D-Cell Power Revisited

by Dick Parks
2620 Lake Ridge Ct.
Oakton, VA 22124
Email: rparks9@cox.net

My recent column on running a one-tube radio on one or two D-cells[1] brought enough interest for our editor to suggest I try the trick on a full-size portable radio. After giving this my usual minimum of thought, I went to eBay and spent $4.00 for a handsome old Philco portable, model 39-71, and set to work trying to make it play with D-cell power.

I chose this radio because it runs on a 1.5 volt "A" battery. Most later portables use an A supply of 6 to 9 volts, with all the filaments in series. This allows for fudging the bias for the output tube by operating its filament a few volts above the A- ground return.

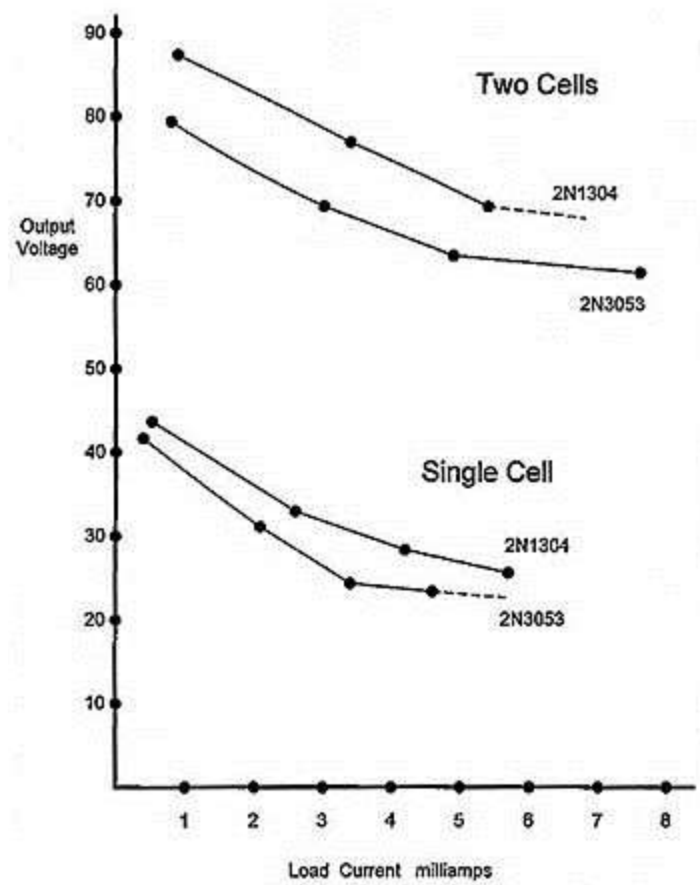


Fig. 1. Power drain curves from the original D-Cell article.

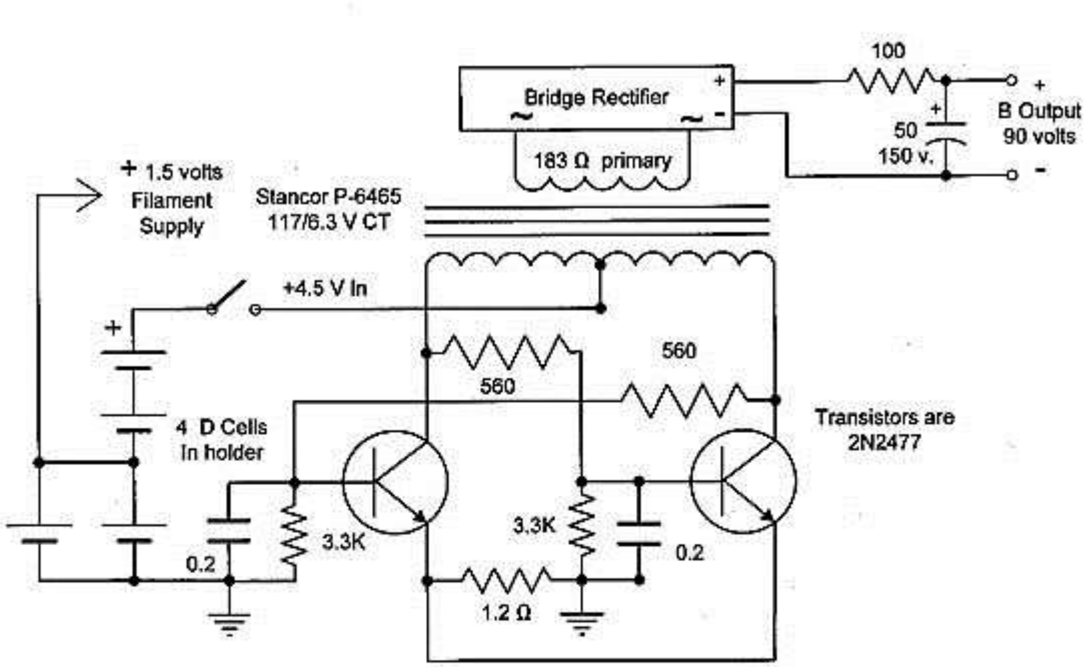


Fig. 2. Power inverter circuit operates on 4.5 volts. 1.5-volts, from two paralleled cells, is tapped off for receiver filament circuit.

But I wanted to use a minimum number of cells for this experiment, and having all the filaments in parallel simplified things. After I got it running, I found that my 39-71 needs 9 to 10 milliamps of B+ at 90 volts and 240 ma. of filament current. That squared with the Rider's values I got by downloading the schematic from Nostalgia Air's web site[2].

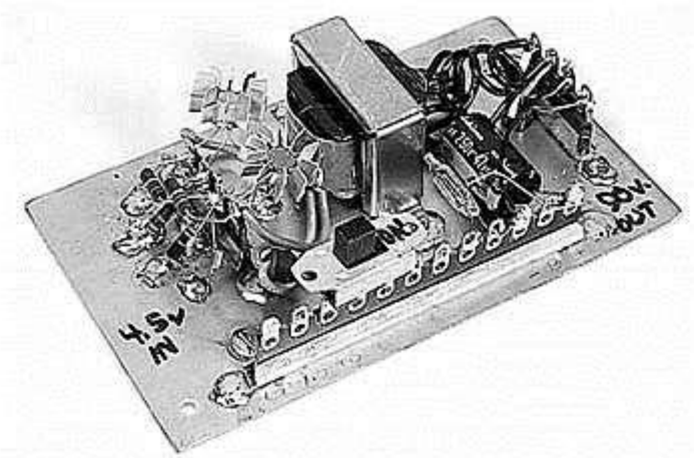
Figure 1 repeats the power curves I got from the simple inverter of the previous article. It's obvious at the start that my Philco would need a little more oomph than could be had from that design. I hit on the idea of four cells - two D-cells in parallel for the filaments boosted by two more cells in series to drive the inverter with 4.5 volts. From the junk box, I took a four-cell battery holder and rewired it accordingly.

Starting with the basic inverter circuit and the same 6-volt filament transformer described in the October 2006 column, I first tried driving a pair of medium-power NPN silicon transistors with a DC supply set at 3.0 volts. When you try breadboarding this, you'll find that changing the values of the two resistors cross-connected

We don't know what took a piece out of the corner of Dick's Philco 39-71. However, the $4.00 eBay acquisition made an excellent test bed for the "d-cell power" scheme."

between the collectors and bases controls the output power.

The best that could be done was about 60 volts into a 10K load resistor, and that was by using 1K resistors. The next series of tests was at 4.5 volts input and the same transistors, but with small heat sinks added (after blowing a pair of 2N2477s). This got me to 90 volts easily, and that meant 9 ma. into the load resistor, just what's needed to feed the Philco portable. Figure 2 is the schematic of the final version.



The power inverter circuit.

You'll notice an emitter degeneration resistor of 1.2 ohms, giving a bit of protection to the transistors during startup. When you build one of these, you'll arrive at the final values for the drive resistors (560 ohms in my schematic) by noting that the circuit starts with the transistors in class A and quickly settles into the normal state, with the transistors saturating on alternate half-cycles. Reducing the drive resistor values will make the inverter start faster but will also reduce its efficiency.

The above circuit takes 0.42 amps at 4.5 volts, and gives 91.2 volts across the 10K load, so the efficiency is 44%, not bad for any power supply. The 3.3K resistors protect against thermal runaway, just in case. And the capacitors from base to ground reduce switching spikes and the resulting noise in the radio receiver. You can also tweak the output just a bit by changing the 100 ohm resistor at the output. This rig should run most any early portable that takes a 1.5 volt A supply.

As to battery drain, the paralleled cells are delivering 330 ma. each when the set is on, while the two series cells are working at 420 ma. It would have been nice if all cells were equally loaded. An alkaline D-cell is supposed to be good for 15000 ma-hours; so a fresh set should run my radio for (15000/420) = about 36 hours of intermittent use. But I think I'll stick to my Radio Shack DX-440 for emergency listening!

References

1. Dick Parks, "D-Cell Power," *AWA Journal*, Vol. 47, #4, October 2006, p. 39
2. Nostalgia Air website, www.nostalgiaair.org