October 2012

Howdy!

The topic for this tech tips newsletter will be *Coil Splitting* and *Coil Tapping*.

Coil Splitting and *Coil Tapping* are two methods which can be used to extend the range of tones on can get from a magnetic pickup.

First, a few definitions:

Coil splitting refers to disabling one of the two coils of a humbucking pickup by shunting that coil's output to electrical ground.

Coil tapping is most often used to describe a single coil pickup which has a coil start and more than one coil end (output tap).

Because I intend to devote most of this article to *Coil Tapping*, let me start with *Coil Splitting*. In many modern humbucking pickups each of the two coils of the pickup has a coil start and a coil end. One coil is typically wound clockwise and the other coil is wound counter clockwise. In the usual "PAF" style humbucker configuration a single bar magnet located under the two coils provides the magnetic field for both coils: one coil is north up and the other south up. When these two coils are connected together in series the signal generated by vibration of the instrument's strings in each of the two coils is in phase and these two signals add together providing reasonably high output. An external noise signal (which can come from alternating current (AC) electrical devices in the environment) can also be present in each of the two coils of the humbucking pickup. These two noise signals (one noise signal in each coil) have the opposite phase from each other and subtract to effectively cancel the total noise signal. If a humbucking pickup has an output cable with four conductors (one conductor for the coil start and coil end of each of the two coils) one can "split" the humbucker by shunting the series connection of the two coils to an electrical ground. This *Coil Splitting* reduces the output of the humbucking pickup and also eliminates the noise cancellation effect. A humbucking pickup which is *Coil Split* tends to have a more single coil like tone and output.

Now, on to *Coil Tapping*.

Most standard single coil pickups have two leads: one connected to the start of the coil windings and one connected to the end of the coil windings. The lead associated with the coil start is often connected to an electrical ground in the instrument's controls circuit (such as the casing of a volume or tone control potentiometer (aka "pot")) and the other lead is considered the "hot output" which is often soldered to a lug on a pickup selector switch or volume control pot in the instrument's controls circuit. A shielded pickup can

have a third, independent lead which is soldered to copper shielding surrounding the pickup's coil; this lead should be connected to a known electrical ground in the guitar's circuit in order for the shielding to function properly.

Let's explore the types of tapped single coil pickups starting with the most basic design. Imagine an unshielded strat style single coil pickup which is wound with 7,500 turns of 42 gauge wire in the usual way. This standard design single coil pickup has two brass grommets located on the bottom flange of the pickup: one grommet for the start of the coil windings and one for the end. Let's call the first grommet where the coil windings start "S" and the second grommet where the coil windings end "E1" The DC resistance (DCR) of this coil (as measured between S and E1) will be approximately 5.5 k-Ohms. To this pickup we can add a second output grommet, E2. Assuming there is space on the bobbin one can add more turns on top of the original coil by starting the new windings at the grommet where the first coil windings ended (E1) and finishing at a third grommet (E2). If we add an additional 2,000 turns to this pickup, the windings from the first coil *plus* those of the second coil will be in a series connection and will result in a higher output signal with perhaps a noticeable emphasis in the midrange frequencies. With an appropriate switch added to the instrument's controls circuit one would be able to change between the first output lead (coil tap E1) which has a DCR approximately of 5.5 k-Ohms to the second output lead (E2) with a DCR of approximately 6.9 k-Ohms. It would also be possible to obtain a very under-wound tone from this simple coil tapped pickup by using the first output tap (E1) as the coil start and the second output (E2) as the coil end. This would result in a coil having effectively 2,000 turns of 42 gauge wire and a DC resistance of approximately 1.4 k-Ohms.

To this tapped single coil pickup we could also add another grommet (E3) and add even more windings.

Another option for this tapped single coil design would be to underwind the first coil and add additional coil windings for the second and third output taps (E2 and E3). Here is an example: wind the first coil with 5,500 turns of 42 gauge wire, the second coil with an additional 2,000 turns of 42 gauge wire and a third coil with an additional 1,500 turns of 42 gauge wire. The approximate DCR values would be: S to E1: 4.0 k-Ohms, S to E2: 5.5 k-Ohms and S to E3: 6.6 k-Ohms. As described in the previous example one could also access the intermediate taps having 2,000 turns (E1 to E2) and 1,500 turns (E2 to E3) for DCR values of 1.4 k-Ohms and 1.1 k-Ohms respectively. In this pickup with three outputs (E1, E2 and E3) one could also envision utilizing the coil windings between E1 and E3 for a coil having 3,500 turns and a DCR of approximately 2.5 k-Ohms.

Here is a brief, generalized summary of the effect on tone and output of under and over winding a single coil pickup:

1. Under wound: lower output than standard wound, brighter, clearer tone and more "airy" sounding.

2. Standard wound: higher output than under wound, more midrange emphasis than an under wound coil and in the case of a strat style single coil: bell like tone.

3. Over wound: higher output than standard wound, more emphasis on the midrange than standard wound and a "heavier" tone.

It is not necessary that all of the coil windings be made using the same coil wire gauge (42 gauge in the previous examples).

A tapped coil can have the first coil made with 42 gauge wire and the second and third coils made with 43 gauge wire. This design option might be chosen if space is limited on the pickup bobbin.

As a practical matter, the multiple output options available for tapped single coil pickups can be accessed using a variety of switches. Here are a few examples:

In a single pickup instrument the controls circuit might include a three-way toggle switch (as found on Les Paul style instruments), a blade style pickup selector switch (as used on many tele style guitars) or a push-pull pot to change between the output taps. Installation of a tapped single coil pickup and the appropriate switches in the controls circuit can give an instrument with only one pickup a wide range of useful tones.

In an instrument with two or more pickups one can include push-pull pots to access the output options of coil tapped single coil pickups. Each push-pull pot may be used to switch between two output taps of two coil tapped single coil pickups simultaneously. One could also use a two position on-on or a three position on-on-on mini toggle switch to control the output of coil tapped single coil pickups.

Custom tapped single coil pickup designs are available in many size formats including pickups designed for strat or tele style guitars, soapbar or dogear P-90 style single coil pickups, humbucker size single coils, pickups for lap steel instruments, bass guitars and many others. Please contact Vintage Vibe Guitars for more information on tapped single coil pickups.

I hope you find this information useful.