LETTERS

Dear Sir,

I think there is an error in the design of the ETI-1501 Negative Ion Generator (April '81, p. 30), or at least a contradiction in your explanation of how it works.

Firstly, in your accompanying feature article on negative ion generators (pages 15 to 21, same issue), on page 17 you give the circuit of a commercial negative ion generator, showing a 10-stage 'Cockcroft-Walton' voltage multiplier-rectifier which works on the principle of multiplying the peak-to-peak value of the ac mains input. As the peak-to-peak value of the mains is about 680 V, the rectifier would give nearly 7 kV, which is nothing like the 3 kV you say is applied to the emitter head in Figure 2, page 16. It seems, then, that the voltage multiplier-rectifier only multiplies the peak value of the input.

Looking at the ETI-1501 project, the circuit on page 31 shows the same sort of rectifier, only it has six diodes, not ten. It should only produce about 1.8 kV. On my unit, which I built from a kit, I can measure about 1 kV with my multimeter. Taking into account the loading effects, this seems to confirm my suspicion that the rectifier in the project only produces 1.8 kV.

I looked up the rectifier circuit in a textbook, which says that it multiplies the peak of the ac input voltage, and I asked my electronics lecturer at tech. and he says there seem to be insufficient diodes on the high voltage board of the ETI-1501 to produce the voltage specified (3 kV).

How do you get 3 kV? Can you enlighten me?

W. Dillon
Melbourne, Vic.

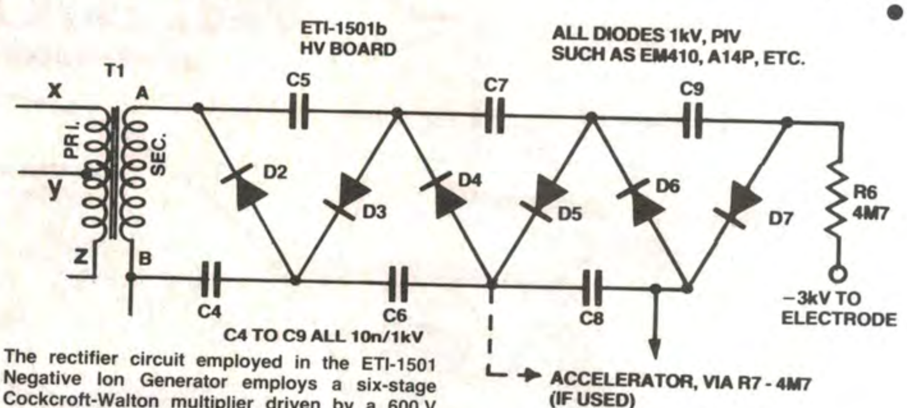
There is neither a mistake nor a contradiction in the way in which the ETI-1501 works and how it is explained. However, there is some confusion arising, as you are comparing the circuit of the commercial ion generator on page 17 of the April issue with the circuit of our project on page 31. The commercial ion generator employs a voltage multiplier driven by a sinusoid — the mains. This type of rectifier multiplies the ***peak*** *value of the ac input. The peak value of the (nominal) 240 V mains is about 340 V. The 10-stage multiplier rectifier on page 17 will thus produce about 3.4 kV. Our project, page 31, employs the same sort of rectifier-multiplier, but it is driven by a* **square wave** *(1:1 duty cycle) from terminals A-B of the transformer secondary (T1). The peak value of the square wave at A-B is about 600 V. Thus the six-stage Cockcroft-Walton rectifier-multiplier produces around 3-3.5 kV. The proof of this is in the measurement. If you use a high impedance input meter to measure between terminal B and the electrode connection you will get the predicted voltage. We measured it, and we did. Note that the peak and the peak-to-peak value of the square wave at the secondary of T1 are the same. To properly measure the voltage at the anode of D7 you will need a meter with an input impedance of at least 10 M.*

The voltages quoted are ***not*** *specifications but measurements.*

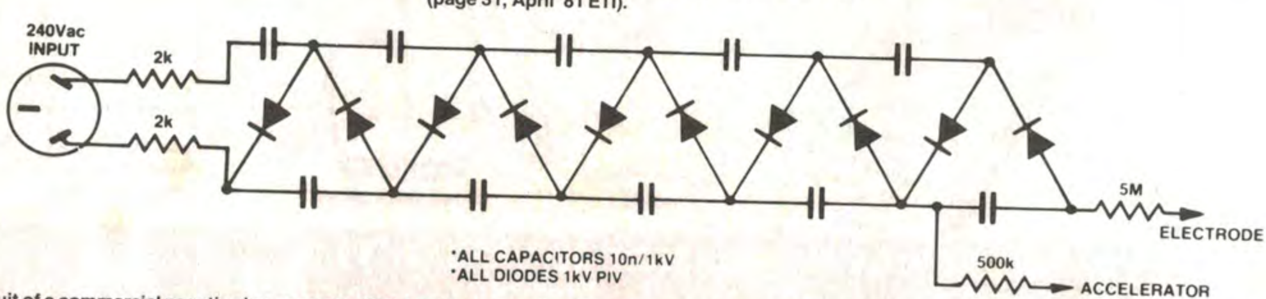
Most texts, when explaining the operation of voltage multipliers (and rectifiers for that matter) fail to mention that the results obtained are predicated on a sinusoid input.

In retrospect, we should have explained the operation of the rectifier in more detail, as it is employed here in an unusual application and a number of readers wrote puzzling about it in the same way you did. I trust you have now learned a little more about electronics.

Roger Harrison
Editor ETI



The rectifier circuit employed in the ETI-1501 Negative Ion Generator employs a six-stage Cockcroft-Walton multiplier driven by a 600 V peak square wave, producing around 3-3.5 kV (page 31, April '81 ETI).



Circuit of a commercial negative ion generator (ETI April '81, Figure 3, p.17). This is driven by the 240 Vac mains, a sinusoid with a peak value of about 340 V, the ten-stage Cockroft-Walton multiplier producing about 3.4 kV.