

Talking Amps with...

Sergio Hamernik: *Transformers and Amp Tone*

For decades, unquantifiable numbers of discussions have wrangled over the main ingredient of amplifier magic. Some amp gurus say it's the vacuum tubes. Others swear by the capacitors. One question has always remained: Does the *transformer* have anything to do with an amp's tone?

At *Mercury Magnetics*, founder Sergio Hamernik readily acknowledges *transformers* are a bit of an enigma. Nonetheless, he very firmly believes they are the true foundation of tone.

"They remain the biggest and most misunderstood black hole on the subject of amplifiers and tone," he said. "But it's really not all that mysterious. Get an amp's magnetics right, and everything else falls into place."

But what does a *transformer* really do? We recently spoke with Hamernik, posing that question along with a slough of others about the design, purpose, and effect on output "trannies" in guitar amps.

VG: How does a transformer affect the sound of an amp?

SH: A power transformer that's under-built is much the same as an automobile with an undersized engine. Take two cars; one has a five-horsepower engine, the other has 500 horsepower. Run them both to 70 miles per hour. How long does it take the five-horse to get there?

In an amp, energy has to be converted into sound – and the quality of the *transformer* determines the quality of the rest of the amplifier. The better the power supply, the faster it will respond to the sonic demands of the player. It's the amount of energy available; you don't want to be wait-

ing for the *transformer* to play catch-up with every note you pluck.

VG: A lot of players believe the main contributor to an amp's tone are its vacuum tubes.

SH: Tubes are greatly influenced by the reactance of an *output transformer* and how it's built. That's why a *Marshall* amp sounds different than a *Vox* or a *Fender*. It's the main reason why a *Marshall* has a distinct *output transformer* design. When you swap power tubes, the differences in tone are actually quite subtle. But if you replace the *output transformer*, you have a completely different-sounding amp.

VG: Does that mean some players put a little too much stake in "matched" output tubes?

SH: It's partly true that you don't need exactly matched tubes to get great tone. Often, you can get great tone with mismatched tubes if they're at least operational. An old studio and touring trick was to swap power-tube positions, which often provoked the best tone. The trick was simply taking advantage of the differences in unmatched tubes!

So, while it's important that tubes be tested for defects, they do not necessarily need to match. Tubes used for preamp and phase splitters should, as a rule, be matched for balanced operation. The "imbalanced" concept is actually a fundamental design philosophy, noting dif-

ferences between *transformers* built for hi-fi audio versus guitar tone.

VG: How's that?

SH: *Output transformers* in amplifiers are highly reactive components. Not only are they reactive, they tend to be reactive in a lopsided way, which disturbs the tube into distorting in a manner we find pleasing for its musical qualities.

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This introduces a key point; there's a *huge* difference in design and execution between hi-fi and guitar amp *transformer* designs. In order for a guitar-amp *transformer* to sound its best, certain imbalances must be built into its design. With hi-fi, you're trying to get as clean and undoctored an output signal as you can, without distortion. The opposite characteristics – distortion, overdrive, “grind,” and “crunch” – are the cornerstone of what makes a guitar amp toneful. The term “clean” in a guitar amp actually means “less distorted,” but it's still a distorted signal.

This reactive element of *transformers* running imbalanced is key to creating a complex soup we call amplified guitar “tone.” When you're making good soup, how thick or thin you cut the vegetables, the other ingredients you put in, all affect the flavor. The ingredients are often subjective, but in the end, the effort and attention to detail make all the difference.

Musicians were on the verge of losing the quality of their tone until somebody stepped in to utilize these fundamental principles. At **Mercury**, we made it our mission to gain the knowledge and craft of how to make guitar-amp *transformers*.

VG: Do they still make *transformers* like they used to?

SH: No, with **Mercury** being one of the few exceptions. Consider the quality of the wonderful *transformers* of the 1950s and early '60s, when manufacturers were still building to military specifications.

How could this happen. Well, *transformers* have always been the most expensive parts of an amp, somewhere around 50 percent of the costs. Not to mention they're often heavy, which affects shipping costs. The folks responsible for purchasing face a lot of pressure to get costs down, thus maintaining the trend toward low-budget *transformers*. So it was inevitable that the “baby” – in this case, tone – got tossed out with the bath water.

Older *transformers* were designed to meet a power ratio of 6:1, 7:1, or even 8:1, the

ratio meaning the power supply rating versus audio output rating. It wasn't unusual to find 600 watts of power supply on a 100-watt amp. Talk about headroom! By the '70s, though, price points started having more influence on product than did design, and power ratios started to slim down. Case in point; a popular line of amplifiers that made their mark in the '60s were built requiring power ratios of 6:1 or 8:1. By the '80s they were dropped to 4:1, 3:1, or even 2:1. Today a lot of *transformers* coming out of Asia are as low as 1.5:1!

Why is this important? Two main reasons; the first is that note separation and the amp's punch-through characteristics depend on these ratios. The lower the ratio, the less dynamic and more dull-sounding the amp becomes. The second reason has to do with the operating tem-

former manufacturer to easily wind more than one coil at a time. Back then, nylon bobbins were a high-priced alternative, but were recognized even then for superior performance.

Another problem plaguing paper bobbins are their sloppy tolerances, which make it difficult for any two *transformers* to sound the same. And paper tubes tend to collect moisture, which varies the reactive properties of transformer design, and thus, tone. We've proven this by taking *transformers* from highly humid environments and driving the moisture out of them. This procedure noticeably improved tone, brings back detail, and makes an amp sound less dull.

We have no bias one way or the other. Certainly, it would be less expensive to use paper. But we had some of the best studio players help us make the determination, and the choice was clear.

VG: How do you devise specs for *transformers*?

SH: We've been documenting designs for decades. Many include “happy accidents” and hidden treasure among the thousands of mediocre-sounding specimens. Our *transformers* are duplicates of those from the best-sounding amps in the world, many of which were literally one-of-a-kind designs donated by collectors and artists.

Next month, we'll continue our discussion with Hamernik and learn some shocking truths about rust, and whether or not it could possibly be good for a transformer!

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perature of the *transformer*. Many reissue amps have undersized *transformers* with low power-to-audio ratios. With as little as a half hour of play, many of these amps are running hotter than a bitch kitty.

Weak power supplies equate to weak sounding amplifiers. Understanding the relationship of *magetics* to tone is the foundation of getting the tone thing right.

VG: Do *transformers* made with paper tube bobbins sound better than those with nylon?

SH: Paper bobbins will not rescue dull tone. Does wearing the right ball cap make you a better baseball player? Perhaps this myth started when someone compared a great-sounding vintage *transformer* that happened to have a paper bobbin with a modern-day generic *transformer* with a nylon bobbin.

Paper tubes were a cost-cutting measure, first and foremost. They allowed a *trans-*