*From the Nationwide Supreme Sound Studio, Incorporated's*

*COMPLETE Guitar Repair & Set-Up Clinic*

For all styles of acoustic, electric, and bass guitars.

# Guitar Set-Up Procedures

by Brian Csencsits

*Foreword*

When I was in first grade, I started studying piano. In the fifth grade I began guitar, then progressed to bass in high school and drums in college. I received a Bachelor of Music with a concentration in Music Technology from NYU. Upon graduation, I opened and operated a recording studio for the next 20 years. During that time, I engineered and produced many independent artists as well as worked on various global TV, radio, and web direct advertising commercials. I have been teaching privately for over 30 years.

I started working in music stores when I was 16. I always found it funny that professional guitar players would come in and drop off their guitars for me to "fix". I always felt that as guitar players, we should know how our instruments work and be able to make the necessary adjustments so they play their best. Luckily, I had guidance in the shops from the techs and management I worked with, but I learned as I went, as well. I continued to hone my skills in college and really started to understand how instruments work when I took Physics of Sound and Music classes. During the 12 years I was employed in music stores, I worked my way up from clerk to the repair department, then to assembling guitars and handling sales, and finally into management. I've been a buyer at National Association of Music Merchants (NAMM) shows in Los Angeles, Anaheim, and Nashville and a voting member of the National Academy of Recording Arts and Sciences (NARAS), which oversees the Grammys, for over 10 years.

It's been a real pleasure touring the country offering my COMPLETE Guitar Repair and Set-Up Clinic for almost a decade, and sharing the knowledge that I've learned over the years to over 1600 guitar players to date. Thank you so much for your attendance at my class and/or for purchasing this set-up manual. I really appreciate it and I feel blessed that I can help you learn your instrument better, tackle some of the regular maintenance needed on your collection on your own, and to continue to do this for many more guitar players in the future.

Thanks again and all the best,

Brian

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# Overview

We all use our guitars differently. Some of you may gig several times a week, and others hang your guitars on the wall and play them only periodically. Some musicians travel with their instruments, while others keep them at home in their bedrooms, music rooms, studios, basements, or living rooms. Depending on its use, you need to be aware of how often your guitar experiences temperature and/or humidity changes to help determine how often it needs maintenance. Guitars are like cars: For every so many miles, a car needs an oil change. Likewise, after so many hours of play or temperature/humidity changes, a guitar needs a set-up. Guitars are mostly made out of wood, so they expand and contract, thus making components move. Vibrations while playing also add to the movements of the guitar parts, which cause high or low action or intonation issues.

If you transport your guitar to gigs, rehearsals, jam sessions, or lessons, you will most likely require more set-ups per year than if you only play your guitar at home. Always be careful not to store your guitar next to a heater or air conditioner and try not to keep it in the car in cold or hot weather. Proper environments are never easy to maintain or perfectly kept, but understand that extreme and quick temperature fluctuations can damage your instrument. If you must subject your guitar to very high or low temperatures, try to lessen the impact by bringing it back to room temperature slowly and letting it acclimate to the room before playing it.

The three main aspects of performing a proper set-up include adjusting the truss rod, setting the action, and adjusting the intonation. These tasks must be performed in this order. If not, you will wind up changing parameters that need to stay in place. Cleaning the guitar is usually included and is normally done before anything else. When doing a set-up, you should also change your strings.  Be sure to follow the correct procedures and go in the order specified. Otherwise, you will have problems and wind up "chasing your tail."

## Changing Your Strings

Some players change their strings often, while others don't change them until they break. It is a preference, but I personally like the sound of new strings. I often put on new strings before an important recording session or gig. New strings tend to sound brighter, but it's entirely up to you (and your wallet) how often you change them.

## String Gauge

String gauge is generally a guitarist's preference. Manufacturers will ship their guitars with the gauge they feel best suits that type of guitar. A good rule of thumb is that a Les Paul, SG, or 335 style will come from the factory with .10 gauge, while a Stratocaster style will come with .09 gauge. (The gauge is determined by the thinnest string on the guitar.) Acoustics generally run a little heavier, such as .12 gauge, but again, you can change strings to your liking. If you are doing alternate tunings that are lower than standard tuning, I suggest you consider a heavier gauge so there is less slack and a little more tension to the string. This is recommended so that fret buzz is less likely to occur and there is better chance of keeping your guitar stable while fretting notes and using heavier strumming patterns.

If you experiment with string gauges, make sure that your guitar is set-up for that particular gauge. For instance, if your guitar is set up with a light gauge and you switch to a heavier one, there will be more pull on the neck and your action may be higher than before. Conversely, if you use a heavier gauge and switch to a lighter one, you might experience more fret buzz because your neck could become more relaxed and your action may be lower. Always set up your instrument to that specific gauge before you decide whether you like the gauge. Your action is usually affected when changing gauges, but you can typically adjust the action accordingly by going through the proper set-up procedures.

## Alternate Tunings

Alternate tunings can be fun, challenging, and necessary, but if your guitar is not set up to that specific tuning, your instrument may be slightly out of tune as you play up and down the neck. When a guitar is set-up in standard tuning (E, A=440, D, G, B, E) and then switched to an alternate tuning, there is more or less tension on the neck. When occasionally experimenting with a different tuning or playing something that uses an alternate tuning with a guitar set up in standard tuning, you might have to adjust your feel or technique slightly to compensate for that amount of tension on the neck. If you always play in an alternate tuning, you should set your guitar up with that specific tuning. If you are gigging and playing half a set in standard tuning and the other half in alternate tuning, you'll probably want to use two guitars: one set up in standard tuning and the other set up in the alternate tuning. This way, you won't have to worry about tuning in between songs, but more importantly, you won't have to adjust your playing to stay in tune as you play up and down the fingerboard.

I always leave my guitars in tune when storing them and never loosen the strings when putting a guitar in its case for any extended period of time. Most guitars have a truss rod that pulls on the neck one way, and with the strings in tune with proper tension, they pull on the neck the opposite way. This helps hold the neck stable. If you loosen the strings and leave the guitar untouched for a long period of time, warping or twisting is more likely to occur than if you keep your guitar tuned to pitch. The only time I loosen the strings is if I travel with the guitar by plane or if I ship it by air. The pressure at high altitudes can tighten the strings and cause damage to the instrument. As soon as I land, I'll tune it back to pitch.

# Cleaning

Before beginning, take a good look at the guitar as it is, to see what you're up against. Play it and assess the neck and action quickly, but remember that you will look at it in greater detail later. Then take off all the strings. I'm often asked whether replacing one string at a time is better. You never want to leave your guitar for long periods of time without any strings. However, since you will be doing several things - such as cleaning, tuner maintenance, and fret assessment - before your set-up begins, removing all the strings at once is the most efficient method. It will only be without strings for 10-15 minutes, so I wouldn't worry.

## Fretboard Cleaning


Fig. 1

Start your set-ups with a thorough cleaning. Fretboard cleaning is the first thing to do when working on the guitar once all the strings have been removed. I prefer to use Fast Fret Fast, a string lubricant and cleaner, by GHS. Though I don't use anything on my strings, as they tend to die fast enough as it is, I use Fast Fret to clean the fingerboards. It goes on and comes off easily with a small piece of paper towel, which you should discard immediately because you don't want the usual buildup of the dirt and grime on your fretboard to get on the rest of your guitar. Again, Fast Fret is only for the fingerboard. Its applicator allows you to get up to the fret wire and wipe away most of the accumulation of dirt and grime that's up against the fret (see Fig. 1).

You can use a lemon oil or fret board conditioner instead, but it takes a little more elbow grease to get the excess off. Sometimes, even a day or two later, the oil may still seep out of the pores of the wood. This excess oil will get on your new strings, so try to avoid that, if possible. If the fretboard appears to have dried out or is showing signs of cracking, go ahead and apply a lemon oil or fretboard conditioner to moisturize it. It's best to remove most of the oil off before putting the new strings on, though. Some manufacturers actually say not to use any oils on their fingerboards, as there is enough oil on your fingers to moisturize the wood. Be sure to check with your guitar's manufacturer if you have concerns.

## ***Cleaning Procedures***

1. Clean the fretboard with Fast Fret, lemon oil, or fretboard conditioner. Wipe off the excess with a paper towel which you should discard.
2. Clean the back and sides of the guitar with polish and a soft cloth.
3. Clean the front of the guitar, back of neck, headstock, and all hardware with the same soft cloth. Additional cleaner may be used.

## Cleaning the Body

You can choose from plenty of good guitar cleaning products that are available. I've talked to painting and finishing experts at length about differences in products. Some sprays will act as a glaze and polish, while others will fill cracks and minor scratches. Some will be more oily, while others will evaporate faster. I've used many of the top manufacturers' brands and find that I prefer some of them to their alternatives. I recommend finding out the exact finish of your instrument and contacting the manufacturer for product recommendations. I have used ordinary $6 instrument polish for years with great results. Avoid furniture polish or any kind of wax, as it can cause buildup and may not be a great choice for your guitar's finish. Try a few different brands and see what works best for you. Be careful on vintage finishes though, as they might require a different polish due to the age of the instrument or the original finish used.

With the polish, you can clean the front, back, and sides of the body, the back of the neck, the headstock, and any hardware on the guitar. Use the polish sparingly and try not to shoot it directly at the pickups. The fingerboard has already been cleaned, so there is no need to wipe that down again. Be sure to use a soft cloth that will not scratch or mar the finish. Once the complete set-up is done, wipe the guitar down one last time to get rid of any fingerprints you may have left while working on it. No more polish is needed at this point - just a final wipe-down with the cloth already used.

# Tuning Machine Maintenance

There are many types of tuners on the market. Some have better gear ratios while others may be more secure to your headstock. There are vintage-style tuners, locking tuners, slotted tuners, open-back tuners, and sealed, closed-back tuners, to name a few.

A tuner works by turning the handle or knob of the tuner attached to a spiral gear, which turns a second gear connected by a screw to the tuner post. You want your tuners to make a good connection to the headstock so that you have better tuning stability and more sustain. During this step, you need to tighten your tuning machines. If your tuner has a cast metal threaded hex peghead bushing that secures the tuner in place through the headstock (see Fig. 2), you'll want to tighten that up. Be sure not to overtighten it, as you can crack it or damage the finish on the headstock. Next, tighten the small screws that hold the tuner knob to the shaft (see Fig. 3). Again, just snug these up as you can crack the small clear or white plastic washer that is in between the handle and the shaft. After that, if there are any other small screws that hold the tuner in place, tighten those as well. If you have an open-back tuner and can see the large screw that secures the gear to the tuner post (see Fig. 4), tighten that, too. You can't access this screw on many sealed or closed-back tuners, but if you can see it, this is an important screw to tighten.

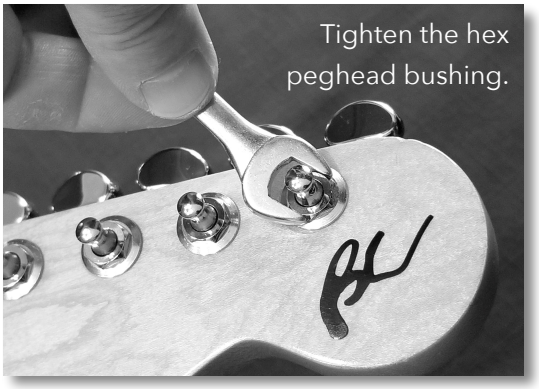



Fig. 2


Fig. 3


Fig. 4

# Fret Assessment

With the strings off, now is a great time to look at your fret wear and see if you have damage or flat spots on your frets. Frets should be as round as possible, so that when the string makes contact, it only touches one point on the fret. If you have flat frets, divots, scratches, or dings on your fret, you may now be making contact with more than one point on the fret, thus producing a false tone, "smearing," or "sitar-ish" sound. When you have fret wear or flat spots, you have to push the string closer to the fingerboard. This may even cause more wear to frets in front of the damaged spots.

The first line of defense in keeping frets fresh is a fret dressing. Fret dressing and fret replacements (as discussed next) are best left to experienced professionals. It's a very precise and meticulous skill that takes time, specific tools, and a lot of practice to do correctly. If you are interested in learning this skill, do more extensive research on the procedures and techniques and maybe even find a mentor to help you. Practice on inexpensive guitars first, and always use the correct tools for the job.

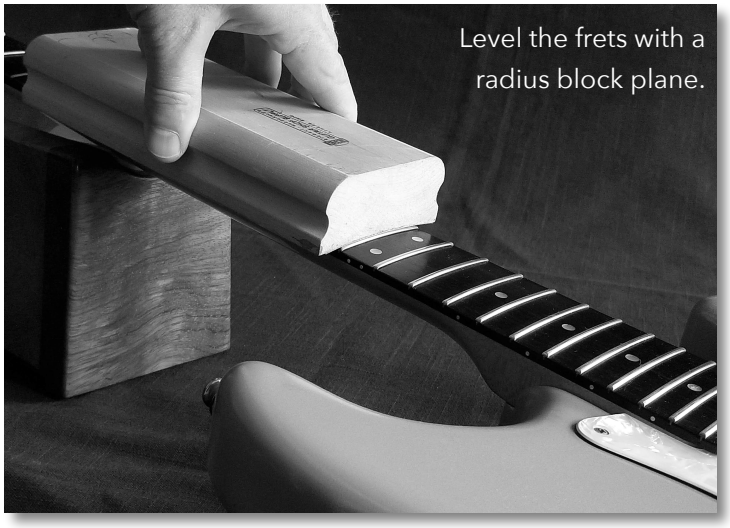
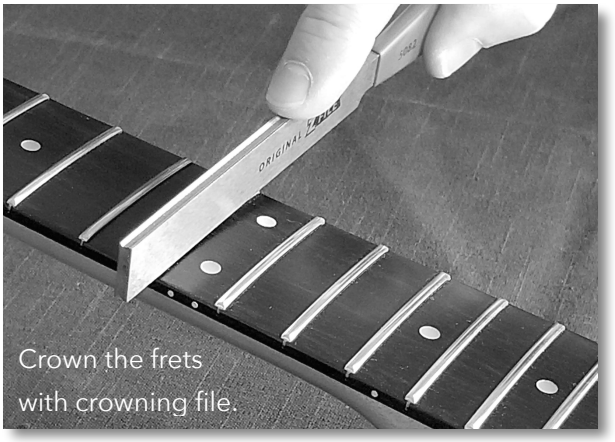

Level the frets with a radius block plane.

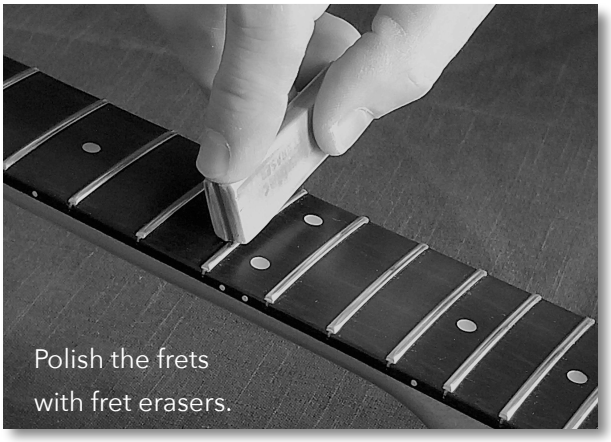
Fig. 5

Fret dressings start with flattening the fingerboard and leveling the frets so they are all the same height. This means removing some of the material of the fret to get down to the lowest little divot or flat spot. Yes, this makes your frets lower, but this helps to achieve more consistency in height across the entire fingerboard. Once you have leveled them with either a flat or a radius block plane (see Fig. 5), which is usually 300 or 400 grit on the cutting side of the plane, you then have to re-crown them to get the roundness back. To do that, you will use a crowning file. There are many types of crowning files available, e.g., Z-File (see Fig. 6), centered, or concave. The first two files will crown the frets without touching the top, so your fret height will usually remain intact. The concave files may touch the tops of the fret, so more care is involved while using this type of file. Some luthiers, when using a concave file, may count strokes to make sure that the top of the frets remains the same height all the way up and down the entire fretboard. Once you've re-crowned the frets, you then need to polish them to a nice smooth finish. Fret erasers (see Fig. 7) are



Crown the frets
with crowning file.

Fig. 6



Polish the frets
with fret erasers.

Fig. 7

great for this because you can go up in grit from 220 to 8000. After the fret erasers are used, I like Frine Fret Polish by Music Nomad for an even and consistent shine.

You can usually perform only one fret dressing before you need a fret job or fret replacement. However, if you have higher frets to start with and do a fret dressing early on with minimal damage or low spots, it might be possible to get a second dressing done. After frets are dressed once, or possibly twice, the next course of action is to replace the frets. This is where you pull the frets out and replace them with new fret wire. Once the new frets are installed, do a light dressing to ensure consistency. This is also best left to experienced luthiers with the proper tools and experience to do the job correctly.

*When searching for a reputable luthier to get any of these fret dressing or replacement procedures done, be sure to ask around, get references, and look at the work of the technicians who will work on your fine instrument. Again, these are not easy tasks, so leave them to the professionals.*

# Restringing

Once you've cleaned the body, the neck and fingerboard, tightened up your tuners, and assessed the frets, it's time to put strings back on and get into the procedures for doing your set-up. Many people have different opinions about stringing guitars, but I like to be able to do it in the most efficient, neatest, and tightest way possible to ensure the guitar stays in tune. Also, if a string breaks, I want to be able to change it very quickly so as not to waste time, especially if I'm in a session or at a gig.

You don't want to have extra windings on your tuner post or string windings crossing each other. This will leave a bit of slack in your string and if you bend a string, there is a better chance that the guitar will go out of tune faster. I don't believe in tying knots in my strings or going above the portion of the string that goes through the post. I want all my winds to be below the part of the string that goes through the post, staying on the concave section, pushing up on the string protruding through the post, thus creating its own clamp (see Step 6 in Fig. 8). You only need about two full winds to keep the string tight and maintain a stable tuning. I don't kink the string or cut it until I'm done, unless I'm stringing a slotted-style tuner. I let the string kink itself wherever it falls into place; I don't want to accidentally compromise the string in the wrong place, or what might possibly be in the windings. (In the case of slotted tuners, I will cut the string first so that I don't have too many winds.) Keeping all of my winds below the portion of the string going through the tuner post creates a better break angle on the headstock side of the nut. This will help keep the string snug in the nut and not jump out of the string slot.

## ***Restringing***

1. Straighten the tuner so you can pull the string straight through.
2. Measure 2-3 fingers past the post.
3. Pinch the string at your measured point and push back so the string is slack.
4. Hold the string down with your thumb close to headstock and tuner and tighten the string.
5. Make sure the excess string goes over your winds.
6. Clip excess about 1/8-1/4" from the post.

The first step is to turn the tuner so that you can pull the string straight through the little hole, and then measure two to three fingers past the post. Next, pinch the string 2-3 fingers past the post and push it back so there is slack. That 2-3 finger measurement is basically the amount of string you'll get around the post. (Some people with bigger or smaller fingers will have to adjust accordingly, but about 1-2" is needed. Some tuner posts may also be a little shorter, but with a little trial and error, you'll get it right.) At this point, hold the string with your thumb close to the headstock right in front of the tuner post and start to crank counterclockwise with your string winder. (The string winder is a guitarist's best friend when restringing.) Be sure to let the straight excess part of the string that goes through the tuner post go over your winds and keep your string taut from your thumb to the post to help you get clean, tight winds around the post. When you are close to pitch, cut the excess off, keeping it about an eighth or a quarter of an inch protruding through the hole (Step 6). Be sure not to overtune. This stringing method will also help when you have string breakage as it will be easy to get the string off the post without fighting any knots or extra bends (see Fig. 8 for the full sequence).

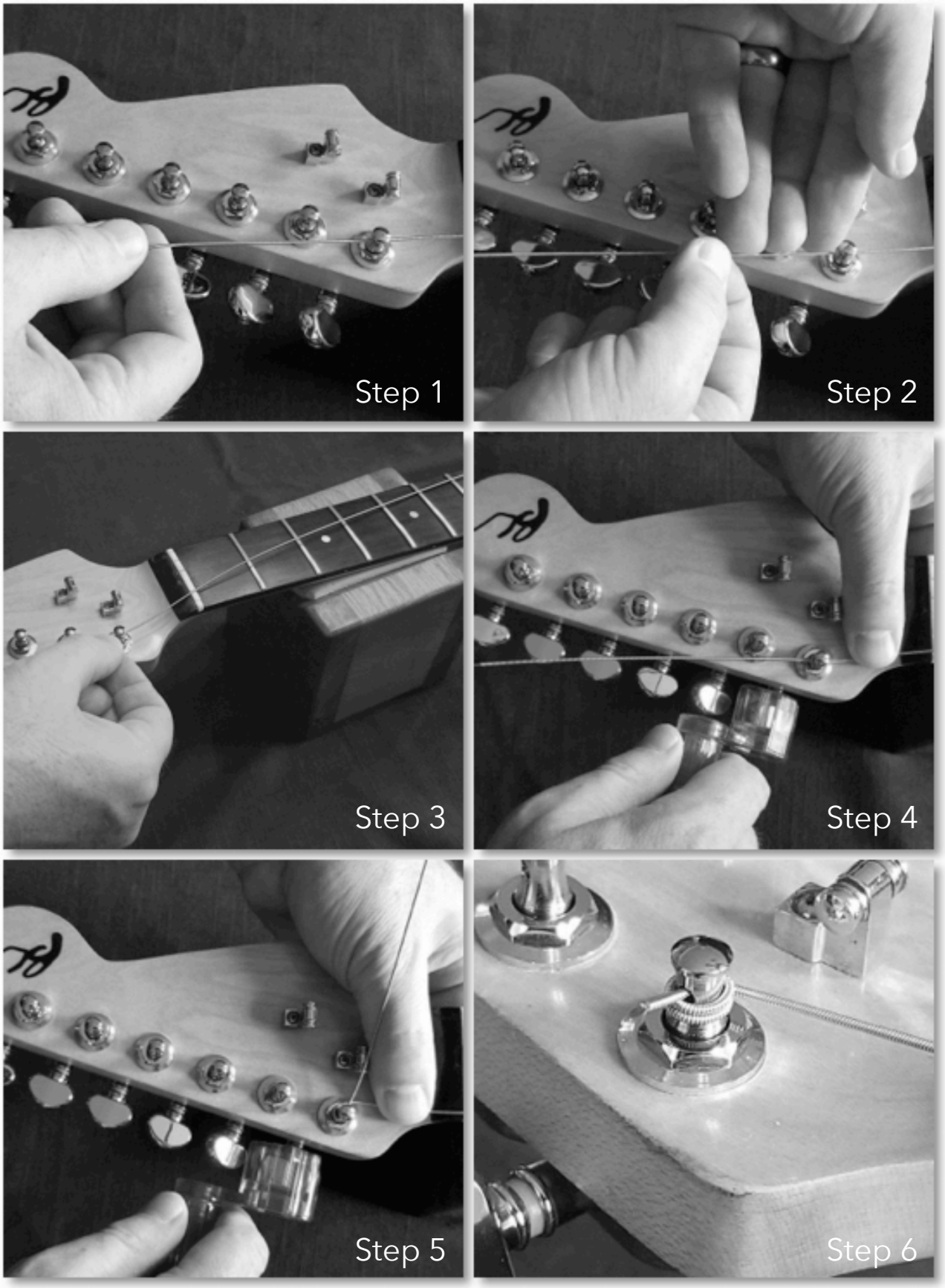



Fig. 8 - Restringing Regular Tuners


Fig. 9 - Restringing Slotted Tuners

## Slotted Tuners

For a slotted tuner, begin by pulling the string tight right across the top of the tuner that you are restringing. Next, measure about four fingers past the post, or about 3", then cut the string there. In this case, you will need to cut the string first, in order not to have too many windings. Place the string in the hole in the slot of the tuner (see Step 5), pushing directly down, and manually wind it once or twice (Step 6). Hold the string close to the headstock while pulling up on the string with your other fingers, cranking counterclockwise with the string winder bringing it up to pitch. Finally, you should now have a nicely wound string on your tuner (see Fig. 9 for the full sequence).

### ***Restringing Slotted Tuners***

1. Pull the string directly across the tuner you are working on.
2. Measure four fingers past the post.
3. Pinch the string at your measured point.
4. Cut the string at the measured point past the tuner.
5. Push the string directly down into the hole in the slot of the tuner.
6. Manually wrap the string around the post once or twice.
7. Hold the string close to the headstock, keeping manual winds tight on the post.
8. Pull up on the string with your other fingers and draw the string taut from the bridge.
9. Use the string winders to tighten the string close to pitch.
10. Tuner should have tight, clean winds when done.

## Locking Tuners

For locking tuners, simply pull the string straight through the post so it is taut, lock it in place with the thumbwheel on the back of the tuner, and tune it up. Locking tuners normally don't require any windings.

Once the guitar is strung, tune it to pitch or to the alternate tuning to be used, and play it a bit. I'll usually stretch the strings by bending them the way I would while playing. Bend them somewhere around the second or third position, as well as around the twelfth fret, and then tune it again. Bend the strings a second time and tune it again. At this point, the strings are relatively seated and ready to go. I don't like to pull on the strings too much or pinch them excessively, as I'd like to leave some life left in them.

**We are now ready to begin the most important steps in the set-up procedure.**

# Truss Rod Adjustment

Once you have new strings installed and they are tuned to either standard or alternate tuning, be sure your neck relief is set correctly. This is where the art form of guitar set-up comes into play. You want to finesse the guitar into the best shape it can be, in the condition it is in. Always keep your guitar tuned from this point forward, and anytime you make any adjustment, tune it again. Never crank wildly on anything, but go a little at a time. Be sure to tune it and check your work periodically.

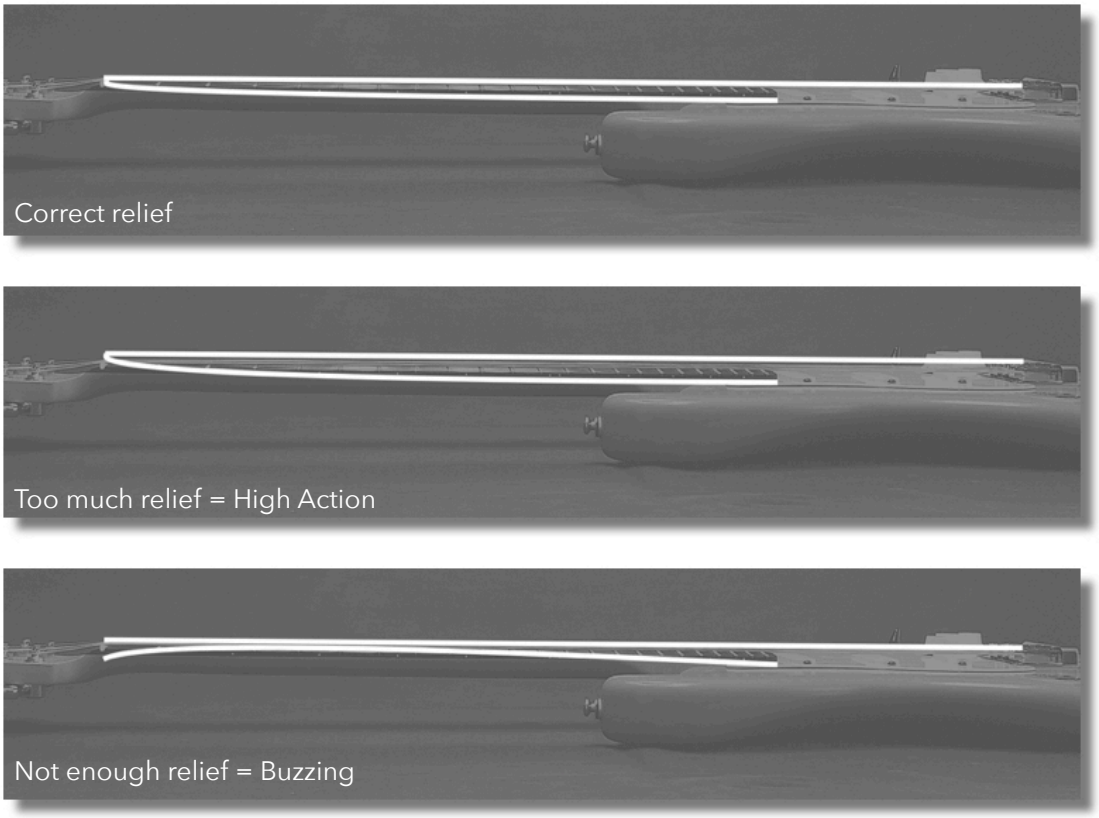



Fig. 10

In a perfect world, the neck should be as straight as possible, with just a hint of a curve coming up around the first or second position (see Fig. 10). The reason you want this little bit of relief is that the string needs room to vibrate. If the curve is too much or too high, the action will be too high. If the curve is going down, or backward, the action will be too low and you will experience fret buzz. If the neck is too straight, you may have good action at the lower positions, but as you move up the neck toward the body, it may gradually get higher. In this case, you want to add a touch of relief and then lower your action to get more consistency across the entire fingerboard.

I like to use the string as my straight edge. Since it's tight, it is a straight line from the bridge to the nut. Hold the guitar with your left hand on the back of the neck and your right hand on the body, bringing the bottom of the guitar up to your eye. Close one eye and look down the neck, sighting your eye down the top of the plane of the frets. Don't look at the wood of the fingerboard - focus only on the fret tops. Look at the relationship of the top of the fret to the bottom of the string, all the way down the neck from body to nut (see Fig. 11).

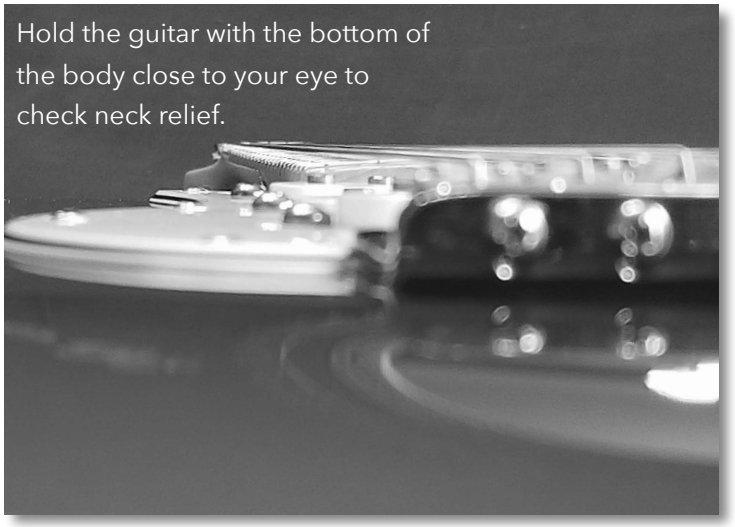



Fig. 11

Look down the bass side and the treble side to see if there is any difference. At this time, look at the neck to see if you have the proper hint of a curve upward, closest to the nut, in the best-case scenario. Sight the action to get a good relationship of what is happening up and down the fingerboard, but don't be too concerned with the action at this point. That will be addressed next. Be sure to adjust your neck with your guitar tuned the way you intend to use it.

Now, depending on which way you need to adjust the truss rod, you'll need to turn the Allen wrench, nut driver, or screwdriver, but only a little at a time. Start with about an eighth or a quarter of a turn. Access to the truss rod will be located either at the heel of the neck or in the headstock (see Fig. 12).

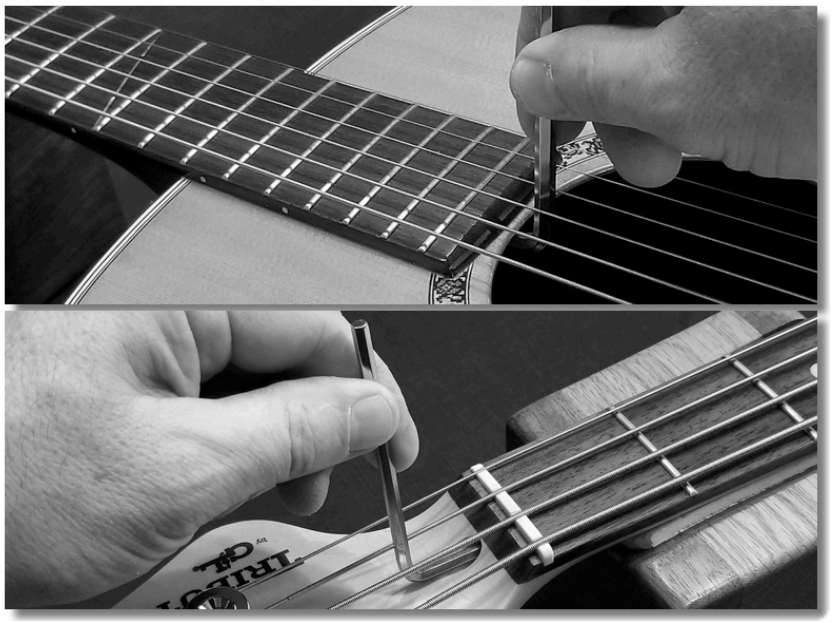


Fig. 12

As you tighten or turn the screw clockwise, it brings the neck toward the workbench or backward. If you loosen the truss rod, or turn it counterclockwise, the neck will come forward or up off the workbench. Make small adjustments and then tune it and check to see if you have adjusted it correctly, giving the neck a bit of relief.

In the case of some electric guitars where the truss rod is located in the heel of the neck behind the pickup and below the pick guard, it's very easy to take the neck off and make your adjustment. You'll need to loosen the strings quite a bit and take out the screws that hold the neck to the body. Tilt the neck back, make your adjustment, and put it back together, maintaining the neck snug in the pocket. Tune it again and check your work. Because you had no string tension on the neck when making the adjustment, it was basically guesswork, so you may have to take the neck off two or three times to get it set correctly. Take your time and always tune to pitch before checking your work.

After making your truss rod adjustments, you have, in fact, adjusted your action. However, this may not be the way you necessarily want to adjust it. Yes, while truss rod adjustments can improve your action, it can worsen it as well. Don't worry - the main action adjustments will be taken care of in the next step. You first need to make sure the truss rod is adjusted correctly, giving that hint of relief to the neck, before moving on.

# Action Adjustments

The action is the height of string off the fretboard. The higher the string is, the harder your guitar will be to play. If your action is too high, your notes will be sharp, because you are bending the string too much when fretting a note. If your action is too low, you'll get fret buzz and place excess wear on your frets.

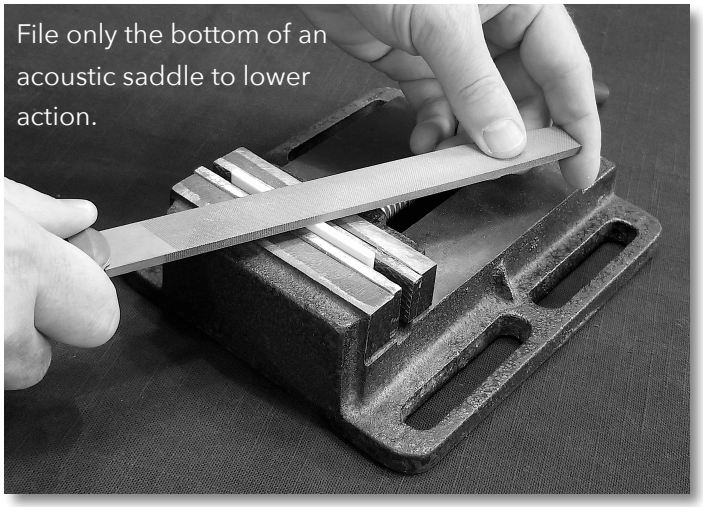

File only the bottom of an acoustic saddle to lower action.

Fig. 13

## Acoustic Action

Acoustic action is adjusted by either shimming the saddle to raise it or filing the saddle to lower it. You never want to touch the top of the saddle because it is already cut to mirror the radius of the fingerboard. When filing the bottom of the saddle, we want to keep it as flat and perpendicular to the sides as possible so that you have as much surface material of the saddle making contact to the bridge plate or pickup underneath it. I suggest using a vise and protrude however much of the saddle that needs to be taken off (see Fig. 13). Then file the saddle right to the vise, using the latter as a straight edge. You can use a piece of sandpaper on a flat surface and rub the bottom of the saddle across it, but don't let it tilt or rock back and forth when doing

this. This will produce a rounded bottom and will reduce your connection to the bridge plate or pickup resulting in loss of both tone and sustain. If you happen to file too much off, you can always get a replacement saddle or simply shim it back up. When using a shim, be sure to use a hard material such as a credit card. I usually want the shim to be the exact length and width of the saddle. Don't use a soft material such as a business card or soft wood like a toothpick. This will act as a mute and, again, you will lose tone and sustain.

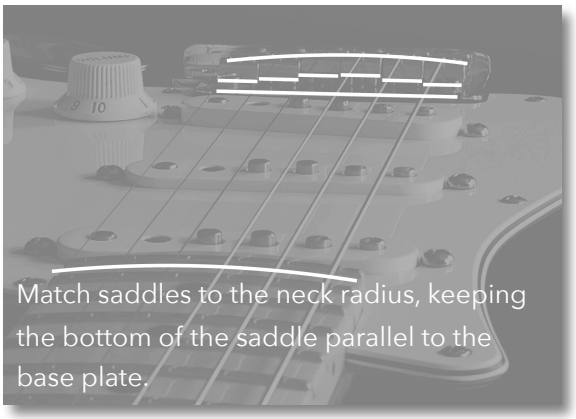
## Tune-o-matic Action

Turn the thumbwheel screw to adjust the action on Tune-o-matic bridges.

Fig. 14

Action on a Les Paul, 335, SG, or Tune-o-matic style bridge is quite simple. It's either tightening the thumbwheels (see Fig. 14) deeper into the body to lower the action or loosening them, away from the body, to raise the action. (If it is difficult to raise the action, you may have to loosen the strings a bit.) On some models, you may be able to use a screwdriver or hex wrench to turn the two height adjustment bolts. If your action is overall too high or low, you can adjust both accordingly. If one side is fine and the other isn't, then only one side should be adjusted and the other left alone. Floyd Rose-style tremolos are adjusted in the same way, by turning the bridge mounting studs with a hex wrench.

## Stratocaster Action

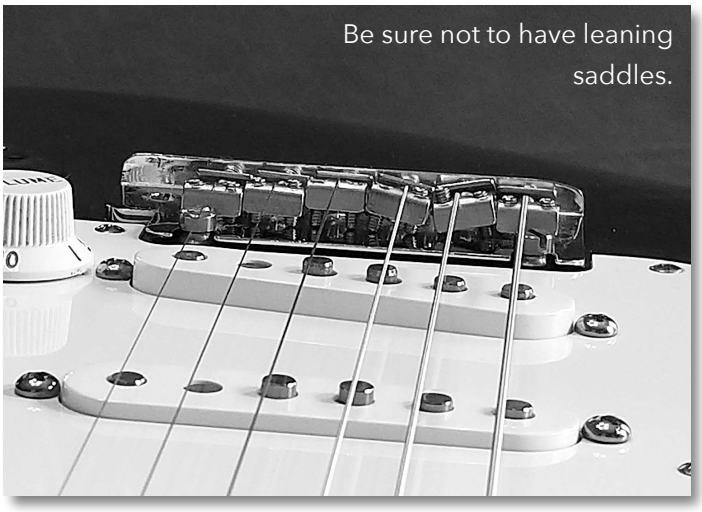


Match saddles to the neck radius, keeping the bottom of the saddle parallel to the base plate.

Fig. 15

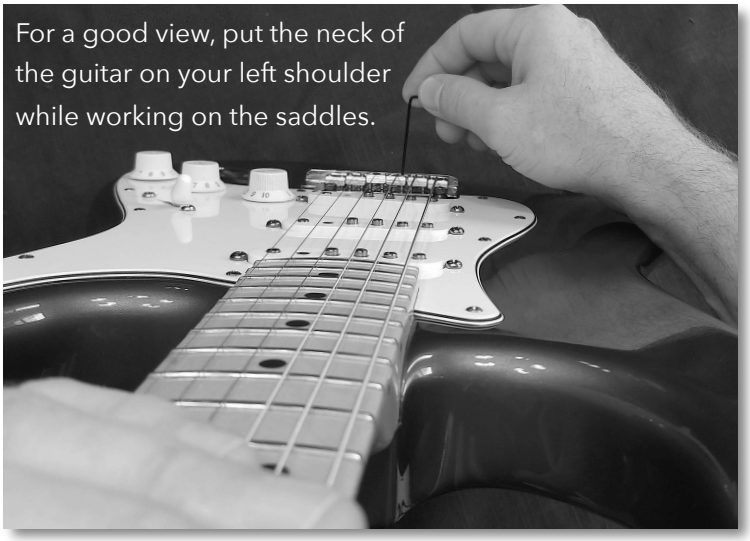
On a Stratocaster-style bridge with six individual saddles or on a bass that has four or five, the saddles should mirror the radius of the neck profile. In order to achieve this, keep the bottom of each saddle parallel to the tremolo plate or bridge plate (see Fig. 15). This will ensure an even amount of pressure is on each set screw of every saddle. You don't want saddles to be cockeyed or leaning one way or the other (see Fig. 16). This will put more pressure on one set screw than the other, and can result in one loosening up and moving, as well as possibly causing rattle. To achieve the matching

neck radius, you should have the saddles aligned in a stepwise array or arc. The outside saddles will be the lowest and the inside ones will be the highest. To get the best view of this while working, hold the guitar upright on the bench, putting the neck on your left shoulder. Hold your left hand across the fingerboard, lightly pressing the strings while using your right hand and the small Allen wrench to perform the adjustments to the set screws on each saddle (see Fig. 17). Once done, tune it and play it, bending strings and playing every string and every note all the way up and down the fingerboard. If you bend strings and they die on an upward bend, you'll need to raise the string a bit more. If you experience buzzing on a particular string, raise the corresponding saddle slightly. It's trial and error, but the more you do it, the better you will get. If your action is still too high or your radius feels off, you can address the problematic string or strings.



Be sure not to have leaning saddles.

Fig. 16



For a good view, put the neck of the guitar on your left shoulder while working on the saddles.

Fig. 17

Take your time, but make sure to tune and play the guitar once you think you are close. If you are having trouble getting the correct radius, you can also try using radius gauges to help you. They come in sets, so you can choose the correct one for the specific guitar you are working on.

## Tremolo Angle

If you use a tremolo, you most often will want the tremolo to sit parallel to the body or be slightly off the body, just enough to fit a piece of paper underneath it. That being said, if you have a Fender tremolo and want to be able to go backward on it, you can set it so that it is lifted off the body a little more to allow movement both ways. But generally, the tremolo should be flat or parallel to the body if it is floating in a cavity. If you happen to

change string gauge or switch to an alternate tuning, the tremolo at rest may have changed position due to the different tension and become either too high or too low. It is easy to fix that at this point, before you work on your action. You'll need to take the backplate off the guitar and adjust the two screws that hold the spring claw to the body (see Fig.18). They will either be tightened deeper into the body to bring the tremolo down or loosened to raise the tremolo out of the cavity or off the body. Be sure to keep the claw parallel to the cavity wall. I recommend adjusting the screws until the tremolo is about halfway to where you want it to be while at rest, because once you make an adjustment, you will have to tune the guitar again. This will typically move the tremolo closer to where you want it, so do these adjustments in increments. Once in place, you can adjust the action at the mounting studs or saddles.

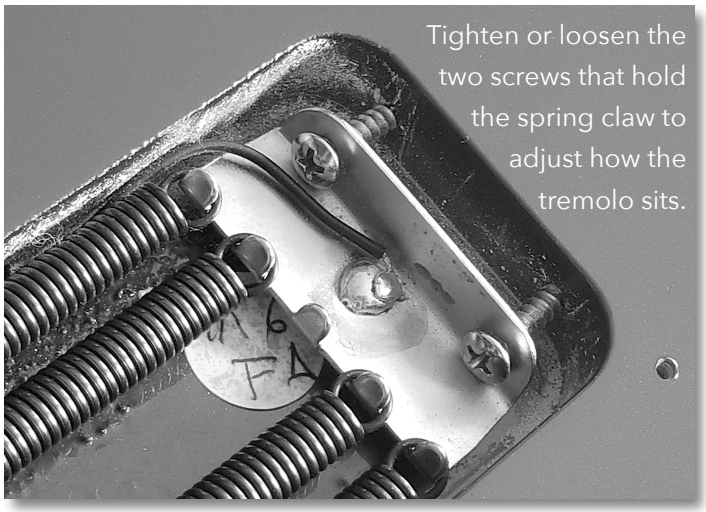



Fig. 18

### Telecaster Action (Three Saddles)

Telecaster-style bridges that only have three saddles can be set to the radius of the neck by having the inside saddle relatively flat and the outside two leaning slightly downward on either side. This is acceptable for these style bridges because there are two strings per saddle.

If you can't seem to get your action set just right, go back and double-check your neck. You shouldn't have too much curve one way or the other, and your neck shouldn't be too flat. Make another adjustment if necessary, and then work on the action again before you proceed to adjusting the intonation.

## Intonation

Intonation is the accuracy of pitch, and on a guitar, you would do this by splitting the string in half at the twelfth fret and making sure it is in tune. To explain intonation, let's use a vocalist as an example: If a vocalist sings a note in one octave and then sings the same note an octave up or down and that note is sharp or flat, the singer's intonation is off. The

same goes for guitars. If you play an open note and play an octave up, you want that note to also be in tune and not be sharp or flat. Always set your intonation to the fretted twelfth note, not the harmonic or overtone. If you think about it, when you play the twelfth fret, you are bending the string slightly. When you play the harmonic, you are not. So you want that fretted note to be in tune. Also, you're most likely playing that fretted note far more often than the harmonic, so that fretted note is much more important than the harmonic. When working on your intonation and fretting the string at the twelfth fret, always use good technique and push the string directly toward the fingerboard. Don't pull down or push up on the string.

## Acoustic Intonation

Acoustic guitars don't have any intonation adjustments, so the truss rod and the action must be set properly. If your intonation is sharp on your acoustic, it is very likely that your action is too high, thus making you "bend" the string too much when you are playing the twelfth or other frets. If your intonation is flat, you may need to reassess your truss rod and possibly use the relief to change your scale length. A compensated saddle will help your acoustic's intonation, if one can possibly be substituted.

## Electric Intonation

Getting your electric guitar with individual saddles intonated properly consists of a five-step process for each string. The first thing you need to do is to have your guitar tuned in the open position. If you are setting it up in an alternate tuning, you should be tuned to the desired tuning. This is very important, especially on Floyd Rose-equipped guitars. It is imperative that there is the appropriate tension on the neck.

1. Play the first open string to verify the open string is in tune.

2. Play the twelfth fret. If the fretted note at the twelfth fret is sharp, you will need to move the saddle backward or toward the bottom of the guitar. This lengthens the scale. If the fretted note at the twelfth fret is flat, you will need to move the saddle forward, toward the neck. This will shorten the scale. (Flat forward, or "FF," is a way to remember.)

3. Make your adjustment. This is usually done with a screwdriver by turning the screw at the back of the Stratocaster bridge (see Fig. 19) or Tune-o-matic bridge (see Fig. 20). (It may also be on the front of some Tune-o-matic style bridges.)

4. Tune it open again.

5. Check your work at the twelfth fret. If you are in tune at the twelfth, you are done with this particular string. If not, repeat the process. Once you are done with the first string, repeat the same process for all other strings.

Fig. 19 Adjust the screw at the back for proper intonation on a Stratocaster.

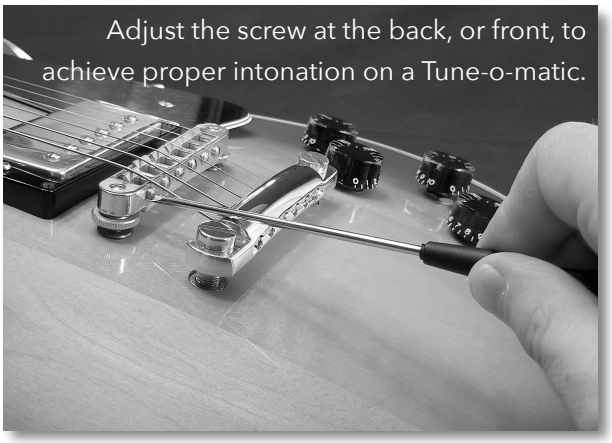


Fig. 20 Adjust the screw at the back, or front, to achieve proper intonation on a Tune-o-matic.

In the case of Telecasters with only three saddles, you must find the average of the two strings at the same time. If you get one string in tune at the twelfth and the other string isn't, compensated saddles can help. If you don't have compensated saddles, you can cheat a little by raising or lowering the problematic side of the saddle, if possible. This may help you get closer to having both strings intonated properly.

On a Gibson Melody Maker or SG Junior-style guitar that does not have individual saddles, your intonation adjustment is an average of all strings. Usually, the bridge will have two small set screws on the back that push against the two bridge posts that go into the body. These set screws will move the bridge back and forth on each side. Sometimes, the bridge itself may already have a compensated saddle across the entire length, but you can adjust the set screws to get your strings closer to being intonated correctly.

Your guitar should now be set up and playing properly. If you can't get your intonation set correctly, check your truss rod first, then double-check your action, and always finish with your intonation.

# Extra Tips for Accurate Intonation

Here are a few additional notes when working on your intonation.

- **Stratocaster Saddles**: When the saddle intonation screw is loosened, it occasionally backs itself out of the bridge. This happens due to the string coming up through the saddle and the tension of the string acting as a clamp, holding the saddle in place. Anytime you loosen the screw, always give it a little nudge with the screwdriver to make sure it moves forward. When tightening the screw, the saddle is dragged backward on the threads, so it will always move back.

- **Tune-o-matic Saddles**: If the saddle is up against the bridge and you need it to go farther, but run out of space bottoming out against the bridge, the saddle can be turned around. For instance, if the bevel of the saddle is leaning inward, you can always take that individual saddle out and flip it around so that the bevel moves the string contact point to the outside to buy yourself a little more room. This applies to both directions or sides of the bridge.

# Conclusion

Every guitar is different. I've played tens of thousands of guitars over the course of my career, and some have played like a dream while others have been nightmares. Some guitars may have fret wear while others may have a high or loose fret. A guitar may have a little excess wear to the nut or perhaps a damaged saddle or bridge. Be sure to follow the procedures in this manual to get the best set up achievable for your particular guitar. Set-ups are necessary maintenance that needs to be done periodically throughout the year, but they are important in order for our instruments to play at their best.

If you have issues once you complete your setup, review the three main topics starting with the truss rod, then the action, and finally the intonation. If problems persist, look over the main components of the guitar with a fine-tooth comb to ensure that they are all functioning properly. To isolate a problem further, you may want to consider acquiring more specific tools to add to your collection such as a fret rocker, radius gauge, straight edge, or measuring tool. Do additional research on other procedures for more in-depth maintenance, and always leave the most advanced fixes to the professionals if you are not comfortable performing such tasks. I've listed some of our past and present sponsors, as

well as other companies that I like in the “Recommended Vendors” section. You can contact them directly through their website or by phone. If you are watching videos on YouTube, I highly recommend viewing more than one. Some are good, but some are not. Guitar manufacturers can also usually be contacted for replacement parts or warranty issues.

The more you work on your guitars, the better you will get at the set-up procedures. Take your time and always check your work and keep your guitar in tune. A good cleaning and set-up for me usually take about an hour or so. Hopefully with the aid of this manual, you will better understand what you are trying to achieve at each step and you will be able to identify problems easier and fix them faster. Good luck, have fun and enjoy your properly set-up instruments!

# Recommended Vendors

Stewart MacDonald (StewMac)

Music Nomad Equipment Care Products

Luthiers Mercantile International, Inc. (LMI)

Allparts Music Corporation

Harbor Freight

Philadelphia Luthier Tools & Supplies

Grizzly Industrial, Inc.

# Guitar Collection

1963 Gibson J45

1972 Fender Mustang

1984 Gibson Les Paul Custom

1993 Alvarez Yairi DY69

1995 “BC” Stratocaster

2003 G&L Tribute L-2000

2010 Fender Stratocaster (on loan from Steve Matheis)

2015 “BC” Telecaster

2015 “BC” ES-335