

## Chapter Twelve

### Mounting Levers



Mounting levers is a matter of precision and learning how the lever works. Both will improve as you mount more levers and become familiar with the quirks of various models. In this chapter I will outline the procedure I use for mounting Truitt levers. The second part of the building guide (Chapter 19) will provide a more general discussion of various levers and the principles that can be used to mount and regulate them accurately.

*When they are disengaged, Truitt Levers fall under the string*

The lever consists of a base with three or four slots for attaching the lever to the neck, the handle, a fret pin (or barrel) to engage the string, and for wound strings a stop or hook. Because they push up on the string when they are engaged, they hold themselves to the neck. This is one of their nicest features, and allows novice harp builders to do a pretty good job if they are willing to take their time and be fussy about it.



*I like to work with the harp laid on a table top (with the harp laid out flat). The work is close to my eyes and hands, parts fall onto the table top instead of the floor, I can keep the tools I need close at hand, and work seated.*

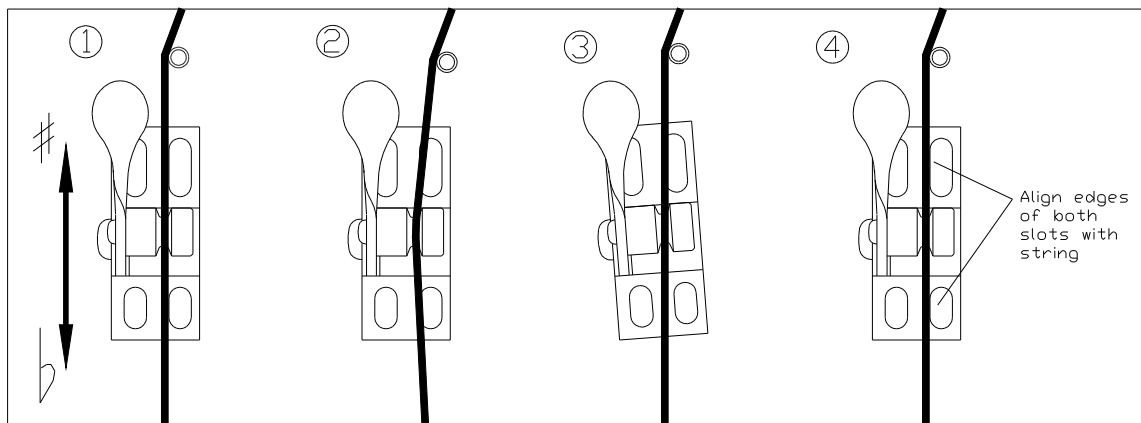
It is usually a bit trickier to mount levers in the bass and treble octaves, so when someone comes to the shop to learn how to mount their own levers, I have them start on the second octave.

The bass strings start to vibrate harmonically when a string is plucked. This can cause the needle on most electronic tuners to jump around indecisively, so I place a rag over the strings on the bottom octaves to dampen them.

I pluck the first string (lets say it is an A), and note the reading on the meter. It may be spot on, it may be 5 cents sharp. Let's say it is five cents sharp. It is not necessary to retune each string as the levers are added. The main goal is to get the lever to raise *exactly* ½ a step.

I slide the lever under the string, engage it and pluck the string a second time. Lets say the tuner now reads a B flat, 10 cents sharp. The lever is supposed to raise the string's pitch exactly one half step, to 5 cents sharp (remember that initial reading!). The lever makes the string too sharp, so it needs to be moved up towards the bridge pin, effectively making the string longer, flattening the string. If the string were dead on, or five cents flat, I would move the lever away from the bridge pin. In the first and second octaves small adjustments (an eight of an inch) are usually enough to change the strings pitch significantly. Most people rapidly develop a good feel for how far a lever should move, and can get it within 2-3 cents of a perfect half step.

After I am happy with a lever's position, I will check to make sure the lever is centered under the string and the base is running parallel to the string. While I hold the base down with one hand I will flip the handle up and down. The string should silently fall right into groove in the fret pin. If does not, the base needs to be shifted to the right of the left. This will ensure that the harp player can silently engage and disengage the levers.



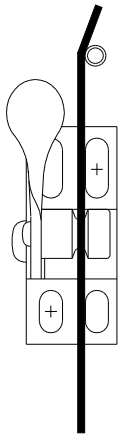
1. Move the lever up and down to sharpen or flatten the intonation. Levers 2 and 3 will not engage or disengage quietly. Lever 2 is pulling the string to side and needs to be moved to the right. 3. Check to see if the lever is skewed. 4. The slots should be aligned with the string. Check for all three positioning requirements before pricking the divots and drilling the screw holes in the neck.

I also sight between the edge of the lever base and one of the strings to ensure that the lever is aligned with the strings. This has a cosmetic benefit – aligned

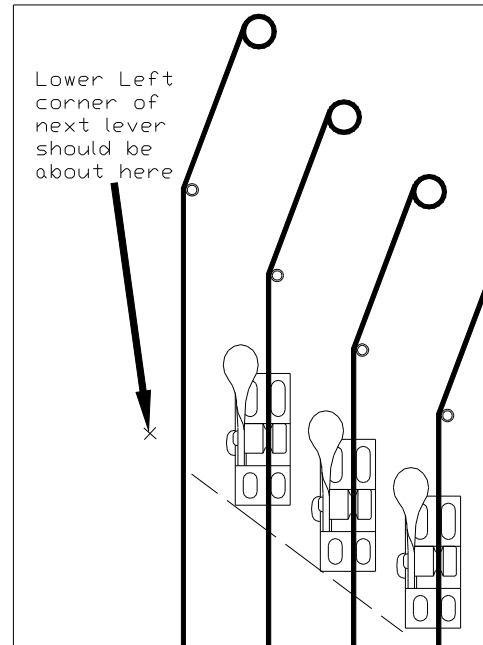
levers look great. It is also a mechanical benefit. Once the lever is screwed to the neck, some will have to be shifted up or down. If the lever is not aligned with the string, the groove in the barrel will move to the right or left, it will not be centered underneath the string, and the string will “twang” as it is engaged or disengaged.

*Useful Tip:*

*I use an imaginary line along the lower left corners of the last two levers as a “first guess” position for lever placement.*



After I am happy with the placement of the lever, I will use an awl to mark a divot to guide the drill point right in the center of two elongated holes in the base. I place screw in one of the two slots at the top of the base and another below, preferably on opposite corners. Parallax can throw off the positioning of the prick mark made with the awl, so move your head directly over the lever to ensure the divot is truly in the middle of the “well” created by the slot.



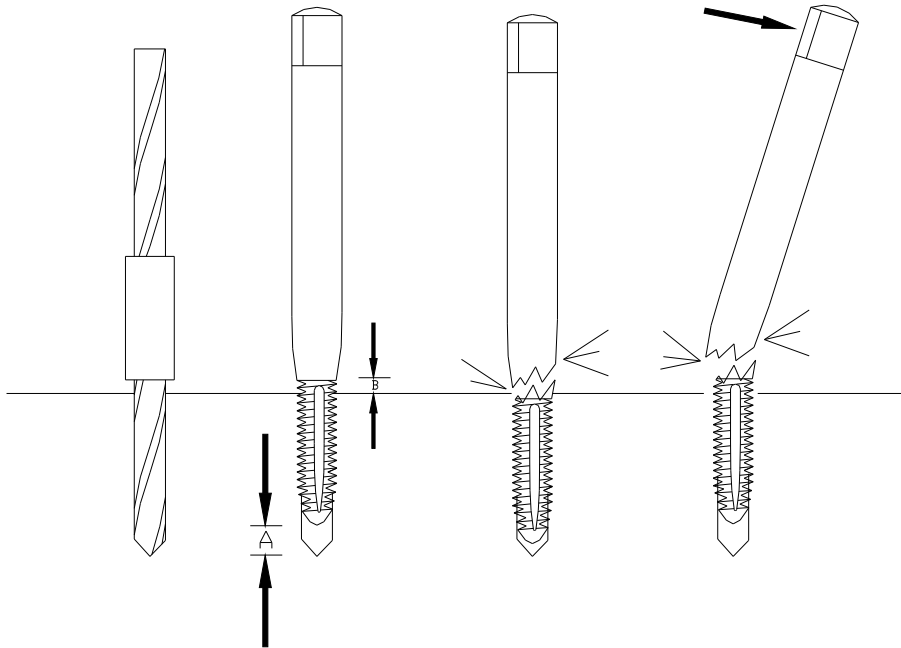
I usually position and mark four or five levers at a time. After I have drilled and tapped the holes, mounted the levers and regulated them I will move on to another set of five.



Some tips on Drilling and tapping

I remove the levers and use the divots to start the holes for the machine screws.

Betty Truitt recommends using the venerable mechanical hand drill for boring and tapping the holes. I find an electrical drill will work if I am careful about keeping the drill vertical and have good speed control. The tap is especially fragile. If the drill does not remain vertical, or if an overly enthusiastic trigger finger bottoms out the tap on the tip or the shoulder, it will usually break, leaving the tip in the hole. It is impossible to remove without making a mess of the neck. With Truitt levers, this boo-boo will be covered by the lever, and you can use one of the other mounting slots. Still, those little taps are expensive, and I hate leaving a chunk of hardened steel in the neck.



*Ensure the pilot hole is deeper than the tap (A). A piece of tape wrapped around the drill will make this foolproof. Stop the tap before the shoulder of the shank hits the neck (B). If you drive the tap in too far, or can't keep the drill in line with the hole, the tap can break.*

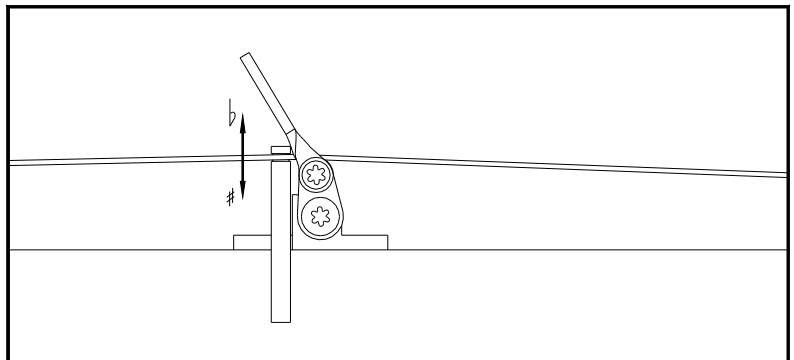
The bit and tap will usually brush against the strings while you are drilling. The drill bit heats up enough to melt nylon, and the tap is sharp enough to cut it, so I use the middle finger on my left hand to hold the string to the side while my thumb and forefinger steadies the chuck of the drill as it is lowered positioned between the strings

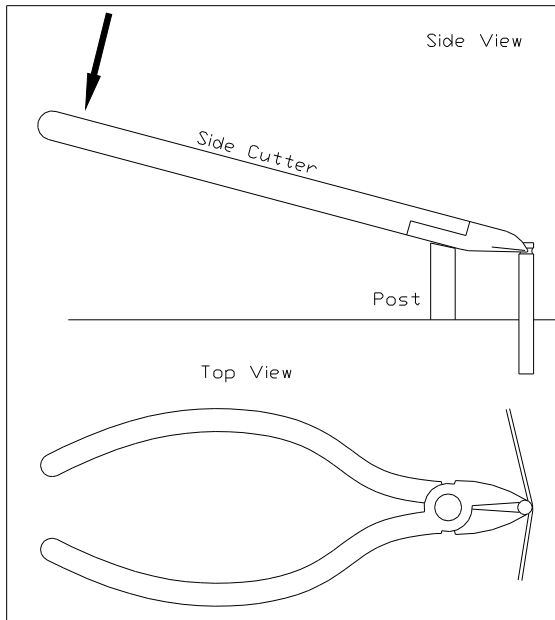
After the holes are drilled and tapped, I attach the levers with screws and operate each lever one last time.

### Top Octave

On strings less than seven inches long, the Truitt base will usually be very close to (or right up against) the bridge pin. It is easier to fix the regulation by tapping the pin in or pulling it out.

*If the note is too flat when the lever is engaged, I lightly tap the bridge pin in with a small punch and a hammer. If it is too flat, I use pair of old wire cutters (dull at the tips) to gently lever the pin out. These adjustments are small, usually about 1/32 of an inch at a time.*





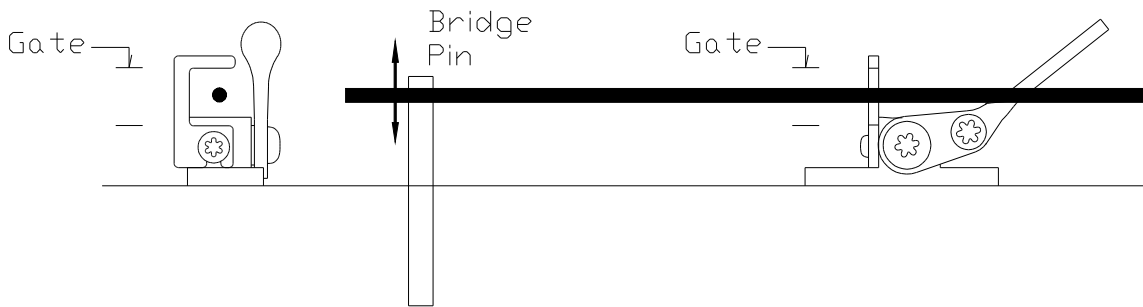
With a worn pair of side cutters and piece of 3/8 dowel as a post or fulcrum, I can lift pins without having to remove or take the tension off of the string.

There are usually several other pins and strings running nearby, and you can't press down on them for leverage. I place the post an inch or so away, grip the tip of the pin with the tips of the side cutters on the groove and press down on the handles. To keep the post from scooting back, I press against the back of the post with my thumb.

The post is about 3/4" long with a 10 degree bevel.

### Wound Strings/Bass Octave

With wound strings, there are significant changes in string diameter from string to string. On these strings, I hold the lever in its approximate location and center the string between the "gate" formed by the lever base and hook. Then I go on with same procedure used for the middle octaves of the harp.



Frontal and side view of the lever and string. On the wound strings, disengage the lever and center the string in the "gate".

Bass strings are long, and harmonics can make the indicator on the tuner dance around. Damping the other strings and plucking the string *at the middle* will make the readings more consistent and accurate.

Because of the changing composition and diameters of the strings over the last two octaves, my levers rarely fall into a nice sweeping curve on the first try. Before I mark for the holes, I position all of them where the tuner says they are supposed to be (again, Truitt levers are nice this way. They hold themselves in place when they are engaged). Then I go back and double check the outliers

(levers that are too high or low). They can usually be brought into line by moving the bridge pin in or out or pushing firmly down on the lever (simulating the pressure the screw heads will exert on the lever base).

Honest confessions

On really hard woods (Bubinga or Wenge) I will still break a tap off every 100 levers or so. It just happens. Two or three days after I have mounted the levers, I will go back and test each one last time to see if they engage/disengage silently and they are properly regulated. There are usually one or two that need adjustment - sometimes new holes have to be drilled to remount the lever.

The following table can be used to troubleshoot most of the problems you will encounter with a wide variety of levers. Truitt and Loveland levers are vertical action - they push the string towards or away from the neck. Side action levers work by pushing the string sideways. Popular side action levers include Pilgrim and the L&H performance levers.

<u>Symptom</u>	<u>Likely Problem</u>	<u>Solution</u>
Poor tone when lever is engaged	Loose fasteners Poor alignment Groove too large	Tighten Fasteners Correct alignment Change Fret pin
Buzzes when plucked hard (disengaged)	Clearance problem or a loose lever	Clearance - Shift bridge pin in or out Loose lever - check each lever to see if it is loose or jangly, tightening any loose base screws
Buzzes when plucked hard (lever engaged)	Poor alignment* String not held tightly against lever	Loosen screws and straighten lever alignment For Vertical action levers pins, tap the bridge pin in (1/16"). For Cam action levers, move lever towards the string
Pitch too sharp when Engaged	Lever too Low*	Loosen base screws, shift Lever up. If Lever is vertical action on top octave, manipulate bridge pin in or out to tune.
Pitch too flat when engaged	Lever too High*	Loosen base screws, shift Lever down.
Stiff, hard to engage	Screw too tight	Loosen the screw, nut or rivet holding lever to base. Apply graphite to the bearing while working the lever up and down.
Repeatedly	Self-tightening	Use Loctite to keep nut or screw from

becomes stiff a few days after loosening	Worn bushing	tightening during normal flipping. Truitts have small plastic bushings that can be replaced if they are missing or worn
Lever does not stay engaged	Lever arm Screw or nut too loose	Tighten screw. If looseness returns, use Loc-tite to keep screw from backing out.
Base Screws will not tighten.	Hole is stripped*	Remove screw, add drop of Superglue. Let it cure (2-3 minutes), replace screw

\*In extreme cases, it may be necessary to drill and tap new holes for base screws.