



by JAMIE ELLIS

Gahan Endowed Associate Professor  
of Entomology  
Honey Bee Research and Extension Lab  
Dept of Entomology and Nematology  
University of Florida  
jdellis@ufl.edu  
www.ufhoneybee.com



# Assembling Wooden Frames

Frames are the workhorses of the man-made parts of a honey bee hive. They provide the structure in which bees build the combs; thus, frames bear the entire weight of a colony's wax infrastructure, honey/pollen stores, and brood nursery. They are spaced from one another and the hive's walls a distance of 3/8s of an inch. This spacing, termed "bee space," limits bees' placement of propolis or wax in the area between adjacent frames and between frames and the hive's walls. Herein lies the simple beauty of a Langstroth colony. The frames lack attachment to other structures in the hive because of the use of bee space. Resultantly, they can be removed from the hive with ease. The discovery and exploitation of bee space ushered in modern beekeeping. For the first time, combs could be inspected and colonies intensely manipulated.

The basic frame is simple in design and the vast majority of frames are made of wood, a smaller minority of plastic. The wooden frame has four basic parts: a top bar, two end bars, and a bottom bar (Figure 1). Top bars (Figure 2) have a flat upper surface, two "lugs" that overhang the joint they share with the end bar, and a lower surface that contains a groove. The groove is flanked by two bulges of wood I will call "ribs." Top bars are either "grooved" (both ribs are attached to the top bar) or contain a wedge cleat (one rib is attached to the top bar). The wedge cleat can be removed from the top bar to make it easier to install Crimp-wired foundation.

The end bars of a frame (Figure 3) are what give the various sizes of frame their names. This is because there are three heights of end bars: tall, medium, and short.

This, then, makes frames "deep" (when the tall end bars are used), "medium" or "Illinois" (when the medium end bars are used), or "shallow" (when the short end bars are used). End bars have notches at the top and bottom that are cut to accommodate the top and bottom-bars respectively. Most end bars contain two-to-four holes that are used when wiring foundation into frames.

The bottom bars of a frame come in three types: (1) solid, (2) split, and (3) grooved (Figure 4). The grooved bottom bars are the most common, followed by the split bottom bar. I rarely see solid bottom bars used any longer.

Frames are a very important part of the bee hive so it is essential that they are assembled correctly. Frame assembly is a simple process, but there are a few key points one must consider in order to maximize the long-term usefulness and integrity of the frame.



Figure 1 – The parts of a frame include a top bar (top piece of wood), bottom bar (bottom piece of wood), and two end bars (right and left pieces of wood).

1) First, frames are under a lot of pressure in the hive. They are suspended by their lugs which rest on a special groove present on the front and back internal walls of the super in which the frames are placed. The weight of a deep frame full of honey can exceed 10 pounds. This, coupled with the fact that frame lugs are glued into the hive boxes by the bees using propolis, means that great force must be used to free the frame from the hive when removing them for inspection purposes. Thus, frames must be assembled in a manner that they can withstand the pressure placed on them by their own weight and a beekeeper's hive tool.

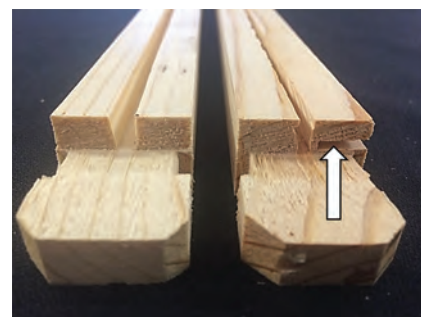


Figure 2 – A close view of a grooved top bar (left) and a top bar with a wedge cleat (right, with the removable cleat arrowed). Both top bars' lugs are in the foreground. The lugs rest on a ledge in the supers, thus allowing the frames to be suspended in the hive. I call the raised pieces of wood on either side of the grooves "ribs." The top bar with a wedged cleat has only one rib.



**Figure 3 – End bars of a medium (or Illinois) frame. The big notch at the top accommodates a top bar while the smaller notch at the bottom accommodates a bottom bar. The holes are used for wiring frames.**



**Figure 4 – Three styles of frame bottom bars. They include solid (left), split (middle), and grooved (right).**



**Figure 5 – Wood glue can be put into a plastic container to make it easier to apply to the frame parts. A brush can be used to apply the wood glue to the various frame parts.**

2) Frames should be assembled with wood glue (Figure 5). The glue should be applied on all frame joints prior to fastening the parts together with nails or staples. Wood glue helps the frame parts stay together better. It reinforces the holding power of the nails or staples that will be applied later.

3) Most people who assemble frames fasten the frame parts together using nails or staples. Staples are a nice option because they are, essentially, two nails held together by a small bar (or crown). Of course, one can use nails to assemble frames. However, it takes twice as many nails as it does staples to assemble a frame. In the end, staples are less work.

4) A common mistake when assembling frames is to use too few nails/staples (“fasteners”) when assembling the frame. Of course, a top bar and bottom bar must be secured to the end bars using fasteners driven straight through the one and into the other. Usually, beekeepers will drive a fastener (1) through the top of the top bar and into the end bar and (2) from the bottom of the bottom bar and into the end bar. These are the “essential” fastener positions, but they are not the only place that the fasteners should be inserted. A frame assembled using fasteners only in these positions can come apart when being removed from the hive. This is due to two reasons. First, bees glue frame lugs to the hive walls using propolis. Thus, a hive tool must be wedged under the top bar of the frame and pressure applied in a downward direction to lift the frame out the hive. Second, fasteners driven into the frame in the opposite direction that the force is applied from the hive tool can slide out of position if other parts of the frame are glued securely to the hive wall. So, it is common to pop the top bar of a frame from the end bars while the rest of the frame remains secured to the hive body with propolis. The way to get around this phenomenon, which happens often and is very annoying, is to apply fasteners in a 90° angle to the direction of the force applied by the hive tool when loosening/removing the frame from the colony. This will make more sense when you read the step-by-step instructions for assembling frames, where I use figures to illustrate this point.

5) Frames do not need to be treated with wood preservative. They remain inside a colony their entire life. I mention this because many new beekeepers hear about treating colony woodenware and assume the frames should be treated as well.

6) A properly assembled frame must be square, i.e. each corner in a frame must be a 90° angle. A properly assembled frame is a rectangle, not a rhombus. I like to take my frames and apply the “wobble” test once I have finished assembling them. I use one hand to grab the top bar of the frame and a second hand to grab the bottom bar of the frame. I, then, try to force the top and bottom bars in opposite directions, back-and-forth. If the frame wobbles, it needs more fasteners.

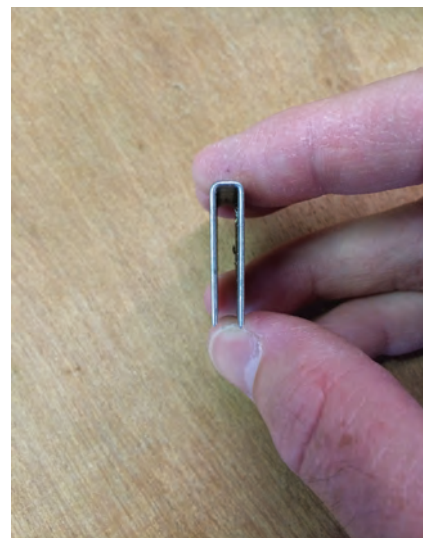
You might find the following recommendation strange given all of the information I just provided on assembling frames. I believe it is easier and more economical to purchase assembled frames. Most equipment manufacturers/vendors sell assembled frames. These frames usually are assembled with glue and staples. Furthermore, the frames often are assembled with an extra staple driven through the face of the end bar and into the rib of the top bar (a figure illustrating this follows). This extra staple provides extra support to the top bar of the frame, making it very unlikely that you will pry the top bar from the end bars when attempting to remove a frame from the hive.

Furthermore, the added price of a pre-assembled frame over that of an unassembled one, i.e. the price you pay for the frame’s assembly, usually is considerably less than the value of your time assembling the frame. In summary, preassembled frames are assembled well and worth the slight increase in price over unassembled frames. Of course, every beekeeper should assemble a frame, or even a hive’s worth of frames. However, I believe it is usually more economical to purchase frames fully assembled. Since this is true, I believe it is overwhelmingly more economical to purchase frames rather than make them from scratch. I have made frames from scratch and it was a fun endeavor for me. It was not, however, an economical one.

#### **STEP-BY-STEP INSTRUCTIONS FOR ASSEMBLING FRAMES**

1) Collect the following equipment/supplies:

- Wood glue (Figure 5)
- Staple gun (or hammer) – Staple guns that are run using air compressors work really well. You should consider using a tack hammer if you go the hammer route. Regular size hammers are too big for the job.
- Staples (or nails) – The staples (Figure 6) should be about 18 gauge, 1 – 1.5



**Figure 6 – A 1 inch long, 1/4 inch crown, 18 gauge staple used to fasten frame parts together.**

inches long, and have a crown at least 1/4 inch wide (a 3/8 inch crown is best because this often is the rough distance between two ribs on the frame's top bar). Similar sized nails work well if you elect to forgo the staple route.

- Small paint brush (seen in Figure 5) – The head can be ~1/4 – 1/2 inch wide.
- Small container for glue (seen in Figure 5)
- Unassembled frames
- Framing square – These can be purchased at most hardware stores.
- Safety goggles – You should use these when driving staples or nails.

2) Pour some wood glue into a small container. It is easier to apply the glue when it is available this way.

3) Using a paint brush, apply wood glue to the inside part of the top notches of two end bars (Figure 7).



**Figure 7 – Applying wood glue to the upper notch in an end bar using a paint brush.**

4) Fit the top bar and end bars together. Make sure the groove in the top bar is pointing down. Wood glue should bleed from the joints between the end and top bars if enough glue was applied (Figure 8).

5) Drive one staple or two nails through the top of the top bar and into the end bar (Figure 9).

6) Flip the frame over and apply glue to the inside part of the bottom notches of both end bars (Figure 10).

7) Fit the bottom bar and end bars together. Make sure the groove in the bottom bar is facing toward the top bar.

8) Drive one staple or two nails through the bottom of the bottom bar and into the end bar (Figures 11 and 12). Try to avoid driving the staple or nails through the middle part of the bottom bar (i.e. the groove). You want to drive the nail or staple through solid wood. Notice how that is done in Figure 11, where the staple is being driven through the bottom bar, to the left of the groove.

9) Drive one staple or one nail through the outside face of the end bars into the



**Figure 8 – A properly glued top and end bar. You know that you have added enough glue when glue bleeds from the joints once the parts are assembled.**



**Figure 9 – Using a staple gun to drive a staple through the top bar of a frame and into the end bar of a frame. The staple gun is powered by an air compressor.**

lower ribs of the top bar (Figures 13 and 14). This is an extremely important nail/staple as it will keep the top bar from becoming separated from the end bars under normal use. This fastener runs at a 90° angle to the fastener driven through the top of the top bar and into the end bar.

10) Lay the frame on a flat surface (Figure 15).

11) Drive one nail (Figure 16), not a staple, through the side of the top part of the end bar and into the top bar. Do this in the upper left end bar/top bar joint (Figure 17).

12) Drive one nail, not a staple, through the side of the bottom part of the end bar and into the bottom bar (Figure 18). Do this in the bottom right end bar/bottom bar joint.



**Figure 10 – Applying wood glue to the notch at the bottom of an end bar.**



**Figure 11 – Driving a staple through the bottom bar into the end bar. Notice how the staple is being driven to the left of the groove in the bottom bar. This ensures that the staple is driven exclusively through solid wood.**

13) Flip the frame over, lay it on a flat surface, and repeat steps 11 and 12. Done this way, every corner of the frame will have one nail driven through the side of the end bar and into the corresponding top or bottom bar (Figure 19). Two nails will be driven from one side of the frame (upper left and lower right corners) and two nails will be driven from the other side of the frame (same positions, but different corners).

A top bar fastened to the end bar as described will not pull away from the end bar during normal use. This is because there are fasteners joining the two pieces of wood from three directions: (1) straight from above (the Y axis), from the side (the X axis), and from the face of the frame (the Z axis). Some may consider this overkill. I

consider it essential. My frames' top bars do not separate from their end bars when I work my colonies.

It is important that the frame be assembled squarely. This is hard to do unless you (1) check it with a framing square during the assembly process, (2) assemble it on a single frame, framing jig, or (3) assemble it in a multi-frame, framing jig (shown in the next section). I do not show frame assembly using a single frame, framing jig. These, usually, are flat pieces of wood on which a second flat piece of wood is fastened. The second piece of wood is smaller than the first piece of wood on which it is mounted. This second piece of wood is exactly the size of the inside dimensions of a frame. Thus, the parts of the frame can be assembled on the



**Figure 12 – A staple properly driven through the bottom bar and into the end bar.**



**Figure 13 – A staple is being driven through the face of an end bar and into the rib of the top bar. This, in my opinion, is the most important fastener added to a frame. This single fastener will keep the top bar of a frame from being pried from the end bars in normal circumstances.**

first piece of wood and around the second piece, thus keeping it square. Some equipment supply companies sell these jigs.

#### **FRAME ASSEMBLY USING A MULTI-FRAME, FRAMING JIG**

These types of jigs usually are home-made. I include images of a jig my father-in-law (Bruce Morgan) made and uses. He



**Figure 14 – The staple driven through the face of an end bar and into the rib of the top bar.**



**Figure 15 – A frame resting on a flat surface and waiting to receive the nails that are driven through the sides of the end bars.**



**Figure 16 – This nail gun drives small nails, the type that is good to drive through the top and bottom sides of the end bars and into the top and bottom bars, respectively. 3/4 inch nails can be used for this purpose.**



**Figure 17 – A nail driven through the side of the end bar and into the top bar. This nail complements the staples driven (1) from the top of the top bar and into the end bar and (2) the face of the end bar and into the rib of the top bar. Thus, there are fasteners driven into the top/end bar joint in three directions, the X, Y, and Z axes.**

is able to assemble 10 frames in a matter of minutes using this device.

1) Place end bars in the slots on both sides of the jig. These slots accommodate 10 frames (Figure 20).

2) Apply wood glue inside the top notch of all end bars using a paint brush (Figure 21).

3) Fit top bars to all of the end bars (Figure 22). Make sure that the grooves in the top bars face down.

4) Drive one staple or two nails through the top of the top bars and into the end bars (Figure 23).

5) Flip over the jig.

6) Apply wood glue to the bottom notch of all end bars using a paint brush (Figure 24).

7) Fit bottom bars to all of the end bars (Figure 25). Make sure that the groove in the end bars face toward the top bars.

8) The jig shown in Figure 26 uses a wedge inserted between the end bars and side wall of the jig to square the frame prior to final assembly. Regardless of the jig used, frames should be squared at this step.

9) Apply one staple or two nails through the bottom of the bottom bar and into the end bars (Figure 27).

10) Remove the squaring wedges from the jig.

11) Repeat steps 9-13 of *Step-by-step instructions for assembling frames* above.

#### **Acknowledgement**

I would like to thank Bruce Morgan, my father-in-law, for allowing me to photograph him assembling frames (this column) and supers (November 2014 column) and for allowing me to marry his daughter.



Figure 18 – A nail being driven through the bottom side of the end bar and into the bottom bar. This single nail keeps bottom bars from pulling away from the end bar under normal frame use.



Figure 19 – The face of a frame into which nails have been driven in the lower right and top left joints from the sides of the end bars.



Figure 20 – Using a jig to facilitate frame assembly. In this jig, 10 end bars are inserted into a special compartment made to accommodate them.



Figure 21 – Wood glue being applied to the upper notches in the end bars.



Figure 22 – Top bars being fitted into the end bars.



Figure 23 – Using a staple gun to drive staples through the top bars of frames and into the end bars.



Figure 24 – The jig is flipped and glue applied to the bottom notch in the end bars.



Figure 25 – The bottom bars are added to the end bars.



Figure 26 – In this jig, a wooden wedge that runs the width of the jig is inserted between the frame end bars and the wall of the jig. Similarly, a wedge is added to the other side. These wedges square the frames prior to driving the fasteners through the bottom bar and into the end bars.



Figure 27 – Staples should be driven through the bottom bars and into the end bars of the secured frames.



**COOK & BEALS**  
INCORPORATED  
HONEY EXTRACTING EQUIPMENT

**BEAT THE RUSH!!!!**  
Bring your machines  
in early for winter  
overhauls

*Merry CHRISTmas!!!!*  
*Christmas came so*  
*that we could have*  
*Easter.*  
*Remember to check*  
*out convention.*

PO BOX 220, LOOP CITY, NE 68853  
PHONE & FAX: (308) 745-0154  
EMAIL: [info@cooknbeals.com](mailto:info@cooknbeals.com)  
[www.cooknbeals.com](http://www.cooknbeals.com)

# CHRISTMAS FOR BEEKEEPERS

by JAMIE ELLIS

I thought I would take a break from my *Honey Bees 101* column and chat with you a little about Christmas, from a beekeeper's perspective. I do not intend to discuss it from a historic perspective, except to note that there is a reason we celebrate Christmas. Instead, I want to offer some thoughts on what beekeepers can give as gifts and even some pointers to those of you struggling to determine what to purchase your beekeeper.

## GIFTS BEEKEEPERS CAN GIVE TO OTHERS

1) Do not overlook the obvious. Bees make honey and honey is a good, no a GREAT, gift for the non-beekeeper. If you elect to give honey, do not underdress your gift. Remember, it is a gift. Put it in a special bottle, such as a wine bottle or something similar. Print and use special holiday labels. This really will dress up your product.

2) Similarly, wax products make good gifts, especially if they are made with wax you harvested from your colonies. Many candle and wax gift makers will use your wax to make their products. Even better, make your own wax products to share as gifts.

3) Consider giving an interested individual a "starter hive". I know of a lot of people who are just interested enough in my craft that they likely would view a bee hive as a favorable gift. You can use Christmas to create new beekeepers. ☺ The gift can be hive equipment, the promise of a package of bees or a queen, or the complete hive with the bees.

4) Beekeepers also can give gifts made from other hive products. For example, use your wax to make lip balm or other health and beauty products. Some beekeepers make mead and this is a good gift for the wine connoisseur.

5) For the cooking beekeeper, you can use your honey to make honey snacks. Honey brittle, various honey candies, honey cakes, etc. make great gifts for most people.

6) Gift baskets are great gifts and allow you to showcase the variety of products you derive from your craft.

## GIFTS TO GIVE BEEKEEPERS

1) Give them more bees! This is true especially for hobby beekeepers. Let's face it; all hobbyist beekeepers want more bees.

2) Every beekeeper needs a cordless drill (or better yet, a second cordless drill). These are very useful when assembling supers and sundry hive parts. It is okay if your beekeeper owns two.

3) Get your beekeeper an air compressor and the corresponding nail and staple guns that go with it. They will thank you often when assembling frames! I was given a small air compressor kit years ago. It came with one nail gun and two staple guns. I love using it. The small compressor/gun kits usually are very affordable.

4) Give the gift of a subscription to a beekeeping periodical. Of course, I highly recommend giving your beekeeper the *American Bee Journal*.

5) Similar to #4, all beekeepers want more books about the craft. I find that beekeepers never can have too many books about beekeeping.

6) Give them a trip to a national or international bee meeting. Many countries have national bee meetings; thus, there likely is a bee meeting just about anywhere you want to travel. After all, this trip will benefit both of you, assuming you are able to take it with your beekeeping significant other.

7) You can give your beekeeper a trip to see their favorite bee guru of choice. Beekeeping is a small fraternity, but nearly everyone has someone that they admire in the craft. Call these gurus the "rock stars of beekeeping" if you will. You always can arrange a meeting between your beekeeper and their beekeeping idol.

8) There also is a good idea for those of you who do not like to give gifts for Christmas, but rather enjoy making donations in people's names. For example, you could donate money on behalf of your beekeeper to beekeeping charities such as *Bees for Development* (<http://www.beesfordevelopment.org/>). There are even organizations through which you can purchase colonies that will be provided to individuals in developing countries. World Vision, for example, does this. You can visit their website (<http://www.worldvision.org/>), click on "ways to give," and search their gift catalog for bee colonies. *Heifer International* (<http://www.heifer.org/>) does something similar. Thus, you purchase colonies for people who live in developing countries. What a great way to give bees and a livelihood to others. Finally, you can donate money to other organizations supporting bee research, extension and instruction. These can be universities, local bee clubs, etc.

I hope some of these ideas prove useful to you this holiday season. My family and I would like to wish you a Merry Christmas and Happy New Year! God bless you all and happy beekeeping.

Controls American and European Foul Brood.

**HONEY BEE FARMS**  
A.H. MEYER & SONS INC.  
**HONEY MAKER**  
TERRAMYCIN FORMULA

Cash for Beeswax at our Beeswax Rendering Plant.

16 Ga. Galvanized Pallet Clips.

**HONEY BEE FARMS**  
A.H. MEYER & SONS INC.  
P.O. Box 98 Winfred, SD 57076  
Phone: (605) 485-2221 or 1-800-841-7952 Fax: (605) 485-2231

Flourescent Nets made to order.