

THE SECRETS OF PAF TONE REVEALED...

The monkier "PAF" has been so completely abused over the last 40 years by anyone making humbuckers, it has lost a lot of respect and meaning. I don't recall Gibson using ceramic magnets in them, potting them solid in a block of wax, or putting four conductor wiring on them, with double screw poles; yet we see "authentic PAF tone" being touted on these kinds of products all the time. The true experience of them is being lost over time in trite advertising slogans.

Almost every detail of an original Seth Lover-designed, vintage product is unique compared to modern pickups. Without giving it all away, I'll describe some important details. The coil bobbins, for one, are nothing like what parts sellers offer today. The originals are noticeably shorter, and made of butyrate, a cheap plastic that almost melts if you try potting them in wax (go ask Eddie V. Halen!) There are other things about them unique as well, shhhhhh...

The magnets. Some of them were radically different than what I have seen in any other pickup. All modern alnico 5's are cast in a powerful magnetic field and when finished will only hold a charge in one direction. Yet, in vintage PAFs there is such a thing as an alnico 5 that was cast without being in a strong magnetic field, so they are a non-oriented magnet and can be magnetized in any direction, the same as alnico 2, 3 or 4. Modern magnet manufacturers refuse to make non-oriented A5 magnets as custom orders without you buying a literal ton of the material. Tim Shaw found this out yet was unable to get Gibson to pay for doing it right. They also refused to pay for plain enamel magnet wire and used a poly coated substitute.

The magnet wire varied quite a bit due to crude manufacturing tolerances of the time, some were thicker, some were thinner and, most importantly, the insulation thickness varied a lot as well. Insulation affects capacitance, the thicker the build the less capacitance, the more open the tone. This is why "heavy" (build) formvar wire makes Strat pickups super chimy, loud and quacky; more of the signal gets through. It is just like using tone caps. The higher capacitance, the darker the tone, lower capacitance, the tone is brighter. The varnish on the plain enamel wire isn't the same as is used today, so there is a slight difference in the dielectric effect which again relates to the capacitance effects. Dielectric simply means how efficient an insulator is, the less efficient it is the more the coil sounds darker. Some of the old wire was better insulated than modern fare, thus more open toned.

The winding pattern was one or two different known turns per layer. The Leeson 102 industrial winder used by Gibson, which Seymour Duncan now owns, was a very sloppy winder and run by minimum wage labor. There is a certain turn count (how many turns of wire per layer), but how the wire was laid down was inconsistent and crude, resulting in some coils that are all piled up against one wall of the bobbin, or an hourglass shape, or a bulge in the middle shape, no consistent form. This is often mistaken for being a hand wound coil. Seth Lover himself stated the only ones hand wound were the ones that came back for repair, the production pickups were all machine wound.

Now, we get to the core engine of the tone. The metal parts, specifically the magnetic circuit parts, consist of the pole screws, the



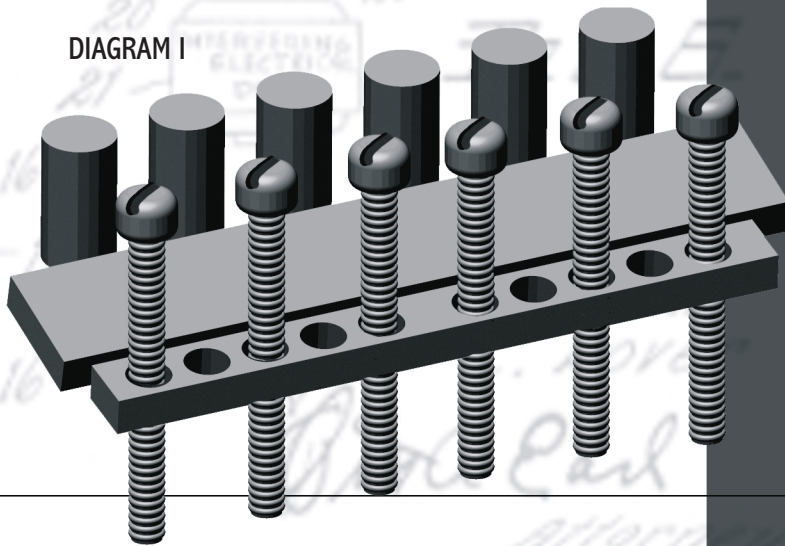
A 21st Century Pickup Maker's Research and Views BY DAVE STEPHENS

As a pickup maker, the subject of PAFs, (or "patent applied for" stickered vintage Gibson pickups), has been my main obsession for the last six years. I am not one to accept myths at face value, or to believe that "they don't make them like they used to," a battle cry heard over and over again. If something exists in the physical world, it can be back-engineered and understood and hopefully replicated. This has been a personal challenge for me, and a few other pickup Makers who adore that tone.

What is "that tone" and why does it cause irritation and arguments on Internet forums when broached? Many will repeat thoughtlessly that, "oh, they all sounded different, some of them were horrible, some of them great." This may be true to some extent, but the real truth is there is an identifiable characteristic "PAF tone" that is common to every authentic example. It's almost pointless to try describing tone in words, you end up tripping over your tongue and confusing everyone. But, that said, to me the archetypical tone has a metallic ring to it, a certain elusive chimy top end, best heard at lower gain settings. The feel is direct and touch responsive. Duane Allman's solo wth Herbie Mann on "Push Push" is a great example of the tones I study.

There is a touch of acoustic hollow sounding notes that are very human-like, vocal in expression, this is very noticeable in the neck position, and is there regardless of the cover being on or off. The in-between middle position on a two-pickup guitar sounds much sweeter and almost tele-like when compared to modern products. They have an almost single coil-type of tone in many ways, probably what attracted Bloomfield and Peter Green to them for the blues. If you *know* that tone, you instantly recognize it when you hear it. Yet, those characteristics are easily drowned in the overuse of gain pedals or master volume mush, then they begin to sound like everything else if drowned by layers of noise.

DIAGRAM I



slug poles and the spacer or "keeper," that the pole screws are sunk into, and that butts up against the magnet in the base of the pickup. This circuit is where all the action happens. In diagram I you can see the flat bar magnet with slugs contacts the north side of the bar, the opposite side or south side contacts the keeper/spacer bar, and the pole screws are sunk into that. The coils/bobbins are not shown. The magnetic flux flows from the top of the pole screws, to the top of the slugs, then down and around through the magnet to the spacer and back up again through the screws to complete the circuit. Every vibration of the string reverses the direction of the magnetic flow, this alternating magnetic flux flows through the coils and creates an electric signal to your amp.

The kind of metal these parts are made of determines the overall main tone. Period. That is the primary true secret of PAF tone, being what kind of metal was used. A good analogy is that the type of metal has the same effect as changing the type of alnico magnet you are using. PAFs used a soft iron magnetic alloy, the use of this alloy continued to be used into the early Ttop stage and then later disappeared, taking the tone secret with it. Ttops changed the metal in the slugs after awhile and that changed the tone again. Magnetic alloys sound nothing like common hardware store steel alloys, big difference. Modern production pickups generally use common mild carbon steel and will never duplicate those historic tones.

Magnetic alloys are all about efficient following of the alternating magnetic field, the more efficient the more true to the actual tone of the vibrating strings and the acoustic sound of your guitar will be produced. This is why these pickups can sound very acoustic guitar-like at lower gain settings. These early alloys, though, were not perfectly "hi-fi" efficient, so the metals and coil combination didn't produce a flat frequency response but had its own characteristic tonal signature. The PAF tone. These alloys were made using the technology of the time, quite different than modern industrial techniques, so they may never be reproduced exactly, the same as magnets back then were different than most we get now.

The different magnets in PAFs changed the character somewhat

but not the overall tone signature. Alnico 4, 2, and non-oriented 5's were the most common, and rumors of 3 being used in some. The non-oriented alnico 5 magnets sound a lot like alnico 2, alnico 4 has a more clear, sharp tone, alnico 3 is very dark, weak and fat sounding, alnico 2 is like a darker version of 5 and not as strong. The modern alnico 5 is very strong and midrange heavy, very rock 'n roll. The magnets used were also thicker than what is made today, measuring .133" thick versus the modern .125" thick. Thicker magnets are stronger and fatter sounding.

This "secret" of PAF tone has been somewhat known by a few for some time, but is now surfacing more in the small pickup making world of the "boutique" tone artists (I hate that "boutique" label, uhhh, we don't sell dresses, duh...). So why, if this stuff has been known, don't we hear accurate copies reproducing that tone? The biggest reason is that magnetic alloys are very expensive nowadays, they just aren't suited for a mass production product, so less expensive, "sorta close" alloys are used, and that's all they are, is sorta close. Now, I am not "dissing" the "PAF style" product that exists out there, many of my fellow pickup makers are doing wonderful sounding products in that vein. I was personally able to get closer than anything I've heard so far using a "work-alike" material, very expensive magnetic alloy, that I shape and form myself, but its not a dead-on copy but closer than anything I've tried. I continue to learn more about these amazing pieces of vintage technology every year and put the knowledge to good use, with the hope of getting even closer. It is an obsession with me, though it is dubious that a big market even exists or would care for a really accurate PAF tone signature product. All I care about it having my guitar sound like that! And sharing it with other guitar players...

HOW TO BUY A REAL PAF FOR DARN CHEAP

One of the benefits of studying vintage PAFs is that I figured out how to score authentic PAF pickups for relatively cheap on Ebay. I've done this twice now and anyone willing to take some risk and do some study work can do it too.

The materials that make those pickups sound the way they do, were used beyond the PAF sticker period. Early patent sticker pickups had exactly the same core metals and magnet wire as the real deal. About 1963 the magnet wire changed to an orange poly coated wire from the original plain enamel. There is even a black enamel coated wire that appeared then as well (very rare). The poly wire did change the tone but not a whole bunch, and these can be had for as little as \$300-400 if you get a fixer-upper. What you want to look for is original magnets and original wire, hopefully plain enamel but the reddish orange wire is ok. The plain enamel wire is brown with a purple tint. Original coils, not rewound, and all original pole screws, slugs and keeper bar. Changed baseplates are fine, rewired to four conductor is also fine, as it can easily be put back right. Even if it was potted its fine, it won't change it that much.

Even early Ttops have essentially the same metals in them, but the wire is again the poly coat, and pretty quickly the bobbin dimensions changed radically to what we mostly use today, so the tone got brighter and more distinct due to taller coils and the newer oriented alnico 5 magnet, now a shorter and thinner version. So while these are outside the true PAF sound, they are great pickups and sure to appreciate in value over time. Buying slightly altered or semi-damaged early patent sticker pickups (dateable to '60-'63 is the way to go if you are just after the tone), your pickup maker, if experienced, can easily repair them and make them useable and are worth the risk. Often you will see some auctions with photos that are completely out of focus; those are the ones to look for, could be trash, but with enough of the right questions you could have a true tone treasure for your favorite axe. There are some websites that show in detail the elements of different year PAFs and these can help you figure out if an auction is for real or a scam. If you find one you think you might want to risk, email me and I'll try to help you figure out if its a real one or not, and can help you restore any that are damaged or are missing parts. ☺

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