New Razors for Old
by Gerald Fitton

No! I do not have inside information that there is an old razor out there which, if I use it, will reveal a Genie granting my wish for the perfect shave. I don't have a stock of new razors to give you in return for your old razor even if you assure me that yours contains the most magical of Arabian Treasures. What I do have is my beloved, 1982 vintage, rechargeable electric razor working better than it did when it was new! You too can share the pure joy which comes from the successful completion of any restoration job whether it be furniture or an antique Hi-Fi which you inherited from your grandparents!

I've Cheated

Let me say from the beginning that the razor which you'll see in my pictures is not my beloved razor which I received as a present in 1982 but a more recent razor which was in need of the same restorative magic that I had worked on my favourite. The truth is that I was so pleased with the first restoration that I decided to repeat the rejuvenation process on my second favourite razor and to take some pictures as I went along. My choice for this article was either to take my beloved heirloom to pieces just to take some pictures or to use the pictures I had already taken of the newer razor. I chose the latter.

It's not cheating really because the motivation to 'give it a go' was my great affection for the 1982 razor—and that was the razor I worked on first.

In the spring of 1982 my electric razor was not of the rechargeable type; it was beginning to do all sorts of bad things. I was about to go on a Summer School course; I had just been made redundant; I was out of a job and couldn't afford a new razor. I was a bit concerned that, whilst I was at the Summer School I might find myself becoming a hirsute monster. Seeing my predicament my wife, Jill, gave me this super, top-of-the-range, rechargeable razor as a 'going away present' which, as she said, might be something to "remember her by" whilst I was away. Those of you who have attended a Summer School might have some understanding of what she meant!

Lead Acid Batteries

The rechargeable part of the 1982 razor is two AA size Nickel – Cadmium (Ni–Cd) cells. The razor shown in the picture below has only one. The only thing which went wrong with both of my razors was that their Ni–Cd cells would no longer hold a charge.

The battery in a car is not a Ni–Cd battery. It is a Lead Acid battery. To keep a Lead Acid battery in good condition it is best to keep it fully charged all the time, indeed, if you can keep the battery on charge almost all the time then a lead acid battery will last for decades.

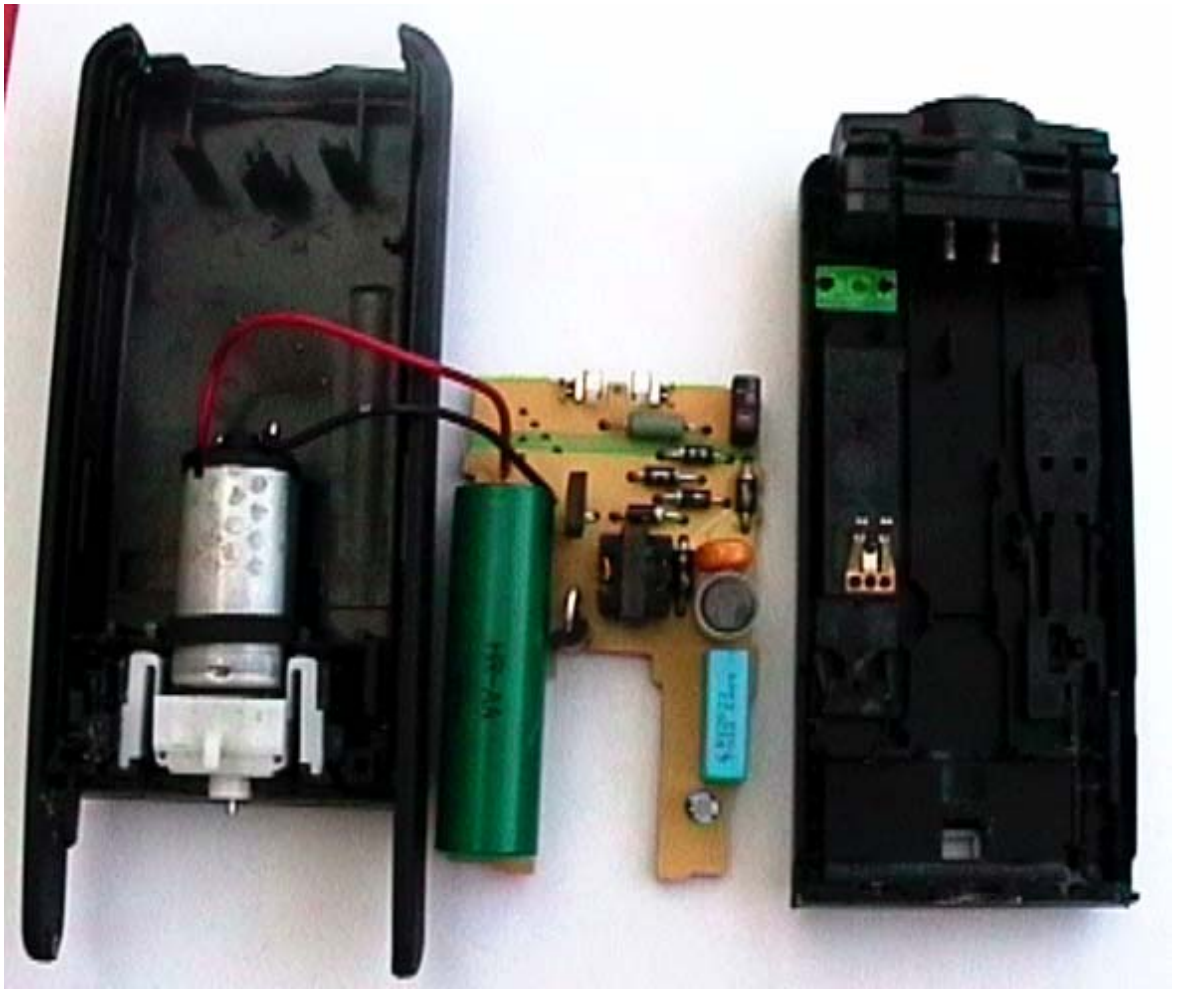
If your only experience is with Lead Acid batteries (as mine was in 1982) then it takes a great deal of mental will and resolution to treat a Ni–Cd battery in the way it likes best.

From the start, my new, top-of-the-range, rechargeable razor was undoubtedly the best razor I had ever owned. It was a present and I was determined to look after it properly.

When to Recharge

I read the instruction book and was surprised to find that regular charging was very bad. If you do not completely discharge a Ni–Cd rechargeable cell then, sooner rather than later, you'll find that the amount of charge it holds becomes vanishingly small. You will have to use your appliance directly from the mains because the cell will be useless.

So I completely discharged my razor batteries once a month by running the motor until it stopped. My devotion to this procedure kept my 1982 razor alive for fifteen years.



The dismantled razor shown in the picture will work not only from the battery but also when it is plugged into the mains. My 1982 razor was different. It would not operate whilst it was charging and so it had to run from the battery. When the battery died in 1997 I was distraught! It had great sentimental value for me as well as being a much better shaver than the one shown in my picture.

Dendritic Failure

I wish I could show you a picture of a dendrite—but I don't have one. Ni–Cd cells sometimes fail because tiny crystalline slivers of metal called dendrites grow from one of the plates to the other causing an internal 'short circuit' of the cell.

These ‘short circuits’ consist of very thin slivers of metal and, as such, they are of relatively high resistance. so, to call them a ‘short circuit’ is a misnomer—but it is sufficiently descriptive for you to understand what is going on.

When this happens the cell will not charge up properly and, even if it does, then it discharges through the resistive ‘short circuit’ in a few hours or at most in a day or two.

Removing Dendrites

In the case of my 1982 razor I new that I had dendritic failure because the battery power didn’t die completely. The motor was sluggish on the second day after a charge and continued to be sluggish for several days afterwards until I recharged it. I deduced correctly that the razor would have more than one cell in series and that only one of them had failed this way.

I took the razor to pieces and checked the voltage across each of the two cells. It was the usual 1.2 volts across one of the cells and, surprise, surprise, the voltage across the other cell was slightly reversed!

It was 1997 and I had learned a lot about Ni–Cd rechargeable cells. I had ‘mended’ quite a few by then, including one for my mobile ’phone. I had built a piece of kit which I would like to pretend I used only for removing the dendrites in Ni–Cds which had suffered dendritic failure; but you wouldn’t believe me. I had built a variable low voltage power supply and I included in it a huge 0.15 farad electrolytic capacitor. Capacitors are usually measured in microfarads. A microfarad is a millionth of a farad.

When a capacitor of 0.15 farad is discharged it will produce something like 15 amperes for a hundredth of a second—and 15 amperes is ‘a lot’!

My technique was to charge up this huge capacitor, use a switch to disconnect it from the supply and then discharge it across the poorly cell.

I guess that you’ve seen these scenes on the TV where a patient whose heart has stopped is brought back to life with an electric shock. Sometimes it needs more than one shock. Often in these dramas the number of joules is increased on subsequent shocks. A few hundred joules is typical. My 0.15 farad capacitor can contain a couple of joules when it is charged to about 15 volts so you’ll see that those life saving machines hold a lot more of this life giving ‘juice’ than my device.

What happens when I discharge my 0.15 farad capacitor across the terminal of a poorly cell is this. The huge surge of current usually provides an external flash as I connect it. Inside the cell, the resistive dendrite heats up so rapidly that the heat can not be dissipated. The unwanted dendrite vaporises in a flash. This may sound quite dangerous but the dendrite is microscopic and the amount of vapour produced is minuscule.

After applying this shock treatment once I check the voltage across the faulty cell. Like the application of a shock to the heart, it may require more than one shock and it may require a bigger shock than that which is applied initially. My machine went up to 15 volts and almost invariably worked at about 6 volts. Now and again on a stubborn, usually very old cell I have used the full 15 volts.

After the Shock

Anyway, I applied my usual 6 volt shock to the dendritic Ni–Cd and it came back to life. I shocked the other Ni–Cd just for luck and, as a result, my beloved razor lived a further five years in perfect health. Well not really. I knew that it was on borrowed time because, in my more honest moments, I had to confess to myself that the motor didn't purr at the high speed it did when it was new.

I really loved that old razor but, finally, in 2002, twenty years after it was given to me, it finally gave up the ghost. Electric shock treatment failed to stimulate it and, as I have said, the motor doesn't run when it is connected to the mains. The battery wouldn't hold a charge long enough to shave even one half of my tough beard. But I loved it and kept it.

The New Razor

With a great deal of reluctance I took out the razor which you see in the picture. I bought that one in 1997 when my 1982 razor first failed. During the last six months that new razor began to fail. I had to charge it up before every shave and, even then, it would just about make it. It's saving grace was that it would work when connected directly to the mains supply so, finally, I reverted to that mode of operation.

But I did long for the good old days and the good old shave I used to get with my treasured 1982 heirloom. I knew that I had to mend it. So, one fine day I did.

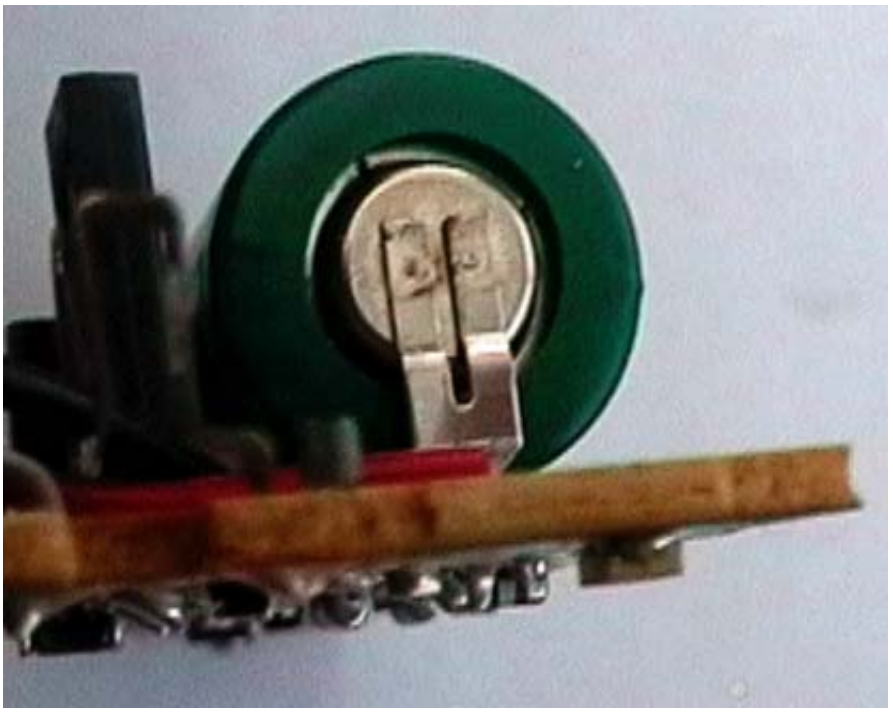
Nickel Metal Hydride

The trigger which sparked off my action was an Argos Catalogue given me by a friend. They were selling AA size rechargeable Ni–Cd batteries. I went along to the shop and looked at the more recent in shop catalogue and saw that the description of their Ni–Cds was that they held 500 mAh (half an ampere for one hour). I knew that this was fairly standard for an AA Ni–Cd. Then, further down the page, at double the price, I saw a pack of four Nickel Metal Hydride (Ni–MH) batteries which held not 500 mAh but 1700 mAh, more than three times as much 'juice'.

I hadn't seen AA size Ni–MH on sale before and so I coughed up the extra and paid the princely sum of just under £10 for a pack of four Ni–MH batteries. Four cells would be enough to rejuvenate both my beloved and my second best razors with one cell left over.

Battery Removal

After opening the razor carefully and noting where everything was so that I could put it back together again (why do you think I took those pictures?) the first big job was to remove the useless cell.



Usually batteries in dedicated equipment of this era are soldered in place. I have noticed that in more recent equipment such as portable CD players and chordless ‘phones there is a tendency to make the rechargeable cells as easy to replace as a standard battery but, in older equipment, they are soldered in place.

If you look at the picture you’ll see that the now useless cell doesn’t have the usual AA terminals. Instead there is a lug which has been spot welded to the cell. The leg of the lug is soldered to the printed circuit board. This cell, like many in other equipment, was doubly difficult to remove. Between the cell and the board there is something similar to double sided sticky tape but thicker and a bit spongy.

I have found that the easiest way of removing these ‘glued in place’ batteries is to cut the legs of the lug at both ends and then prise the battery away from the board. Afterwards it is relatively easy to apply a soldering iron to the board and extract the legs with pliers.

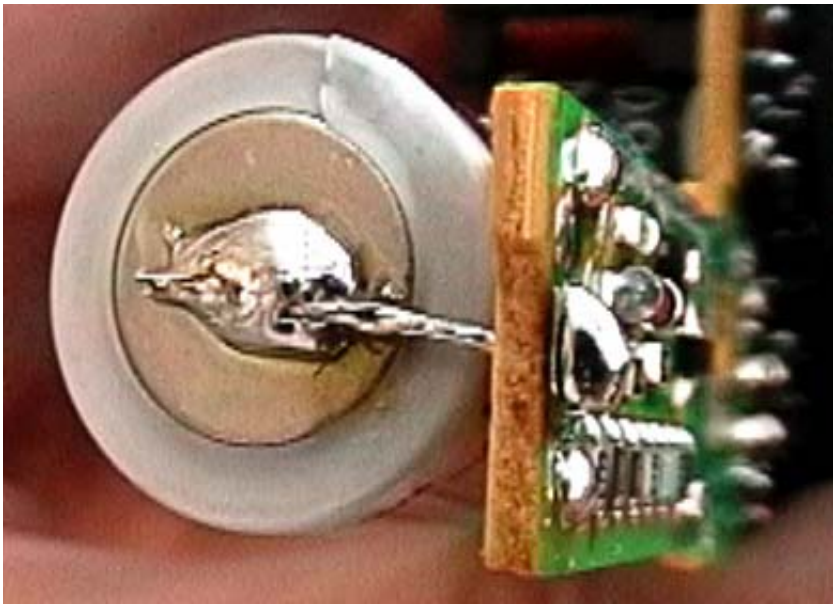
Installation

After removing the leg from the board I found that, as usual, the solder filled the now vacant hole. I have a pointed soldering iron which I use to remove this surplus solder and leave a neat round hole ready for the new fixing.

My next task was to solder connectors to the terminals of the new cell.

I use thin multi stranded flexible wire for the cell connections. I cut a length in excess of that which I need and thoroughly tin it with solder. I have found that the best way of making a good firm connection to the rechargeable cell is with a ‘big’ soldering iron but good results can be achieved with something smaller. A lot of heat for a short time is the key to success.

Having make the connections to the cell, the pre tinned wires can be pushed through the holes in the board and then it is a relatively straight forward soldering job to make the final connections to the board. I’m not too pleased with the soldered joint shown in the picture below but it isn’t a ‘dry joint’ but only a bad looking joint. None of us are perfect!



Success

I haven't measured the current taken by the motor but the new Ni–MH cells are classed as 'heavy duty'. This means that they will provide a large current without suffering a serious voltage drop. I am sure that the 1700 mAh Ni–MH batteries have a much lower internal resistance than my original 1982 vintage Ni–Cd cells. If so then the voltage applied to the motor is a bit higher. Certainly the motor now whizzes with a much more satisfying noise and, when the razor hits a particularly tough piece of stubble, there is no faltering in the motor's note as there there was previously even in 1982.

There seems to be some dispute about the need to regularly discharge Ni–MH batteries as often as a Ni–Cd. However, what is agreed on is that it is not a good thing to keep them fully charged as we used to do with Lead Acid cells. Discharging them completely on a regular basis can't do any harm.

An interesting thing I have found with these Ni–MH cells is that, when the charge runs out it does so very suddenly compared with the earlier Ni–Cds. Indeed, in operation it goes from whirring away at full speed to a dead stop in a few seconds whereas the Ni—Cd would die a much more gentle death.

For the Future

I am greatly encouraged by the results of replacing my useless old Ni–Cds with 'heavy duty' Ni–MH cells. Now I am considering 'improving' other pieces of equipment containing Ni–Cd cells that are coming to the end of their useful life. At £10 for four AA cells I can afford it and, being retired, I have the time!

I haven't seen any Lithium – Ion (Li–ion) cells available for sale anywhere yet but I am pretty sure that day is not far away. My limited knowledge is that Li–ion cells are even more robust than Ni–MH when it comes to the so called 'memory effect' which plagues the much cheaper Ni–Cd. Furthermore, I believe that they have a much higher capacity to size ratio than even Ni–MH. Of course even the Li–ion cells do not have as much capacity as do Lead Acid cells.