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DEPT. **YOU BUILT WHAT?!**

INVESTIGATOR: **MIKE HANEY**

TECH: Tiny guitar amp

COST: Around \$425

TIME: 6 days

Half a Watt of Pure Rock

Zachary Vex's tiny vacuum-tube guitar amp delivers classic-rock crunch without deafening the neighbors

PRACTICAL ■■■■■ POPCORN

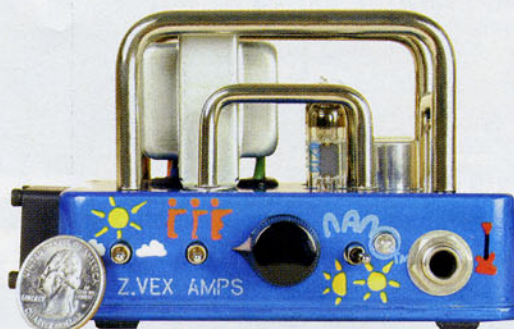
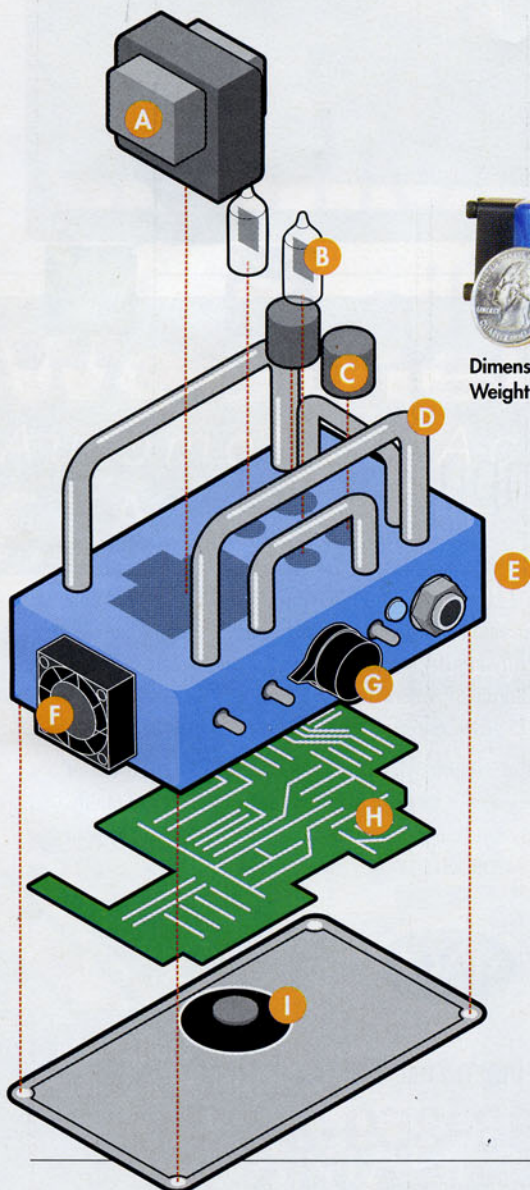
Setting aside the pure aesthetic appeal of Zachary Vex's handcrafted Nano Head vacuum-tube guitar amp, why would anyone want a palm-size box that puts out half a watt at maximum power? Isn't rock 'n' roll about kicking out the jams and rattling the windows?

On the stage, sure. But not when you're recording in a studio, or practicing in the basement while your wife sleeps. To achieve what Vex calls "that sweaty, crunchy sound a guitar is supposed to have," a traditional amp has to be turned up so loud that it's difficult to mic and impossible to snooze through. Vex knows—he spent 10 years as a recording engineer and producer before starting his own guitar-accessories company, Z.Vex Effects, 10 years ago. He designed the Nano Head to produce authentic-sounding distortion at around 20 decibels less than a common 50-watt Marshall amp.

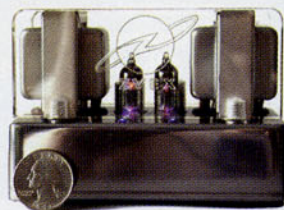
He did it by using vacuum tubes—an electronic component left over from the first half of the 20th century, before solid-state transistors were invented. Tubes are still found in audiophile gear and guitar amps because they produce a more harmonic sound at the ends of the sonic spectrum, and guitar distortion

that's more pleasing to the ear. But tubes require a huge amount of voltage, so Vex had to design a circuit that could safely crank up a 12-volt input to as much as 230 volts inside his tiny case.

Each amp is manually assembled and painted in Minneapolis, where Vex lives, and sells for around \$425 at guitar shops in the U.S., Europe and Asia. Vex's next project, currently in development, is a tube stereo amp about the size of an iPod [below]. See more photos of the Nano Head and other Z.Vex things at zvex.com.



Dimensions: 3 x 4.75 x 2.4 inches
Weight: 1.2 pounds



THE iMP is what Vex is calling his next product, a one-watt amp that will give tube-quality sound to any stereo or MP3 player.

[Taking Apart the Tiny Amp]

- A) The audio-output transformer works like a gearbox, converting the high-voltage signal from the tubes to a low-voltage, high-current signal that can drive an external speaker.
- B) The tubes are military surplus. The U.S. government was once a large purchaser of tubes, in part because of their ability to survive an electromagnetic pulse from an atomic explosion. Although Vex's tubes have an estimated life of around 100,000 hours, he built gold-plated sockets for them to sit in so that they can be replaced by the user.
- C) The two high-voltage capacitors work sort of like batteries, storing power that drives the dual-triode tubes. One powers the first three stages the sound signal passes through, in which the voltage is ratcheted up to achieve the distorted sound. The second powers the final stage: output to the speaker, via the transformer.
- D) The nickel-plated brass roll bars, custom-made for Vex, protect the exposed electronics.
- E) The enclosure is cast-aluminum, hand-painted in two stages with automotive epoxy to give it a glossy, almost gooey, finish. Vex's painter fires the cases in a toaster oven.
- F) The one-inch-square fan cools the internal components.
- G) Front-panel controls [from left to right]: mellow (treble), thickness (bass), volume, brightness (adds sparkle at low volumes) and the guitar input. Speaker output and power input are on the back panel [not shown].
- H) The circuit board is mounted upside down so that the tubes stick out the top of the case. The entire high-voltage circuit uses just 18 components.
- I) The built-in, downward-facing speaker is, Vex says, a lark. "It's cute that you can use it without an external speaker, but it kind of sounds like a fly buzzing."