beginners (and even a lot for experienced brewers) warn about boilovers when adding pellet hops. An easy way around this is to dip a small amount of boiling wort out of the brewpot with a small saucepan (make sure it's clean!), dissolve the pellet hops in the saucepan, and then pour it back into the wort. No fuss, no muss, and most of all, no boilover. Any particulate added to boiling water will cause foaming, but eventually the compounds that cause foaming will get spent and not foam again. Hop pellets have more small pieces than cone hops and therefore cause more foaming problems. Wetting the pellet prior to addition reduces this problem.

Christopher Poel
Numazu, Japan

homebrew calendar

November 3
Maine Brewer's Festival
Portland, Maine

The 8th annual festival in celebration of Maine microbrews is presented by Gritty McDuff's. The newest and most popular craft beers from around the state will be featured, along with great food and music. Admission is $20 at the door. Visit www.mainebrew.com or call (207) 771-7571.

November 3
Novembeerfest
Kent, Washington

Held at Larry's Brewing Supply, the Novembeerfest is touted as the "oldest and most respected homebrew competition in the Pacific Northwest." All homebrew entries must be submitted by October 31. Visit www.brewsbrothers.org or call (425) 821-9388.

November 17
Strong Ale Homebrew Competition
San Diego, California

At this unique competition, all entries must have an original gravity of 1.080 or above. Entries are accepted from October 29th until November 9th and should be sent to SAHC, c/o Alesmith Brewing, 9368 Cabot Dr., San Diego, California 92126. Enter online at www.softbrew.com/SAHC or call (760) 419-1204.

November 30 to December 2
Sixth Annual Holiday Ale Festival
Portland, Oregon

This celebration of holiday ales from 24 selected Pacific Northwest brewpubs is held in downtown Portland. The festival is outdoors under a large, heated tent below the giant decorated Christmas tree. Some microbreweries on the roster include Alameda, Alaskan Brewing, Anchor, Hales Ales and Full Sail. Admission is free but the purchase of a souvenir mug is required for beer tastings. Visit www.holidayale.com or call (503) 228-3119.

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Honey Mead

Turning liquid gold into a tasty libation

by Thomas J. Miller

COURTESY OF GORDON HULL

Brewer: Gordon Hull is president and meadmaker at Heidrun Meadery in Arcata, California. He completed the American Brewer's Guild apprenticeship program and started Heidrun in 1997.

Getting Started. A good beginner batch is two U.S. gallons of traditional semi-sweet still mead with a target alcohol content of 16 percent by volume. This size batch needs two quarts (4 pounds) of amber honey.

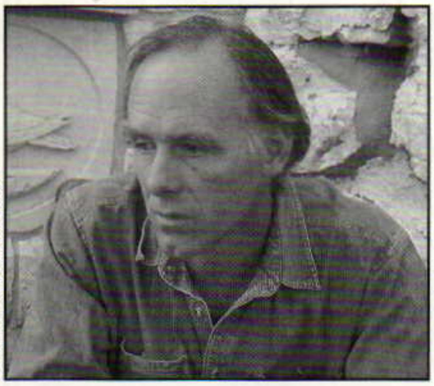
Choosing Your Honey: Honey color is a reasonable indicator of flavor intensity. The "floral source" of the honey is not critical for novices, though it should be noted for future reference. If the honey has a pleasant aroma and flavor, it should work fine. To obtain honey, contact a beekeeper, farmer's market or organic food store. Be sure to select unfiltered, unheated and unpasteurized honey, as these processes rob honey of essential yeast nutrients and other flavor components.

Our Procedure. For two gallons of mead, add 7 quarts of non-chlorinated water to a 3-gallon (minimum) kettle. Bring to a boil, then remove from the burner. Slowly stir the honey into the hot water. Once the honey is dissolved, put the kettle on high heat and cover. Stir occasionally.

A white foam will appear before boiling commences. This is protein and beeswax from the honey. Skim it off with a strainer and continue skimming throughout the boil until the foam stops forming. This takes less than 15 minutes. By boiling, you have killed the wild yeast or microorganisms that might harm your final product. You also have removed most of the colloidal material that creates haze. Remove the kettle from the burner and cover. Cool to fermentation temperature (70° to 72° F) as quickly as possible. Once you have hit the right temperature, rack to your fermenter.

Add 8 grams of diammonium phosphate (DAP) yeast nutrient and 4 mg. of vitamin B1 (vitamin B1 tablets are available at homebrew shops). Or add a dosage of pre-mixed wine yeast nutrient like Fermaid-K. Aerate your must before pitching your yeast. I recommend a champagne yeast, like Red Star's Premier Cuvée. One small packet works great. Try to maintain a steady temperature of 70° F throughout primary fermentation.

Primary fermentation takes a week to several months. Once the yeast flocculates and the mead is fairly clear, rack to a second vessel, then place in a cool location. Clarify for two months, then rack once more before bottling. If the mead is too dry, add honey according to taste before bottling. Allow one month in an airlocked fermenter to avoid a secondary fermentation.



COURTESY OF BOB SORENSON

Brewer: Bob Sorenson of Native Wines in Mount Pleasant, Utah. Bob undertook "lots of study and experimentation in the art of wine and meadmaking" before opening Native Wines in 1996.

Native Honey. We prefer strongly flavored honeys, unlike those that come from plants like clover, which make very mild, sweet and one-dimensional meads. We prefer honey gathered from native flowers, bushes or trees. We end up with very complex honey that is filled with nutrients.

About Boiling. There are two methods of handling honey: to boil or not to boil. Both methods are valid and professionals do it either way. But I never boil. By not boiling, I create more complex mead; you can smell the nectar in the finished product. Boiling takes the high notes off the mead.

Our Method. Our honey is raw and never heated. We mix it with cold water, always measuring sugar content until we get a reading of 21° Brix (1.090 specific gravity). We never add chemicals. Once we reach 21° Brix, we add yeast. Our yeast is a strain that I cultivated locally while I was making an elderberry wine. I simply cultivated the wild yeast from the berry skins.

Our mead is dry, meaning we let it ferment down to 0° Brix (1.000 SG). The only way to make a stable sweet mead is by adding preservatives like sulfites or sorbates. These cut off fermentation and leave residual sweetness behind. The average mead recipe calls for 3 to 3.5 pounds of honey per gallon of finished mead, depending on the sugar content of the honey. This makes strong mead in the range of 14 percent alcohol. Since we don't boil or filter the mead, clarity usually comes between 9 and 12 months. We mature the mead in old French casks, so they don't impart much oak into the mead.

Time in a Bottle. Aging is the most important step for dry meads. I recommend at least two years of aging, but I prefer four or five years, if possible, to take off the green edge.

Brewer: Jon Hamilton is president and head meadmaker of White Winter Winery in Iron River, Wisconsin (founded in 1996). Jon started as a homebrewer and beekeeper and is now president of the local beekeeping association.

About the Honey. Procure a high-quality honey. I prefer a white or water-white honey for my sweet and dry meads. This honey usually has clover, trefoil, basswood or something similar as a nectar source and is usually early-season honey. In general, early-season honey is lighter in color and flavor, while later-season honey is darker and heavier. You might be lucky enough find a varietal such as orange blossom. These can impart subtle, intriguing variations to your mead.

Use 1.5 to 5 pounds of honey per gallon, depending on your target for residual sweetness and alcohol content. The more honey, the more residual sweetness and the greater potential for a high final-alcohol content.

Yeast Choice. Use a yeast with a "killer" factor to overwhelm other wild yeasts. (Some yeasts are known as "killer" yeasts because they suppress the growth of other yeasts.) Try Lalvin EC-1118 or Pasteur Champagne.

Fermentation. Keep fermentation temperatures up around 70° or 75° F. Fermentation should last between 10 to 20 days. Stop the fermentation when the desired level of sweetness and alcohol is reached. Do this by putting the fermenter in a freezer overnight and adding 2 teaspoons of potassium sorbate and 1/4 teaspoon of potassium metabisulfite.

Potential Problems. The most common problems that occur with homebrewed meads are low acid and high alcohol content. The primary goal is to balance the alcohol with acidity and residual sweetness. Shooting for a high alcohol content is fine, but balance it so it is drinkable. A high alcohol content in and of itself does not make a good mead. Generally speaking, the higher the residual sweetness, the higher the final total acid should be. A sweet mead could be as high as 0.85 percent, or 8.5 grams per liter, while a dry melomel is as low as 0.6 percent, or 6 grams per liter. You can purchase an acid test kit at your local homebrew store.

Traditional meads have very low acid levels because honey has very low acid levels. This can be corrected by adding acid blend powder or lemon or lime juice to reach those acid levels mentioned above. The juice is not as easy to measure as the acid blend, but I like the flavor complexity it imparts. Add juice or acid blend prior to the yeast then adjust final balance at the end of fermentation.

The other problems for homebrewers are lack of nutrients and underpitching of yeast. Both of these can lead to stuck fermentations. I recommend 1 to 2 grams of nutrient per liter of must and 10 grams of dry yeast per 5 to 6-gallon batch. ■

Clear Beer

Steeping times, fermentation and recipes

Mr. Wizard

I am about to brew a batch of pale ale, but first I would like to know the best way to separate the ale from the yeast before I transfer the beer to the keg. I want to do this to cut down on any off-flavors that the dead yeast might add to the beer. I'm hoping that this will give me a better brew to enter into a competition.

Matt Story
Chula Vista, California

One of the best ways for homebrewers to clarify beer is to simply move the carboy to a refrigerator and hold it cold (38° F is ideal, but anything colder than the final serving temperature should work) for at least a week.

Chilling your beer will accomplish several important things. The most obvious effect of chilling is that a big portion of the total yeast in suspension will "flocculate" or drop to the bottom of the fermenter. Chilling your beer will also help to promote a reaction between proteins and tannins or polyphenols that results in chill haze. The great part of having chill haze at this stage of the game is that it will settle to the bottom of the fermenter. In a commercial brewery, the settling time takes weeks, but, luckily for homebrewers, the beer depth in a carboy is about two feet and the settling time is measured in days, rather than in weeks.

Depending on the flocculation characteristics of the yeast strain, this method may produce very clear beer or it may do very little to improve clarity.

A more active approach to yeast removal is to use a fining agent, such as isinglass. Isinglass finings are a very pure form of collagen and are derived from fish swim bladders. When hydrated in an acid buffer solution, the collagen protein becomes positively charged. When you add this solution to beer, the collagen will act like a big net to bind yeast cells and drag them to the bottom of the fermenter. There are some isinglass preparations available today that are treated with the acid buffer and then dried. They can simply be re-hydrated in water before use to make preparation easier. I have always wondered how this practice first got started!

The last common option available is filtration. Few homebrewers filter their beer because filtration equipment is usually on the expensive side and, if done improperly, filtering can quickly ruin great beer. However, when the process of filtration is carefully and properly performed, the result can be very gratifying. I have heard countless brewers, both commercial and hobbyist, bash filtration. Detractors of filtration claim that it strips flavor and color from beer and makes beer taste watery. While this can happen if certain types of filters are used, especially membrane filters, it is the exception. Most commercial beers are filtered to produce a brilliant beer. Some styles, like hefeweizen, cask ale and bottle-conditioned beers, are unfiltered, but you will find that most other styles are typically filtered.

Whether you rely on cold storage, isinglass or filtration, you can reduce your yeast load. By reducing the amount of yeast in beer you can worry less about autolysis (yeast death) and will also have a clearer beer that better displays the colors of the malts used in the brew. One factor that you should be mindful of is that bottle conditioning becomes difficult when too little yeast is present and impossible when there is none! Some brewers who bottle condition actually filter their beers "bright" and then add a small dose of healthy yeast along with priming sugar just prior to bottling.

Mr. Wizard

In looking through all your wonderful extract recipes, I've noticed a wide range of temperatures and steeping times for the specialty grains. Is there some formula that will help the homebrewer determine how long a particular type of grain should be steeped? I am beginning to develop my own extract recipes, and steeping times is one of the few variables that I still don't really understand.

Nils Hedglin
Sacramento, California

As difficult as it is to admit, brewing is a whole lot like cooking and there are many ways to get the job accomplished. Steeping is one of these tasks. When using malts as color and flavor additives to extract brews, there really is no exact science. For example, grains like crystal, chocolate and black malt do not change when they are mashed, the way pale, Munich, wheat and pilsner malts do. Most specialty malts contain either fermentable sugars (crystal malts) or roasted starches (chocolate malt) and neither type is enzymatically altered when soaked in hot water. This is as true for brewers that "steep" these malts as it is for brewers who "mash" them.

In practical terms, this means that steeping temperature is not terribly important in the grand scheme of brewing. A good cooking analogy is tea. Some tea bags intended for "iced tea" suggest using hot water to extract the flavor and aroma from the tea bag while others suggest using cold water. Increasing the water temperature used to brew tea may extract more tea color and flavor per unit weight of tea leaves — but not much more. When tea is brewed using very hot water, excessive tannins are extracted and the tea has an astringent, harsh character.

The same holds true in brewing with steeping grains for extract beers. Beers made from steeping grains in the temperature range from about 120° to 160° F will taste very similar. Steeping temperatures greater than 160° F will produce beers with progressively more astringency, but this difference in flavor will likely be marginal. All-grain brewers need to be much more cautious about mashing temperature because enzymes are involved and these enzymes are irreversibly de-activated at temperatures above their denaturation point.

If I were brewing a beer made from extracts and specialty malts, I would steep my grains at 150° to 160° F for 30 to 60 minutes and sparge or rinse the grain bag with water at about the same temperature. This method will work as a very good starting point. Only if the resulting beer had odd flavors attributable to steeping temperature or time would I consider changing the temperature. Happy brewing!

Mr. Wizard

My latest batch of beer hasn't stopped fermenting after I racked it into secondary about a month ago. The fermentation has slowed down to the point that the water column in the fermentation lock always rises up but it does not seem to bubble after I press on the cover to expel air. This takes about an hour to occur. The fragrance smells okay when I do this. I'm worried that if I bottle, the continued fermentation will increase pressure and the bottles will explode. Can you give me some recommendations of what to do at this point?

Dan Curylo
Brookside, New Jersey

This question is a common one for the type of homebrewer I call "bubble watchers." Bubble watchers use the fermenter airlock as a barometer for how their fermentations progress. Although bubble watching does provide general information about what is going on in the fermenter, it can be very deceptive.

In the peak of fermentation, a large volume of carbon dioxide is produced. When this occurs, the airlock dances up and down at a rhythm in sync with the rate of fermentation.

There comes a point at which the rate of fermentation and the movement in the airlock are no longer related.

This can occur for a couple of reasons, but the most common reason the airlock continues to bubble when there is little to no fermentation is that the beer in the fermenter contains more carbon dioxide than the amount allowed by the "equilibrium condition." The equilibrium condition is a function of both temperature and pressure. If the temperature and atmospheric pressure remain absolutely constant during fermentation and aging, you will find that the excess carbon dioxide in the fermenter will slowly release during aging and the airlock will eventually become still.

In reality, temperature and pressure do change. A quiet fermenter may become "active" when the room temperature is increased a few degrees. This doesn't mean that fermentation has re-started; rather, the increase in temperature changed the equilibrium condition and the beer must release carbon dioxide to adjust. The same thing can occur when there is a decrease in atmospheric pressure.

So what happens when the temperature decreases or the barometric pressure increases? This new condition allows the beer to hold more gas and the gases in the atmosphere will migrate into the fermenter if allowed. Glass fermenters and stainless-steel soda kegs prevent gas ingress, while many plastic fermenters have poor barrier properties and allow gas to enter. This is one reason the beer industry has been very slow to use plastic for packaging. Recent developments in bottle polymers permit brewers to use plastic as an alternative to glass, but that's a whole different issue. If the fermenter has an airlock and fermentation has stopped, this condition will also cause the liquid to be sucked back into the fermenter.

It sounds to me like you have a batch of fermented beer that is building sufficient pressure in the fermenter to raise the plastic doohickey in the airlock. Pushing on the lid of a plastic fermenter or "burping" it like a food storage container does not do your beer any good. Usually when a fermenter lid is pushed a bunch of bubbles emerge from the airlock. When the pressure is removed from the lid a huge slurp follows and the contents of the airlock are sucked back into the fermenter.

Check the specific gravity with a hydrometer, let the beer sit a few more days and then get ready to bottle. When you have the time to bottle, give it a second check with the hydrometer. If the specific gravity has not changed, which I am guessing will be the case, you should just get on with it and then bottle away!

Mr. Wizard

I was given a retired commercial recipe for a black ale called Black Horse. The recipe calls for a certain

amount of sugar to make up the original gravity. I don't like using sugar so I increased the amount of malt by the required ratio until I reached the correct specific gravity. The problem is that I ended up using 1.2 kilograms (2.64 pounds) black patent and 3.25 kilograms (7.15 pounds) two-row pale and fermenting began to slow at 1.022 instead of about 1.015. I used Wyeast British 1098 in a starter and got a racing fermentation. Rousing did not reactivate the yeast crop and, although it is still fermenting, it is very slow and has not dropped below 1.019 after two weeks. Is this a yeast problem or a badly balanced recipe with a high level of dextrins? Should I have just replaced the sugar with rice? I was given the recipe by the head brewer and I would dearly love to resurrect this now-dead beer as it was a favorite of mine more than 20 years ago. Once I've ironed out the bumps I'd be glad to share this recipe with the world, but a bad recipe will always be remembered as such.

Gavin Tiernan
via e-mail

It can be very rewarding to brew a great beer at home that was once brewed commercially. According to the weight of malt used in this brew, the original gravity is somewhere around 1.072. For an average ale I would roughly estimate a 75 to 80 percent reduction in this number during fermentation and that the final gravity would be between 1.014 and 1.018. Of course mashing technique and temperature(s), wort aeration, yeast pitching rate, yeast strain and fermentation temperature all influence either the time taken to reach final gravity or the final gravity itself. The "dropping" technique (another name for rousing or rough racking) is a good method that helps slow-to-finish fermentations caused by very flocculent yeast strains, like the 1098 you used in this brew.

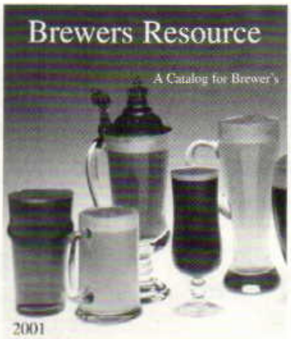
I don't find your brief description of this fermentation to be a sign of any major imbalance in fermentable versus non-fermentable sugars in the mash. The final gravity of your brew, 1.019, is pretty close to my generic guess of 1.014 to 1.018. However, this question does raise some other thoughts about beer recipes.

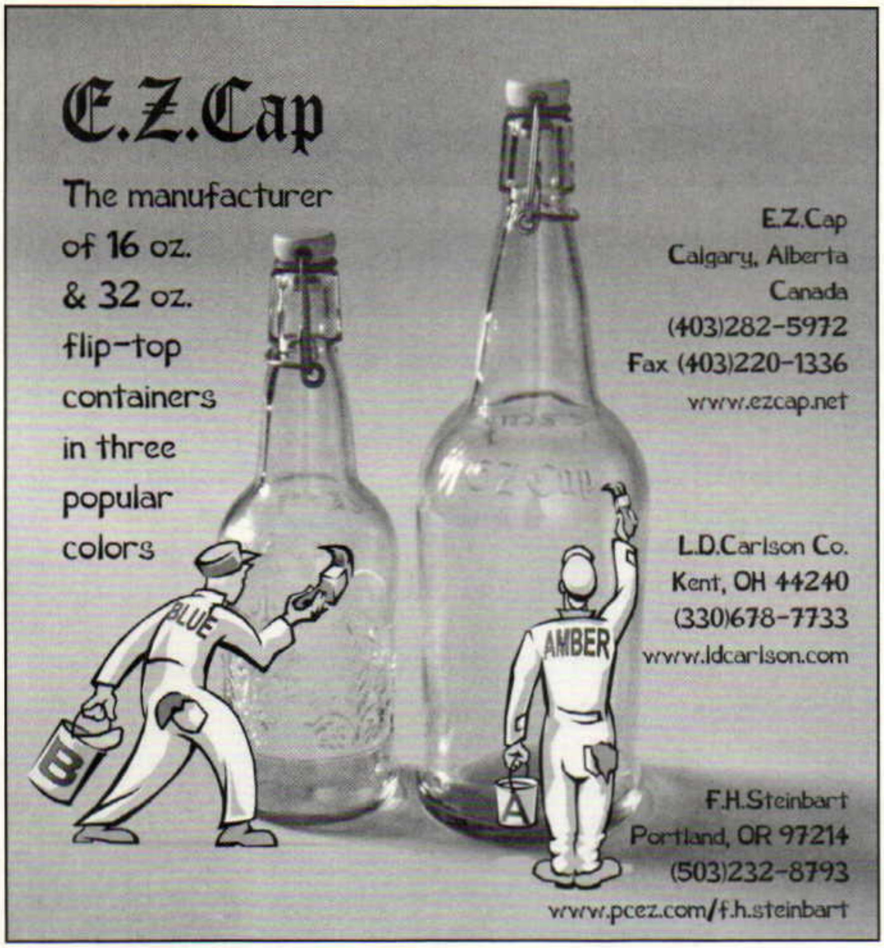
You decided to substitute malt for sugar in this recipe. Substituting ingredients is often a necessity because a certain ingredient listed in a recipe may not be locally available or you may not want to use a particular ingredient. The key rule to making substitutions is to use a similar replacement. It sounds from your description that you modified both the amounts of pale and black malts. If you simply kept the ratio of pale malt to black malt constant when you modified the recipe, then you made a mistake.

For example, the original recipe may have called for 1 kg (2.21 lbs.) sugar, 1.46 kg (3.23 lbs.) pale malt and 0.54 kg (1.2 pounds) black malt. The ratio of pale to black malt in this example is 2.7 parts pale to 1 part black. If you want to use all malt and no sugar, one possible alternate recipe would be to use 3 kg (6.6 pounds) pale malt (substituting 1.5 kg or 3.3 pounds malt for 1 kg sugar) and 0.54 kg (1.2 pounds) black malt. The ratio of pale to black malt in the alternate version is now 5.55 parts pale to 1 part black, but this recipe will produce about the same color as the version containing sugar because the black malt provides about 99 percent of the color in a black beer. The ratio of pale malt to black malt is really not that critical; rather, it is the amount of dark malt used per volume of beer that is most important.

If the original recipe for Black Horse ale called for 1.2 kilograms of black malt, then you did not make any substitution errors. However, if the recipe really called for 1.2 kilograms of black malt for a five-gallon batch, I would be hesitant to follow the recipe. When I look at a recipe, I try to imagine how the special malts listed will taste in the final beer. One way to do this is to convert ingredient weights into percent of total extract. In the recipe you used there is roughly 2.2 kg (4.85 pounds) extract from the pale malt and 0.7 kg (1.54 pounds) extract from the roasted malt. In percentage terms, this is 25 percent black malt. In my experience, this is way too much black malt and the resulting beer is likely to taste very burnt and acrid. Most stouts are about 12 percent at an original gravity between 1.040 and 1.044. In your case, a high-gravity beer is being brewed. As the original gravity of beer increases, the percentage of extract provided by special malts tends to decrease since the additional extract required for higher-gravity beers is typically supplied by pale malt or some other good sources of fermentables, such as rice.

Another method that brewers use to evaluate a recipe is to look at the weight of an ingredient in weight-per-beer volume terms. Commercial brewers frequently speak about hops in these terms. One pound of finishing hops per barrel (31 gallons or 117 liters) produces a very hoppy aroma, for example. One of my favorite beers that I brew regularly is a nitrogenated





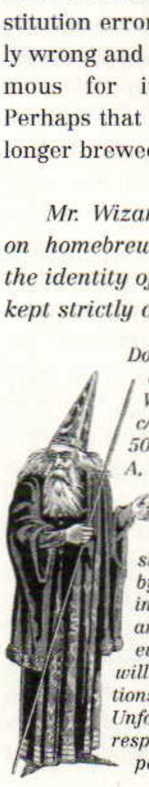
stout. This brew contains 0.15 pounds of roasted grains per gallon of beer.

I recently brewed a schwarzbier. I did a fair bit of research into the beer and reluctantly used 0.20 pounds of a de-husked roasted malt per gallon of beer. The resulting beer looked something like motor oil, but it still had a smooth flavor because of the de-husked malt. Your recipe calls for 0.5 pounds of roasted malt per gallon. Wow, that's quite a lot!

In your question, you ask if this recipe was improperly balanced with respect to dextrins. The fermentability of wort certainly decreases as you use more special malts, especially roasted malts. Depending on the beer, a higher ratio of non-fermentables is not necessarily bad. Again, starting out at about 1.074 and finishing at 1.019 is not that uncommon. The potential imbalance I do see in this recipe has to do with flavor. I strongly encourage all homebrewers to use some sort of system to evaluate their recipes before they start brewing them.

Recipes may contain errors or a brewer with a less-than-delicate palate may have developed it! In your case, it sounds like a communication error between you and the brewer might have occurred, or else you made a substitution error. Or I could be completely wrong and Black Horse ale was infamous for its extreme roastiness. Perhaps that is the reason why it is no longer brewed. ■

Mr. Wizard is a leading authority on homebrewing whose identity, like the identity of all superheroes, must be kept strictly condidential.



Do you have a question for Mister Wizard? Write to him c/o Brew Your Own, 5053 Main Street, Suite A, Manchester Center, VT 05255 or send your e-mail to wiz@byo.com. If you submit your question by e-mail, please include your full name and hometown. In every issue, the Wizard will select a few questions for publication. Unfortunately, he can't respond to questions personally. Sorry!

Beers Cloned

Warthog Cream Ale and Blue Whale Ale

by Steve Bader

Dear Replicator,

I have been making the two-hundred-mile trip up to Canada just so I can buy a traditional Canadian ale called Warthog Cream Ale. Warthog Ale is brewed by Big Rock Brewery in Calgary, Alberta. It would be great if I could get a good clone recipe for this beer so I can try to to replicate this excellent Canadian brew at home.

Tim Kober
Great Falls, Montana

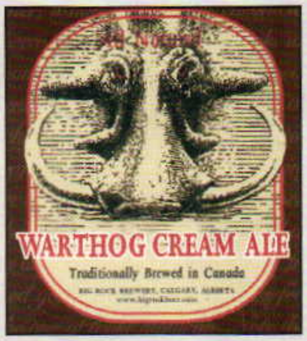
Big Rock Brewery in Calgary was established in 1984 and has evolved into one of North America's premier breweries. Big Rock went all the way to Switzerland to hire its brewmaster, Bernd Pieper. Bernd had brewed Guinness in Africa and then became the head brewmaster for Löwenbraü in Zurich. Fortunately, I was able to get some hints from him.

According to Bernd, Warthog Ale is a crossbreed of a British mild ale and an American cream ale. It's a lighter-bodied beer, with some crystal malt for a bit of a malty flavor and relatively low hop bitterness. The description on the Big Rock Website also states that this beer has some resemblance to British brown ales, with a nutty finish.

To keep the lighter body in an all-malt beer, I suggest using a high-attenuation yeast that will ferment a higher percentage of the malt sugars. A lighter-bodied beer needs to be extremely clean to allow the delicate flavors to come through. Try to keep a close eye on the fermenting temperature. Don't allow this beer to ferment above 68° F. For more information about the Big Rock Brewery and its beers, go to www.bigrockbeer.com or call (403) 720-3239.

Big Rock Warthog Cream Ale

(5 gallons, extract with grains)
OG = 1.045 FG = 1.011 IBUs = 14 to 16



Ingredients

- 3.3 lbs. Coopers light malt syrup
- 2 lbs. Muntons extra-light dry malt extract
- 0.5 lb. crystal malt (40° Lovibond)
- 3.75 AAUs Willamette hops (0.75 oz. of 5% alpha acid) (bittering)
- 4.4 AAUs Centennial hops (0.5 oz of 8.8% alpha acid) (flavor)
- 1 tsp. Irish moss
- Dry English Ale yeast (White Labs WLP007) or Thames Valley Ale (Wyeast 1275)
- 3/4 cup corn sugar for bottling

Step by Step

Steep crushed crystal malt in 3 gallons of water at 150° for 30 minutes. Remove grains from wort, add malt syrup and dry malt extract to wort, and return to a boil. Add Willamette hops and Irish moss and boil for 60 minutes. (Adding Irish moss at this time is purely for convenience reasons.) Add the Centennial hops for the last 3 minutes of the boil. When done boiling, strain out hops, add wort to 2 gallons of cool water in a sanitary fermenter and top off with cool water to 5.5 gallons. (I always use filtered water.)

Cool the wort to 80° F with a wort chiller or in an ice bath. Aerate well and pitch your yeast. Allow the wort to cool over the next few hours to 68° to 70° F, and ferment for 7 to 10 days. Prime and bottle your beer, then age for 2 weeks and enjoy!

All-grain option: Replace light syrup and dried malt extract with 8 pounds of milled pale malt, and mash your grains at 150° to 152° for 45 minutes. Collect enough wort to boil for 90 minutes and have a 5.5 gallon yield (approximately 7 gallons).

Decrease bittering hops to 0.6 ounces of Willamette to account for increased hop extraction efficiency in a full boil. The remainder of the recipe is the same as the extract recipe above.

Dear Replicator,

I recently tried Blue Whale Ale from Pacific Coast Brewing Company in Oakland, California. Wow! How can I replicate this brew?

Fred Goeldi
Warren, Michigan

Pacific Coast Brewing brews with malt extract syrup as the base. They supplement the extract with specialty malts and hops, just like a homebrewer would. Pacific Coast has been brewing Blue Whale since 1988 and won a silver medal at the 1989 GABF. According to brewmaster Don Gortemiller, Blue Whale is a cross between barleywine and IPA. It is very full-bodied, due to a high finishing gravity, and it has a big hop character from dry hopping. One unusual ingredient in this beer is wood chips, which are added in the fermenter to simulate oak aging. For more information, call (510) 836-2739 or go to www.pacificcoastbrewing.com. ■

Blue Whale Ale

(5 gallons, extract with grains)
OG = 1.070 FG = 1.025 to 1.030 IBUs = 70

Ingredients

- 9.5 lbs. Alexander's pale malt extract syrup
- 1 lb. crystal malt (120° Lovibond)
- 1 lb. crystal malt (40° Lovibond)
- 8 AAUs Nugget hops (0.75 oz. of 12% alpha acid) (bittering)
- 8 AAUs Chinook hops (0.75 oz. of 12% alpha acid) (bittering)
- 3.75 AAUs Willamette hops (0.75 oz. of 5% alpha acid) (flavor)
- 6.6 AAUs Centennial hops (0.75 oz. of 8.8% alpha acid) (flavor)
- 2.0 AAUs Perle hops (0.25 oz. of 8.25% alpha) (flavor)
- 3.25 AAUs Chinook hops (0.25 oz. of 13% alpha acid) (flavor)
- 1 tsp. Irish moss
- 2-1/2 tsp. White Labs yeast nutrient
- 1.75 oz. French oak chips
- 15.4 AAUs Centennial hops (1.75 oz. of 8.8% alpha acid) (dry hop)
- British Ale yeast (White Labs WLP005 or Wyeast 1098)

Step by Step

Steep crushed crystal malts in 3 gallons of water at 150° F for 30 min. Remove grains, add malt syrup and bring to a boil. Add Nugget and Chinook hops, Irish moss and yeast nutrient and boil for 60 min. Add flavor hops for the last 10 min. of the boil. Strain out hops, add wort to 2 gallons cool water in a fermenter and top off with cool water to 5.5 gallons. Cool to 80° F, aerate heavily and pitch yeast starter (0.5 gal.). Allow the wort to cool to 68° to 70° F, and ferment for 10 to 14 days. Transfer wort to a secondary fermenter, and add the oak chips and Centennial hops for dry hopping. After a week, prime and bottle, then age for 4 weeks.

Scotland and Austria

A strong Scotch ale and a Vienna lager

by Tess and Mark Szamatulski

With the first sighting of a few snowflakes we are assured that winter is almost here. This means curling up by the fire with a glass of homebrew. This month we will brew a wee heavy, a complex and warming beer with a hint of smoke. And we'll brew a Vienna lager that will ferment through the winter months.

Strong Scotch Ale (Wee Heavy)

OG = 1.072 to 1.088+ FG = 1.019 to 1.025+ IBU = 20 to 40 SRM = 10 to 47

The history of brewing in Scotland dates back to around 6500 BC, when the native Picts added heather tips to their crude fermented beverages. Commoners took up homebrewing in the Middle Ages, when women, called "browster wives," used spices (a gruit mixture) to preserve their beer and occasionally replaced some malt with treacle. In the 1500s, commercial breweries were founded to provide beer to the growing population of beer drinkers. Rich, malty, complex brews, the original Scottish-style ales, were the beers of choice until the 1800s when the Scots discovered hoppy, English pale ales.

First, a definition: Scotch and Scottish ales are not one and the same. Scotch ales are strong, high-gravity beers, while Scottish ales are lower-gravity brews. Scottish ales comprise three categories — heavy, light and export — while Scotch ales are also referred to as strong Scotch ales or wee heavies. Both styles are brewed using a similar process that was essentially dictated by Scotland's geography.

Hops do not thrive in Scotland, but barley flourishes there. Traditionally, all Scottish-style beers were minimally hopped because the hops had to be imported at great expense. This minimal hopping, along with an abundance of malt and a cool climate, was what made Scotch and Scottish ales what they are today. The beers are fermented and aged at cooler temperatures than most ales because of the climate in Scotland. This makes them very clean, with intense malt flavors.

According to style guidelines, wee heavies should have a deep, caramel malt aroma. Roast malt and smokiness from peat-smoked malt may also be apparent. The color ranges from dark amber to dark brown with ruby highlights. Thick, chewy and full-bodied, the flavor is of malt and caramel. There may be a nuance of peat-smoked malt or roasted malt with some nutty or buttery diacetyl character. Malt dominates the flavor and warmth from alcohol is apparent.

Our wee heavy pours with a creamy dark-beige head. The aroma is of sweet malt and bread. The complex palate is an earthy combination of sweet malt with a touch of roasted malt and just a hint of smoke. The finish mimics the palate, sweet and warming.

Commercial Beers to Try

The classic examples of wee heavy are Belhaven Wee Heavy, Traquair House, MacAndrew's Scotch Ale and McEwan's Scotch Ale. Other interesting versions are Scotch du Silly from Brasserie de Silly in Belgium, Vermont Pub and Brewery's Wee Heavy and Bert Grant's Scottish Ale.

Hops, Malt, Adjuncts and Yeast

Hops are used to balance the sweetness of wee heavies. To brew a traditional wee heavy, use either Kent Goldings or Whitbread Goldings for bittering. A small amount of Target can also be combined with the Kent or Whitbread Goldings for bittering (up to 1/4 the total bittering amount). Use up to 1/2 oz. of Fuggles, Kent Goldings or Styrian for flavor. Up to 1/4 oz. of either Fuggles or Kent Goldings can be used in some instances for aroma. In American-style Scotch ales, Willamette may serve as a substitute for Fuggles.

Well-modified Scottish two-row pale malt, Maris Otter or English two-row pale malt should make up the majority of the grain bill. Up to 12 oz. of English crystal malt should be included. Optional grains are British roasted barley and British black patent malt (not more than 1 and 1/2 oz. of each), 2 to 4 oz. of British peated malt and up to 6 oz. of either Belgian biscuit or Belgian aromatic malt. In American-style Scotch ales, all of the preceding grains can be used with the addition of up to 12 oz. of Munich malt and up to 8 oz. of Belgian cara-Munich malt. U.S. crystal may be substituted for British. Invert sugar, such as Lyle's Golden syrup (up to 1 pound), also can be used. Up to 6 ounces of treacle will also add some complexity to the beer.

Try Scottish Ale yeast (Wyeast 1728) for a smoky effect. For a rich, malty Scotch ale without smokiness, use Irish Ale (Wyeast 1084), Special London (Wyeast 1968) or Edinburgh Ale (White Labs WLP028).

Wee Heavy

(5 gallons, extract with grains)
OG = 1.082 to 1.083 FG = 1.019 to 1.020
SRM = 29 IBU = 30 ABV = 8%

Ingredients

- 14 oz. British crystal malt (55° Lovibond)
- 4 oz. Belgian aromatic malt
- 2 oz. roasted barley
- 2 oz. peated malt
- 6 lbs. Muntons extra-light DME
- 3.5 lbs. John Bull light malt extract syrup
- 8 oz. invert cane sugar (Lyle's Golden Syrup)
- 8.5 AAUs East Kent Goldings (1.75 oz. of 4.8% alpha acid) (bittering)
- 1 AAU Fuggles hops (0.25 oz. of 4% alpha acid) (flavor)
- 1.2 AAUs East Kent Goldings (0.25 oz. of 4.8% alpha acid) (flavor)

1 tsp. Irish moss

Scottish Ale yeast (Wyeast 1728) or Edinburgh Ale yeast (White Labs WLP028)

1-1/4 cup Muntons extra-light DME for priming

Step by Step

Bring 1 gallon of water to 155° F, add crushed grain and hold for 30 min. at 150° F. Strain the grain into the brewpot and sparge with 1/2 gallon of 168° F water. Add the DME, malt extract syrup, invert sugar and bittering hops. Bring the total volume in the brewpot to 3.5 gallons. Boil for 45 min., then add the flavor hops and Irish moss. Boil for 15 minutes, then remove the pot from the stove. Cool wort for 15 min. Strain into the primary fermenter and add water to obtain 5-1/8 gallons.

Add yeast when wort has cooled to below 80° F. Oxygenate-aerate well. Ferment at 66° to 68° F for 7 days, then rack into secondary (glass carboy). Ferment at 66° to 68° F until target gravity has been reached and beer has cleared (4 weeks). Prime and bottle. Carbonate at 70° to 72° F for 3 to 4 weeks. Store at cellar temperature.

Partial-mash option: Acidify the mash water to below 7 pH. Mash 1.5 lb. British or Scottish two-row pale malt and the specialty grains in 1 gallon of water at 151° F for 60 min. Sparge with 1.5 gallons of water at 5.7 pH and 168° F. Then follow the extract recipe, omitting 1.75 lbs. of Muntons extra-light DME from the boil.

All-grain option: Acidify the mash water to below 7 pH. Mash 13.5 lbs. British or Scottish two-row pale malt and the specialty grains in 4.75 gallons of water at 151° F for 90 min. Sparge with 5 gallons of water at 5.7 pH and 168° F. The total boil time is 90 min. Add 6.8 AAUs of bittering hops for the last 90 min. of the boil. Add the invert sugar, flavor hops and Irish moss as indicated by the extract recipe.

Helpful Hints: If your water is soft (below 50 ppm hardness), add 1/4 tsp. gypsum and 1/8 tsp. non-iodized table salt. If it is moderate (50 to 200 ppm), add 1/8 tsp. non-iodized table salt. If your water is hard (greater than 200 ppm), dilute it one-to-one with distilled water and add 1/8 tsp. non-iodized table salt. This beer is ready to drink 2 months after it is carbonated. It will peak between 3 and 9 months and will last up to 1 year at cellar temperatures.

Vienna Lager
OG = 1.046 to 1.052 FG = 1.010 to 1.014 IBU = 18 to 30 SRM = 8 to 12

When thinking of Vienna lager, two other beers come to mind, the Märzen and the Oktoberfest. They are all similar, but the Vienna stands out for its understated elegance. The way in which Vienna lager came to be is a long and interesting story.

When brewing was developing in the Austro-Hungarian empire in the 1800s, a man named Anton Dreher created the first Vienna lager. He studied in Munich where he met a major figure in German brewing, Gabriel Sedlmayr. Together, Dreher and Sedlmayr discovered bottom-fermenting yeast. In 1841 Dreher brought the yeast to his family brewery in Vienna, and at the same time Sedlmayr introduced this yeast to his Munich brewery. The resulting Vienna-style beers soon became extremely popular.

Vienna is the original amber lager. These beers traditionally were brewed from the finest Moravian barley and noble hops. Much of the character of this beer is derived from the method of malting that Dreher developed. Using only Moravian barley, Dreher created a "Vienna" malt that is deeper in color than pilsner malt, yet lighter than Munich. In the 20th century, classic Vienna was gradually replaced in popularity by pilsners and export Dortmunder-style lagers.

Stylistically speaking, the Vienna lager should have a German Vienna or Munich malt nose with a lightly toasted nuance. The color is reddish amber to light brown with brilliant clarity and a long-lasting head. Malt complexity and softness, coupled with a decisive hop presence, prevents a cloying sweetness. There may be a toasted character. The body is light to medium with subtle creaminess and medium carbonation.

Our Vienna lager is a clear amber beer with auburn highlights and a tightly-beaded, light-tan head. It has a soft, toasted Vienna malt aroma that leads to a smooth, well-balanced palate. It finishes long and dry.

Commercial Beers to Try

There are no more true examples of the Vienna lager from Austria, but the style has been revived by microbreweries. According to the BJCP style guidelines, the following beers represent the style today: Negra Modelo, Portland Lager by Portland Brewing Company in Oregon, Dos Equis Lager, Augsburger Red and Leinenkugel Red.

Hops, Malt and Yeast

German two-row pilsner should be the base malt, coupled with 15 to 20 percent German Vienna malt. German light or dark crystal is used for color and malt character. Up to 2 oz. of chocolate malt or up to 1 oz. of black malt may be used to obtain color. For extract brewers, use a German extract, such as Bierkeller light or Weyermann.

Hops should be noble and used for bittering, flavor and, sparingly, for aroma. Czech or Zatec Saaz can be used throughout the beer, Styrian Goldings for bittering and Tettnanger and German Hallertauer can be used for all applications. Use Bohemian Lager yeast (Wyeast 2124), Bavarian Lager (Wyeast 2206) or German Lager (Whitelabs WLP830).

Vienna Lager

(5 gallons, extract with grains)
OG = 1.053 FG = 1.012 to 1.013
SRM = 15 IBU = 23 ABV = 5%

Ingredients

8 oz. German Vienna malt
6 oz. German dark crystal malt (65° Lovibond)
1 oz. British chocolate malt
3.5 lbs. Bierkeller light malt extract syrup
3 lbs. Muntons extra-light DME
3 AAUs German Hallertauer Hersbrucker (1 oz. of 3% alpha acid) (bittering)
3.4 AAUs Tettnanger (0.75 of 4.5% alpha acid) (bittering)
1.25 AAUs Tettnanger (0.25 oz. of 4.5% alpha acid) (flavor)
1 tsp. Irish moss
Bohemian Lager (Wyeast 2124) or Oktoberfest/Märzen (White Labs WLP820)
1-1/4 cup Muntons extra-light DME for priming

Step by Step

Bring 1 gallon of water to 155° F, add crushed grain and hold for 30 min. at 150° F. Strain the grain into the brewpot and sparge with 1 gallon of 168° F water. Add the malt extract syrup, DME and bittering hops. Bring the total volume to 2.5 gallons. Boil for 45 min., then add the flavor hops and Irish moss. Boil for 15 min., then remove from stove. Cool wort for 15 min. Strain into the primary and add water to obtain 5-1/8 gallons. Add yeast when wort has cooled to below 80° F. Oxygenate-aerate well. Start fermentation at 60° to 62° F. Bring primary fermenter to 47° to 52° F for 7 days, then rack into secondary (glass carboy). Ferment at 47° to 52° F until target gravity has been reached and the beer has cleared (4 weeks). Prime and bottle. Carbonate at 70° to 72° F for 2 to 3 weeks. Store at cellar temperature.

Partial-mash option: Acidify the mash water to below 7.2 pH. Mash 1.5 lbs. German two-row pilsner malt, the specialty grains and an additional 8 oz. of Vienna malt in 1 gallon of water at 122° F for 25 min. and then at 152° F for 90 min. Sparge with 1.5 gallons of water at 5.7 pH and 168° F. Follow the extract recipe, omitting 1.75 lbs. of Muntons extra-light DME from the boil.

All-grain option: Acidify the mash water to below 7.2 pH. Mash 7.75 lbs. German two-row pilsner malt, the specialty grains and an additional 1.5 lbs. of Vienna malt in 3.5 gallons of water at 122° F for 25 min. and then at 152° F for 90 min. Sparge with 4.75 gallons of water at 5.7 pH and 168° F. Total boil time is 60 min. Add 5.1 AAUs of bittering hops for the last 60 min. of the boil. Add the aroma hops and Irish moss as indicated by the extract recipe.

Helpful Hints: If your water is soft (below 50 ppm), add 3/4 tsp. gypsum, 1/8 tsp. non-iodized table salt, 1 tsp. calcium carbonate (chalk) and 1/4 tsp. Epsom salts. If it's moderate (50 to 200 ppm), add 1/8 tsp. non-iodized table salt and 1/4 tsp. chalk. If it's hard (greater than 200 ppm), dilute it 1-to-1 with distilled water and add 1/8 tsp. non-iodized table salt and 1/4 tsp. chalk. It can be lagered for 3 to 4 weeks. Begin at 45° F and slowly decrease the temperature to 34° F over 2 weeks. This beer will peak between 1 and 3 months after it is carbonated and will last at cellar temperatures for 7 months. ■

Tess and Mark Szamatulski are the authors of "Beer Captured" (Maltose Press, 2000) and "Clonebrews" (Storey Publishing, 1998).

WINE KITS

PHOTO BY CHARLES A. PARKER

Making GREAT wine from KITS!

Everyone knows that good grapes make world-class wine. But in recent years, the quality of kit wines has improved enough to impress even the most dedicated fresh-fruit purist. As a homebrewer, you can also try your hand at winemaking with this new generation of kits. You already have the majority of the equipment, such as fermenting buckets and carboys. Plus, you have a solid grasp on the basic skills needed for wine kits, such as sanitation, siphoning and using a hydrometer. Making wine from kits as a homebrewer is easy. You'll be impressed with the final quality of your first batches.

The spectrum of wine kit choices available guarantees that there is a variety to suit almost any taste. From hardy reds to delicate whites, well over 2,000 different styles of kits are now being sold in North America. These kits give the homebrewer a chance to easily make wine any time of the year with juices and concentrates sourced from vineyards in California, Australia, France, Italy and other classic wine areas. Plus, you'll end up saving quite a bit of money over commercial bottles of wine of comparable quality. Another bonus: Many kits are all-inclusive. They contain all the additives you need, pre-measured. The recipes are easy to follow and the results are fairly predictable.

There are four main types of wine kits: sterile juice; fully concentrated grape juice; partially concentrated grape juice; and kits that combine juice and concentrate. Many wine kits also

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WINE KITS

give you a clear idea of the length of time before the kits will ready to bottle, such as four-week kits or six-week kits.

The approach to making wine from these kits is similar. The only difference is that the all-juice kits require no additional water. These kits tend to be the most expensive due to juice's comparative purity and costly transport (it weighs more than concentrate). Grape concentrates are simply grape juices that have had water removed through a high-tech process. Some kits are fully concentrated; you have to add water, and sometimes sugar, before making the wine. Juice-concentrate blends require less water and produce a wine that's truer to character.

Kit prices should directly correlate to the purity of the product. Higher-percentage juice kits and those with a higher percentage of a specific wine grape will tend to be more expensive.

Since you are a homebrewer, you already have most of the equipment you'll need. You'll use a primary fermenter, a long-handled stainless steel or food-grade plastic spoon, a glass carboy with airlock, siphon tubing and a hydrometer. A typical wine kit will contain one bladder pack of juice and-or concentrate, a yeast packet and several numbered, pre-measured and pre-mixed additive packets.

Open the can, pail or bladder pack in your kit. Taste the contents — they should be clean, sweet and fruity. Pour the contents into a primary fermenter and add the first group of ingredients (water, any wine acids, grape tannins and nutrients, and sometimes oak chips, depending on the wine style). The recipe will be very specific. Once you have mixed the concentrate and the first group of ingredients, stir them well with your sanitized spoon.

You may now want to take a specific gravity reading, even though the recipe will usually provide it. It's just nice to know that you're on track, especially this early. Sprinkle the yeast package on the surface and stir it in. Try to keep fermentation temperatures in the range recommended in the recipe. Usually, red wines ferment between 70° F and 80° F. Whites should begin between 72° F and 75° F and then be brought down to 68° F to finish fermenting. If you keep your batch at the right temperature, the yeast will start working fairly quickly and provide a vigorous fermentation.

After the main activity of fermentation dies down, you are ready to rack (or siphon) the wine. Most kits will give a recommended specific gravity target for your first and subsequent rackings. The main purpose is to draw the wine off the sediment into a fresh, sanitized carboy. The last two rackings will also


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WINE KITS

usually introduce sulfite powder to fight any oxidation brought on by your wine's contact with air.

Fining agents may also be added in pre-measured ingredient packages during rackings to help clarify the wine. The final gravity target reading will be listed in your kit instructions. Keep in mind that many wine styles will result in final gravity readings well below that of your homebrew. For instance, many dry wines come in below zero!

Bottling is very easy and is similar to bottling your beer, with the exception of using corks instead of caps as closures. Just as with homebrew, a bottling wand makes life easier. There is a broad selection of bottle styles and sizes to match the wine of your choice. For a five-gallon batch, you will need the equivalent of 26 standard 26-ounce (750 ml) bottles. You'll sanitize your bottles and bottling tubes. After you fill the bottles, cork them. Confer with your retailer regarding the need to "prep" your corks (some corks require a cursory soaking in hot water to make them easier to place in the bottle). Hand-held corkers can range in price from $8 to $20, depending on the features. (Remember, these corkers can also be put to good use for bottle-conditioned Belgian-style homebrews!)

There will be aging instructions in your kit recipe. Although as a rule, even the most basic kit will improve with at least three months aging in the bottle and juice-concentrate kits benefit from even longer aging times.

As a homebrewer, you already have the skills and the equipment. Now all you need to do is try out a wine kit for yourself!

PHOTO BY CHARLES A. PARKER

bring on the HEAT!

by colin kaminski

An outdoor cooker may be the best investment you'll ever make. So get the basics on gas burners ... and get out of the kitchen!

ONE DAY, YEARS AGO, I was waiting for my girlfriend to get home when I decided I would brew some beer. I have always been an all-grain brewer, but back then I heated water in all of the pans I had, mashed in a plastic bucket and boiled on the stove.

This particular brew went like most brews for me. Everything was fine until it came time to boil. Since I didn't have a six-gallon kettle I had to spread my boil across the stove. I had to divide my hops by three and watch three boils. Since all three pots were different sizes, it was quite a challenge.

You can guess what happened: Right when all three pots were boiling over and syrupy wort was running down the front of the stove, my girlfriend walked in. If it had been my house, I would have gotten away with it, but I was in her apartment. She hit the ceiling and forbade me to brew inside.

The next weekend I bought my first outdoor cooker from a local homebrew shop. Since I was helping out at a nearby microbrewery, the master brewer gave me two kegs. I cut the lid out of one for a boil kettle and had a coupler welded in the side so I could install a ball valve. I borrowed a friend's propane tank and I was back brewing.

That was the best thing that ever happened to my brewing. I saved about 30 minutes per brew, I had much more control over my final gravity and volume and I could hose down the deck when I was done. My girlfriend was satisfied. (She was never happy with me brewing, though, so satisfied was as good as it got. Next girlfriend...)

I think a large boil kettle and an outdoor cooker is the best investment any homebrewer can make. The two arguments I can make are social harmony and brewing quality. There are many designs available and I hope to clear up some of the confusion. But before we can decide on the best burner for you, we need to decide what gas you are going to use.

Propane and Natural Gas

Two gases are widely used for homebrewing: propane and natural gas. The most common is propane, a product of refined petroleum. It is usually purchased in small cylinders at RV stops, gas stations and gas companies (look under "gas-propane" in the phone book). It's sometimes trucked into large tanks to heat peoples' homes. (If you have a propane tank the size of a small car in your backyard, you've probably noticed it by now.) When put under enough pressure, propane turns into a liquid. This liquid is sometimes sold by weight (pounds) and sometimes by volume (gallons).

You can purchase or exchange your small propane tank. Since the propane tanks require Department of Transportation (DOT) safety certification every few years, many people choose to rent or exchange theirs. If your tank has passed your DOT certification date, it needs to be pressure-tested before it can be filled. It usually is cheaper to purchase another tank, rather than having one re-certified. If you choose to exchange, you simply purchase a tank. Whenever it gets empty, you swap it for a full one.

The main advantages of propane are that it's easily transported, commonly available and can be supplied in high pressures. A regulator is used to lower the pressure of the gas from the super-high pressure in the tank to a pressure that can be used. The higher the pressure, the more gas will flow from a given jet size at a higher velocity. That translates into more gas burning. At a certain point, the velocity gets so high that the flame blows itself out. Just before this happens, the flame starts to "tear off" the jet.

Affordable regulators are available up to ten pounds per square inch. Regulators are also available in very low pressures, as low as 11 inches of "water column" or 0.40 psi. Water column is another method of measuring pressure; it's widely used in the gas industry and comes in handy when designing gas-control systems. Water column is often used when very low pressures are involved; in basic terms, it measures how high a given amount of pressure will push a column of water. One psi equals 27.7 inches of water column.

Natural gas is a combination of gases that are extracted from a well in a field. Depending on the field, the properties can be very different. It is supplied to many homes by a pipeline in gas form at very low pressures (less than 0.5 PSI). If your house is one of these, you probably know it.

The main advantage of natural gas is that it can be piped into your home if you are lucky enough to live in a delivery area. And you can use off-the-shelf water heater parts to make a custom-designed gas system.

When we burn gas, we get heat by tearing off the carbon molecules and adding oxygen (in the form of air) to make carbon dioxide and water. We also get a little carbon monoxide (CO), hopefully not much since it is a poison, plus some partially unburned gas molecules called hydrocarbons and various NOx (oxides of nitrogen) compounds. The reaction is exothermic, which means we get more heat out than we put in to get it started. In an ideal propane burn, we start with one molecule of C_3H_8 (propane) and 5 molecules of O_2 (oxygen) and end up with 3 molecules of CO_2 (carbon dioxide) and 4 molecules of H_2O (water). Or in chemical notation:

$$C_3H_8 + 5\ O_2 = 3\ CO_2 + 4\ H_2O + \text{heat}$$

"What?" you say. "I have never seen little streams of water coming from my burner!" That's because pure steam is an invisible gas. The "steam" you see coming from boiling water is actually droplets of water re-condensing after hitting the cold air. (You probably don't notice the 7 gallons of water coming out of the exhaust pipe for every gallon of gasoline you burn, either!)

The heat output of a gas is measured in BTU (actually, BTU/hr is the technical specification, but it is commonly written as BTU). Anyone who has looked in a brewing catalog has seen BTUs, but what are they? A quick look into the reference library reveals that BTU means "the quantity of heat that must be added to one avoirdupois pound of pure water to raise its temperature from 58.5° F to 59.5° F under standard pressure." (Avoirdupois pound is the proper name for the pound with which we are familiar). In plain English, that means if you take a pint of water on a cool day at sea level and add one BTU, it will go up one degree Fahrenheit in temperature.

Propane and natural gas have very different properties. Propane has more energy per cubic foot than natural gas. Therefore, propane jets are much smaller than natural gas jets.

Choosing between indoor and outdoor use often determines the choice of natural gas or propane. While it is true that natural gas is easier to burn completely and should be safer when used indoors, it is a mistake to move your

1. Camp Chef SH-140L: high-pressure burner, 140,000 BTU ($69). 2. Camp Chef SB-35: ring burner, 35,000 BTU ($69). 3. Bayou Classic: Venturi burner, 185,000 BTU ($69). 4. Bayou Classic: jet burner, 185,000 BTU ($50). 5. Cajun Cooker: high-pressure burner, 185,000 BTU ($50).

Left: A ring burner is a cast-iron circle with holes in concentric rings around the burner. It has an adjustable air inlet and runs better at lower pressures. Center: This is a multi-jet natural gas burner. Each jet has an orifice and four air-inlet holes. They are quiet and put out more heat than other standard burners. Right: A high-pressure burner is two pieces held together with a bolt. It has an adjustable air inlet and lots of power for big boils.

converted outdoor cooker indoors. It is illegal for any manufacturer, in fact, to make an unvented burner over 5,000 BTU for indoor use.

The proper methods for designing an indoor brewery are beyond the scope of this article. Briefly, you need to vent all exhaust gases through a properly designed hood or build a combustion chamber around your burner and vent all gases through a flue. I would also install a carbon-dioxide meter but I question their reliability.

An outdoor cooker has three main features: the burner, the stand and the regulator. The heart of any cooker is the burner.

Five Common Burners

Burners are available from a variety of sources. When a manufacturer is looking for burners for a cooker, they usually use an existing casting instead of designing their own. Here is a summary of the common burner castings used by most outdoor cookers.

High-pressure burner: This is the burner style in the popular Camp Chef SH-140L. It is two pieces held together with a bolt in the middle. It has an adjustable air inlet, which provides the ability to have a large or small flame and maintain efficiency. (Air provides the oxygen that makes the flame possible, but you need the right ratio of propane to oxygen molecules. If the mix is too lean — not enough oxygen— there's no flame. If the mix is too rich, you produce too much carbon in the form of soot.)

The high-pressure burner has lots of power for big boils and can do a 20-gallon boil. It runs well at 15 psi and below. Above 15 psi, it is difficult to get enough air and the flame starts to "tear off the burner" or sputter out. The new regulators are limited to 10 psi, but this burner still puts out plenty of heat. It fills up with sugar when you boil over and can be a challenge to disassemble after years of use. I would describe the flame pattern as medium wide and the sound level as medium. They can't be converted to natural gas.

Ring burner: This is a cast-iron ring with a bunch of little holes in concentric rings around the burner. It has an adjustable air inlet. It runs better at lower pressures than the high-pressure burner, making it useful for smaller boil volumes. It has a very controllable flame and spreads the heat out to a large surface area. This is probably the most wind-sensitive design. Most outdoor cookers that use this burner provide a piece of sheet metal about 4 to 6 inches high that goes around the burner and is designed into the stand to provide some wind protection. With a 10 psi regulator, they can do a 10-gallon boil. I have seen these converted to natural gas, but at household pressures they are barely suitable for a 5-gallon boil.

Jet burners: This burner is a square tube with a gas jet inside. It relies on creating a large amount of airflow from bottom to top while burning. It is not very efficient, because the air does not mix very well with the gas, and it is very powerful, so it uses lots of propane. They are very loud and have been described as sounding like a 747. Because the flame pattern is so small, some people have had problems with scorching wort. There used to be a conversion kit available for natural gas but I was unable to find one.

Multi-jet burners: These put out more heat than any other standard homebrew burner. The flame is spread out very well and they are the quietest burner I have found. You probably have seen these lately — they are a ring with a bunch of brass jets. Each jet has an orifice and four air inlet holes and is a burner all its own.

The best ones are made by Solarflo and are available in size ranges from about 20,000 BTU to about 2,000,000 BTU. They have a wide range of options, like flame height and choices of gases and pressures. The Solarflo burners are mostly used by commercial establishments and are very difficult to get for home use.

The ones available to the homebrewer are Asian knockoffs and are available only in one size. The quality is not anywhere near the Solarflo burners, but they are 1/7 the price (about $50). I have not seen one with a stand yet, but I am sure one will be available soon. If you want to use one now you will have to design and weld your own stand.

The main advantages are they have no air adjustments, they have a very large output and they run very well on low pressure (less than 0.5 psi). Gas controls for propane are designed to work at very low pressures, so this becomes one of the only options for electronically controlling your hot liquor temperature.

Multi-jets are the most expensive

burners. They are available in natural gas or propane. They are jetted for commercial natural gas pressures, but will burn very well at residential pressures. The output is about 25 percent lower, however. Some people find these burners too powerful for homebrewing and the output can be lowered by replacing some of the jets with bolts and copper washers.

Venturi burners: This is the burner used in the common Bayou brand of cookers. I have not used one of these burners, so I am only mentioning them for completeness. I expect them to be similar to the jet burners, but with better efficiency.

The Stand

If the burner is the heart, the stand is the soul. If you have ever tried to put a keg on a ring, tried to siphon wort upward or had to lift 5 gallons of boiling wort, you will understand why choosing the right stand is important. As a rule, the more legs a stand has, the more stable it will be. If you use or ever plan to use a converted Sankey keg for a brew kettle, I would avoid the ring-shaped stands, as the keg can rock on the ring.

Carefully plan your transfer out of the boil kettle. Depending on what vessel you're using next, the height of your stand can be very important. A good brewing stand should be taller than your carboy. If you brew in the wind, a windshield not only protects the flame but helps air flow.

The last thing to consider is the finish. Stands are available in black paint, black high-temperature paint and stainless steel. The cheapest stands have paint that burns off the first time you use it and makes a very bad smell. The stand then starts to rust. Stainless is expensive but is the easiest to maintain. High-temp paint is the best compromise between cost and durability.

The Regulator

Most, if not all, outdoor cookers are supplied with a regulator, so this is a no-brain decision. If you end up having to buy your own there a few things to consider. The first is size. If you are only going to run one burner, then the smallest regulators are suitable, but when you start running three multi-jet burners, a larger regulator becomes necessary. Regulator manufacturers are reluctant to supply BTU capacities for their cheapest regulators, so you are on your own to figure out the capacity of your regulator.

The second thing to consider is pressure. Propane regulators used to be available adjustable from 0 to 18 psi. As of this writing, the 18 psi regulators are no longer available and the replacement is 10 psi. There is a rumor in the industry that these will be replaced with a lower pressure as well. Low pressure regulators are usually set to about 0.43 psi.

The last thing to consider is the connection to the tank. Recently tank manufacturers have begun to change the thread on propane tanks. The old tanks have a female left-hand thread that is much like a bolt thread. The new tanks have a male square thread like an ACME thread. I am told it is an effort to keep people from cross-threading them (getting the fitting out of line) and creating a gas leak. Soon all propane tanks and regulators will be the new style.

How to use your cooker

So you made the plunge and bought a burner. Now you are wondering, "how do I use this thing?"

All you have to do is light it, right? Well, sort of. Don't forget to connect the regulator to the tank. This is pretty simple; don't cross-thread it, leave it loose or tighten it too much. Just past snug is usually good. If you think you might have a leak, spray soapy water on the union and look for bubbles.

Next you get to light the burner without getting burned. The trick here is to light the match or lighter before turning on the gas. (I recommend the long butane lighters.) When the flame is in place, turn on the gas and keep your hair out of the way. The burner should light right up. If it does not, turn off the gas until you figure out what the problem is. If you have an adjustable regulator, make sure it is adjusted to high pressure (all the way in).

Once you have a flame, your next

BTU: WHAT DOES IT MEAN TO YOU?

BTUs in the outdoor burner world are a lot like talking fishing with the good ol' boys. In searching through major suppliers' catalogs, I was able to find the Camp Chef SH-140L — a widely available model that I highly recommend — listed as anywhere from 70,000 BTU to 125,000 BTU. Camp Chef lists it at 75,000 BTU. So what is the truth? There have long been rumors that outdoor cooker manufacturers (or suppliers) inflate the specs on their burners. I contacted Camp Chef and spoke to their engineer. He recommends the following test for checking your burner output.

1. Weigh your propane tank.
2. Burn full blast for 15 minutes.
3. Weigh the tank again.
4. Multiply the weight difference by 4 to get an hour's burn.
5. Multiply the result by 20418.

For a 15-minute burn, the equation is as follows:

$(Wi-Wf) \times 4 \times 20418$ = BTU/hr rating of your burner
Wi = initial weight
Wf = final weight

This test assumes a complete combustion of the gases. If your burner is producing a large amount of soot, this test is meaningless. By changing the jet size on this Camp Chef model, you could possibly get 125,000 BTU from the burner. But my experience tells me it would be difficult to get enough air to make the burner burn efficiently with a jet this large.

Since you cannot weigh your natural gas supply, there is no easy method for calculating the output of a natural gas burner.

—C.K.

A propane regulator lowers the gas pressure to levels that can be used.

goal is to adjust it. This is easy to do, unless you are pushing the limits of the burner. I pick the setting I think I need, then I close off the air and adjust up until the yellow flame disappears. If you practice this, you can set the flame higher and lower than the average brewer. When I need a different heat setting I adjust the gas, then the air.

Caring for your burner is fairly easy until you boil over. Then it is easiest to clean it right away. Once I heated up my high-pressure burner and turned it upside down. A few ounces of syrup poured out!

When you get your regulator, it has a cap on the gas end. If you save this and reinstall it every time you disconnect the tank your regulator will last longer. Dust and moisture are bad for regulators. Also, there is a small hole on the front of the regulator that cannot get plugged. If you spill on your regulator it is very important to check to see if the hole is clean. Do not put a pin in and puncture the diaphragm!

If you want to tweak your burner, it can be done. The limiting factor in burner design is the burner's ability to mix gas and air. If the mixing is done internally, you can polish all of the casting flash out of the air passage to get more air. If you do this carefully, you can bump up the pressure or jet size a little more. If you make the jet size larger, more gas can flow through at the same pressure. At some point you are unable to get enough oxygen and you only make soot.

Multi-jet burners are more efficient if you separate all of the air from the top and bottom with a large donut. It should be made from steel sheet metal and have an inner diameter slightly larger than the burner and an outer diameter the size of your kettle. While you are fabricating the ring, you may as well tie it into a wind screen about 4 inches high that extends above the donut. This will make all of the air come up through the center. It is important to eliminate any air coming from the sides of a multi-jet burner to maximize efficiency.

If you keep your burner clean and the significant other happy, you will have a long and happy life brewing on your outdoor cooker. ■

Colin Kaminski works as a brewer at Downtown Joe's in Napa, California and as a product developer for Beer, Beer and More Beer. He got married on October 16. Congratulations!

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Reno • Nevada

Charles Street Brewery
What's a big, beautiful brewing rig without a room to put it in? This building in Scott's backyard was once filled with junk, until the day he realized that beer was way more important than junk. So he rented a dumpster, hauled out the trash and got to work on the Charles Street Brewery. Scott installed a large stainless sink with hot and cold running water and an overhead sprayer for easy cleanup. He put up a pegboard and a cabinet for miscellaneous brewing supplies. The overhead shelf houses his sparkling clean glass carboys, and a woodstove keeps things warm in winter. Then he fired up his welding torch and commenced work on the three-tiered Brew Machine.

PHOTOS BY SCOTT LEAREY

Like most of us, Scott Learey began brewing with a five-gallon bucket and a few cases of bottles. But after using a gravity-fed, three-tiered brewing system at The Reno Homebrewer, he knew his bucket days were over. A single man in those days, Scott had plenty of time to learn the art of brewing and make his dream machine a reality.

Scott's high-tech Brew Machine comes complete with everything he needs and then some: It has three stainless kettles with thermometers and stainless drain valves, a trio of 30,000-BTU low-pressure burners and a three-way gas manifold to direct propane from a single tank to the burners. It also has an on-board water distribution system for sparge water and filling kettles.

The frame can be easily disassembled into three parts, which makes the Machine portable. Scott takes it to events to spread the homebrewing message to the masses. Most people's first reaction is "What the hell is that?" Their second reaction is "Where can I get one?"

by Chris Colby

brew machine

Scott put his Brew Machine together in about five weeks. He attached three 40-quart stainless vessels to the welded steel frame and equipped each vessel with its own propane burner. Much of his brewing equipment sits in the frame (which features wheels for easy transport), including his immersion wort chiller and an oxygen tank for wort aeration. Stainless-steel "quick-disconnects" make it easy to connect spouts for filling and remove them for cleaning.

hot liquor tank

Scott's hot liquor tank (sparge pot) is fitted with a copper filling tube (left) and a plastic sight tube (right). The sight tube was made from an old racking cane. Red marks in one-gallon increments allow Scott to see the water level inside the sparge pot. The see-through tube also has a quick release so it can be moved to the mash pot to see how much water is needed for the grain bed. The quick-release sparge ring, made with 3/8-inch stainless tube, connects to the valve at the base of the pot. It sprinkles hot water on the grain bed below.

hot liquor tank, sparge ring and mash pot

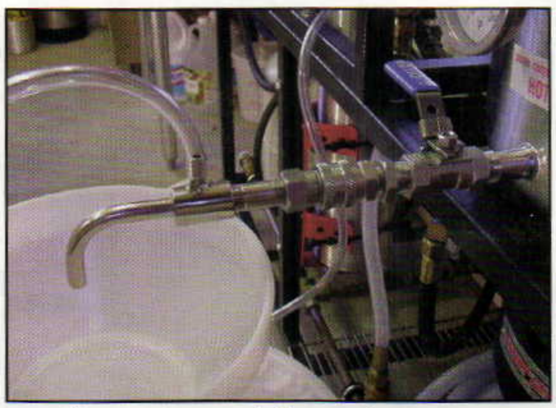
The mash pot has a false bottom, made of perforated stainless steel, that keeps the grain bed off the bottom of the mash pot. This keeps the loose grain from flowing through the mash pot valve into the boil kettle. When the sparge begins, Scott opens the valve at the bottom of the mash pot. From there, the wort runs through a long stainless tube to the bottom of the boil pot. This prevents hot-side aeration.

kettle and chiller

Once the wort is in the kettle, Scott disconnects the stainless tube and starts the boil. His copper wort chiller has quick-release connectors and snaps on and off the water connections. It takes about ten minutes to cool the wort to 85° to 90° F. The cooled wort then exits the kettle through a stainless tube.

pickup tube

The boil pot has a false bottom (not shown) to keep the whole hops away from the drain. On the outside of the boil pot is a 3/8-inch out-take pipe going to the valve. The out-take pipe is 1-1/4 inches above the bottom of the pot. The stainless pickup tube slips into the out-take pipe and gets wort from the bottom of the boil pot and into the fermenter.



aeration system and fermenter

As the wort exits the kettle, it passes through a stainless filling tube, where it is injected with pure oxygen. Aerating with O_2 minimizes lag time. A plastic fermenter is set up below the tube. The lid has a hole in the center for a screened funnel that keeps out any remaining hop debris.

TLC for STAINLESS

COMPUTER USERS ENVY THE GUY WITH A FASTER PROCESSOR, CAR LOVERS ENVY ANYTHING WITH MORE HORSEPOWER, WOODWORKERS WANT A LARGER TABLE SAW. AND HOMEBREWERS ASPIRE TO OWNING AS MANY SHINING STAINLESS-STEEL VESSELS AS POSSIBLE. STAINLESS-STEEL KETTLES WITH STAINLESS IMMERSION COOLERS, STAINLESS HOT LIQUOR TANKS, STAINLESS MASH TUNS AND STAINLESS FERMENTERS. IS THIS MADNESS, ENVY OR A SENSIBLE ASPIRATION?

Stainless is the homebrewer's metal of choice — not because it is the perfect material; it isn't. Silver, aluminum and copper all conduct heat better. But stainless steel shines because of its invisible barrier to rust. Iron and steel corrode in the atmosphere; they rust, forming big flakes of red-orange oxide. But when chromium is added to steel, an invisible "passive" film, only a few molecules thick, covers the surface and prevents rust. This makes it as corrosion-free as gold.

So what, exactly, is stainless steel? Stainless, unlike mild steel, contains only a bit of carbon and 10 percent or more chromium by weight. It's the surface film of chromium that resists oxidation and makes the material "passive" or corrosion-resistant. If this oxide film is damaged — mechanically or chemically — it is self-healing in the presence of oxygen. So stainless steel resists rust and will continue to do so, if treated correctly. There are other reasons why stainless is the metal of choice in the food and beverage industry, but the most important is that it can be easily cleaned by almost any method.

There are more than 60 grades of stainless steel, each with a special purpose. The divisions are centered around the alloying elements that affect the group's micro-structure. The 400 series of metals — 405, 409, 430 and so on — are magnetic and don't weld well. They're used in knifes, surgical instruments, bank vaults and automobile exhausts.

Homebrewers are concerned with stainless steels that have had more chromium and some nickel added. These metals are used for kitchen sinks, food-processing equipment, restaurant food-preparation areas, ovens and chemical vessels. The 300 family (304, 310, 316, 317) are also the stainless steels used for brewery equipment. The 304 is the most commonly used, 310 is designed for high temperature, 316 offers improved corrosion resistance and 317 has the best corrosion resistance. Most high-quality brew kettles are made of 304 and 316 is the best steel for fittings and tubing. Often you'll find stainless-steel cooking pots, even big ones, marked with 18/8 or 18/10 on the bottom. This is the alloy content — 18 by thom cannell

percent chromium and 8 percent or 10 percent nickel. Both are good quality.

According to the Specialty Steel Industry of North America (SSINA), a trade association, stainless steels have some limitations: The maximum temperature under oxidizing conditions is 925° C (1695° F), and they are suitable only for low concentrations of certain very powerful reducing acids. Neither of those drawbacks affects homebrewers. What is important to us is that in crevices and shielded areas, there might not be enough oxygen to maintain the passive film. Then corrosion might occur. That means when adding a nipple or coupling, or at any joint in the metal, you could actually experience rust! Another significant problem is that very high levels of halide ions, especially the chloride ion, can break down the passive surface film. That means bleach is a potent enemy of stainless steel.

Caring for your stainless

Even an inexpensive stainless-steel brew pot costs nearly $100. If you have larger pots, like those manufactured especially for homebrewers by Polar Ware, you've invested more than $100. And a fifteen-gallon, three-vessel system? Even if made from three legally obtained kegs, you still have at least $300 invested by the time they are cut and equipped for brewing. Proper cleaning and care protects your investment and ensures successful brewing.

Another reason for keeping your stainless steel stain- and corrosion-free is iron. Rust is iron and stainless steel contains more than 70 percent iron. Iron is not good for either your beer's flavor or your yeast's health.

Caring for your stainless steel is not difficult. Ordinary household soaps and detergents can do most of the necessary cleaning. For heavy-duty grime, common cleaners like Bar Keeper's Friend, Zud or even Comet can remove most soils. One of those woven nylon scrubbers will loosen almost any soil.

Problems can occur when homebrewers use chloride-based cleaners, like chlorine bleach. Bleach is incorporated into many cleaners — and used by many homebrewers for sanitizing. Chloride ions will attack your stainless steel and remove the invisible chromium oxide shield. The first solution is the easiest: Don't use bleach on or in your stainless-steel utensils. If you must, rinse repeatedly and air dry. Also, don't allow any cleaners to dry on the surface of stainless-steel utensils or pots. Rinse thoroughly after use. Don't let chlorinated sanitizing solution sit in your kettle; it will attack the surface right at the liquid-air boundary. Don't clean with steel wool pads; they leave steel particles embedded in the surface that will become rust. Once surface rust has breached the protective chromium layer, the iron in your stainless steel vessel will itself rust. Use Scotch Brite scrub pads.

For more serious cleaning, rely on products like Five Star Chemical's PBW (Powder Brewery Wash), which does not contain chlorides. After welding or brazing be sure to clean the surface and repassivate by drying in the air.

Keeping stainless passive

We keep mentioning "passivating" or "passive." All that means is that stainless steels are naturally resistant to rust, similar to the so-called "noble" metals: gold, silver and platinum.

Your new stainless vessel arrives with its invisible chromium surface layer — the passive surface — intact and gleaming. If you create a deep scratch, do some welding or let beerstone build up (beerstone is a combination of organic compounds bound to oxalates of calcium and magnesium, all found in your wort), the passive layer could lose its integrity. Corrosion gets a great starting place under the beerstone because there is no free oxygen to maintain the passive chromium oxide. If those brownish or whitish deposits on the bottom of your brew kettle aren't removed, you could develop severe pitting underneath them.

Commercial manufacturers quickly clean stainless steel by dipping it in nitric acid to remove all traces of free iron. This absolutely not a do-it-yourself project. To keep your vessel passive, or to repassivate it, all you need to do is clean it! Scrub your kettle till it shines, rinse it thoroughly and let it air dry for a couple of weeks. The passive layer will form naturally, spontaneously, as long as there is oxygen.

If you have severe cleaning problems, Five Star makes Acid #5, a mix of nitric and phosphoric acid. Use it according to directions, by circulating a dilute solution and then air drying. That's as close as most homebrewers should get to professional passivation.

Working with stainless steel

Now that you know a bit about stainless steel, perhaps you'd like to add a ball valve or thermometer or sight glass to your brew kettle. None are impossible projects for any competent do-it-yourselfer.

Working with stainless steel is no different from working with any other metal. You can cut it, grind it, drill it, solder it or weld it. However, most tools used on stainless should never be used on any other material — not aluminum

A hands-on guide to understanding and working with stainless steel, the rust-resistant metal of choice for any high-level homebrewery.

and particularly not on mild steel. Steel will contaminate your grinder(s) and metal brushes and in turn contaminate your stainless. It's not that bits of mild steel will immediately cause a failure in the stainless, more that molecules or particles will imbed themselves into your work and rust will form.

This means that you must have separate tools — wire brushes and grinding wheels in particular. What about separate drills, shears or files? That's not practical, and those edges that have been drilled, cut or filed can be ground or brushed to remove stray particles of mild steel, according to the experts at the SSINA. Once mechanically cut, stainless steel should naturally form its protective oxide coating.

The entire 300 family of stainless steel is very tough metal. It is highly alloyed and the process used to form it into shapes also hardens it. If you won't take my word for it, try to drill a hole into 1/8-inch stainless sheet stock.

Stainless steel has a high level of chromium and can't be cut with simple oxygen-acetylene cutting torches, due to the very high melting point of the chromium oxide that's formed when heated. High-speed abrasive wheels (die cutters and die grinders) can be used for any necessary cutting of sheet, thin plate and bar material. With good technique and practice, even large-radius curves can be cut.

Abrasive cutting generates heat. So take care not to overheat the cut edge. Always use fresh or dedicated abrasive discs or wheels. And always observe safety precautions like wearing gloves and goggles and removing watches, rings, and necklaces.

The best way to cut stainless or any steel is with a plasma arc cutter; it cuts steel using ionized gas, usually ordinary air. An electrical field creates a plasma — a mixture of free electrons, positively charged ions, and neutral atoms — which exists at sun-like temperatures up to 55,000° F. This incredible heat melts metal and the gas jet removes the molten metal.

Plasma arc cutters are expensive and generally not home equipment unless you're a sculptor or metal crafter. There is some controversy about cutting stainless with plasma arc cutters. Some say the spray of molten metal adheres to nearby metal, like the sides of your freshly cut kettle or keg. Others insist this is not true. In any case, protect any exposed surface with a noncombustible covering.

Assuming you consider yourself handy with tools, there are some special or different tools you will need for working with stainless steel.

Your stainless tool box: things that drill, cut, grind

Drills and a drill motor: The motor should have a low range of under 1800 rpm. While wood cuts best at high rpm, steel cuts best at 500 to 1,000 rpm. Because stainless is harder than mild steel, your drill bits should be titanium-coated or carbide. Unfortunately, they are more expensive than common high-speed steel (HSS) bits — which will work in a pinch on thin stock. But forget trying to drill through a converted keg with HSS bits. Buy individual titanium drills; we suggest 1/8-inch for pilot holes ($3 for two) and larger bits like 7/8-inch ($18) as needed.

Hacksaw: An ordinary hacksaw can cut stainless steel. Use a 32 tooth-per-inch (tpi) blade for thin stock up to 16 gauge (0.062 inch) and 24 tpi when the stock is thicker — between 1/16-inch and 1/4-inch — as with a coupling. Cut on the "push" stroke and do not drag or slip the blade on the reverse stroke. Instead lift it clear of the work.

Jig saws and "Sawzall" reciprocating saws also can cut stainless and require less effort. Again, use 32 tpi blades for thin stock and 24 tpi blades for thicker. Jig saws cost $30 to $150. Genuine Milwaukee Sawzalls are around $170; other reciprocating saws are $40 and up. Blades like RemGrit (carbide coated, 6- and 8-inch) cost $5 to $7. Ordinary 24 tpi metal-cutting blades are $10 for ten.

Files: A single-cut or double-cut mill file costs $5 to $7. Longer is better and you'll need to have several diameters of round files and half-round files.

Grinders: Dremel tools, pneumatic and electric die grinders, bench grinders and angle grinders can all perform the grinding chore. A bench grinder will cost $35 to $100; die grinders are $30 to $100 with pneumatic (air) grinders lowest in cost; angle grinders are $10 to $79; Dremel tools cost $30 to $50. Remember to purchase cutoff and grinding wheels reserved just for stainless.

Plasma arc cutters: Though you can use it for welding or brazing, you cannot cut stainless steel with a regular oxy-acetylene torch. For serious cutting, you'll want a plasma-arc cutter that generates up to 55,000° F heat. SSINA says that these "thermally cut" edges may be changed chemically and metallurgically. They add that "dressing is necessary so that impaired areas of mechanical and corrosion-resistant properties are minimized." In other words, grind it clean and let nature repassivate the surface. You're looking at $720 for an HTP MicroAir 125 with a built-in air compressor. Other manufacturers charge more.

Your stainless tool box: things that solder, braze, weld

Acetylene-air torches: These are familiar tools to plumbers. Hotter than propane or MAAP (methlacetylene gas; it burns hotter than propane), they use acetylene gas and air. Acetylene-air torches would provide plenty of heat for soldering (400° to 500° F) and perhaps enough for brazing (1000° to 1400° F.) They'll cost $100 to $190 and require purchase of an acetylene tank for another $60 to $200.

Oxy-acetylene torches: These cost anywhere from $90 to $400 new. This a great way to start joining metal. I recommend a kit from Henrob (Henrob 2000) because of its versatility. You can weld copper, aluminum and steel, and braze (but not weld) stainless steel and aluminum. The set comes with cutting and acetylene-air soldering attachments. Its special design operates similar to the shielding gases of MIG and TIG (for more on these acronyms, see below). A #1 tip will braze stainless like a dream. If you purchase oxy-acetylene welding equipment you'll have to buy tanks of gas for $60 to $200 each.

GMAW or MIG: Gas Metal Arc Welding or Metal Inert Gas welding (also called "squirt" or wire welding) is a good bet for stainless. MIG gets the "inert gas" tacked onto the "metal arc welding" name because a continuous flow of inert gas — argon, carbon dioxide, helium, hydrogen or a mixture — surrounds the weld. A good small unit requires 220V/30 amps and will cost upwards of $700. Some good 110V MIG welders, intended for sheet metal only, will work on 110V/25 amps and cost as little as $409 (the HTP America MIG 120) and will weld metal to 1/4 inch.

GTAW or TIG: This stands for Gas Tungsten Arc Welding or Tungsten Inert Gas. If you want to play in the brewhouse and make pretty toys, TIG is the holy grail. Learning TIG welding means school and practice. And until I researched this article, I thought it meant spending $1,200 minimum. Surprise! HTP America makes a tiny TIG welder that costs $400 (plus $60 to $160 for gas).

A beginners' guide: how to join stainless steel

Stainless steel can be mechanically fastened with fasteners, such as nuts, bolts, washers and screws. Be sure these fasteners are also made of stainless, to prevent corrosion. Stainless can also be soldered, brazed or welded. Each method has its own requirements, strengths and weaknesses.

Soldering

Soldering is a low-temperature joining process using an alloy — usually a mixture of tin, lead, antimony and sometimes silver — with a melting point around 500° F. Metal surfaces are usually dirty, so a cleaning mixture called "flux" is applied before heating. Flux melts before the solder and aids in its flow. Stainless steel can be easily soldered with familiar tools and techniques. All you need is a heat source, flux and the correct solder. All surfaces in the joining area must be cleaned thoroughly with a rag and any good solvent. If the surface is smooth, roughen it with sandpaper. Never use steel wool. For a heat source, a powerful soldering iron will do for joining small plates together, and perhaps even adding a fitting.

Stainless conducts heat more slowly than copper or steel and the iron should be held in contact with the joint longer. This ensures solder penetration into the joint. Heat is concentrated at the soldering point and stays there longer. So use a somewhat cooler iron; it will be more effective.

Silver-soldered joints are very strong in terms of sheer (think right-angle forces like cutting) but do not have the same structural strength offered by welding. The metal flows into and between surfaces, so if you are joining a 3/4-inch nipple to a thin 16-gauge pot, the only mechanical contact is that hair-thin 16-gauge circle.

Harris Welco, a welding-supply company, recommends two of its products for silver-soldering stainless steel, StayBright (430° F melting point) and StayBright 8 (535° F). Both are rated by the NSF (National Sanitation Foundation) for food-service use and require Stay-Clean liquid flux. Our limited experience says silver solder is effective, but may crack after a year or two of homebrewing service.

When soldering stainless you need adequate heat; MAAP gas might work, acetylene-air or oxy-acetylene is preferred. The surfaces must be absolutely clean and fluxed. If the flux flows and the solder doesn't, don't add more heat. Stop, cool the surfaces, reclean and flux again. It is surprisingly easy to overheat the metal; then it gets brittle and cracks or breaks.

Be sure the flux is a phosphoric acid, not a chloride-containing flux. Phosphoric acid fluxes clean up with water and are active only at soldering temperatures, 350° F to 550°F.

Brazing

Brazing is a higher-temperature metal-joining process. A brazing flux is applied to a filler rod of brazing metals (usually brass with other alloys, like silver) to aid in cleaning the surface chemically (oxide removal). The metals to be joined are heated to a glowing-red temperature and the brazing rod fills the gaps between the pieces. The melting point of the filler metal is typically above 840° F but less than the melting point of the metals being

This is the author's Henrob 2000 oxy-acetylene torch set. He's used it to weld mild steel and aluminum, braze and cut mild steel, and braze stainless.

For TIG welding, the best protection is a great welding helmet. This Speedglas 9000V instantly changes from the tint of sunglasses to the "look at the sun" darkness of a welding helmet.

The HTP Invertig 100 can do TIG welding as well as using regular coated rod. A kit includes the welder, a gas-fed torch, rod holder and gas regulator.

TIG is similar to oxy-acetylene welding or brazing; there's a torch head that emits gas, argon in this case, and heat is created by an electric arc.

HOW STAINLESS STEEL IS MADE

THE MATERIAL WE know as stainless steel was first created in the early 1900s, when scientists noticed that if chromium was added to steel, it didn't rust. Modern stainless steel is not made with the familiar Bessemer process, with open cauldrons and sparks shooting out of liquid fire. Instead it is produced in an electric arc furnace, where carbon electrodes contact recycled stainless scrap, raw materials, and various alloys of chromium, nickel, molybdenum and other exotic materials. Electricity is passed through an electrode and the temperature increases to a point at which the scrap and alloys melt.

The molten material from the electric furnace is then transferred into an AOD (argon oxygen decarbonization) vessel, where the carbon levels are reduced — stainless has a much lower carbon level than mild steel — and the final alloy additions are made to create a precise chemistry. The steel is cast, either into ingots or a slab, and then hot-rolled or forged into its final form.

Some material receives cold-rolling to further reduce the thickness; for example, it can be made into sheets or drawn into smaller diameters for rods or wire. Most stainless steels receive a final annealing (a heat treatment that softens the structure) and pickling (an acid wash that removes furnace scale created during annealing and also helps promote the passive surface film that naturally occurs).

—T.C.

joined. Brazing is our choice for homebrewers as it is simple, more people have the equipment and skills, and the cost is low if you own the equipment.

Harris Welco recommends a brazing rod containing 45 to 56 percent pure silver, plus copper and nickel. It produces a connection (a fillet) comparable to professional welding.

Harris Welco's SafetySilv 56 is NSF approved, and with stainless steel you want to use the Stay-Silv Black Flux. Regular white flux is for lower-temperature applications; stainless takes more heat to braze than copper or steel and the flux has a tendency to burn up because its active range is lower. Black Flux has a greater range and the alloy will "wet out" easily; it melts, cleaning and protecting the metals to be joined and promoting a good bond. SafetySilv 56 is a low-temperature brazing alloy — 1205° F melting point — making it easy to work with.

Welding

Welding actually melts both metals to be joined, creating a uniform union. (The melting for point for various metals ranges from 600 to 3300° F; 304 stainless melts at about 2600° F). Welding is the skill that separates normal homebrewers from really crazy ones. Why crazy? An hour of welding time at a good welder's shop is less than $50 and could encompass 5 to 10 projects if you're organized. Or the cost might only be a couple of cases of stout.

Learning to weld will cost you a term's worth of evenings, $40 to $200 in course fees, plus another $40 to $300 in lab fees, tools and specialized clothing. Then there's another cost for equipment. But if you can learn to weld, do. You'll never regret it.

Most trade schools and community colleges spend lots of time teaching gas and stick welding. But you cannot weld stainless with oxy-acetylene equipment and you can't weld thin stainless with stick and a buzz box. You must have either GMAW or GTAW, also known as MIG or TIG to most of us. If you have no welding skills, MIG is the easiest to learn. TIG more closely resembles the skills of traditional welding and is by far the most difficult skill to acquire.

Stainless School: Welding 101

Whichever welding method you choose to learn, remember that stainless steel conducts heat slowly and concentrates it in the weld zone. Chill bars (large chunks of similar-shaped copper plate) will help minimize heat-produced distortion.

To prevent internal damage (the flow of shielding gasses is only on the outside) you need to flood the opposite side of your weld with a neutral gas like argon. If you're welding a coupling into a kettle, run an argon gas hose into it, tape the cover on, tape all the cracks and then weld. This will minimize or eliminate oxidization on the opposite side of the weld.

If you're just beginning to weld, invest in a self-darkening helmet like those made by Speedglas. These wonders transform from the modest filtration of cheap sunglasses to a shade dark enough to allow you to look into a welding arc in thousandths of a second. Why would you spend $100 to $360 on a welding helmet when they're available for $50? Because it's safer and simpler. No more nodding your head violently to flip down a heavy helmet. No more striking your arc half an inch off target. The Speedglas 9000V (Variable) we tried could be adjusted from an "off" shade that was just dark enough for gas welding to a shade appropriate for stick, MIG or TIG.

MIG Basics

As the operator pulls a trigger to start feeding a wire electrode onto a metal surface, a valve opens and flows an inert gas around the soon-to-be-established electric arc. This cools the weld and prevents the creation of oxides — corrosion — in the weld puddle. This permits welding exotic materials like aluminum or stainless steel, where oxides created by breathable air will ruin or prevent a good weld.

Some companies, like HTP America, manufacture small rigs that work on 110V/25 amp current and some can be adjusted to weld even razor blades together. Don't be fooled by MIG welders that use flux-cored wire exclusively. You can't weld thin — under 1/2-inch — stainless steel with flux cored wires. Buy one that accepts or requires inert gas shielding.

MIG is the easiest welding to learn and novices can be making clean welds with good penetration (melting the metals together) in a matter of hours. A decent MIG, like the HTP MIG 120, will cost $410.

TIG Basics

Why is TIG the choice of professional stainless welders? Control. Like MIG, TIG welds are surrounded by a flow of shielding inert gas. Like oxy-acetylene welding, there is a "torch," an electric one that creates a high-temperature electric arc between torch tip and work surface. Expensive rigs have a foot pedal that controls the heat of the molten welding puddle by varying the amperage of the arc. They also have the ability to jump the air gap between torch tip and work surface for easier arc starting. So the operator has three things to control: foot control, welding rod and torch head.

The inexpensive HTP Invertig 100 ($399) uses a simpler method called "scratch start." The operator touches the metal to be welded with the tungsten electrode (torch tip). If he's lucky the arc will strike and the electrode won't weld itself to the surface. With a constant current, heat is controlled by moving the torch. The electrode is tungsten and is the point current flows from. Tungsten is the chosen metal because it doesn't melt. To add filler metal an operator feeds bare welding rod into the puddle. This requires skill.

The reason TIG is preferred is that you can weld aluminum, stainless steel or even titanium if you have the skill, the correct gases and the correct filler rod. Smaller, thinner welds put less heat into the welded metal and cause less problems with warping or changes in molecular structure that might lead to corrosion or cracking.

Harris Welco suggests that for welding 304 to itself or 316, you use a 308 stainless rod. Cost is minimal, a couple of bucks a pound. If you're thinking you might want to buy a welder, give the Invertig 100 its 90-day free trial. But only after you've got a diploma from Welding 101. ■

PUTTING IT ALL TOGETHER: A STEP-BY-STEP BRAZING PROJECT

As an example, we've torn apart the stainless-steel, no-weld hopback we made last month *(October BYO)* and installed two stainless-steel couplings. We chose to use silver brazing, a decision based on our lack of TIG welding expertise.


1

1. Enlarge the holes to accept the one-inch diameter stainless steel coupling. I used a Dremel tool.


2

2. Insert the coupling into the hole and support it from beneath with wire or a metal object (I used a tin can). Check that the coupling is vertical and horizontal; plumb at right angles to the surface. Then apply the flux. The black flux is easy to see on the reflective surface.


3

3. "Tack weld" (make small support welds) in two or more locations. The flame, and majority of the heat, is directed onto the thick coupling. Sufficient heat reflects down to heat the much thinner stainless steel and melt and flow the SafetySilv 56 rod.


4

4. Check for plumb after each tack weld, then complete the fillet. Brazing requires protection: I'm wearing dark goggles, gloves and protective clothing. Also note that I placed a large piece of ½-inch sheet steel underneath the vessel to absorb stray heat. Fire is always a danger; have two large extinguishers nearby whenever welding.

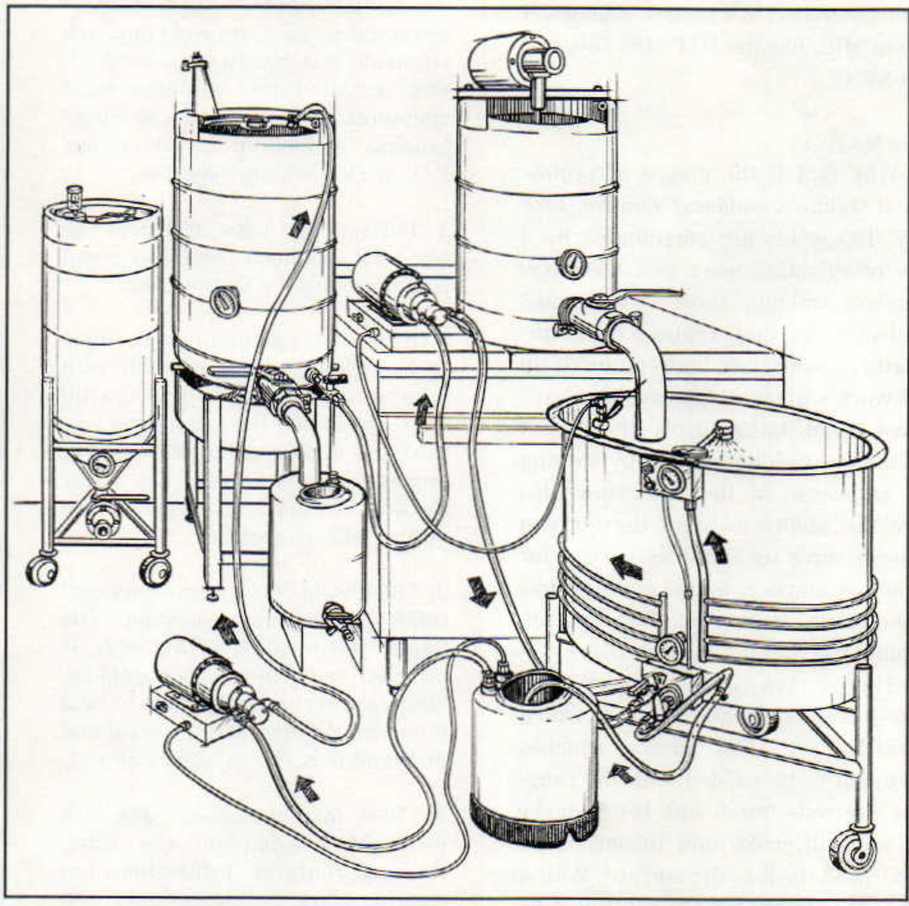

5

5. Our completed brazed coupling looks as good as a TIG-welded fillet and is just as sturdy and structurally rigid. When cleaned and polished it will shine. It is also non-porous, so it harbors no bacteria.

Knowing how to care for your stainless-steel brewpots and other vessels is crucial to making great beer. Cleanliness, as in all aspects of homebrewing, is an absolute. Understanding how to modify and improve your equipment is an exciting facet of the hobby, one that can make your brew day easier and shorter ... and help you create the beers you envision every time you pick up a glass. —T.C.

RANDY mosher

Chicago • Illinois



The Buckapound Brewery
This illustration depicts Randy's entirely self-made brewery (he drew the picture, too). The "hot side" of Randy's brewery consists of a mash tun, a lauter tun and a brew kettle. He also has a hopback and a grant, a small vessel used for draining and inspecting the mash when it's transferred to the lauter tun. Pumps bring hot water to the lauter tun and connect the grant to the kettle. Float switches control the flow of liquids. For example, when enough wort has drained from the lauter vessel to fill the grant, a float switch is tripped and a pump moves the wort from the grant to the kettle. Likewise, when the lauter vessel fills to a certain level of water, another float switch is tripped and the water from the brew kettle is turned off. This highly automated system allows Randy to sparge his grain bed unattended, which frees up time to clean carboys or do other brewing chores. Randy also built a 12-gallon unitank fermenter from an old milk can, but still uses carboys as well.

Randy Mosher started building his homebrewery around 1985. He began with an old Sankey keg that he modified to serve as a brew kettle. Since then his brewery has undergone many different permutations. Currently, he has a 15-gallon, three-vessel brewery with a separate mash and lauter vessel and boiling kettle. Numerous modifications make the Buckapound Brewery mostly automated.

A skilled welder and metalworker, Randy built all of the equipment himself and named his brewery Buckapound because that's exactly what he paid for it. Most of the equipment was built from scrap metal and parts that he found in junkyards and surplus shops.

Mosher describes his brewery as "overcomplicated, but that's the point." For Randy, fabricating his own brewing equipment is as much of a hobby as brewing is.

by Chris Colby

mash vessel

Randy's mash vessel is a modified keg. A large motor is connected to mash paddles that stir the mash. After mashing, the grain is released through a $1^{1}/2$-inch valve that Randy calls a "glorping valve." Even with a very thick mash, stirring reduces the mash to a consistency such that the mash will flow (or glorp) easily from the mash tun into the lauter tun when the valve is opened.

lauter vessel

The lauter tun is a large vessel with a false bottom. This vessel has a temperature gauge and a vacuum gauge. The vacuum gauge, which Randy modified from a gauge in a CPR dummy, measures the pressure at the bottom of the lauter screen. By watching this gauge Randy can judge if he is running off the wort too fast, especially in the early stages of the runoff. The outside of the vessel is covered with insulation.

brew kettle

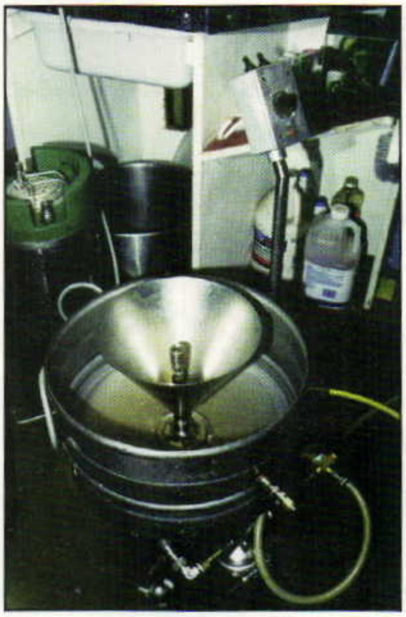
The brew kettle, another modified keg, is equipped with a light fixture to illuminate the inside. Since kitchen cookware often incorportates copper layers, Randy has joined copper to the stainless steel on the bottom of the kettle. The copper provides for a more even distribution of heat, which in turn reduces scorching of the wort. He used an aluminum-bronze TIG welding rod to join the metals.

hop percolator

To get hop aroma into his beers, Randy has built a hop percolator. This hopback vessel is made from a 2-gallon Cornelius keg. Inside of the vessel is a perforated stainless bucket, salvaged from a scrapyard, that holds the hops. Randy cut the lid off the keg and sawed a "Cornelius hatch" out of it, which he then welded to a new scrap steel top. The hatch allows access to the inside. Wort flows from the kettle, through the hop bucket, and out through the valve in front to the wort cooler. The hop percolator can also be used to filter boiling hops from the hot wort.

carboy

The carboy is perhaps the only storebought piece of equipment in the entire brewery. Although he has a homemade 12-gallon unitank fermenter, Randy sometimes still ferments in carboys.



clean-in-place vessel

The clean-in-place (CIP) vessel takes the drudgery out of cleaning carboys and Cornelius kegs. The CIP is a tank made from a used keg, with a pump mounted underneath. You fill the tank with hot water and cleaning solution and the pump forces it out through the spray valve. The water is recirculated and can be drained and refilled as often as needed. It can be used two ways: You either invert your carboys or Corny kegs onto it, or you can attach a hose for spraying larger vessels.

MORE GEAR for beer

by craig hartinger

Adding new equipment helps you make better beer, every time. Here's a quick guide to the gadgets every homebrewer wants.

roller mill for cracking grain

mash jacket for a kettle

brew kettle with false bottom

cooler mash and lauter tun

Adding new equipment to your homebrewery does more than just boost the economy and provide topics for magazine articles: New gear allows more control over your brew, saves time, reduces hassles and can allow you to try new variations or bigger batches. Often, new equipment can help you pinpoint a specific flavor and then duplicate it with confidence in future batches of homebrew. In order of the brewing process, here's the general range of goodies and upgrades.

GRAIN MILLING

Many of us are content to let the homebrew supplier mill our grain, whether it's a bit of crystal for an extract batch or seven pounds of pale for an all-grain ale. But barleycorns that have been milled will absorb moisture from the atmosphere, and the quality of the grist does degrade over time. So many choose to mill grain at home, right before the mash, for ultimate freshness.

Generic "cereal" grain mills produce freshly-cracked grist, but the milling pace is slow and the grain comes out with a wide variation of sizes — some of the grains sneak past without being cracked and others get pulverized too fine. The well-known Corona, which looks like a meat grinder and screws to the edge of a tabletop, can sometimes be found used for $20 and should be under $50 new.

A roller mill — most models are under $200 — produces a more even, regular grist by passing all the kernels between two rollers that are just a little closer together than the size of a kernel. There are also models that use one roller and one fixed plate at roughly half the price.

The regularity of the crack from roller mills will provide excellent extraction, and mashes will be easier to lauter because there won't be shattered pieces that can get gooey. In most models the gap between rollers can be adjusted to crack different grains — rye, for example, has a much smaller kernel than barley. Roller mills also can be motorized with a belt and an electric motor by the fully obsessive —

just look for a quarter-horse electric motor at your industrial supply. A good compromise is to tighten the chuck of your electric drill to the mill.

MASHING

For most all-grain brewers, their first mash tun is their brewkettle. First all-grain batches tend to be on the small side — 5 gallons yield or smaller — and a small mash tun will cool quickly due to its smaller mass. That's why a brewkettle makes a great starter mash tun — when the heat drops, it can go right back on the heat source. When the kettle is off the heat, a lid is vital to help keep the temperature from dropping too rapidly. After the mash, the brewer transfers the mash into a lauter tun, the vessel that strains the wort away from the grain husks.

An accurate thermometer makes mashing possible — the thermometer is popped into the mash frequently for readings. Glass "dairy" thermometers are accurate and less than a ten-spot in cost, but take up to two minutes to display the reading and can break if dropped. Dial thermometers show a reading very quickly and break less easily — if you have a chance, go for a large dial that you can read through wort-spattered, steamed-up eyeglasses. Some dial thermometers come with a clip for the edge of the kettle, so the thermometer can stay in the mash while the brewer uses both hands to stir or to move the kettle.

A four-gallon kettle, like the classic 16-quart enamel "canner," seems to be a common size for a first kettle, and brewers can yield 5 gallons from this size by boiling a concentrated wort. This size will be adequate to mash the grains for a 5-gallon batch, even if it's a high-gravity beer.

When the time comes for the first kettle upgrade, get one of at least 7.5 gallons to do a full-wort boil of a 5-gallon batch. This kettle could someday become your dedicated mash tun, even if you go up to a 15-gallon kettle. Stainless steel remains a great choice for toughness and ability to be welded; someday you will be likely to add a spigot through the wall.

Larger mashes hold their heat better. Brewers who reach the 10-gallon batch size, with a 15-gallon kettle, can usually get the mash to the proper temperature, then leave it alone for 90 minutes. But mashes for 5-gallon batches or smaller usually require some kind of insulation. Some brewers drop their kettle right into a Styrofoam insulated box. Others buy a ready-made mash jacket that covers the entire kettle.

A beverage or picnic cooler also works well. Add water and grain to a cylindrical or rectangular cooler, check the temperature and adjust, and close the lid. As you check the mash temperature over a 90-minute mash, you'll find that a 5-gallon batch will typically only lose three or four degrees Fahrenheit, even outside on a cool day. At the end of the mash period, transfer the mash to a separate lauter tun, like the bag or double-bucket lauter described below.

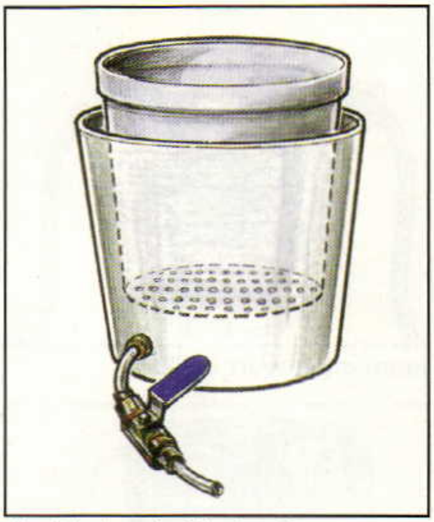
New equipment helps you pinpoint flavors and gives you more control over your beer.

LAUTERING

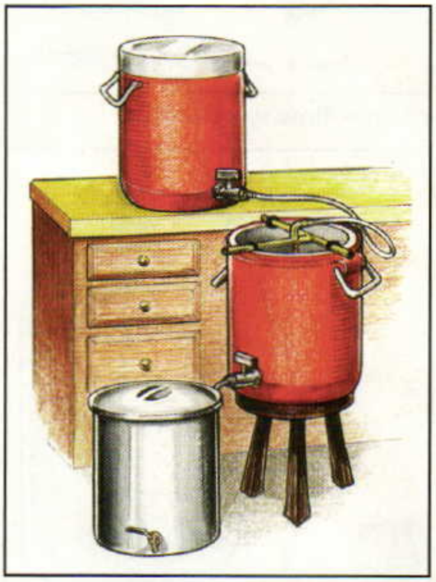
This process, in which wort is gently drawn off the barley husks, requires a grain vessel with some kind of false bottom. The false bottom is not really a filter — the grain itself acts as a filter — but it does allow wort to be drawn out the bottom as water is sprinkled on the top (a process called "sparging.") The simplest lauter tun is a mesh bag in a bucket, with a drain hole in the bucket; similar is a pair of buckets, nested, with lots of holes drilled in the top bucket and a drain hole on the side of the lower bucket. In each case, the brewer installs a hose with a shut-off clamp to control the outflow.

To use a bag-in-a-bucket or a double-bucket lauter, the brewer must transfer the mash to the lauter vessel. Apart from the mess, there are the real risks of aerating the mash and of dropping the mash temperature. Wouldn't it be nice to lauter right out of the mashing vessel?

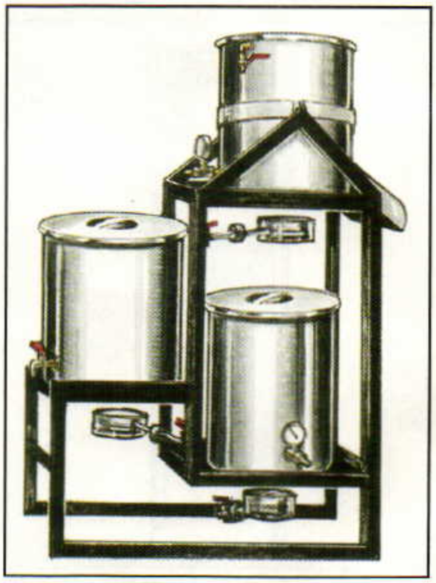
Mashers can do this easily: The



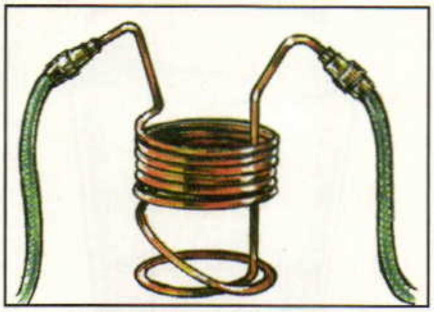
double-bucket lauter tun



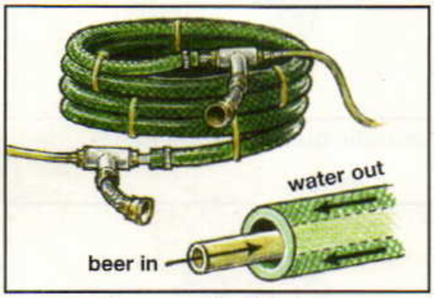
simple three-tier brew system



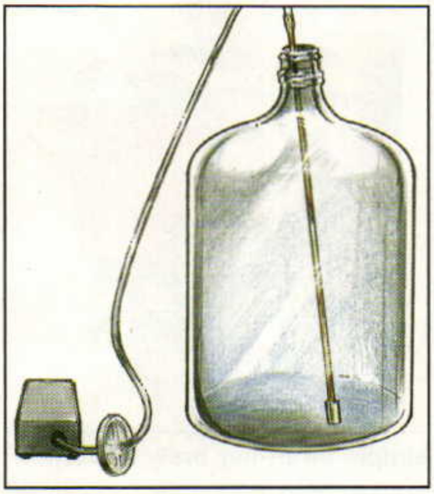
stainless three-tier brew system



immersion wort chiller



counterflow wort chiller



aquarium-pump aeration system

stainless-steel conical fermenter

mash vessel is insulated to retain heat during the mash, and the false bottom is built right in to the mash vessel. Then we call it a mash-lauter tun. Mash-lauter tuns with false bottoms, thermometers and spigots are readily available at many homebrew shops. There are both plastic and stainless-steel models available in various sizes and price points.

While obsessive mashers can build a double-walled mash-lauter vessel, they probably already have one at home. An insulated cooler, whether a cylindrical beverage cooler or a rectangular ice chest, is perfect. For a cylindrical cooler, Listermann makes a well-designed "Phil's Phalse Bottom" for both 5-gallon and 10-gallon sizes. The outflow hose goes out through the drain valve, although some brewers remove the valve completely to put in a larger outflow hose.

A very efficient false bottom for a mash-lauter cooler can be homemade from half-inch CPVC plastic piping (regular PVC is not designed for high temperatures). Get enough elbows, end caps and tees to build a four-arm "fork" in the bottom of the cooler, and the "handle" of the fork will lead out the drain. (Other configurations also work.) Make saw cuts every half-inch around the fork, about halfway through the pipe.

BREWING KETTLES

For the brewer looking to make only minimal equipment upgrades, a large kettle and a high-powered heat source are great choices. (Plus, they do great dual duty for a truly giant order of chili!)

The brewer making five-gallon batches with a four-gallon canning kettle has to make a concentrated wort – two to three gallons total boiled, with water added later. Some memorable beers can be brewed this way, but a brewer who steps up to an 8-gallon kettle (which leaves enough room to start with 6 gallons of wort and boil down to five) will reap several benefits: In a thinner, lower-gravity wort, hops are utilized more efficiently; the wort will clear better due to better protein coagulation ("hot break"); and you don't have to pre-boil and cool the makeup water (or worry about infection if you don't pre-boil).

Another enhancement to a large kettle is a spigot and ball valve. Spigots allow the brewer to use gravity to empty the kettle, a huge plus for somebody using a counterflow chiller and a requirement for using a hopback.

If you do move to an 8-gallon kettle or larger, your kitchen range will probably not have the horsepower to bring a boil in a reasonable time. An electric range may have a 10,000 BTU burner, while an outdoor cooker powered by propane might produce 100,000 BTU or even more. *(For more on burners, see page 32.)*

While many brewers don't feel a need to move beyond coolers and a kettle, a three-vessel system allows more control and options. Prefabricated three-tier systems range in price from a few hundred dollars maximum (for some coolers and a kettle) to $4,000 and beyond (for a deluxe, all-stainless model with digital controls). Briefly, the three-vessel system is:

1. A kettle with a heat source for sparge water and backup mash water. Only water will go in this tank — never grain or wort — and it is known as the hot liquor tank. A dial thermometer with a probe leading into the kettle shows water temperature. At the bottom is a spigot and valve that leads to some kind of sprinkler or "sparge arm" — a copper coil with holes, a rotating arm, a big old shower head — anything that keeps the stream of sparge water from disrupting the grain bed below.

2. The mash-lauter tun is the second kettle, positioned with the top edge lower than the bottom of the HLT and also with a burner underneath. This vessel will have a false bottom, in this scenario usually perforated stainless steel; it will also have a spigot and valve; and ideally it will have a dial thermometer to keep close track of the mash temperature.

3. Below the mash-lauter is the brewkettle, with a spigot. Ideally, the brewkettle output is still high enough above the ground to use gravity to get the wort through the chiller and into the fermenter.

The three vessels are all mounted on a framework strong enough to hold all the heavy liquids, sometimes with permanent gas and water piping attached. Fifteen-gallon kettles are about right for 10-gallon batches.

A quick word about a term that has entered the homebrewing world over the last few years: RIMS. A recirculating infusion mash system is a closed mash vessel system that pumps the mash past a heater and a thermometer. It is not exposed to air, so the risk of hot-side aeration is low, and the temperature can be kept very precise throughout the mash.

HOPBACKS

You know that great smell of late-addition hops? Did it occur to you that every whiff you get is hops that are leaving your wort?

A hopback offers a way to run newly boiled wort right through fresh finishing hops, usually right between the kettle and the chiller. The simplest option: Take a handful of hops and wrap it in a stainless-steel "Choreboy." Hold this down at the bottom of your kettle with the tip of your siphon, or put it right upstream of your spigot in the bottom of your kettle. A hopback can also be made from a square box of perforated steel, or can be made from a Mason jar and put outside the kettle before the chiller. A new ready-to-use hopback is also available *(see page 67)*. Hopbacks also serve to help strain some spent boiling hops and protein out of the wort.

WORT COOLING

The first way many brewers cool their wort is just . . . waiting for it to cool down. A bathtub full of icewater helps, too, and a snowbank is pretty good. But a real chiller provides regular control and time savings. There are two basic kinds, either of which can be bought or made.

An immersion chiller is a coil of copper tubing, usually 25 feet or more in length and commonly 3/8-inch diameter, that has a hose fitting on the "input" end and a loop that aims out of the kettle at the "output" end. The brewer attaches a garden hose upstream, throws the coil into the wort at the end of the boil for a couple of minutes to sanitize it, and then turns the heat off and turns the cold water on. The cold water flowing through the tubing will cool the wort fairly quickly — maybe from boiling to pitching in 15 or 20 minutes.

A counterflow chiller takes an additional step: Instead of running cold water through a tube immersed in wort, the wort runs through a copper coil that is jacketed by a larger flexible hose (sometimes a garden hose) that has cool water flowing in the opposite direction. The heat transfer is dramatic and efficient — by adjusting the speed of the water flow, the wort can be cooled to pitching temperature in the time it takes to run the whole kettle through.

AERATING WORT

After years of shaking carboys to mix vital air into the cooled wort, brewers now can actually purchase pure oxygen to bubble through their wort. The Oxynator works very well and consists of an oxygen tank about a foot tall, a regulator with a dial, a length of vinyl hose and a steel aeration stone with dozens of tiny holes. The stone is attached to the hose, sanitized and dropped into the cooled wort; the brewer opens the valve and pure oxygen bubbles through the wort. The Oxynator costs the better part of a hundred bucks, but will provide oxygen for dozens of batches and replacement tanks are available.

Some brewers use an aquarium pump and a stainless-steel aerating stone to pump air through the wort, but sanitation can be a challenge because aquarium pumps use room air. To improvise this aeration setup, just run the "out" line from the aquarium pump to an aeration stone, sanitize the stone and the portion of the line that will touch the wort, drop the stone in the wort and turn the pump on. Because air contains a little less than 20% oxygen, run it for five minutes total, and be ready to pause when the wort foams up. An inline air filter may reduce the chance of infection by airborne nasties.

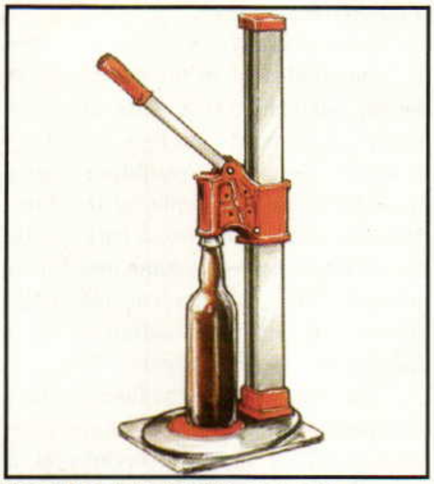
FERMENTATION

Covered plastic buckets have surely fermented some of the world's great beers, but glass carboys do offer the option of seeing the process and many brewers feel more confident about their ability to clean and sanitize glass. Move to a 6.8-gallon "acid carboy" for better yield and less volume loss due to blowoff. These 25-liter carboys originated with chemical suppliers, but homebrew shops often carry them.

The next step up in fermentation equipment, the cylindro-conical fermenter, offers fantastic options at a cost. They are a flat-topped, cylindrical vessel with a 60-degree conical base and some kind of legs or stand. They are filled with cooled wort through a port in the top, and they have at least one valve to run the finished beer out. They also have a port used to harvest yeast for storage or for the next batch. These fermenters are available in plastic for a couple hundred dollars, or in stainless for much more. If you're considering a stainless fermenter, educate yourself about what a "sanitary weld" looks like: all welds should be absolutely smooth and finished, so no micro-organisms or rogue yeasts can hide out in the cracks and avoid your sanitizing solution.

Every fermenter, by the way, should have a liquid crystal thermometer attached. These flexible adhesive strips cost only a few dollars and display the vessel's temperature within a couple of degrees Fahrenheit.

Some brewers cherish a dedicated fridge for lagering (or serving) beer, and most homebrew shops stock temperature-control devices that will allow the brewer to set temperatures different than the typical range on a fridge or freezer — if a lager yeast wants 56° F, a standard fridge will be unable to run that high. The item usually costs less than $100 and typically consists of a temperature probe, a control box with a setting dial and a plug. The brewer just sets the desired temperature, puts the probe inside the fridge, closes the door over the wire, and hangs the box outside the fridge. The fridge is plugged into the device, which in turn is plugged into the wall. When



bench-style bottle capper

keg, regulator and CO2 tank

the compressor in the fridge brings the temp to the desired spot, the gizmo shuts off the compressor.

TOOLS AND GADGETS

While a mash tends to land in the correct pH range naturally, a digital pH meter comes in handy. Because mashing and brewing water from different classic regions does vary, some brewers alter the pH of their brewing liquor and of their mash to brew different styles. Disposable test strips are available, but they aren't as accurate and the range they measure is not as wide.

A hydrometer is pretty much a necessity to fine-tune your technique and reproduce great beers, but consider the professional set that comes as a pair: One might read up to 1.060, and the other from 1.060 to 1.130 or so. They are a delight to use because the demarcations are so wide that you can really tell 1.048 from 1.049.

A steel or copper racking cane brings some nice options to brewers: They can be used to rack (siphon) right out of a hot brewkettle, for those who want to use a counterflow chiller but don't have a spigot in their kettle, and they also can be sanitized with heat, unlike a plastic cane. And don't forget to replace your vinyl siphon hose frequently, because it can harbor microorganisms that could lead to nasty flavors.

A microscope may be the one tool that brings yeast and brewer to final intimacy. You may know your favorite yeast's habits, temperature range, smell and taste ... but have you ever actually seen a yeast cell? The experience of viewing a yeast cell may not be worth the price of a new, lab-quality microscope for most brewers, but keep an eye peeled at garage sales. A microscope is an important piece of equipment if you want to culture yeast at home; you can check the health of your yeast cells and also look for wild yeast, bacteria and other contaminants.

PACKAGING

For bottling, brewers can choose between the inexpensive wing capper (easy to store, and less than $20 sometimes) or a bench capper. The bench capper has a time-tested design that allows one-handed operation — the other hand can move the bottle into the case and reach for the next candidate. For the brewer who bottles many bottles, the bench capper will save time. A bottle-drying rack will also help with speed, because the brewer can easily reach empty bottles when the beer is flowing and is less likely to knock over bottles. Many brewers also use a bottling bucket with a spigot, because they don't have to start a siphon that way.

For the brewer who decides to go draft, Cornelius kegs are a popular option due to ease and availability. Kegging systems require a CO_2 tank; a regulator with at least one gauge to show keg pressure (and a second gauge which shows pressure in the reserve tank can be vital — an empty tank that causes the beer to stop flowing can be somewhat of a party-killer); at least one keg (realistically, start with four); plus a beer line, gas line, a "cobra head" tap to dispense from, miscellaneous disconnects and hose clamps. As you look at kegging systems, be aware of several things: one, there are two basic styles of keg-connecting systems (ball-lock and pin-lock) and they are definitely not interchangeable; two, replacement parts for kegs are not cheap and a super-cheap dented keg is no bargain if all the parts need replacing; and three, you may not have a way to cool down the keg before drinking it unless you have a dedicated beer fridge. The setup cost could rise to hundreds of dollars, but over the years the time saved pays the investment back dramatically.

Bottles and kegs both work well as storing and serving vessels, and counterpressure bottling (bottling right from the keg without losing carbonation along the way) is great as long as the brewer is doing enough bottles to make the setup worthwhile. A counterpressure filler can range from $70 to a couple hundred dollars and requires some practice to use properly.

Mini-kegs offer another slick packaging option. These come in a few models, from the 2.25-gallon Party Pig (an oval plastic dispenser with a self-inflating pressure pouch) to little metal kegs that hold 1-1/3 gallons and use either air pumps or carbon-dioxide regulators to dispense (and sometimes carbonate) the beer. These will run you less than $50.

It sure is nice to be able to easily and quickly put some CO_2 on top of a two-liter bottle of beer that you are taking to a neighbor's house. The Carbonator is a one-way valve that allows the brewer to quickly purge the air out of a clean two-liter pop bottle, fill it with beer from the tap, and put some pressure back on top of the beer. It keeps the beer great for up to a day or so, is fast and easy to use, and sells for less than $20.

Whether served from a bottle or a keg, remember the final important brewer's tool: the glass. And after all the money you just spent upgrading your home brewery, you definitely deserve a well-poured pint. ■

Crystal Tips

Add flavor and color with this versatile malt

by Chris Colby

PHOTO BY IAN MACKENZIE

Crystal malts are made from barley grains that are steeped and germinated, then stewed and kilned.

One of the simplest ways to manipulate the flavor of your beer is to use crystal malts. Crystal malts are specialty grains that add flavor and color to any brew. These malts are used in many beer styles, from pale ales to porters, and are the most widely used type of specialty grain. You can use crystal malt no matter what type of homebrewer you are — extract, partial mash or all-grain.

Adding crystal malt is a common way to add a sweet flavor to beer. The sweetness of crystal malt has distinct caramel tones to it. For this reason, crystal malts are sometimes called caramel malts. Crystal malt sweetness is a key characteristic of several styles of beer, most notably in pale ales and related styles. Other sweet styles of beer, such as Scotch ales or milk stouts, employ other methods to achieve their sweetness, including yeast choice and adding sugars that brewer's yeast cannot ferment.

Crystal malts also add color to your beer. Crystal malts are rated according to their color depth. This is usually expressed in degrees Lovibond (°L). Crystal malts range from 20° L to around 200° L and the most common crystals are in the 30° to 40° L range. Pale malts, by comparison, are usually rated between 1.5° and 3° L, while chocolate malts are rated around 350° L. On the low end of their color range they look only slightly darker than pale malts. As you move up the color range they appear more reddish. The darkest crystal malts are nearly brown. The color of the crystal malt is a function of how it was prepared.

How Crystal Malt is Made

Crystal malts are made from barley grain in a process similar to that of making pale malts. As with pale malts, the grains are steeped and germinated. Unlike pale malts, crystal malts are then stewed — they are heated in a closed system that doesn't allow moisture to escape. As a result, the starch interiors of the barley grains are broken into sugars by amylase enzymes in the barley. After stewing, the grains are kilned. Kilning dries the grain, darkens the husk and caramelizes some of the sugar inside.

Recipe Formulation

Crystal malt is used in many styles of beer. The amount of crystal malt used varies with the style of beer. Pale ales, bitters or ESBs may contain up to 20 percent crystal malt. For example, a beer may be made with ten pounds of grain, two pounds of which are crystal malt. Lagers such as Octoberfests or Vienna lagers may contain up to 15 percent crystal malt. Darker ales, such as porters and stouts, may also contain crystal malt along with more darkly roasted grains. See the box *(at right)* for some helpful guidelines to using crystal malt.

The more crystal malt used in a recipe, the darker the color. Since crystal malts are commonly rated in degrees Lovibond, you can calculate how much color you are adding to your beer. To calculate the amount of color contributed by the crystal malt, use the following formula:

HCU = [weight (lb.) x color rating of grain (°L)]/volume of beer (gallons)

HCU stands for homebrew color units. HCU is weakly correlated with SRM. SRM stands for Standard Reference Method, which is the unit preferred by the American Society of Brewing Chemists for measuring the color of malt or beer. *(For more on SRM and Lovibond, see "Homebrew Science" on page 57.)* For beers that measure from zero to 10, the two color measures — HCU and SRM — are roughly equivalent. For beers over 10 on either scale, the HCU value will be higher than the SRM value. As a rough guide, a dark brown beer with 50 HCUs added would typically have an SRM of 20. Measuring actual SRM requires the use of a spectrophotometer.

HCUs only measure the amount of grain color added to your beer. But

Typical amounts of crystal malt used for 5 gallons of beer

Style of beer	Amount of crystal malt (lbs.)
Pale ales	0 to 2.0
Brown ales	0 to 2.0
Porter	0 to 1.5
Stout	0 to 1.5
Bock	0 to 3.0
Octoberfest	0 to 1.8

Notes: These are typical values compiled from numerous homebrew recipes found in books and on the Internet. A minority of brewers use more than the amounts given. For some styles, such as porter and stout, other specialty grains are used along with the crystal malt.

many things that affect beer color do not enter into the HCU equation. For example, extended boil times darken the wort. Oxidizing hot wort will also darken it. In contrast, fermentation decreases wort color. Also, different mash or steeping conditions will extract different amounts of color from the grain.

Another limitation of HCUs is that they only measure the amount of color, not the hue. So calculating HCU does not tell you everything you might want to know about color. However, HCU is useful as a relative measure of color among your own beers. If you use the same equipment and brewing procedures the other variables should cancel out and beers with higher HCUs will be darker than beers with lower HCUs.

Using Crystal Malt

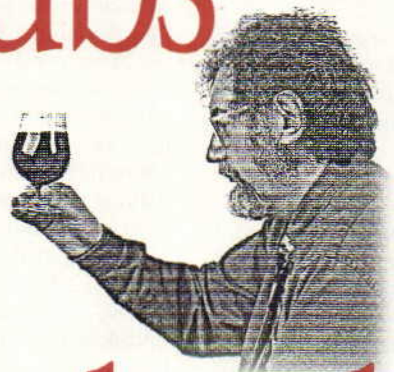
The first step in using crystal malt is to crush the grains. If you don't have a grain mill, have your homebrew shop do it for you. If you do have a mill, the simplest way is to crush the crystal malt along with any other grains you are using. Be aware that the kernel size of crystal malt may be smaller than that of pale malt. If it isn't getting crushed sufficiently, crush it separately. Your goal is to break the grain into pieces, not grind it into flour.

Extract brewers can steep the crystal malt in their brewing water. To do this they should place the crushed grains in a nylon grain bag and heat their brewing water to between 150° and 160° F. The grain bag can then be steeped for 15 minutes. It's a good idea to stir the water every five minutes or so to move color and sweetness out of the bag and into the brewing water.

Once the 15 minutes of steeping are up, lift the grain bag out of the pot with a large kitchen strainer. Hot water from the pot can be poured into the grain bag to rinse out the (slightly) higher concentration of sugar and color from the grains. If you really want to extract all you can from the grains, rinse the grain bag with 170° F water. One quart of hot water should suffice for this. Once the grains are rinsed the bag can be set aside and brewing can proceed as normal.

Homebrewers use different variations of the steeping procedure. For example, some prefer to steep their specialty grains in hot wort rather than hot water. These brewers claim that steeping crystal malt in wort extracts less color and flavor than steeping in water but that the flavor is smoother and less astringent when the specialty grains are steeped in wort. To my knowledge, no data has ever been presented to support this view.

Likewise, different homebrewers use different rinsing techniques. Some homebrewers prefer to rinse their grains with cold water instead of water at 170° F. They claim this cuts down on the amount of starch extracted from the grains. If you are using more than a pound of crystal malt, or have had problems with cloudy beer, you might



try this. Some homebrewers skip the rinsing step altogether. If you swirl the bag around a few times in the water before removing it, most of the color and sweetness will be extracted. Adding a little bit (perhaps 5 percent) more crystal malt may compensate for a lack of rinsing.

Adding crystal malt to a partial mash or all-grain brew is even simpler than it is with extract beers. Just mash the crystal malt along with the rest of your malt and brew as normal. When mashing, enzymes from the pale malt should degrade any starch from the crystal malts, so worrying about extracting starch is not a problem.

Incorporating crystal malt in your beer recipes is a simple way to add color and flavor to your brews. For more information on crystal malts, see "Crystal Chem" on page 57. ■

Chris Colby has earned a doctorate in molecular evolution and population genetics from Boston University.

Crystal Pale Ale
(5 gallons, partial mash)
OG = 1.048 FG = 1.012 IBU = 28

Ingredients
1 lb. pale ale malt
1 lb. crystal malt (30° to 40° Lovibond)
3.75 lbs. light dried malt extract (unhopped)
12 AAUs Northern Brewer hops (1.33 oz. of 9% alpha acid) (bittering)
6 AAUs Cascades hops (1.2 oz. of 5% alpha acid) (flavor/aroma)
American Ale yeast (Wyeast 1056) or California Ale (White Labs WLP001) (yeast starter)

Step by Step
Crush pale malt and crystal malt together. Place the crushed grains in a nylon grain bag. Heat 3 gallons of water to around 160° F and steep the grains for 30 minutes. Do not allow the temperature to drop below 150° F. Remove the grains with a large kitchen strainer. Rinse the grains with 2 pints of water at 160° F, then discard the grains.

Use a fine kitchen strainer to remove any solids in the brewing water. Bring brewing water to a boil. Shut off heat and stir in the malt extract. Boil wort for 1 hour. Add bittering hops with 45 minutes remaining in the boil. Add flavor/aroma hops with 2 minutes remaining in boil. Add about 2-1/2 gallons of cold water to your fermenter. Add hot wort to cold water in fermenter and top up to 5 gallons if needed. Aerate cooled wort and pitch yeast starter.

Ferment for 7 days at 68° F. Rack beer to secondary fermenter and let sit for an additional 7 days. Bottle beer and let bottles sit for two weeks at room temperature. Refrigerate bottled beers for another week before drinking.

Crystal Chem

The science behind our favorite specialty grain

Homebrew Science

by Steve Parkes

PHOTO COURTESTY OF BRIESS

Crystal malt pours out of a ball roaster into the cooling container.

As a young brewer I fell in love with the aroma and flavor of crystal malt. The rich caramel aroma released as the crystal malt hit the hot water was a daily reminder of why I wanted to be a brewer. As I began to gain more brewing experience I learned how to use this malt with more skill. I realized that along with rich, deep ruby colors comes intense caramel flavors, and that balancing the two was the key to a drinkable beer.

Before diving into science, it helps to have a few definitions. Here are the main types of crystal malt available to American homebrewers.

Crystal malt: This is the British term for saccharified and drum-roasted malt. It can be roasted to different degrees to provide a range of colors. The most common range used in the UK is 70° to 80° Lovibond, which tends to produce deep red colors and a strong caramel flavor. These malts may be marketed as light, medium and dark crystal. They are used in pale, amber and dark ales and lagers, and leave a beer tasting sweeter.

Caramel malt: The American term for crystal malt. American producers tend to market these malts by their Lovibond rating. The most common colors used in the U.S. are 30° to 40° Lovibond, but this statistic is skewed because it includes all the caramel malt used by the big commercial producers, who use it in paler, milder-tasting beers. It's typically used in pale, amber and dark ales and lagers.

Carapils: This malt ranges in color from 5° to 15° Lovibond. Carapils is used to provide light color, body and improved foam to lightly colored beers. (Briess in Wisconsin makes a caramel malt with a color of less than 2° L, which is a unique product. I used it at around 5 percent in a pale ale to provide excellent body and foam retention but no color). Above 10 percent carapils imparts a distinctive, almost grainy flavor. Some brewers use it in low-alcohol or light beers, in which increased body and foam is needed to counteract the thinness and low flavor.

Caravienna: A darker, German-style crystal malt in the 20° to 30° Lovibond range. Used for amber lagers and Vienna-style lager beers.

Caramunich: A darker German crystal malt in the 50° to 60° Lovibond range. Used in dark German lagers.

Almost all the world's malting companies offer either one, or a range of, crystal malts. Some companies have succeeded in trademarking specific products they developed. This means other maltsters producing similar malts must use different names. There are many competing trademarked varieties produced by the world's maltsters, but they mainly fall into the categories listed above.

No matter what you call them, all of the caramel-crystal-cara malts are used by brewers to provide a variety of qualities to their beers. They contribute caramel, toffee, nutty, spicy and sweet flavors. Melanoidin compounds — highly colored, high molecular weight compounds produced during roasting — contribute colors ranging from a slight reddish hue, through ruby red, to a reddish brown. They contribute mouthfeel and palate fullness to a beer, help foam formation and retention and aid flavor stability. Although crystal malt contains reductones — a class of caramel-type products that are capable of absorbing oxygen in their reduced state — and are thought to act as anti-oxidants, extending the flavor stability of beers, research has failed to show a direct correlation. It may be that beers containing crystal malts contain flavors that mask the effects of oxidation.

Lovibond and SRM

The method used by professional brewers and maltsters to measure beer and grain color involves producing a standard wort from the malt and then measuring the amount of light the wort absorbs using a spectrophotometer. The resulting absorbance figure is reported in Standard Reference Method (SRM) units or their equivalent degrees Lovibond.

Joseph Lovibond was a brewer who, in the early 1920s, developed a system of standard color hues for assessing beer quality. It was known that the "best beer" had a golden-amber color and that as beer aged it picked up red hues. Lovibond attempted to quantify this change using a device he invented, called a tintometer. In actual fact, it's simply a measure of the amount of light absorbed by a wort or beer at a wavelength of 430 nanometers. This doesn't really tell us much, other than "what shade of yellow" the wort is. With our eyes we perceive wort and beer as a range of colors, from pale yellow through reddish brown and black, so the Lovibond scale has its limitations.

The figure quoted in a malt analysis refers to the color of an 8° Plato (1.032 SG) wort made from that malt. When calculating the color contribution that malt will make to the color of the wort, an adjustment must be made for the °Plato of your wort. Here is the calculation:

Color contribution = malt color x % of total extract from that malt x wort gravity / 8.

For example, the color contribution from using 14% crystal at 75° Lovibond in a wort at 14° Plato (1.056) would be: 75 x 0.14 x 14/8 = 18.4 L.

If you don't use Plato units, this calculation can still be used, but a change must be made to account for specific gravity degrees. The standard wort is produced at 1.032, and in the example above, the brewery wort was produced at 1.056. Just use the last two figures to provide the correct ratio (56/32). So the new calculation would be 75 x 0.14 x 56/32 = 18.4 L.

The brewing process can influence the final beer's color, however, so allowances must be made when formulating your recipe.

Color can be increased by:

- High mash pH.
- Boiling a portion of the mash.
- Maillard reactions in the kettle.
- Direct flame on the boil pot.
- Excessive oxygen pick-up during boil.
- Boiling with old or stale hops.
- Yeast cropped from dark beer, re-used to ferment a pale beer.
- Oxidation during beer storage

Color can be decreased by:

- Good kettle break.
- Cold break removal.
- Some yeast absorb color compounds.
- Short aging followed by filtration.
- Adding water

Maillard Reactions

This is the name for the chemical reactions that result in the colors and flavors associated with crystal malts.

The entire class of reaction, named after the French scientist who did much to unravel them, occurs in a wide range of food products, from baked-bread to cured meat. Essentially, it is a chemical reaction between an amino acid and a reducing sugar. An amino acid is a naturally occurring acid that also contains a reactive basic amine group (this means it contains nitrogen). There are 20 different amino acids found in nature and they polymerize to form proteins. A reducing sugar is a simple sugar that has a reactive site available to take part in a chemical reaction. Glucose, fructose and maltose are examples of reducing sugars, while sucrose (household sugar) is not.

Under certain conditions, these classes of compound will combine in a wide variety of ways. The resulting compounds belong to a class of compound known as Schiff's bases, a class that also contains certain perfumes, dyes, rubber accelerators and liquid crystal display ingredients. These

Schiff's bases will then undergo a number of re-arrangements, known as Amordi rearrangements, to form aldosamines and ketosamines, followed by further polymerization reactions and breakdowns to form a class of compound we have recently begun referring to as reductones. Reductones are capable of absorbing oxygen and so may offer beer some protection against oxidizing agents. Some reductones will undergo further reactions with amino acids, known as Strecker degradations. These result in Strecker aldehyde compounds, which are important to malt flavor. These compounds include hydroxy-methyl-furfural and maltol, described as smelling "malty." Other reductones undergo condensation reactions with amino compounds to produce melanoidins and flavored compounds. These flavored and aromatic compounds include oxygen-, nitrogen- and sulfur-containing heterocyclic compounds, the exact flavor contributions of which are yet to be unraveled, but include caramel, nutty, toffee and burnt. Over the range of temperature and moisture conditions found in a barley kernel stewing in a drum, a range of these aromatic and colorful compounds will be formed. The exact flavors that result from each reaction is still a subject of conjecture among scientists. What is known for certain is that the oxygen containing heterocyclic compounds provide crystal with caramel and toffee flavors, while the nitrogen-containing heterocyclics tend to be nutty, coffee and roasted.

Caramelization

This term is used to describe a specific type of reaction in which reducing sugar is heated. The sugars lose water molecules from their structure, forming double bonds within the molecule and altering the way light is absorbed and darkening the color. Taken to its extreme end, the molecule will break down completely to carbon, which is black. Commercial brewer's caramel is produced by boiling reducing sugars in the presence of ammonia, which is essentially a Maillard reaction. These reactions occur in the roasting drum and the malt kiln and contribute greatly to the flavor and color of malt.

Crystal and caramel malt is made in such a way that these reactions are multiplied. First the concentration of the pre-cursors, amino acids and reducing sugars are increased dramatically. The easiest and quickest way to do that is by raising the temperature of the grain to the temperature encountered during mashing and leaving the moisture content of the grain high. This makes a little "mini mash" inside each grain, resulting in a huge increase in sugars and amino acids. The grain is then heated to encourage a range of Maillard and related reactions inside each kernel of malt.

How crystal malt is made

The process begins with selection

of barley. Higher-protein barleys are preferred and the malt variety can make a difference to the final flavor.

In the USA, thinner six-row malt grains are often used for caramel malt production, although some American maltsters now are offering caramel malts made from two-row barley. The advantage of this is that the malts need not be milled separately. Far more important than plumpness is uniformity of kernel size and nitrogen content. To achieve a consistent product out of the roasting drum, a consistent raw material must go in. As Mary Anne Gruber of Briess Malting puts it: "One fat kernel will be underdone, while a thin one will be burnt." Green malt is sent straight from the germination chamber to the roasting drum, rather than the kiln, at a moisture content of 43 to 46%. The roasting drum resembles a commercial coffee roaster — it's a large rotating drum with an inner compartment made of screen that allows hot air to pass through the contents. The malt is heated immediately with the vent open to dry off the surface of the grain, then the drum is closed to allow the temperature to rise without the moisture dropping further and the temperature is raised to 149° to 158° F. At this temperature, enzymes quickly break down the endosperm to produce a lot of reducing sugars and amino acids. A sample taken from the drum at this point will show a kernel that when squeezed yields a sweet liquid. Depending on the type of product, and the maltster, the temperature may be suddenly or slowly increased to the desired temperature to produce the specific flavors and malt color desired. The final temperature of the highly-colored products may be as high as 320° F, while a low-color caramel malt, such as carapils, will be dried slowly at 130° to 140° F. The malt is then quickly transferred to a cooling container to prevent further color pickup. In an emergency, maltsters can rehydrate kilned malt to produce crystal malt. This would be a fun option for advanced homebrewers keen to produce their own crystal.

Color range and malt specs

Caramel malt is sold in a wide color range, from 10° L to 140° L. Each malt within that range will have a color range of its own. In the low-colored malts (10° to 40° L), the range may be 2 or 3 degrees units on either side of the stated value. As malt darkens, the range increases to 10 units between 40° to 80° L and to 20 units as the malt reaches the 100° to 120° L range.

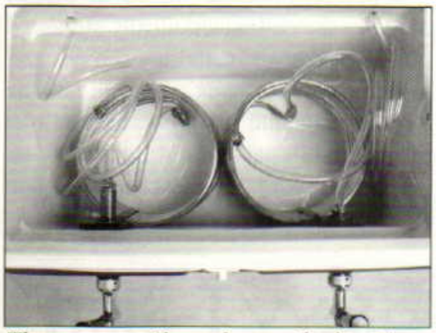
It may seem that the final color is difficult to control. This is true! And since maltsters sell their product based on color, one may be tempted to assume that they blend darker or lighter malts to adjust color. However, the roasted flavors of the darker malts are intense and will interfere with the overall flavor contribution. So maltsters deserve some leeway with their color ranges. ■

Jockey Box

Warm beer from a keg to cold beer in a glass

by Thom Cannell

The finished jockey box (exterior view), complete with two tap handles.



The copper coils exchange the heat in the beer for the cool of the ice water.

Some parts you'll need: a 50-gallon cooler, spigot parts, fittings and tools.

Forming a coil is easy: Just loop the copper around a carbon-dioxide tank.

By the time this story arrives in your mailbox, I'll be gearing up for the annual Oktoberfest party thrown by a local homebrew group. I hope my Fest Brew will capture an honorable mention or better, but I also plan to impress the heck out of everyone with the latest *BYO* project, a homemade jockey box.

What's a jockey box? Ever had beer at a picnic or sporting event that poured out of a picnic cooler with tap handles mounted on it? Inside was a coil of stainless-steel tubing immersed in ice water. That coil exchanges heat in the beer for the cool of the 32° F ice water. Given a sufficient length of tube, you can deliver 40° F beer when the keg is at room temperature. So a jockey box — also called a draft box — is an ice chest with a heat exchanger, taps and beer inlet.

Coils can be made of stainless steel or copper. Copper is easy to find, easy to work with and inexpensive. Stainless-steel tube is none of those, but is preferred because it will not contribute metallic off-flavors to your beer and can be thoroughly cleaned with industrial-strength solutions. Copper, a "soft" metal, requires milder cleaners.

For our project we'll construct a double-tap version built with copper tube. If you choose, you also can make this jockey box from prebent stainless coils. Whether you use copper or stainless, the same construction steps apply.

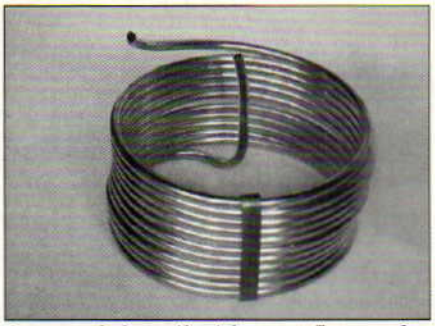
Several homebrew suppliers offer premade stainless coils in 50- to 100-foot lengths. While it seems high, the price ($75 and up) is reasonable when you consider the raw cost of stainless, which runs about 80 cents per foot). Forming a coil may be cheap, but turning corners so the ends are where you need them is not.

When planning your jockey box, you'll need to consider a problem that anyone familiar with beer has experienced: too much foam when the tap is opened. Foam is the result of gas coming out of your beer when pressure changes from high to low. As beer leaves the bottle or exits a beer tap, the gas tries to escape the liquid and is trapped by protein molecules. Some foam is good, but when too much gas tries to equilibrate, there's too much.

Now that I'm kegging, I've been wondering how to stop the problem. My bottle-conditioned beers never had too much foam, so why does my kegged beer gush? The answer is contained in one word: resistance, a subject covered in detail at www.morebeer.com in the "Frequently Asked Questions" area of the Website. Briefly, when considering a properly carbonated kegged beer, the length and kind of tubing between tap and keg is crucial to achieving a proper amount of foam. The chart on page 65, reprinted from www.kegman.net, explains that the total resistance should equal the desired level of carbonation. If your kegged beer is carbonated to 10 to 14 psi (pounds per square inch), the total resistance of all the tubing between the keg and the tap should equal 10 to 14 pounds.

In dispensing beer at home, 5 feet of 3/16-inch plastic beer line will give us the required resistance (5 feet x 2.7 = 13.7 pounds), but what happens when we need five feet of beer line plus 50 feet of metal tube? Fifty feet of 1/4-inch metal tube, for example, would create a resistance of 100 pounds. The answer is larger tubing or more pressure. More pressure will push the beer through, but applying 30 or 40 psi of pressure will over-carbonate the beer.

For our project, we calculated that 25 feet of 3/8-inch (outer diameter) stainless-steel tubing — we're assuming copper has a similar 0.20 pounds of resistance per foot — would offer 5 pounds of resistance, and 6 feet of 1/4-inch (inner diameter) vinyl tubing would add another 4.2 pounds of resistance. Connecting our coil to the tap



I secured the coil with some flattened scrap tube bent tightly over the stack.

Measure the height and left-right distance to evenly place your spigots.

with one foot of 3/16-inch beer line (another 2.7 pounds of resistance) could give us the right resistance for our carbonation — 9 to 12 psi (5 + 4.2 + 2.7 = 11.9 pounds of resistance.)

That's a great calculation. But it is impossible to get 3/16-inch beer line over a 3/8-inch barb fitting. So our project uses 10 feet of 5/16-inch inner-diameter beer line (8-1/2 feet from keg to coil and 1-1/2 feet from coil to spigot). Unfortunately, that gives only 5.7 pounds (1.7 + 4) of resistance.

One answer is to substitute "X" feet of 1/4-inch tube — however much you need — between coil and tap. Also, 1/4-inch x 3/8-inch double-barb adaptors or "splicers" are available for about a dollar apiece. Stepping down in tube size between coil and tap helps prevent foam. The connection from coil to short hose should be done with a splice.

Making your coil

For my two copper cooling coils, I used 3/8-inch outer-diameter tube. This choice was based on calculations, and because I couldn't find 5/16-inch tube. I made two coils because I wanted to build a two-tap jockey box.

Forming a coil is easy. To avoid flattening the tube, simply take care not to pull too hard when wrapping your tube around a cylinder. The other approach is using a commercial tubing bender, which will cost under $20. I chose to wrap tubing around a form chosen to fit easily inside the cooler. I used a CO_2 tank as my form. I simply looped the big coil around the cylinder and started wrapping.

To secure the completed coils I hammered a bit of scrap tube flat, then formed a bend with the correct radius and slipped it over the coil stack. Then I bent the other end up to fit tightly, making the coil mechanically stable.

Commercial coils may have the inlet and outlet ends raised to similar levels. We could have just hacked our copper coil apart like a big Slinky or spring, leaving the inlet pointed one direction at the top and the outlet another at the bottom. Since we will be connecting the outlet (beer out to the glass) to the barbed fitting of the tap with flexible tubing, there is no need for an exact positional match. If you wanted to use flare or compression fittings and mate coil to spigot, you would have to accurately place the outlet side of your coil at the correct height and position to mate with the tap inlet.

For our inlet (beer in from the keg) that passes through the cooler wall, again we can rely on flexible tubing. I bent the bottom coil up to the top of the coil to insure that the coil couldn't sit on the soft plastic tubing and pinch it off. Use a tubing bender — spring-type or other — or you'll kink the tube.

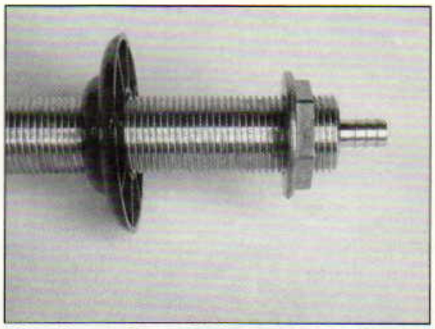
Another concern is "right or left twist," a feature of commercial coils. This is important when using longer coils or coils that are mechanically connected to the tap. If you're using these coils, be careful to measure their position, both beer in and beer out, before drilling your tap holes. You want the coil outlets to line up with the spigot. With the coils complete, all that remains is to assemble the taps, screw on our handle, and put it together.

Step-by-step construction

First assemble the materials: cooler, tubing, tap, shank, fittings and tools (you'll need a faucet wrench). A 50-quart cooler at the local warehouse club cost $20 and provides the potential to move up to three taps or more!

To install the spigots, measure height above the cooler floor and left-right distance. Our cooler was 21 inches wide, so I divided in thirds to leave room for a third tap. I measured down 1-1/2 inches below where the cooler begins to thicken and drilled 1/8-inch pilot holes to allow plenty of room for large homemade backing plates.

Shanks, big shiny pipes that go through the cooler wall, are available in many lengths and two styles. One style requires you to purchase the cor-



Shanks go through the cooler wall. Ours has an attached barbed fitting.

Use a faucet wrench to fasten the knurled collar of the shank to the tap.

rect tail piece and connector fitting. The other, which we used, comes with a barb fitting already attached.

The shanks come with big escutcheon plates in front and large nuts behind. I think that lots of use would soon crack the thin inner plastic wall of the cooler, so I backed each shank up with a large, 2-inch by 3-inch piece of 1/4-inch plexiglass scrap. Any rust-free material would do.

Once the shank is pushed into the cooler and tightened up, you'll need to assemble the spigot or tap. The tap male end is splined (it has one ridge) and can be inserted into the shank at any angle. To fasten the collar of the shank to the tap, you need a special faucet wrench. Or wrap a thick rubber band around the shiny chrome and use an adjustable plier.

To drill the holes for tap and beer line I used common spade bits, 1/2-inch for the beer line and 7/8-inch for the spigot. If you have a correct size hole saw, even better.

OK: The coils are done, the holes are drilled, and I've put the spigot and beer line through the holes. Now I'll join the cooling coil to the spigot and the beer line to the cooling-coil inlet (heat rises, so bring in beer from the top) and clamp all the lines. Why clamp? Such low pressures shouldn't really need them. But I learn from experience: Our club's best brewer brought an Oktoberfest to a competition pressurized at 30 psi. No one knew and the inlet line blew off, filling the cooler with beer. So clamp the hoses.

All that remains is to clean the copper coil. I'd suggest precleaning the coil with PBW (Powder Brewery Wash) just before clamping the tubing and sanitizing it after that. Do not leave sanitizing solution in the coil between uses. Clean, sanitize and use carbon-dioxide to expel the sanitizing solution.

We asked Charlie Talley, of Five Star Chemicals, for the correct method of cleaning a copper coil and preventing metallic off-flavors from developing. Here are his thoughts: "The best way to clean new or used copper brewing materials is with PBW at a dilution of 2 ounces per 2 to 3 gallons of water (stronger for dark, dirty or old copper). Our measurement of free copper in the discharge water after caustic cleaning dropped from 1,700 parts per million (ppm) to just 1 ppm after three uses of PBW. After cleaning and rinsing, sanitize copper coils with Star San. I recommend 2 ounces per 5 gallons." Stainless-steel coils can be cleaned and sanitized the same way.

Copper has been used in brewhouses for centuries, adds Talley. He does warn that prolonged contact between copper and beer will lead to metallic off-flavors. But if you're simply running your beer through the clean copper coils in our brand-new jockey box, it should be fine. ■

Line resistance by beer-line inner diameter or stainless-steel beverage tubing outer diameter

Line (inches)	Resistance (pounds)	Use this in calculations	Volume/foot (ounces)
3/16" I.D. plastic beer line	2.2 to 3.0	2.7	1/6
1/4" I.D. plastic beer line	0.6 to 0.85	0.7	1/3
5/16" I.D. plastic beer line	0.15 to 0.20	0.17	3/4
3/8" I.D. plastic beer line	0.10 to 0.12	0.11	3/4
1/2" I.D. plastic beer line	0.025	0.025	1-1/3
1/4" O.D. stainless tubing	2.0	2.0	1/3
5/16" O.D. stainless tubing	0.5	0.5	3/4
3/8" O.D. stainless tubing	0.2	0.2	3/4

chart reprinted with permission from www.kegman.net

Beer Gear

Homebrew gizmos you gotta have

Charge your Corney keg

This gadget is for anyone who knows what a colossal pain it is to transport your kegged homebrew and the necessary CO_2 tank, regulator and hose to a party. Innovations Inc. in Tucson, Arizona has developed the new "Cornelius Keg CO_2 Charger." This little, portable device gives the homebrewer the ability to pressurize any of the popular small aluminum kegs easily and cheaply. The CO_2 Charger provides enough pressure to dispense your homebrew into your friends' glasses all night long. When the beer stops flowing, it only takes a little pull on the convenient trigger to emit enough CO_2 to replace the lost pressure.

The charger is a simple plastic cylinder with an internal brass trigger valve that screws onto a gas-in ball lock connector. No costly adapters are needed to connect it directly to the keg. The cylinder holds one standard, non-threaded 12-gram CO_2 cartridge, the same kind that are used to fill bike tires and sport balls and for making sparkling water. Relatively inexpensive, just 50 cents each, it takes only three 12-gram cartridges to completely empty a three-gallon Corney keg.

This product is for dispensing only. It can't be used instead of a tank and regulator to force-carbonate a batch of beer in the keg. Another thing to know is that you need a threaded, not barbed, gas-in keg fitting. For information, go to www.innovationsaz.com or call (800) 340-1050.

My own six packs

My Own Labels is offering another way for homebrewers to turn their beer into gifts to give to friends and family. These new, blank, four- and six-pack beer carriers are a great way to package your homebrew. The sturdy "4-pak and 6-pak" bottle carriers are simply blank versions of the ones your commercial beer comes in, allowing them to be personalized to your own satisfaction. Most homebrewers personalize the carriers by using the company's custom labels.

You can view the bottle carriers at the online catalog. Prices range from \$5.40 for six 4-paks or \$20 for 24 6-paks. You can order your blank beer carriers via the Web site, mail, fax or phone. Visit www.myownlabels.com, call (503) 223-5636 or send a fax to (503) 295-2716.

Do-it-yourself label software

4th & Vine recently released an updated version of its popular "Art of Wine and Beer" labeling software. The new CD-ROM (Version 2.0) contains new labels, features, clip-art and a new look. The new software makes it easier than ever to create your own custom beer or wine labels using your home computer and printer.

All you have to do is choose from a variety of labels in the gallery and go to the design screen. The design you select will pop up and show you a sample of the text layout. Then you lay out your text, choose your fonts and select text colors. You can also choose to import a graphic to the label or use one of the images in the clip-art file.

The software is both Windows- and Macintosh-compatible and contains all of 4th and Vine's current styles and designs. If you need assistance, there is a link from the software to online help.

This new product is available for \$29.95. You can either order online at www.4th-vine.com. or find a dealer near you by going to the "Dealer Finder" on the company's Web site. You also can call (403) 262-0260.

New mini-hopback

Hobby Beverage in Temecula, California has added a new product to its "Mini-Brew System" line. The Mini-Hop Jack works like a hopback, allowing you to add a big hop blast to your beer at the end of the boil. A built-in screen also filters spent hops, hot break and trub from your wort.

The Mini-Hop Jack consists of a top tank (4.5 inches by 10 inches wide) and a lower tank (10 inches by 16 inches wide). A 7-inch screw-in porthole in the top tank allows access and another hole holds the screen between the two tanks. An inner cooling cone below the screen consists of four separate lengths of copper tubing and works to cool the hot wort. The whole system is enclosed to retain aroma and keep out contaminants and bacteria.

The Mini-Hop Jack can also serve as a grant (a small vessel with one or more drains used for draining mash) to use when pumping or lautering or with a RIMS. Visit www.minibrew.com or call (909) 676-2337.

Belgian no-boil beer kit

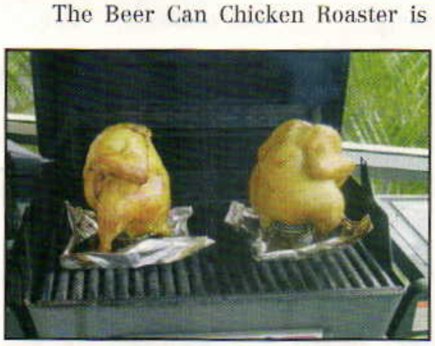
The latest addition to Brewferm of Belgium's lineup of easy no-boil kits, "The Gallia" has a starting specific gravity of 1.055 and an alcohol by volume of 5.5%. The Gallia is described as a "thirst-quenching pale amber beer with a refined bitterness and a soft finish." For more information go to www.brewferm.com.

Grilling with beer cans

Does your chicken spill your beer? If you've ever tried to cook "beer-can chicken" you've probably had this problem. You insert an opened can of beer into the body cavity of your bird and try to arrange the legs to hold the chicken upright but, inevitably, after a bit of cooking, the bird gets tired and soft and tips over, beer can and all. The new Captain Steve's Beer Can Chicken Roaster will make your grilling experience a lot more successful.

This ingenious device allows you to cook your friendly fowl, using the steam from your favorite beer, with ease. A handy wire frame holds a 12-ounce beer can and keeps your bird standing up straight and cooking right. We recently tested this item at home with great success: We bought a can of Bud, dumped it out and filled the can with homebrew.

The Beer Can Chicken Roaster is produced by Aquabiotics, Inc. of Islamorada, Florida. The roaster sells for $19.95. For more information or to order, call (800) 480-4450 or go to www.beercanchickenroaster.com.



New how-to-brew book

"How to Brew: Ingredients, Methods, Recipes and Equipment For Brewing Beer at Home" by John J. Palmer is now available in print for the first time. The first edition was available online only, but now you can add this softcover reference manual to your homebrew library. "How to Brew" is a technical, comprehensive guide to brewing your own beer at home. It lays out the "hows and whys" of the brewing process, beginning with a glossary of basic terms and ending with tips on developing your own recipes and building your own brewing equipment.

Published just this fall by Defenestrative Publishing Company, "How to Brew" is available by sending $20.95 (includes shipping and handling) to John Palmer, P.O. Box 1781 Monrovia, California 91017. For more information about this handy new book, you can send an e-mail to john@defenestrativepublishing.com. ■

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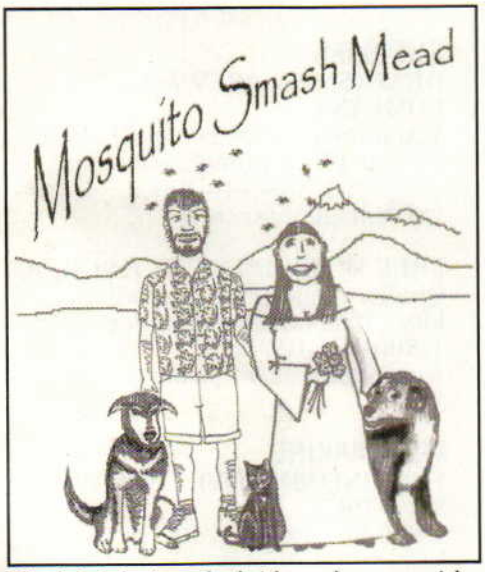

The label depicts the bride and groom with ever-present mosquitos flying overhead.

I have reached that point in my life when all of my good friends are starting to get married. Scary, I know, but as long as it's not me, I don't mind helping them celebrate. The one thing that I can't stomach, though, is the idea of giving one of those mundane gifts that every couple seems to end up with two of. What I've been doing for all of these occasions is making the happy couple their own batch of mead. Most of the couples have never heard of mead before, but they always get a kick out of the story that goes with it. They find it very romantic to hear that the ancient tradition of drinking mead for a month after a wedding is the source of the term "honeymoon." And they're really sold when see the personalized labels.

When my younger sister, Jen, told me that she was getting married, she was not at all shy about demanding that I make a mead for her wedding. She did worry about the folklore that said that drinking copious amounts of mead would help produce a child. Since she and her fiancé, Boe, aren't quite ready for that, they figured that they could cut down on the risk by sharing the mead and using it for the toast at their wedding.

Ideally, you should age mead for two years but, for some reason, Jen wasn't willing to push the wedding back. I'd have to settle for one year. Another obstacle was that Jen and Boe live deep in the Alaskan wilderness, near Fairbanks. They love it so much out there that they wanted all of their friends and family to experience the lifestyle. Luckily, they had the wedding in the summer.

The recipe that I decided on was actually a pyment. Pyment is a mead made from a mix of honey and grape juice (the kind used for wine, of course, not Welch's). Pyment is a good style to carbonate and make a sparkling mead. After all, you can't do a proper toast with a still wine.

I ended up with about 9 months of aging time before bottling. While there was probably still some yeast kicking around in there, I also pitched some champagne yeast just to be sure that the bubbly would actually be bubbly. I had never corked champagne bottles before, but I found that by wetting the cork just a little bit and then carefully using a hammer ... it's still a real pain in the butt.

I was worried about shipping all of these bottles four thousand miles. It would be tough for the newlyweds to celebrate their new life together with a soggy box filled with broken glass. The solution was to split the burden up among all of the East Coast guests and have them carry on the mead.

An artistic friend of mine designed the labels — he's been roped into this many times before. Once in Alaska, we cut out the labels by hand. This task fell mostly on Boe, since I had gotten into some of his homebrew that night and wasn't feeling steady enough to cut in a straight line. Once the labels were affixed, the bottles were chilled for a day and then we brought them over to the wedding hall for the big day.

The wedding was relatively small, which meant that there was plenty of mead for everyone. Beyond the toast, many got to have seconds and thirds, and there were still three bottles unopened. Jen decided to hang on to these and save them as a memento of the occasion. Unfortunately, much later in the evening, bad judgment prevailed and another bottle was popped, but there were still two left. The bride and groom will probably save them for an anniversary down the road. Or maybe they will think to pull them out when they're finally ready to start a family and see if the old ways really are still the best. ■