Several readers pointed out the error in the caption accompanying the picture of the plasma ball in last issue's excerpted chapter of *Copies in Seconds* by David Owen. (The error was not Owen's nor Simon and Schuster's, but *E&S*'s own.) The following, taken from an exchange of e-mails, is perhaps the definitive word on the subject.

Hello Douglas,

I've long enjoyed *E&S*, and would like to commend you and your staff on a great publication.

I'm confident that what I'm writing about is simply a typo, but am compelled to comment none the less.

On page 26 in the subject issue, there is a photo of a plasma ball discharging to a finger, with the accompanying caption, "The creative spark: Static electricity allows you to play with very high voltage but very small currents—this plasma ball has a couple of thousand volts running through it, but only about ONE AMP." I'm reasonably sure the correct statement should say ONE MICRO-AMP, because I can assure you that 2,000 volts at 1 amp could easily be lethal.

I haven't actually measured the current flowing to my finger from my plasma ball, but will do so sometime soon, just to verify my claim, but I can tell you that I regularly measure currents from a Van de Graaff generator at 7 microamps, and the source voltage is somewhat higher—approaching 200,000 volts.

Best regards,
Chuck Newcombe

And later that evening:

Hi Doug—thanks for the quick response. Rest assured the article was informative and interesting in any case.

Ok, let me see if I can sort this out.

First, the plasma ball isn't exactly purely electrostatic in nature, as is a Van de Graaff generator and the Xerox copier—the ball is based on a Tesla coil, which uses a high frequency AC voltage to ionize the gas in the ball, and capacitance to conduct current through the surface of the ball to your hand.

With my Fluke meter I measured about 30 volts at 23 kilohertz at the surface by placing my probe against the ball and grounding the other lead.

Now, 100 picofarads (the estimated capacitance in parallel with the meter's 10 megaohm input resistor) equates to a reactance of about 70 kiloohms at 23 kilohertz, becoming the effective input impedance of the meter. And, using Ohm's law with that reactance, I compute a current of 430 microamps.

Curiously, I did note that the power supply for my plasma ball is rated 12 volts at 1 amp. But that 1 amp supplies the oscillator that produces the high voltage. It does not flow through the hand of the person touching the ball.

As a point of reference, the ground fault circuit interrupter in the receptacle in your bathroom (now required by the national electrical code) allows about 6 milliamps of current to flow before it trips—about 15 times the current I measured on the plasma ball.

This is way more than I ever intended when I wrote you, but I must admit, it sure is fun to go through such an exercise from time to time :-)

Chuck

PICTURE CREDITS:
Doug Cummings