Q & A

READERS' QUESTIONS, EDITORS' ANSWERS
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ER...That Was A Joke!

Our April Fools' Day joke, "The EC909-12 Analog Microprocessor," apparently fooled a number of people too well—we've received a flood of mail about it.

Note that Ecraf is *farce* spelled backward, no address is given for any person or company involved, the claims are outlandish (such as emission of huge amounts of light—enough to light a city—at tiny currents), and the last paragraph of the article says it's due for release on April 1, our national day of tomfoolery.

Two items in "Prototype" (the DVD rewinder and the WIG-WOM) were also put-ons and also specifically mentioned April 1. But the equally improbable-sounding quantum tunneling transistor (pp. 42-43, 50) is real; see www.sandia.gov/media/quantran.htm for more information.

April Fool's jokes are a decades-old tradition at **Electronics Now**; our founder, Hugo Gernsback, published facetious articles under the name of Mohammed Ulysses Fips. Interestingly, though improbable at the time, some of the concepts in those articles—such as an optical audio disc—were uncannily predictive of the future. And that's the problem—one person's fiction can easily be another person's invention.

Ultrasonic Listener

Q *Where can I find plans or a kit for a circuit to allow me to hear ultrasonic sounds such as bats' squeaks?—L. S., Newton, MA*

A I'm not aware of a complete, published project or kit, but Fig. 1 shows a circuit you can experiment with. I used it successfully to listen to the squeaks of a domesticated rat.

The principle involved is *heterodyning* (mixing), a process that gives you the sum and difference of the original frequencies. For example, if you mix a 25-kHz incoming signal with the output of a 20-kHz oscillator, you get additional signals at 25 + 20 = 45 kHz and 25 – 20 = 5 kHz; the latter is audible.

Heterodyning takes place when one signal is multiplied by the other; that is, when the amplification of one signal is proportional to the signal level of the other. Any nonlinear amplifier will do this, but the NE602 chip shown in the circuit uses a sophisticated mixer called a *Gilbert cell* whose advantage is that not much of the original signal appears at the output.

The NE602 was designed for radio receiver front-ends, and it works with low-level signals, so the microphone connects directly to its input. As shown, the microphone is connected differentially across pins 1 and 2. If one side of the microphone is grounded, you can connect the ungrounded microphone lead to C2 and add a capacitor, equal to C2, from pin 2 to circuit ground. Although the NE602 provides some amplification, the output signal is still microphone-level.

The design of the oscillator is up to you; its frequency should be adjustable so you can tune it near the ultrasonic

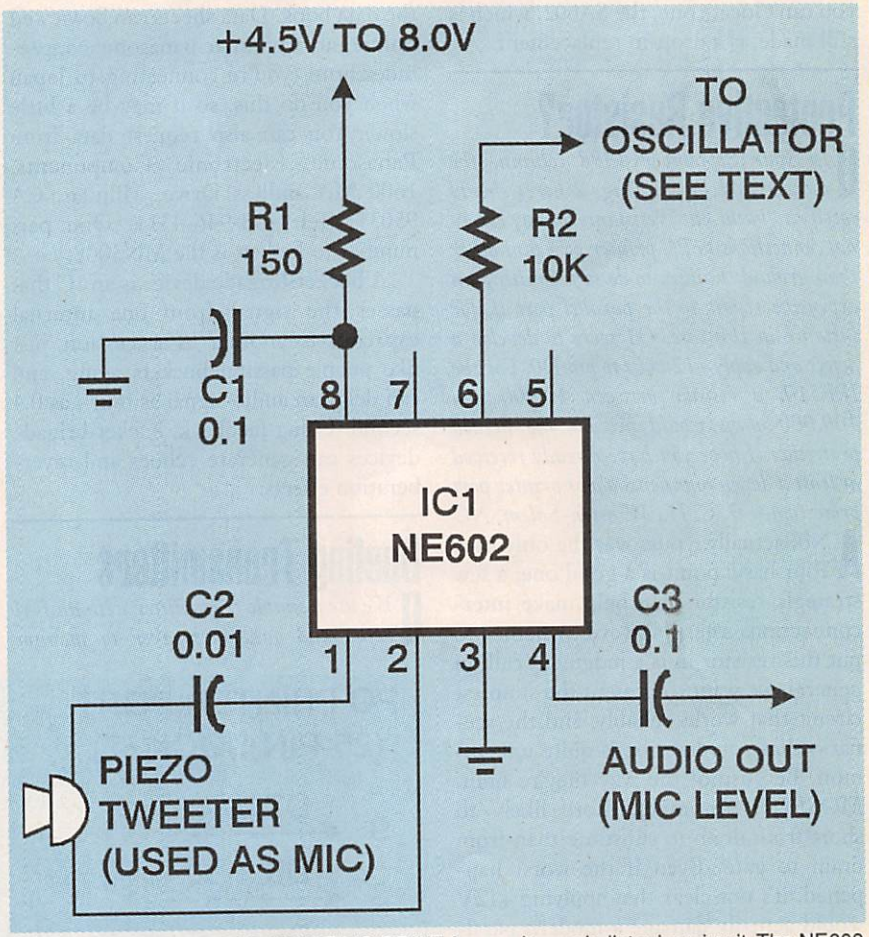

FIG. 1—HERE'S A GOOD STARTING POINT for an ultrasonic-listening circuit. The NE602 mixes 25-kHz ultrasound with a 20-kHz oscillator signal, yielding 5-kHz audio. If you can't find the now-discontinued NE602, the SA602 (still being made) is a direct replacement.

signal you want to hear. From R2 it goes directly into the base of a transistor. Logic-level (5-volt) oscillators work well; I used a signal generator for experiments, but a 555 chip would be a good choice when building a self-contained unit.

Note that the NE602 is no longer being manufactured, but should still be available from a number of sources. If you can't locate one, the SA602, which is still made, is a drop-in replacement.