E1T decade scaler tube (ca. 1954)

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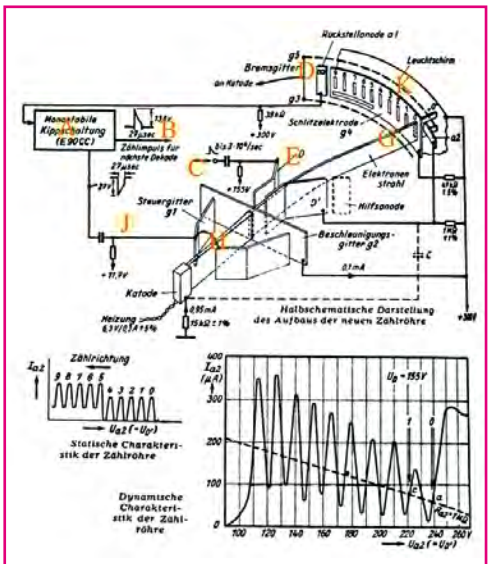
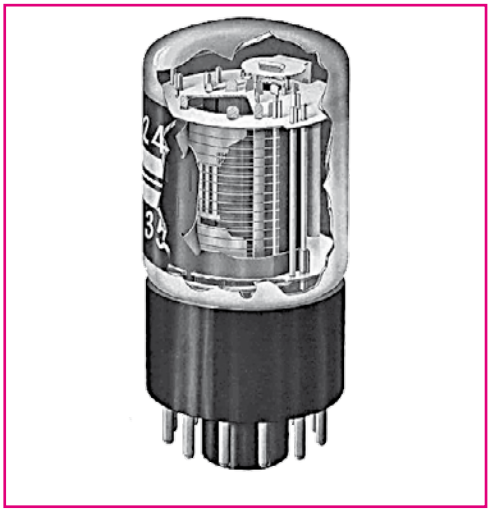
A previous instalment of Retronics discussing the 'Dekatron' decimal counter valve [1] having aroused my attention through feedback published in Elektor's Mailbox section, I thought I'd alert the Editor to another counter tube, the Philips E1T. A good amount of information on the actual use of the device being available on the Internet (see web links), I decided to concentrate on the scientific environment at the time when the E1T was 'prima donna'.

First produced at around 1954, the E1T combines a display, a scratch memory and a counter in one device. Even for those not familiar with electron tubes, the diagram (reproduced from radiomuseum.org) gives an idea about the operation of the E1T and how it fits in a counter cascade arrangement. The E1T may be likened to a small cathode ray tube (CRT) in which the count/display readout (0 through 9) jumps from digit to digit under the control of deflection plates (E) with internal feedback maintaining the position until a new pulse occurs (see dynamic characteristics). The 10th pulse causes the beam to collide with reset anode a1 (D). The resulting negative pulse is processed by an E90CC dual triode connected as a monostable generating two pulses (or 'flags' if you like): a carry bit to drive the next decade, and a cutoff level to reset the E1T to zero. The system, devised almost 60 years ago, is the precursor of 'overflow-with-carry' in a microprocessor!



A monostable: reset to zero (blanking); carry bit generator
B next decade driver
C pulse count driver
D overflow detector
E deflection plates
G ribbon type electron beam
H electron beam gun
J blanking pulse (reset to zero)
K slotted electrode (self-centering) and phosphor screen



The use of the E1T seems restricted to Philips' own scientific division as well as high-end professional instruments and equipment including radar, nuclear and x-ray (XRD, XRF). In the latter application (without computers or calculators!) Bragg's law ($n\lambda = 2d \sin\theta$) was traditionally relied on to count pulses. To cope with the tremendous 'intensity' variations expressed as the number of pulses and their amplitude, two techniques became established after some time. The first was counting all pulses coming from the detector (a Geiger or Flow counter), the second, applying the pulses to a pulse level detector set to 'threshold' or 'window' mode. A linear amplifier supplying output pulse levels between (almost) 0 V and 100 V_{pk} was usually inserted between the counter output and the pulse analyser.

The E1T's maximum 'speed' of about 30 kHz was a limiting factor, as well as the 27 µs necessary to reset the decades to zero (minimum safe width for non-selected tubes). This required the use of a prescaler if, say, three E1Ts were intended to constitute a counter readout.

Usually, the prescaler was a pure 8-bit counter using E90CC triodes with neon lamps as bit readers. Thus any value on the three E1T decades has to be multiplied by the prescaler-selected factor and added to the binary counter for better accuracy.

The E1T was designed conceptually at around 1946 by Adriaan van Overbeek of the famous Philips NatLab (PhysLab), based on earlier research by Jan Jonker. Later, another NatLab worker, Kees Van der Velden (now C. Keith Vandervelden) further perfected the device under supervision of the legendary Klaas Rodenhuis of Philips TubeLabs.

Probably due to cost, the E1T was not mass-produced like other Philips tubes. Yet it's not rare and Rodenhuis once said that the 10,000 or so devices around had been ordered from Philips TubeLabs' sample department (!). He also confirmed that 'E' was for 6.3 V heater, 'T' for 'tellerbuis' (counter tube) and '1' for the first device in the series. See, you could count on Philips for consistency in type designations!

(080365-I)

This month's free Retronics download is the E1T datasheet.

Reference

[1] The 'Dekatron' decimal counter valve, Elektor March 2008.

Web Links

www.radiomuseum.org/tubes/tube_e1t.html

www.dos4ever.com/trochotron/TROCH.html

www.dos4ever.com/E1T/E1T.html

www.tube-tester.com/sites/nixie/different/e1t-tubes/e1t.htm

www.lks.physik.uni-erlangen.de/diffraction/iinter_bragg.html

http://www-outreach.phy.cam.ac.uk/camphy/xraydiffraction/xraydiffraction7_1.htm

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