Tips and Tricks

From readers for readers

Here is another neat solution sure to make the life of any electronics enthusiast that much easier.

Repairing damage from leaking alkaline batteries

By Peter Krueger

You know the problem; you go to the drawer to get out a flashlight, radio or electric travel toothbrush you haven't used for a while and the batteries are dead. Worse still, they've started leaking and left a real mess. If you want to restore the battery contacts to (almost) new again, read on. Cursing might help relieve the stress in your head but won't help with the battery situation. Expired alkaline-manganese primary cells are primarily a real annoyance. As they become exhausted the internal pressure rises as a result of electrochemical processes and bursts the 'safety valve' diaphragm. The electrolyte material (a caustic potash) then empties through two degassing holes at the negative pole [1]. Battery manufacturers don't seem able or willing to make their batteries gas tight! If this happens to you and it ruins the equipment, then you will probably agree with me: a product that can potentially cause so much damage really shouldn't be on the market! If the situation is not so bad help is at hand!

Take it from here

In **Figure 1** you can see how my cycle rear-light looked after being abandoned for two years in a drawer. If you are interested in the process, the chemical reaction in the cell producing electrical energy causes the liquid electrolyte (potassium hydroxide) to break down and generate hydrogen gas. The gas pressure eventually ruptures the battery seals and escapes, allowing the electrolyte to leak out. In contact with CO_2 in the air it forms potassium carbonate (K_2CO_3) which is the white (hygroscopic) crystalline crust that you can see. To be safe you should handle this wearing rubber gloves and try not to breathe in any dust created. This alkaline compound corrodes anything metallic it comes into contact with, usually the contact springs in the battery holder, any wiring and also PCB tracks. To make matters worse, the dry salt deposits make very bad conductors. Just swapping the old batteries for new ones and blowing away the loose salts is not going to do the job. While any damage to wires or tracks can be remedied with a soldering iron and copper wire, unless the gunk is cleaned off, the spring will always be a source of flaky contact and give unreliable device operation. I've seen recommendations to use acetic or some other acid to clean chromium-plated, nickel-plated or gold-plated steel spring contacts but this can give rise to more corrosion. Don't be tempted to try it; there is a better solution…

Damage limitation

While watching a TV science show about bases and acids, I had this idea to try to dissolve these alkaline deposits from an alkaline

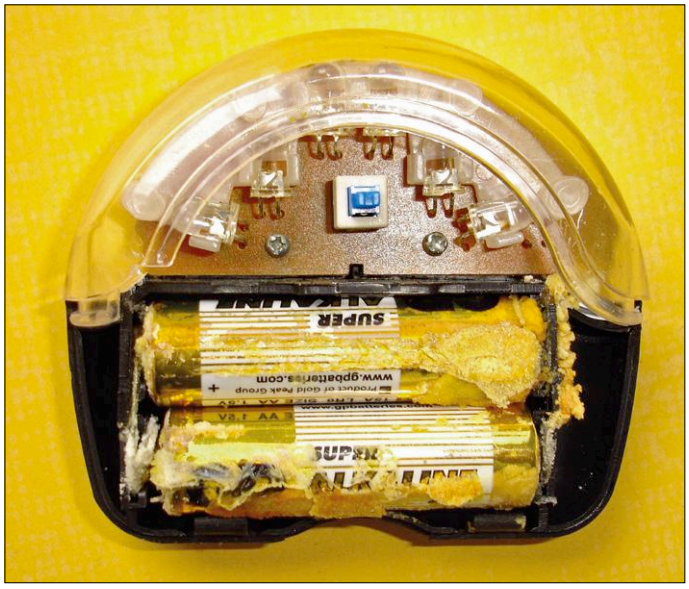

Fig. 1. After two years of neglect the alkaline batteries in this cycle rear light are exhausted and leaking.

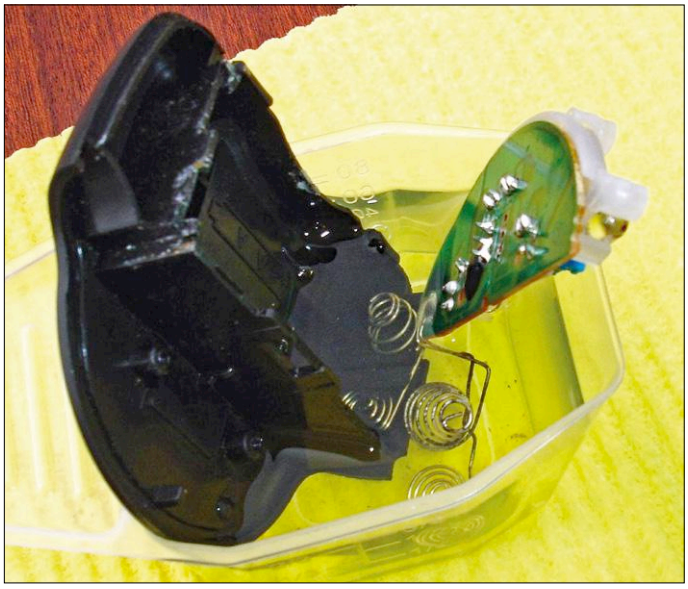

Fig. 2. The battery contacts and affected PCB area are soaked in the bath containing dish washer detergent.

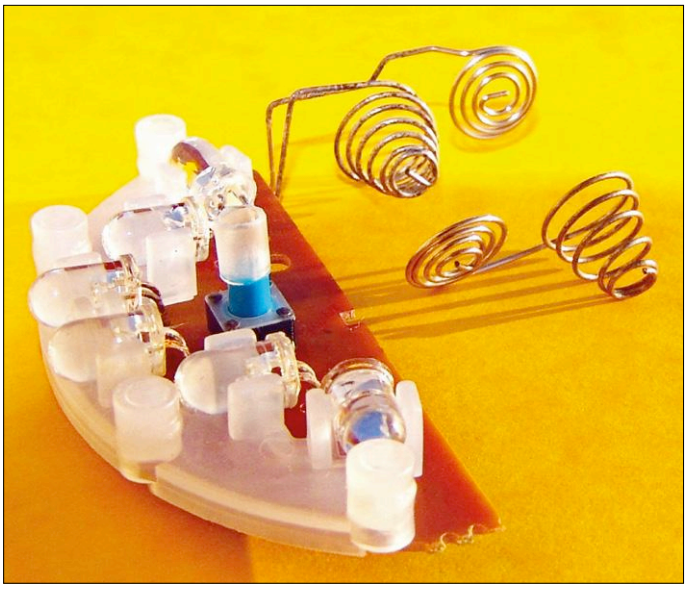

Fig. 3. Sparkling results: The contacts look almost like new!

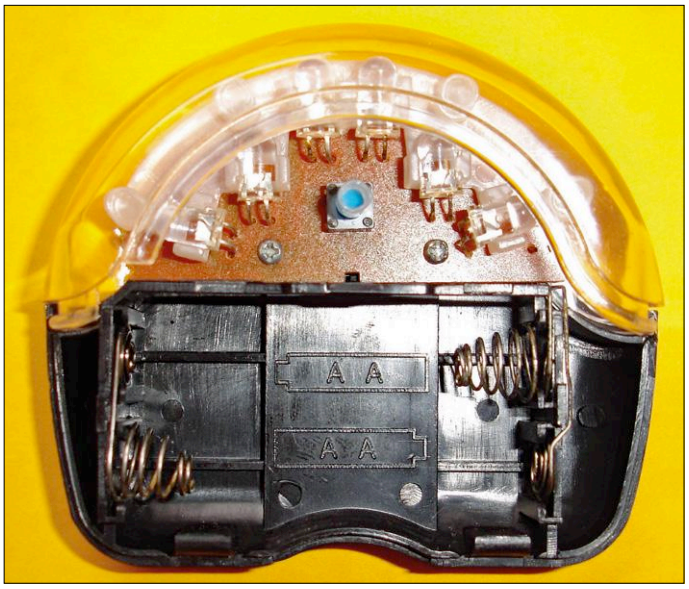

Fig. 4. The rescued rear light just waiting for a new set of batteries. Rechargeables will be a better option.

*battery by using an alkaline solution, such as ordinary dishwashing liquid. I was really amazed after my first test; the recovery of damaged devices is so simple, the idea using dishwashing liquid works a treat. If you don't believe me, just try it for yourself. It's important that the cleaning liquid contents include a few percent anionic surfactants (most do). I got good results using a cheap brand of hand washing liquid soap called 'Aloe Vera' sold at a local store. To avoid any further corrosion damage, the detergent should have a low pH. Check using the simple taste test; it should taste neutral rather than sour. The encrusted battery contacts or complete battery holder (***Figure 2***) can then be placed in a bowl filled with detergent. The solution should be used undiluted, it already contains enough water. After approximately one day soaking in this cleaning solution, the deposits are dissolved and the solution has become thicker during the process. Now rinse with clear water, leave to dry and voilà: almost like new. Check out* **Figure 3** *for proof! Just reassemble and the rear light is ready to go (***Figure** *), all we need now is a new set of batteries.*

What else?

Prevention, they say, is better than cure so I tend to use NiMH rechargeable batteries instead of primary cells. My preference is for the 'ready to use' type which feature low self-discharge (also known as 'Eneloop' from Panasonic). They keep their charge better and can put up with being ignored for a year. Even after this time, it will only be the battery pack that is not working. Standard NiMH rechargeables also succumb to this fate but more quickly and therefore it happens more often. Sometimes the batteries will be totally encrusted and difficult to prize out without causing damage. The solution in this case is to drop the battery holder together with the batteries into a bowl of the cleaning solution. To make things easier it may be possible to desolder the battery-holder leads from the main PCB. Don't worry if this is not possible, I have successfully dunked the whole PCB including batteries and components into the cleaning solution without doing any apparent damage. The PCB is really shiny when it emerges from the process. Make sure that there are no potentiometers, switches or pushbuttons that can come in contact with the cleaning solution; it can be difficult to flush the solution out of all their nooks and crannies so some residue and moisture may remain. Why not try it out? No risk, no fun! ⏮

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Author's bio

Peter Krueger is an electronics development engineer with 62 years of professional experience in the field of digital and analog electronics including hardware and software development.

[1] https://en.wikipedia.org/wiki/Alkaline_battery

Have you come up with an inspired way of solving a really challenging problem? Or found an ingenious but 'alternative' way of using some component or tool? Maybe you've invented a better or simpler way of tackling a task? Do write in – for every tip that we publish, we'll reward you with UKP40 (or local equivalent)!