June 2011

Crosscut

Newsletter of the Witwatersrand Woodworkers' Association
PO Box 411346, Craighall, 2024

⋖ Gorilla poly-urethane glue.

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Go to www.wwa.org.za for back issues of *Crosscut*.

Next General Club Meeting on **Wednesday, the 8th June 2011** from 18h00 at the WWA clubhouse at REEA. Talk on Gorilla poly-urethane glue from the local importer.

Next Turner's monthly meeting is on **Monday, the 6th June 2011** at 18h00 at the WWA clubhouse at REEA. Dries Blignaut will talk on "High-speed Piercing" i.e. how to burn with a Dremel, as well as demonstrating some techniques on the use of a pyrographic system.
Wood of the month is Lebombo Iron Wood. So if you have any examples, please bring them along.

News

Turners' Meeting.

Chris van Heeswijk described Pinus Elliottii – Slash Pine which is one of the species sold as SA Pine. Slash Pine is a native of SE USA and was introduced locally. SA Pine is one of a number of species and has been bred further to optimise yields for local conditions.

Peter Middleton demonstrated the fitting of the Crush-grind pepper-mill mechanism into a turned body. The Crush-grind mechanism has ceramic wear surfaces so it is not susceptible to wear like most. It has special locating tabs on the side that Peter explained how to fit into an internal groove in the body, so that glue is not required. He showed the required geometry and a special tool he made up to simplify the accurate cutting of the groove.

Main Club Meeting and AGM.

Unfortunately, due to a death in the family, Ian Pattison was unable to talk. Shaun Sampson was due to step in to demonstrate the making of Solitaire board, with a router but due to the length of the AGM business, he was also postponed. Both will be rescheduled for future meetings.

During the AGM, Herman Potgieter gave a report on the activities of the Turning section, and Alistair Brande reported on the activities of the main club. Steven Barrett reported on the state of the finances, which are healthy. We are maintaining a substantial reserve in case we have to find new premises. Ken Mutch reported on membership numbers, which are healthy, albeit slightly below target.

Elections were held for committee posts, and thanks to some canvassing by Alistair, all the positions were filled. Alistair will fill the position of chairman and Herman will act as the deputy. Steven Barrett will continue as treasurer and Ken Mutch as secretary.

Club Notices:

The Open Day has been postponed for later in the year, until a suitable date can be arranged.

Wanted:

Woodworking tools for a co-operative run by ex-prisoners. Power tools are needed such as a router and cutters; jigsaw; circular saw; portable drill; drill press; Biscuit jointer. Also G-clamps, T-bar clamps; wood chisels; and various hand-tools are required. This is an initiative run by John's church – please contact John Speedy on 083-359-3149 for more information. Donations can be delivered to the WWA club house at future meetings.

Please Note:

Toymakers. The toymakers meet on the first and third Mondays of every month, at 09h00 till 12h00 at the clubhouse. Contact Eddie Marchio on 011-678-8062 or renato AT pixie.co.za for more information.

Wednesday Workshop. The Wednesday evening workshops are on the first and third Wednesdays of every month, from 18h00 till 20h00. Contact Winston Klein on 011-674-1513 for more information.

Rechargeable Batteries in Portable Power Tools - continued

Trevor Pope

If a NiCd battery pack contained a single cell, discharging and recharging would be relatively simple. However they consist of a string of cells. Due to manufacturing tolerances and aging, there are variances between the cells, one of which is the capacity of the individual cells. As the pack is discharged, all the cells drain simultaneously, however the cell with the lowest capacity discharges first. Then as the pack continues to be used, the discharged cells are driven in reverse, called reverse charging. This is particularly damaging to Nickel Cadmium (NiCd) and Nickel Metal Hydride (NiMH) cells and is a major cause of failure of packs. In use, NiCd and NiMH packs have a relatively constant voltage output, but it drops suddenly as the cells discharge. This can happen rapidly - within a couple of minutes after an hour of use.

DO NOT ATTEMPT TO USE THE PACK FURTHER without recharging it. If you continue to drain the pack, the weakest cells will be driven into reverse, and after a few cycles may suffer irreversible damage. Your 10 cell pack will have only 9 cells contributing and then 8 and then 7 as the weakest cells are damaged first. The cells are designed to tolerate a limited amount of reverse charging, so they will not fail immediately, but don't push your luck. There are a variety of failure mechanisms, but reverse charging is one you can avoid. I know from experience that the pack usually seems to run down just as you are trying to drill the last hole, and you don't want to wait an hour for a recharge. The temptation is push on, but don't – you may be damaging the pack.

So, your battery pack is not holding a charge - what are your options? The easiest is to buy a new pack. The price is likely to be high, and then you need to decide whether the state of the mechanicals warrant a replacement battery. A little investigation is called for.

Perhaps you decide to go for the option of repacking the battery – there are some companies who will do this for you – but again you need to be aware of the costs and limited garantees. You may be better off buying a new unit.

If you decide to repack your own battery, you need to have some soldering and electrical wiring skills. Firstly, you must source the replacement cells at the right price. The label on the pack will tell you the technology – NiCd, NiMH or Li-Ion, the voltage and the capacity. You need to open up the pack to measure the sizes of the replacement cells and count the number.
I have not replaced any Li-Ion batteries, so I can't give you any specific advice. There are some replacement cells available, but you need to check if they are suitable for portable power tools. Some power tools use a particular variety of Li-Ion called a Lithium-phosphate cell that is better suited to power tool demands. It may not be easy to source the right cells. Every battery must have an associated protection circuit that prevents overcharging and discharging. Using a Li-Ion battery without a protection circuit is strongly discouraged, as you risk provoking a catastrophic melt-down of the cells, and a fire. Because of the risks, some battery suppliers will only sell Li-Ion cells to qualified rebuilders.

NiCd and NiMH cells are generally rated at 1.2V, so the voltage of the pack, divided by 1.2 will give you the number of cells. Li-ion cells are rated at 3.6V, so there are fewer. My AEG battery pack said 14.4V. 14.4V ÷ 1.2 V per cell = 12 cells in the pack.

Open up the pack. Hopefully your pack will be held together with screws as was my AEG. Some are welded together – this makes disassembly tricky, and it is not going to look very nice when you put it back to together – See right for an example of a Makita battery that was cut open. (Image from http://gmansdiggerexperiment.com/416/how-to-repack-a-makita-cordless-drill-battery-pack/)

Count the number of cells, and measure the size. A typical size is Sub C which is about 22,5mm diam by 43mm high. This is important to ensure that the batteries will fit into the case once they have been assembled into a pack. There are several sizes, so you must check.

With improving technology, it is likely that the replacement NiCd or NiMH cells will have higher capacities, which you can happily use. I would be cautious going to cells of lower capacity, particularly with fast chargers. Don't mix cells of different capacities or technologies or vintages. It is important to replace all the cells, otherwise you may have a mixture of capacities, and the risk of reverse charging will occur.

I was faced with the option of replacing the NiCd cells with NiMH. For conventional charging, they are basically equivalent. However for fast charging, they do behave slightly differently. The important difference is when the cells are approaching capacity under a fast charge, they behave differently. In my case, the NiCd cells I was replacing were rated at 1400 mAh, (1000 mAh = 1.0 Ah) and the NiMH cells I had in mind were rated at 3000 mAh. I decided to take a chance, because when the old NiCd cells would be approaching capacity, the higher capacity NiMH cells would only be half full, and not in the region where the difference would arise. Also the battery pack has a sensor will guard against thermal runaway. The NiMH batteries I used are rated for fast charging at the rate provided by the AEG charger. In my case, NiCd batteries are significantly more expensive than NiMH, which also alters the economics of process – is it worth doing?

I selected and bought 12 Sub C cells from RS Electronics at R38- ea plus VAT = R520-. Not cheap, but the new replacement drill from AEG that is roughly equivalent to mine is about R1500-, so I thought it was worth doing. These cells are NiMH with a capacity of 3000mAh as shown on the right. They come with tags that can be soldered.

You can use cells without tags, soldering direct to the cells, but I don't recommend it, as there is the risk of overheating and damaging the cells. Better to get the tagged cells – they are freely available.

I could probably have saved some money by shopping around, perhaps as much as 50%, but RS had the right cells in stock. They have an excellent web site with lots of data on what they sell. Some of other suppliers only have a limited selection and no data sheets.

Doing the work

The standard of workmanship is important when repacking a battery pack. You don't want any short circuits, because of the high currents that NiCd batteries can deliver (40A!). If there is a short there may be high temperatures, melted plastic, damaged batteries and perhaps even a fire. Make sure all the tags are sleeved where they can touch. Ensure that the positive tags do not make contact with the negative casings of the same cell. The RS cells have a sleeve on the positive tag. When dismantling the pack, make careful note of the arrangement of the cells and their interconnections, so that they will fit back into the same casing. In use the pack will receive many shocks and may even be dropped, so make sure all the connections are robustly soldered – no wires twisted together. Carefully extract the temperature sensor from the old pack and insert it into the same place in the new pack, avoiding any damage to the wiring.
Make sure all the polarities of the cells are correct, positive to negative. Use a voltmeter to ensure that voltages increase along the string of cells. Ensure there are no unexplained drops due to a cell being connected in reverse.

When fitting the assembled pack back into the casing, make sure that no shorts can develop – if in doubt, put some insulation in place. Don't use cheap insulation tape. The battery pack can get warm and you don't want the tape to slide off, leaving no insulation and a sticky mess. Good quality duct tape will do.

When charging the battery for the first time, watch carefully for excessive temperature rises and then leave the battery pack overnight on a long equalizing charge to bring all the cells up to full capacity. Take precautions against failure, perhaps by standing the charger and battery in a metal pan away from anything flammable, so if there is melting and fire, it is safely contained.

I checked the voltages of the cells that I bought. As delivered they varied quite a bit, due to varying states of charge. When a fast charger operates, it provides a high current to the pack until it reaches a voltage or temperature that indicates that the pack is about 80% charged. It then changes over to a low rate charge. This low rate charge is what will equalise all the cells in the pack over a few days. The cells will equalise over time with normal use, but I prefer to ensure that they were all equalised from the start, so I left the pack on charge for a couple of days.

If you are careful, you should have many more long years of service from your tool. You also have the pleasure of knowing that this is one less thing on the dump and you may have saved some money as well. If my new pack lasts another 10 years, I will be well satisfied – I think the mechanicals may be shot by then!

Dispose of the old cells correctly in a battery recycling centre container, particularly for NiCd cells. Cadmium is particularly poisonous and must be kept out of landfills, so that it doesn't leach into the groundwater.

Sources: www.wikipedia.org www.batteryuniversity.com RS Electronics: www.rsonline.co.za