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To help construct the cooler, a complete downloadable drawing and plan for the base with all the dimensions, materials and cutting lists, plans for removable bottle shelves made from left over plywood and additional design details is available for free from my website at www.beegeek.com.

Note: To assemble the honey warmer, some very simple electrical wiring is required. If you are not comfortable doing this on your own get someone with more knowledge and skill to help you.

Important note: Like pretty much every honey heater out there, this one is home built. As such, caveats to the readers need to be stated. I am not an electrician by profession. Though the wiring is super simple, you may want to have someone verify that the wiring required is done safely.

How to build a Great Small Honey Heater

As all beekeepers know, most honey types will crystalize or sugar after a period of time. The surest way to remedy this problem is with heat. Additionally, warm honey is much easier to pour and bottle. But, it's very important to apply the heat carefully and precisely. And, like most other beekeeping devices, beekeepers have found all kinds of creative ways to heat their honey. A water jacketed bottling tank, bucket and barrel bands are the common commercial tools to heat the honey. One of the most clever solutions I've seen is by a member of our association who puts his sealed buckets into his hot tub over night with the tub cover attached to keep the buckets from bobbing up. Water is thermally quite efficient. Works well.

Short of owning a hot tub, the most common device is that a lot of beekeepers convert an old non-functioning refrigerator into a honey heater by mounting a light bulb at the bottom and controlling the temperature with a rheostat style temperature controller. Though this works well for those with several dozen hives and the space to store a spare refrigerator, it isn't practical for us who work on a smaller scale. It's with that in mind I set out several years ago to design a honey heater that would work for myself and other hobbyists.

Version One

Starting with idea that the refrigerator and light bulb based heaters worked pretty well, I rationalized that making it in miniature might make sense. So, I bought a very used, very beat-up metal-clad Coleman cooler at a thrift shop for \$2.37. I set the cooler on it's short side and built a small platform to rest buckets and jars on and to allow room below for a lamp base and a small 15 watt bulb. All of this was hooked up to a light dimmer inside an electrical box mounted to the top. I also put in an indoor/outdoor thermometers to keep an eye on things. I'd set the dimmer to near full over night and then down to about 1/3 in the morning. After a couple of days my honey would be warm and the crystals gone. A little funky but the total cost was just \$10.

This version had several problems, and I don't recommend it. For one thing the lamp dimmer is not really a heat controller and so the temperature was hard to control and really going all over the place to detriment of the honey. Additionally, unless the heater was not carefully monitored it was potentially unsafe. Finally, it wasn't even ideal from a practical standpoint. For one thing, loading it from the

front was no fun. And, though I could heat up a number of jars or even one of the square 4 gallon buckets of honey I prefer for bulk storage, I couldn't fit in the occasional 5 gallon buckets I get when I need to buy the additional honey from other beekeepers. Time for a new design and better temperature control.

Version Two

The Right Cooler

A few years ago a new type of vertical cooler was introduced by Igloo and when I saw it I knew that it was exactly what I needed to create a much better honey heater. These coolers come in two sizes: the Igloo Ice Cube 50 and the Igloo Ice Cube MaxCold 70 Roller. I took a lot of measurements and found that for enough room for lights, the base and buckets up to 5 gallons the latter one is just the right size. And, it comes with the added benefit of being on wheels so you can move it around easily. I've found that these cost from \$38-\$70, so shop around.

Constructing the Base

To keep as much room as possible in the cooler for buckets, the base has to be very low. The base I've designed is a total of 3" high, uses two bulbs for a heat source and allows enough room in the cooler for 5 gallon buckets to be heated. But, the bottom of the cooler presents several challenges with its various bulges in the floor to allow for the cooler's axle and wheels. Therefore, there are some important dimensions that should be followed.

Being a furniture maker by profession the base for my own heater is overbuilt, made out of mahogany and uses very strong joinery. (Sorry, I can't help myself.) The base needs to be very strong in order to support up to a 60 lb bucket of honey. I recently redesigned it for construction by anyone with just a little woodworking skills and average tools. Though it can be made out of pretty much any 3/4" stock like pine or fir, there are some advantages to using 3/4" plywood if you have access to a table saw to cut it. Since it takes only a small piece of plywood, consider building more than one base at a time by working with other beekeepers in your local association who might also want a heater and just might have the tools you don't have. If you're ambitious a full sheet of plywood can make 16 bases and bottle shelves.

Though this article covers what you need, to help construct the cooler, a complete downloadable drawing and plan for the base with all the dimensions, materials and cutting lists, plans for removable bottle shelves made from left over plywood and additional design details is available for free from my website at www.beegeek.com.

This new base is made up of strips of 3/4" plywood cut from a piece that is 8 1/2" x 32" to these sizes:

4 pieces 1 1/4" x 14"

2 pieces 2 1/4" x 11" with one end cut at 45 degrees

1 piece 2 1/4" x 10 1/4"

Using the photos as reference, assemble the base with screws and glue. Pre-drilling will assure that the plywood doesn't split. You'll need 1 5/8" and 1" drywall-type screws. Use the larger screws except as noted. Start by attaching the 10 1/4" piece to the square side of the two 11" pieces. Next, center and

attach two of the 14" strips to the "U" shaped assembly, one on each end. For stability, add an extra screw to the strip attached to the bottom of the "U". And, note that you need to use the 1" screws on the tip of the 45 degree ends. Using left over 1 1/4" scrap as spacers attach one of the remaining strips next to the mounted strip on the square end. Do the same with the final strip on the 45 degree end. This should leave you a larger gap in the middle as shown in the photo.

Wiring the Base

Now that the base is complete you need to attach the electrical components and wiring to it. Because of the limited space underneath the warmer base, the bulbs mount in what's referred to as a lamp base of a specific kind as shown in the photos. Though there are two kinds of bases that are small enough that will work, I encourage you to use the two-part white porcelain type as they accept the heat better and cover up the exposed wiring.

Attach the two lamp bases by centering them in the large opening of the warmer base exactly 1 1/2" from the bottom of the base to the center of the lamp base. Being that the total thickness of the base is 3", the bulbs will then be exactly half way between the bottom and top. Next, you'll hook up each lamp base by using two pieces of heavily insulated two-wire stranded electrical wire (sometimes called lamp cord) that are about 14" long. Pre-strip the insulation off of both ends of the wire so you can attach them up to the terminals on the two lamp bases.

To make this assembly safe you need to attach the wires to the wooden base. An easy way is to use modified plastic clips designed for attaching coax TV cable to walls. These come with nails, so just pull them out and drill the holes out with a 1/8" drill bit so you can use 1" screws to attach them to the warmer base leading toward the 45 degree end as shown. Once done, add a couple of cable ties to hold the two pairs of wires together in the center on the back.

To complete the warmer base, stability and flatness is added by attaching galvanized hardware cloth (coarse screening) sized to 13 3/4" x 10 1/2" to the top. It can be any gauge you like, but as beekeepers we make good use of the 1/8" size for various things like entrance screens so you might have some around or want to pick some up anyway. Use a heavy duty staple gun to attach it.

Controlling the Temperature

Since you're making really nice heater, it should have a really nice temperature controller. When designing my new one I researched what craft brewers used and found they favor the Ranco electronic temperature controller (ETC) products for their digital control and accuracy. I figured, if it's good enough for the very fussy process of making beer it's good enough for beekeepers to heat honey. These come in a confusing array of models for different voltages so make sure you get the one intended for 120 volt use. Use model: ETC 111000-000. Though I bought mine locally a few years ago, I've found a new low-cost internet source for them at www.rancoetc.com. They cost \$60. Some internal and exterior wiring is needed and Ranco's wiring instructions are rather cryptic. So, if you're all intimidated, they'll send it to you fully pre-wired for an additional \$15.

The ETC needs to be attached to the cooler and the best place is on the lid centered near the back. Once you've taken measurements to position it as shown, I find it's easiest to attach by removing the cover of the ETC (careful, as there are wires in the cover) and attaching it to the lid through the 4 screw points with 1" screws. Make sure you're careful to not damage the electronics inside and don't

over tighten these screws as they're just being screwed into plastic. Once firmly attached, put the cover back into place. Now that the ETC is attached be very careful because when the lid is open the cooler is very top heavy and will tip over. So, put the cooler next to a wall for this final part of assembly. Once warmer base is in place this won't be a problem.

Wiring the ETC

For the rest of the hook up of the ETC you need to attach the all the wires to the cooler, attach the sensor and hook up power to the lamps inside. I've found that the best place to attach all these wires is on the back of the cooler around the roller handle. Because the sensor cable is so long, rather than cutting it and re-attaching it inside the controller I just wrap the excess around the handle as shown and attach everything to the cooler with cable ties. Because of the tight gap between the handle and the cooler you can temporarily detach it by removing the 4 screws holding it on.

Next, you need to get the sensor inside the warmer. After doing lots of temperature tests with a very accurate thermometer inside the warmer and in the honey being heated, I've found the best location for the sensor is centered just underneath the lid. To get it inside, drill a 1/4" hole centered and 3/4" up from the ledge on the back of the lid. After feeding it through, center it on the lid and use two or three of those coax hold down clips with 1" screws like were used to attach wires to the warmer base.

The final part of the hook up is to get power to the lamps. If you bought the pre-wired version of the ETC, you'll need to feed the wire with the female plug along the handle as shown and attach it with more cable ties. Next, making sure you leave extra wire to hook up the lamps inside, cut off the excess wire with the female plug then feed the wire through the drain hole at the bottom of the cooler. Note that the top of the handle makes a nice storage place to wrap up the power cord you'll plug into the wall later.

All that remains is to strip the ends of the wire from the lamp power cord that's now inside the warmer and then attach it to the two lamps. With the completed warmer base inside and standing vertically, attach the black wire from the power cord to one wire from each pair of wires that lead from the lamp bases with a wire nut. Do the same with the white wire from the power cord with the remaining wires from each lamp base. To finish up add more cable ties to attach all three of these wires together into a stable unit so they won't pull apart. The wiring is now done.

Completing the Heater

To complete the heater it's important to protect the cooler from the heat inside with radiant and thermal barriers. This is essential to protecting the plastic interior of the cooler, so don't skip this part. Start by cutting a 14 x 9 1/2" piece of galvanized roof flashing that will fit in the bottom of the cooler. Because the cooler is rounded inside, you'll need to round a couple of the corners to get it to fit. While you're at it, cut another piece 14" x 11" that will eventually rest loosely on top of the warmer base's screened top and underneath your buckets or bottles of honey. It will need to be rounded on all four corners to fit inside the cooler. This piece helps distribute the heat from the bulbs and is useful for catching the inevitable drips from the warm honey sitting on top of it.

Perfect for the function of a thermal barrier while also working as a heat sink that retains the heat from the lamps is a 8x10" ceramic tile that sits on top of the piece of metal protecting the bottom of the cooler. It just fits inside the two supports of the warmer base.

Setting it Up

For bulbs, use two 40 watt heat-resistant appliance bulbs and you're ready to go. The ETC is very easy to set up once you plug it in. Since this is an ungrounded device, plug it into a GFCI circuit if you have one where you intend to use it. You first set desired temperature. To de-crystallize honey I've found that a temperature of between 95 and 110 degrees works depending on honey type, how badly it's sugared and whether it's in bottle or bucket form, etc. Then you'll be prompted to set the temperature gap before the ETC turns the lamps back on when it cools down. I set mine to 2 degrees. Usually overnight is enough time to de-crystallize bottled honey. A little longer for a solid bucket. Finally, note that unless you add a switch, the only way to turn the heater off is to unplug it. So, make sure you unplug it when not in use.

Your new honey warmer is now complete. Now there's no more excuses for your honey to be anything but crystal clear. Enjoy!

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