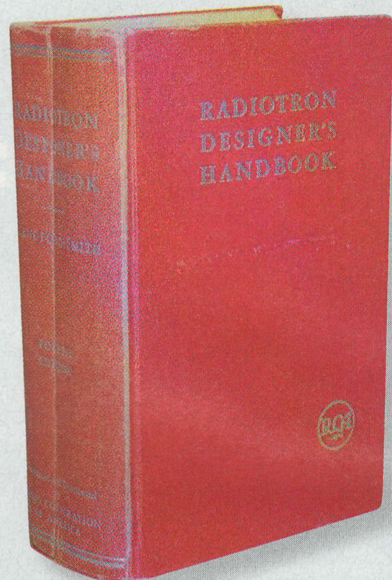

Smooth Your Sonic Ride

BY DAVE ZIMMERMAN, MAVEN PEAL AMPLIFIERS

AS WE ALL KNOW, THERE IS NO substitute for turning a guitar amp up loud. To nail that sweet, organic, classic rock or blues tone, an amp needs to get loud enough to push its power tubes into distortion (a.k.a clipping or saturation). The problem is that when the tubes begin to distort, *everything* in the power amp begins to distort, including the phase inverter and the output transformer (OPT).

OPT saturation—which is similar to tube clipping because the transformer is being asked to pass a signal larger it can handle—is desirable not only because it introduces distortion, but also because it provides a sort of shock absorbing effect on the phase inverter clipping and power tube distortion. (A significant amount of a rig's shock absorption also comes from the speakers, but the OPT's shock-absorbing contribution can't be overlooked.) A good output transformer goes into saturation at the same time—or just a little before—the phase inverter and power tubes begin distorting. This timing allows the OPT to round off any potentially harsh distortion that can sometimes originate from the phase inverter and/or power tubes.

Transformer Troubles

Lower quality output transformers can ring like bells, regardless of whether or not the output tubes driving them are being pushed into distortion. Output transformer ringing often sounds like unwanted fizz on the notes—especially bass notes. But the real problem with a ringing output transformer is the extremely high voltages involved when ringing occurs. Ringing adds voltage to the circuit—just about doubling the high voltages already being carried through the transformer. If the transformer windings (insulated wire) are low quality, they won't be able to handle this additional voltage overload and can short-circuit, causing sparks, flames, and nasty noises.

And even with a high-quality output transformer, dumping all the wattage produced by the power amp into an attenuator (instead of the speakers) can also cause sparks, flames, and nasty noises. This is because speakers offer a significant degree of shock absorption, while attenuators provide *none*.

If you cut the amount of power the amp can produce—either by removing two of the power tubes or via a wattage control—the OPT can't go into saturation. OPTs are designed to handle the highest power (or wattage) available from the amp, and by lowering the wattage, you are reducing the shock absorbing effect provided by a saturated OPT. The end result is often a similar unpleasant ringing or fizz.

Manufacturers have been aware of these problems with output transformer saturation for decades. When CBS took over Fender, their engineers created the "silverface" series amps, which were essentially blackface models with additional diodes to protect the OPT and eliminate ringing. Unfortunately, diodes are designed to create a brick wall (i.e., current flows only one direction through a diode), and they work perfectly when you want that. But the last place a guitarist needs a brick wall is in the power amp. If you own any Fender silverface amps with diodes around the OPT (not all models have them), removing these additional diodes will put your power amp back to blackface specs.

Manufacturers could also have considered adding a "shock absorber" to the entire power amp, which would create a squishing effect when the speaker and/or output transformer saturation fail to do the job. An ideal shock absorber would have no effect on the normal frequencies passing through the power amp, and would remove only unwanted high frequencies. In other words, the shock absorber would be sonically transparent, stop all ringing, and eliminate the possibility of brick-wall blowouts.

Enter the Snubber

The solution was published during the 1930s in the *Radiotron Designer's Handbook*, and it's called a "Snubber." The idea behind it is to create a filter at the primary side of the output transformer that removes unwanted high frequencies while leaving the rest of the frequencies untouched. A relatively simple circuit, the Snubber connects between the two plate/anode connections on the primary

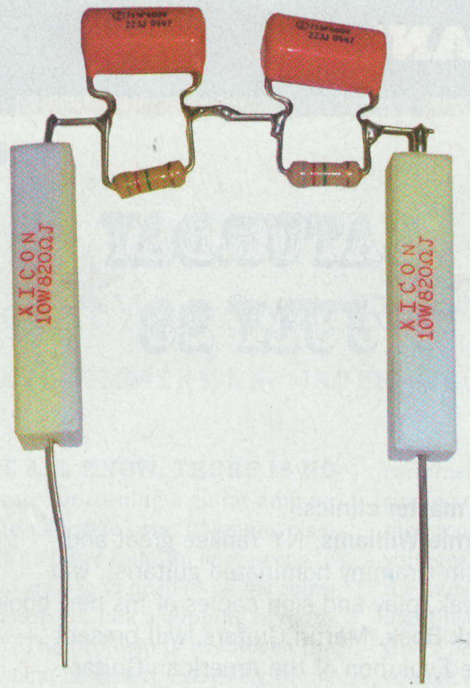

Fig. 1

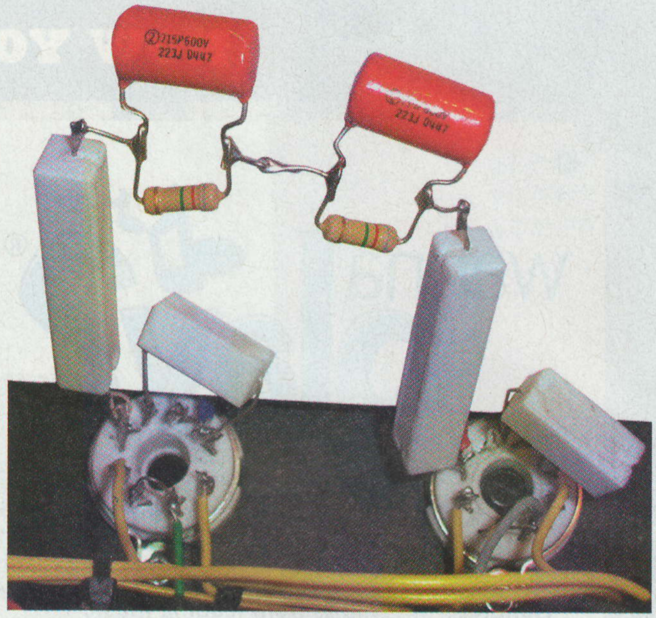

Fig. 2

side of the output transformer. Because only plate connections are required, soldering the Snubber directly to the power tube sockets at the same two locations where the output transformer wires connect to the sockets is an excellent solution. The great thing is that a Snubber requires only six parts: Two high-power resistors, two high-voltage capacitors, and two lower power resistors.

The exact values to use depend on the "primary impedance" of the output transformer, which is dependent on the number and type of power tubes in your amp. So all you need to know is how many and what type of tubes you have in your amp. See the following examples to find the right values.

High-Voltage Resistors

- Tube Quantity and Type = Resistor Values
- Two EL84s = two 3kΩ, 5-watt resistors
- Two octal tubes (6V6, 6L6, EL34, KT66) or four EL84s = two 1.5kΩ, 5-watt resistors
- Four octal tubes = two 820Ω, 10-watt power resistors

High-Voltage Capacitors

The values of the two high-voltage capacitors are also based on the number and type of power tubes. Because the Snubber's purpose is to eliminate unwanted signals (as opposed to passing audio signals), $100 capacitors are not required. I recommend 600 -volt, Orange Drop caps.

- Tube Quantity and Type = Capacitor Values
- Two EL84s = two 0.0047uF capacitors
- Two octal tubes (6V6,6L6, EL34, KT66) or four EL84s = two 0.01uF capacitors
- Four octal tubes = two .022uF capacitors

Low-Power Resistors

The two lower-power resistors essentially spread the voltage evenly across the two capacitors. In all cases, use 8.2MegΩ 1-watt resistors here.

Installing the Snubber circuit

1. Twist the free ends of the power resistors around the same output transformer primary leads that connect to the tube sockets (no Snubber connection is needed for the output transformer's center tap).

2. Tie the Snubber circuitry to the heater wires, or embed it in some RTV silicon caulk for stability.

Fig 1: Assembled Snubber

Fig 2: A Snubber installed

I have never seen a Snubber fail, or cause a failure in other areas of the amplifier, regardless of how badly the amp is abused. Once your Snubber is installed correctly, you will never need to think about it again—except when admiring your amp's great tone!

(Snubber kits are available from Antique Electronic Supply at 480-820-5411; tubesandmore.com)