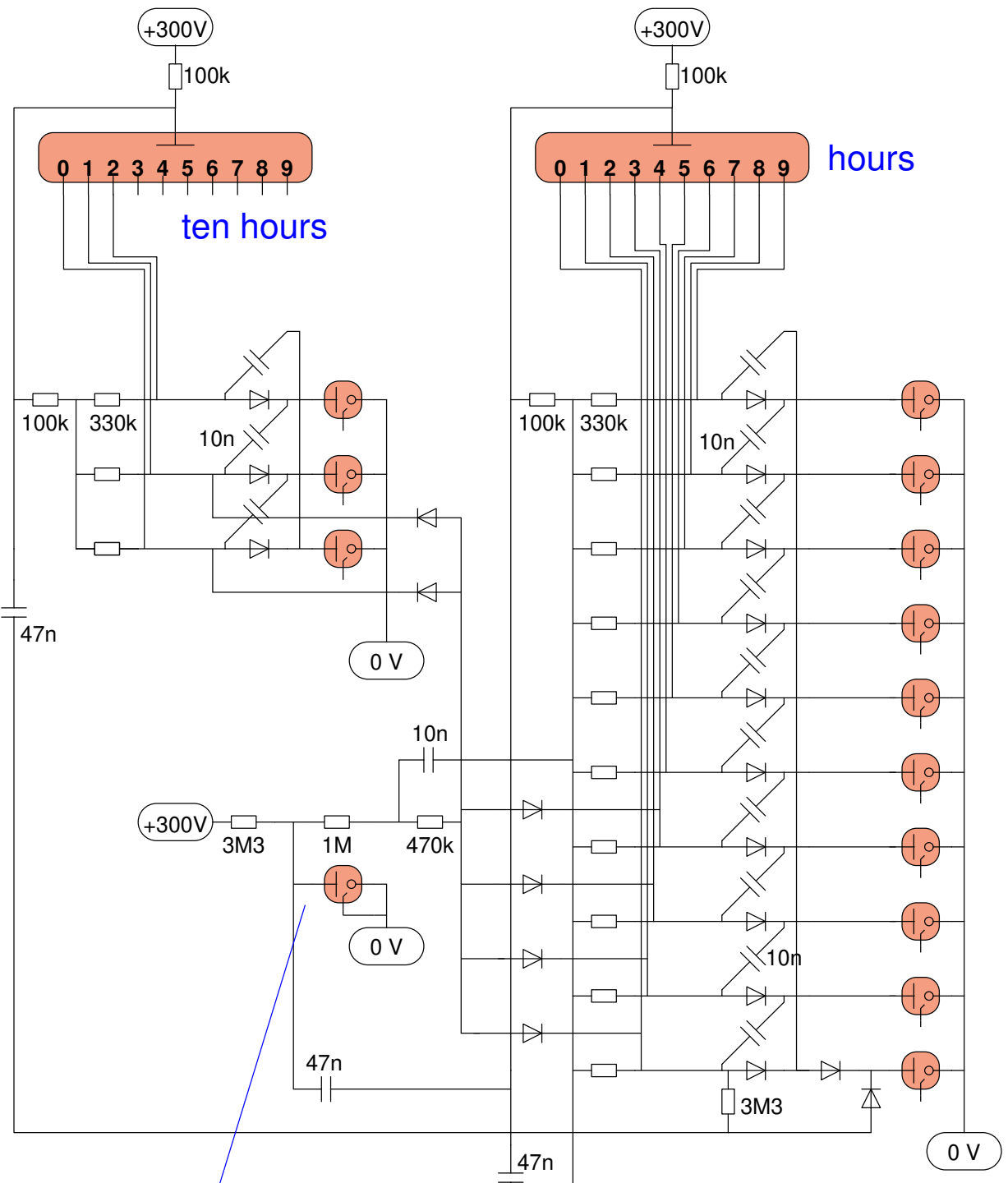
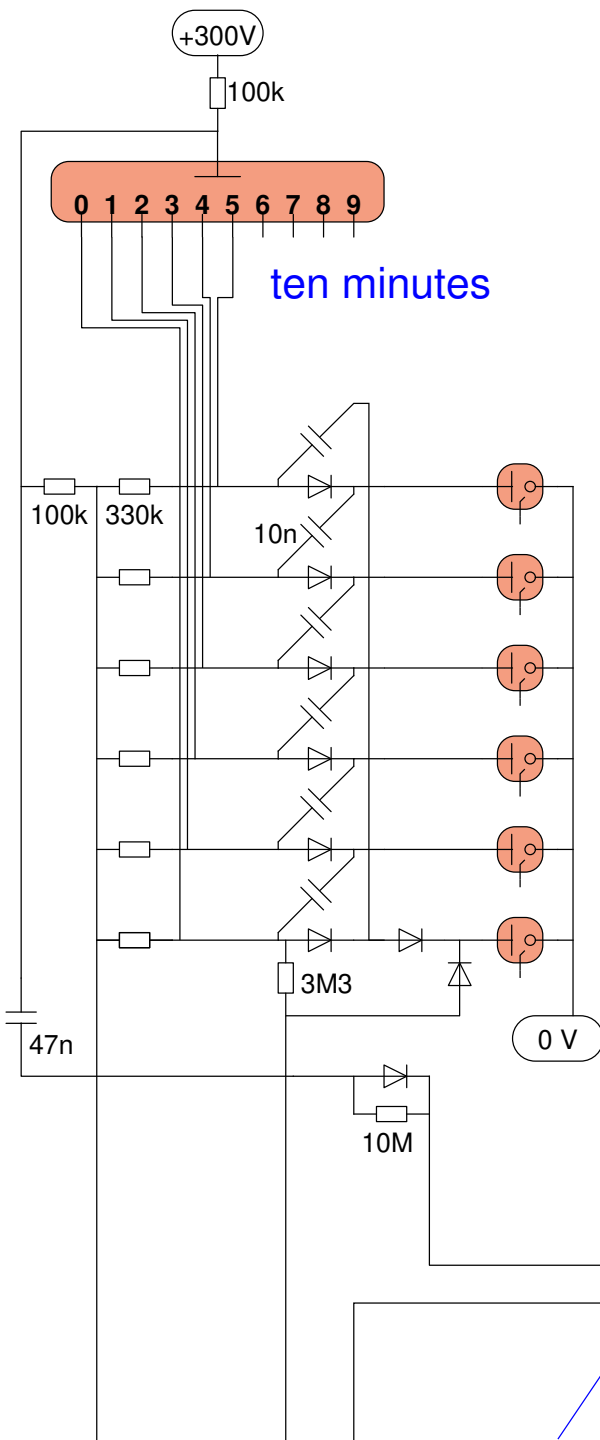
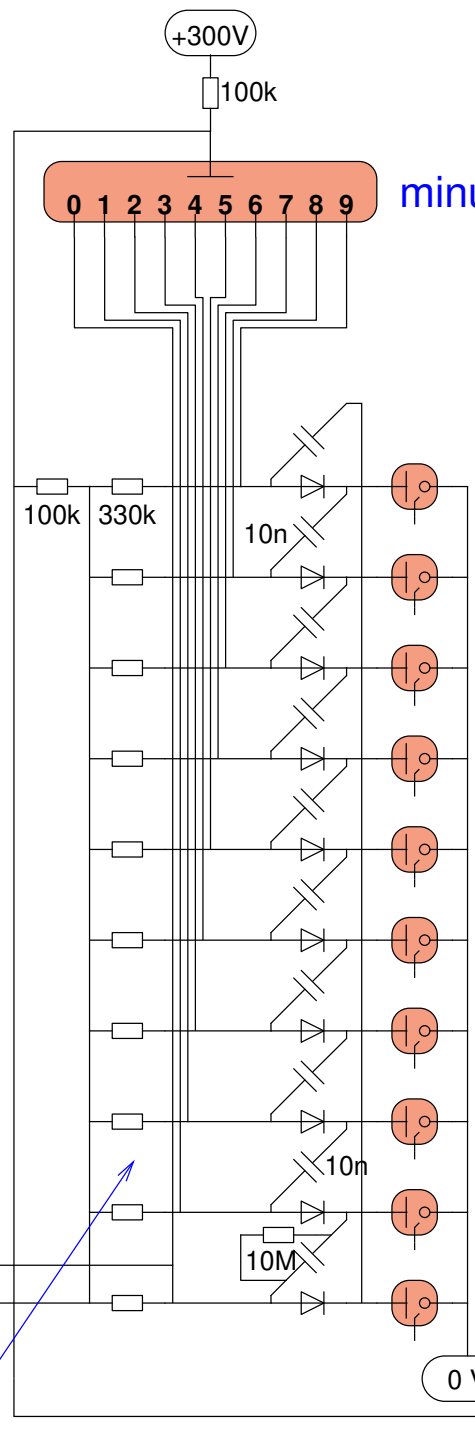
Nixie clock using MTH90 trigger tubes as logic elements

(c) 2020, Pieter–Tjerk de Boer, pa3fwm@amsat.org – version 20211027

https://www.pa3fwm.nl/projects/neonclock2/



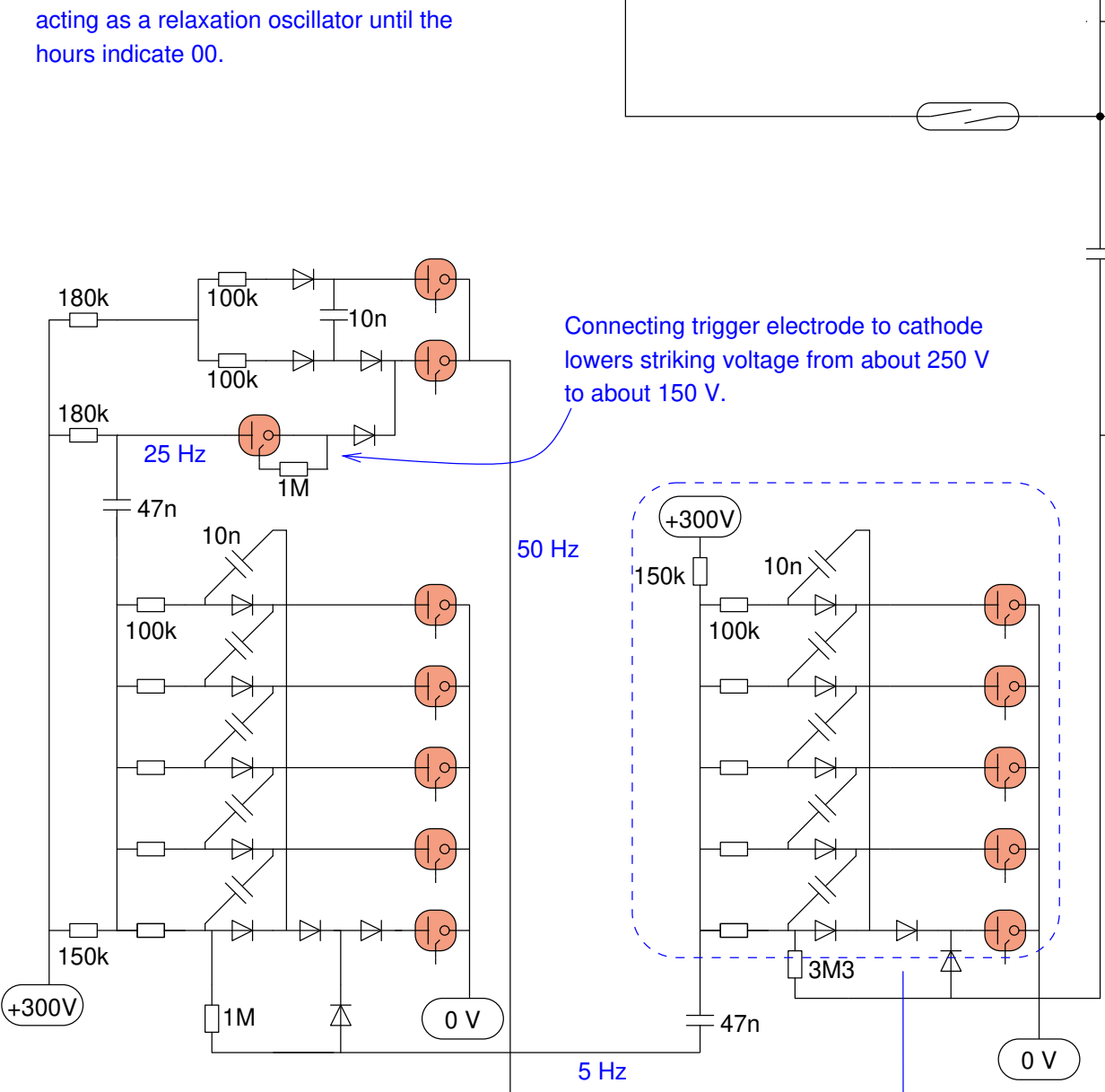




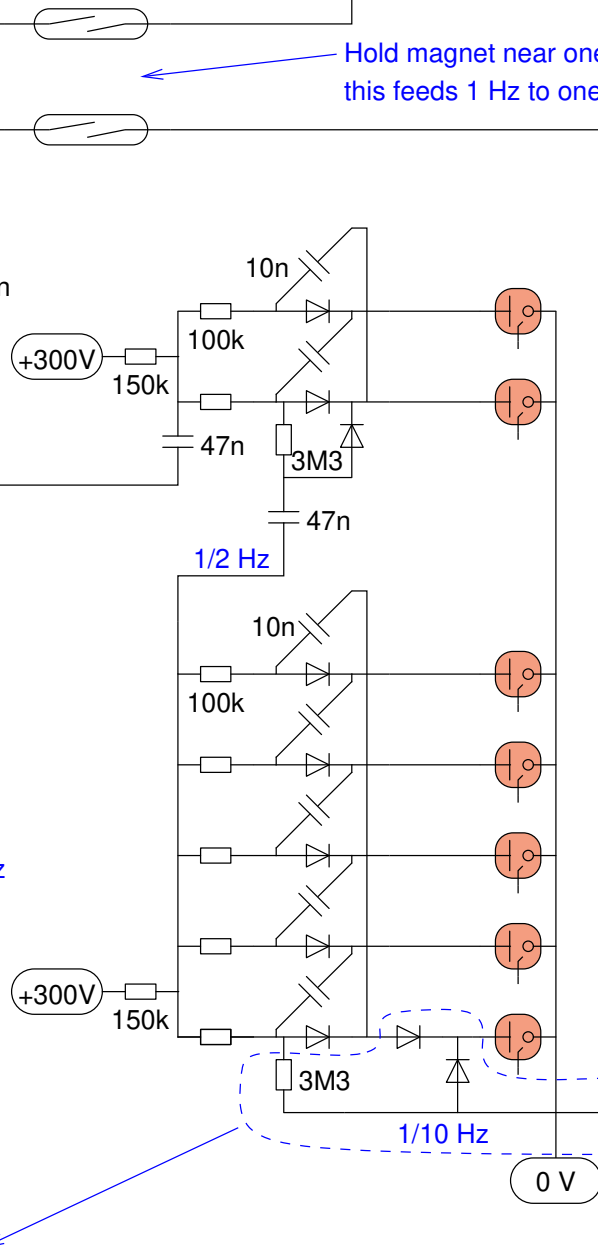
When hours indicates 24...29, the anode voltage of this tube rises high enough for it to trigger, acting as a relaxation oscillator until the hours indicate 00.

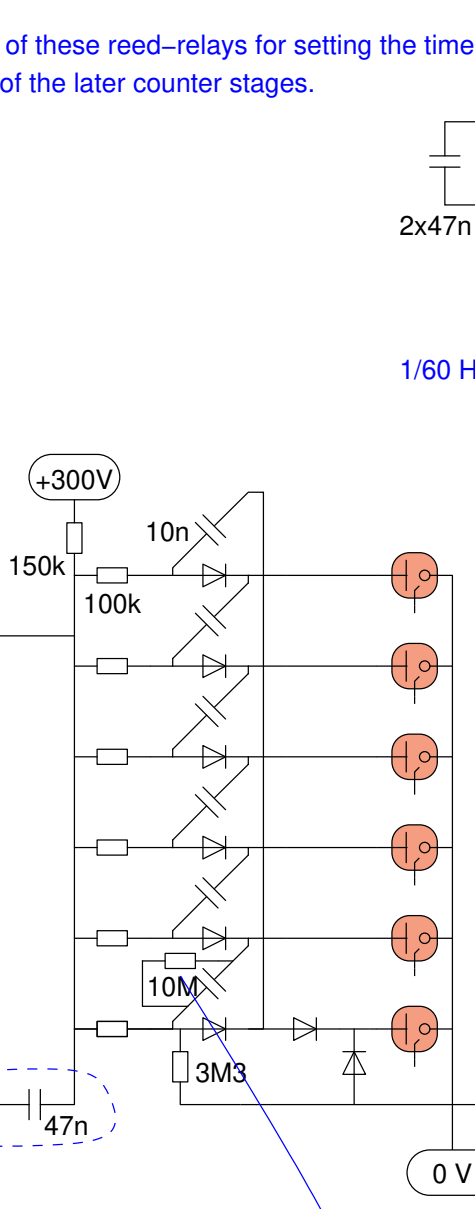
Most current goes through the nixie, not through the 330 k. Nixie stabilizes voltages across the 100+330k, making circuit rather insensitive to supply voltage.
Nixie's anode resistor determines Nixie current / brightness.

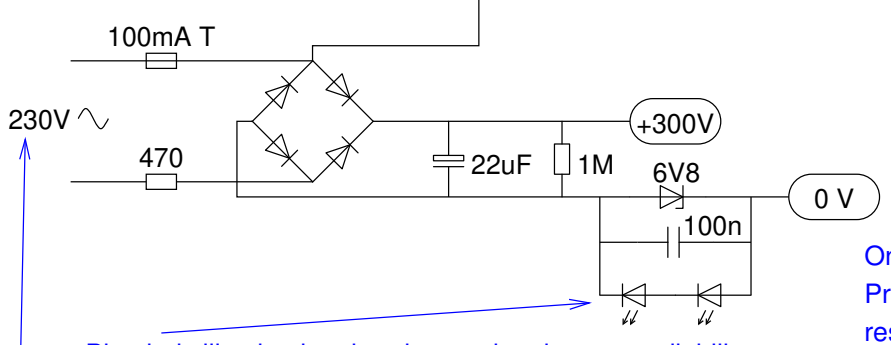
Hold magnet near one of these reed–relays for setting the time: this feeds 1 Hz to one of the later counter stages.



Connecting trigger electrode to cathode lowers striking voltage from about 250 V to about 150 V.







Basic stage coupling circuit.
Diodes allows this (and only this) lamp, when it ignites, to quickly pull the anodes of the next stage low via the 47 nF capacitor. Later the capacitor is slowly discharged again via the 3M3 resistor, without disturbing the ringcounter.

Earlier, less robust versions are found elsewhere in the circuit:
Schematic is as built, not necessarily as best!

Blue leds illuminating the trigger tubes improve reliability in darkness. Neon gas discharge needs an initial ionization to get started, which can be provided by ambient light.

One basic ring counter circuit.
Principle: Assume one lamp is lit. Current through it develops a voltage across its anode resistor, which charges 10 nF coupling capacitor to next lamp. Next, assume negative pulse on anodes (via 47 nF) extinguishes lamp. Diode prevents discharge of 10 nF capacitor. When anode voltages rise again, the next lamp has extra high anode potential due to the charged 10 nF and therefore ignites first.

A little known problem with these ring counter circuits is that when a lamp ignites, all coupling capacitors get charged a bit, which may produce counting errors (depending on spread of lamps' striking voltages). The 10 M resistor lets the spurious charge "bleed away" between two counting steps.
I only installed it where needed, i.e., if a counter didn't work quite correctly.

Dangerous!! The clock is connected to the mains!
Use isolation transformer and much care during testing!
Only try building something like this if you know what you are doing!

Diodes: 1N4007
Trigger tubes: MTH–90
Nixies: IN–12A