73 Review

Dr. NiCad Battery Conditioner/Rapid Charger

Ramsey Electronics Model No. DN-1

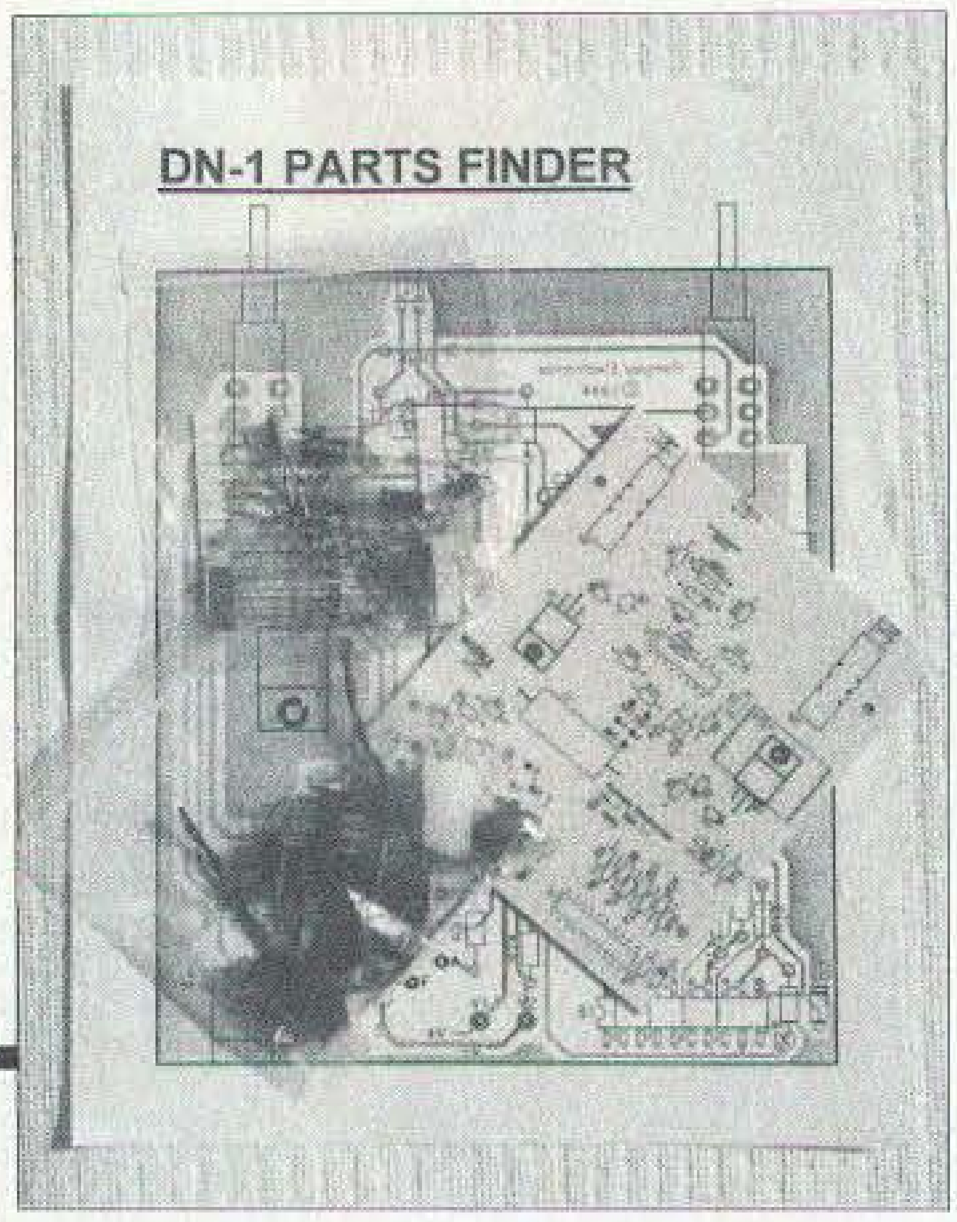

Photo A. *The Ramsey Dr. NiCad kit (all photos by author).*

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How many NiCd battery packs do you have sitting around the shack? If you're a typical ham, the answer is probably at least two for the handheld and several more for various pieces of equipment—and maybe a few for assorted tools, toys, etc. I started looking around and counted half a dozen at this QTH. Some of the packs were functional, and some were dead; but even the dead ones are too expensive to throw out.

So what do you do to charge all those batteries? Are you charging them correctly? NiCds should occasionally be *nearly* fully discharged and then fully recharged to keep them in good condition. Are you doing that? Is your wall recharger overcooking your batteries when they are connected for weeks on end? What about those dead batteries—can you restore them?

Enter Dr. NiCad

The good doctor can handle all these chores for you, plus provide fast charging for your batteries—without overcooking them. The doctor is available from Ramsey Electronics in kit form or fully assembled. If you order the kit, you can get the basic circuit board and parts only. An optional case set can be ordered to go with the internals.

The heart of Dr. NiCad is the Benchmarq BQ2003 chip specifically designed for NiCd charging. It is programmed by external jumpers on the board and switches to sense how many cells are to be charged, what charge rate is to be used, what discharge rate is to be used, and how long the pack should be charged. The chip senses the correct points to discharge the cells to, at what point to start/stop the quick charge, automatically provides a "topping off" charge and then "tops off" the batteries periodically. It also flashes an LED in various sequences to tell you what is happening.

I got interested in Dr. NiCad when I built a new QRP transceiver. For battery power, I connected two 7.2V NiCd packs together to make a 14.4V pack. The 7.2V packs are commonly used in video camcorders. My packs were rated 1,000mAh (milliamp hours). A 7.2V pack contains six individual cells in series, so I had 12 cells connected in series. The rated pack voltage divided by 1.2 gives you the number of cells in the pack.

Most packs used in handhelds contain from six to 10 cells (some contain 11). NiCds for toys and tools may contain from only one cell to several. As explained above, I wanted to charge 12 cells. As supplied, Dr. NiCad can handle from one to 10 cells but it is easily modified to handle more cells. The number of cells to be charged must be set in the unit by toggling the individual switches on a "DIP" switch unit on the circuit board. Since I wanted to charge more than 10 cells, and I wanted to be able to change the number of cells to be charged from a front panel switch, I modified the unit as described below.

Kit parts and assembly

I ordered the basic kit, consisting of the PC board and the parts to stuff it with. The kit comes in a large plastic bag containing the instruction book, a couple smaller bags with the parts, large schematic diagram of the unit, and a large parts placement diagram.

The instruction book is well done. In addition to showing you how to put the parts together, it gives a fairly detailed explanation of the process of charging NiCd batteries, a troubleshooting section, and a question-and-answer section about operation of the unit. The actual assembly portion has a check-off table for each part; this, combined with the parts layout drawing, makes it very difficult to err in putting the kit together.

The circuit board is high quality and silk-screened with the parts layout. The parts were all present and were high quality although some appeared to be surplus as the leads were clipped. Everything fit and assembly went smoothly.

The heat sink for the transistor that is used to discharge the NiCd packs appeared to be undersized to me, especially since I wanted to use a 12-cell pack. I beefed this up by bolting on additional aluminum strips. Also, no heat sink compound was supplied to apply between the transistor tab and the heat sink (I added a dab I had on hand). No lockwashers are provided (I used my own).

Modifications

As mentioned above, I wished to charge a 12-cell pack. The unit as provided is designed to charge up to 10-cell packs. How many cells are to be charged is determined by a series string of 47k resistors. This is a voltage divider string. The switches on the circuit board (S1:1–9) merely short out the correct number of resistors as desired. If only one cell is to be charged, all the resistors in the string are shorted out except one (hence the nine switch positions on S1). This one resistor is permanently left in the circuit as designed and cannot be shorted by the switches, as explained in the instruction book.

To modify the unit for 12 cells, two additional 47k resistors must be provided, plus two additional switch positions. I elected to use a front panel switch instead of the circuit board-mounted DIP switch that contained the nine individual switches for shorting the resistors. I used a 12-position rotary switch available from Radio Shack™. I also mounted all the switched resistors (now 11 47k resistors instead of nine) right on the switch tabs instead of on the board. This way only two wires go from the new switch to the board—one from the arm of the switch, and one from the top of the resistor string to the board (**Fig. 1**).

The DIP switch also contained one individual switch (S1:10) to set the discharge rate. When this switch is closed, a low discharge rate is selected. When it is open, a high discharge rate is selected. I decided a low rate was appropriate for all my uses, so I simply jumpered (shorted) the S1:10 holes on the board. Using an additional front panel switch for this function would make it selectable but I didn't choose that option.

I provided my own case. My case setup didn't allow for the use of the "on-off" power switch (S3:A) provided on the circuit board or the "discharge initiate" switch (S2), also provided on the circuit board. I didn't use the switch provided; I simply brought wires from the appropriate holes on the circuit board to the switches I provided on the front panel of my case. The "on-off" switch is just a normal toggle switch but the "discharge initiate" switch is a momentary push-button switch.

Setup

As mentioned above, the discharge rate can be set at a low rate of 140mA or a high rate of 280mA. I decided the low rate of 140mA would be fine for nearly all use. The low rate reduces the heat dissipation of the current pass transistor and the only disadvantage is that it will take longer to discharge than the higher rate. Set the low rate by closing switch S1:10, or by shorting the switch position with a jumper wire as described above.

The charging current rate can be set at 250mA, 500mA, or 1A by positioning several jumpers on the circuit board. The instruction book explains how to calculate the best setting for your pack and then how to set the jumpers. I decided the 500mA setting would be fine for my packs. This too could be set up by switches to make it selectable but would be a little complicated. I used jumper wires as described in the book.

The charging time-out feature is also set up by jumpers. The instruction book tells you how to select the correct time (180, 90, 45, or 23 minutes) for your pack and set the jumpers. I selected 180 minutes for my application.

Power supply

The unit, in kit form or fully assembled, does not provide a power supply for charging your NiCds. It is the controller; you must provide a regulated source of power for the unit. The instructions recommend a "regulated"

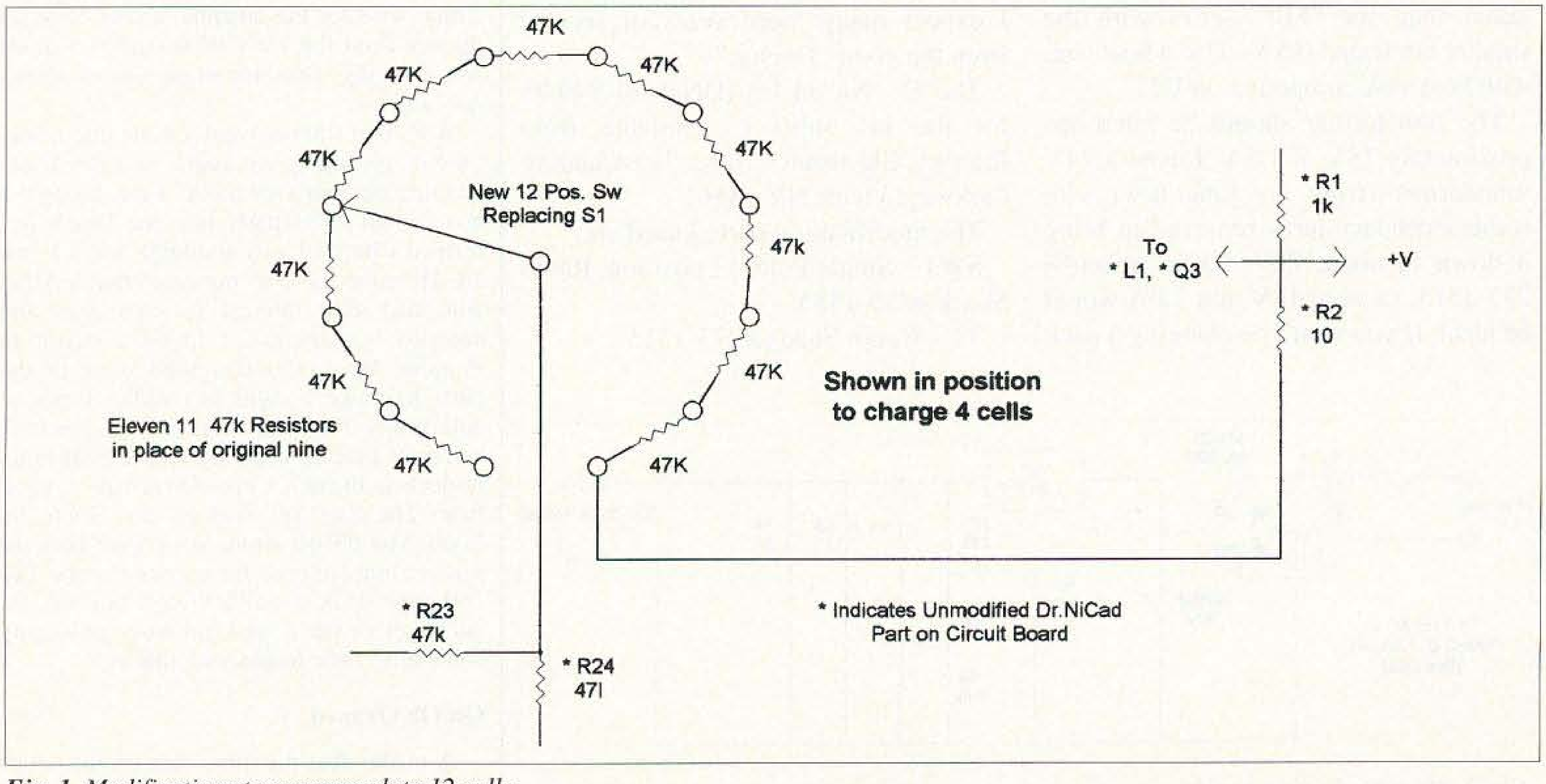

Fig. 1. Modifications to accommodate 12 cells.

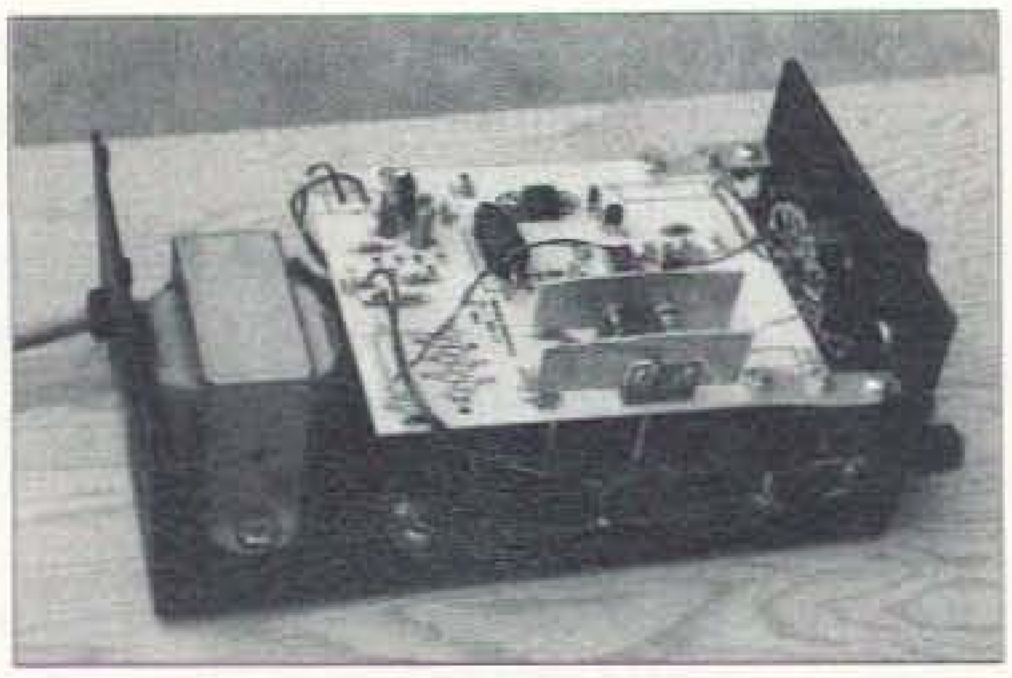

Photo B. The interior, with modifications. Note the extra aluminum strips bolted to the heat sink of the discharge transistor (Q3). The power supply board is mounted below the Dr. NiCad board with the transformer to rear.

supply between 12 and 14VDC capable of at least 1.5A. Most hams have such a supply in the shack already.

I wanted to have the power supply and controller all in one case. I also wanted to charge up to 12 cells, so I decided I would need to provide a slightly higher voltage. The instruction book indicates some problems can be encountered when too high a voltage is utilized with a low-voltage battery pack. With this in mind, I decided to build a supply that could provide a high or low voltage depending on what I intended to charge.

The circuit in **Fig. 2** shows the power supply circuit. It will provide approximately 11V in the "low" position and 18V in the "high" position. The regulator chip, U1, should be a LM317T. The "T" indicates the capability of 1.5A. This is in the full-sized TO-220 case rather than the "MP" series with the smaller tab (rated 0.5A). Use a heat sink with heat sink compound on U1.

The transformer should be rated approximately 18V at 1.5A. I used a 24V transformer (from my junk box) with some secondary turns removed to bring it down to about 20V. Radio Shack™ 273-1515, rated at 18V and 2.0A would be ideal. If you won't be charging a pack of more than ten cells, the Radio Shack 12V, 2A transformer (RS 273-1511) will do the job for T1. In this case you will not need the switch or R3. R2 should be replaced with a 2.0k unit, which should result in a power supply delivering approximately 12V. If the 2.0k resistor is increased slightly in value, the voltage will increase correspondingly.

My unit worked great when I fired it up. I charged up (and discharged) several packs, then tried a pack that was "dead." By cycling the pack several times over a few days, as described in the instruction book, the pack was revived!

I tried another "dead" pack. No matter how many times I tried cycling, this pack remained dead. Three cells out of seven seemed to be shorted. Then I tried an old trick of applying a heavy dose of current to the three shorted cells. I *very* momentarily applied a full 12V from a lead-acid battery to each individual cell. This seemed to cure them. Then I cycled them several times with the good doctor. *Presto!*—another pack restored. **Caution:** If you try the heavy-dose-of-current trick, *be very careful!* Cells can rupture. Use long leads—and place the cells and battery around the corner, or behind something, so you're out of the line of fire should one blow up.

I am very impressed with Dr. NiCad. This is something that should be in every shack. My unit has paid for itself already by restoring two dead packs—and I expect many more years of service from the good "Doctor."

The Dr. NiCad kit (DN-1 @ $49.95 for the kit only) is available from Ramsey Electronics, Inc., 793 Canning Parkway, Victor NY 14564.

The modification parts I used are:

SW1 – Single Pole, 12 position, Radio Shack #275-1385

T1 – Radio Shack #273-1515

Photo C. The finished project.

D4 – One 2A, 50V bridge unit or four RS-276-1661 (3A)

U1 – LM317T (Digi-Key)

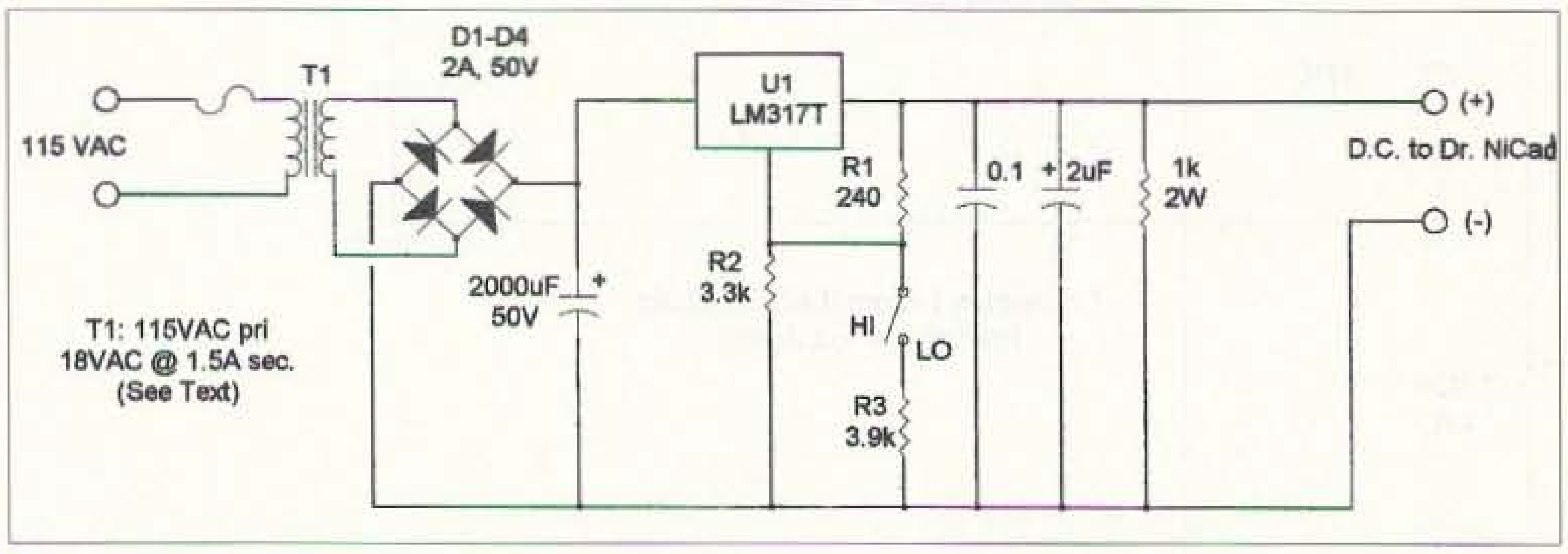

Fig. 2. Dr. NiCad power supply.

NEVER SAY DIE
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need is to elect some new younger hams to the ARRL Board to kick that stodgy old organization in the rear to get it moving. And that's entirely up to your club, which is probably also run by a bunch of old-timers, mired in 1930s thinking.

Your choice for amateur radio: grow or go.

Xtal Sets

Have you seen any snot-nosed kids around who might be helped on their downward path in life by an injection of the hamitis virus? This is one virus that not even the bioelectrifier can cure, and it's simple to administer, even in full sight of the parents.

How about sucking the unsuspecting protonerd in with a very simple crystal radio that can be built in about an hour? The parts? Some Tinkertoy spools to support a loop antenna, wire for the antenna, a pair of headphones from the kid's Walkman™, a diode and a tuning capacitor made out of aluminum foil?

Well, that's about what led me into a lifetime of hamming. An angel, or a devil, depending on your viewpoint of me, brought a box of old radio parts into the Dutch Reformed Church I was attending when I was 14. He gave them to my best friend, Alfie, who had zero interest in such junk and dumped 'em on me. I found a circuit in *Popular Mechanics* that used some of the parts to make a cigar box radio. Unfortunately, it worked and I was hooked. For life.

You'll find 15 easy-to-build crystal radio projects in the new *Crystal Set Projects* book from The Xtal Set Society, Box 3026, St. Louis MO 63130. Some great stuff here for science fairs, or even for science classes. The 160-page book is $17.50, including s/h. Be an angel or devil and get busy poisoning some dirty little minds with this book.

Oh Oh Ozoned

A reader sent me more data on the ozone

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