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## A DEEPER LOOK AT THE PHENOMENON OF CATHODE STRIPPING IN THERMIONIC VALVES

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One may assume that a thermionic valve's susceptibility to the stripping phenomenon primarily depends on its cathode's design, and indeed that the side effects caused by this are most prone to be seen in high grid impedance low level signal tube circuits and their aging behavior:

Indirectly heated (generally Nickel) cathodes coated with a rare earth metal oxide electron emission "cement" compound are prone to mechanical stress caused by thermal cycling; i.e.: the heating and cooling of the cathode. (Manufacture dependent).

The ceramic nature of the indirectly heated cathode's emissive coating with its (from the metal cathode carrier) differing thermal expansion coefficient may cause surface material to crack and become "loose". The thus gradually "powdered" ceramic cathode emission surface may keep minute amounts of electrical charge stored after cooling down; the surface in cold state remains nonconductive. Minute amounts of these cathode borne particles, either with remaining charge or electrically polarized upon sudden apply of anode voltage, may "dust off" and clog onto the most nearby "sieve" i.e.: the control grid; cathode stripping has happened, and here it is that this less heard of tube degradation/aging mechanism (not discussing others) occurs!

Consider this:

Due to heat radiation from the nearby cathode the grid-clogged particles will start to behave as point-wise cathodes themselves, causing beyond normal grid current, this has the effects of:

- Drift in those high impedance biased control grid circuits: And this just in the unwanted direction: Take a tube output stage which is capacitive coupled from the phase inverter and DC biased through (say) 50 kOhms: Current runs from the anode into the control grid and therefore shifts the grid bias voltage to a less negative value... There you go...  
(Ever wondered why some tube manufacturers specify a maximum grid bias resistance?)
- Causing excess noise.
- Etcetera, you don't want to know.

Now, how to be most gentle to your indirectly heated tubes and give them a long life: (and this also applies for all fellow guitar players having a "stand by" switch at hand):

SWITCH ON:

Switch on from standby mode: i.e. only fire the filaments, wait somewhat longer than fully "glown" up, then switch from standby to power (B+). (i.e.: B+ may be suddenly switched on, but only after full filament warm-up) (with regards to "cathode stripping": The cathode is now conductive: All localized cathode charge will have drained).

SWITCH OFF:

The same sequence reversed: I.e.: Turn off B+, wait, and only then turn off the filament supply; This will gradually and properly discharge all charges.

With regards to cathode Stripping; this will assure no charge will remain stored locally on the susceptible cathode surface and so forth...

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