A Klystron Survey

Klystrons are velocity modulated tubes designed to overcome the frequency limits of traditional grid tubes. Pioneers in the development of the klystron were R.H. and S.F. Varian at the Stanford University, which started from the Heil velocity modulation theory and from the 'rumbatron' doughnut resonators ideated by W.W.Hansen of the same university. In 1939 the Varian brothers designed the device in which an electron beam could interact with a couple of rumbatron resonators. The research was financed by the Sperry company.

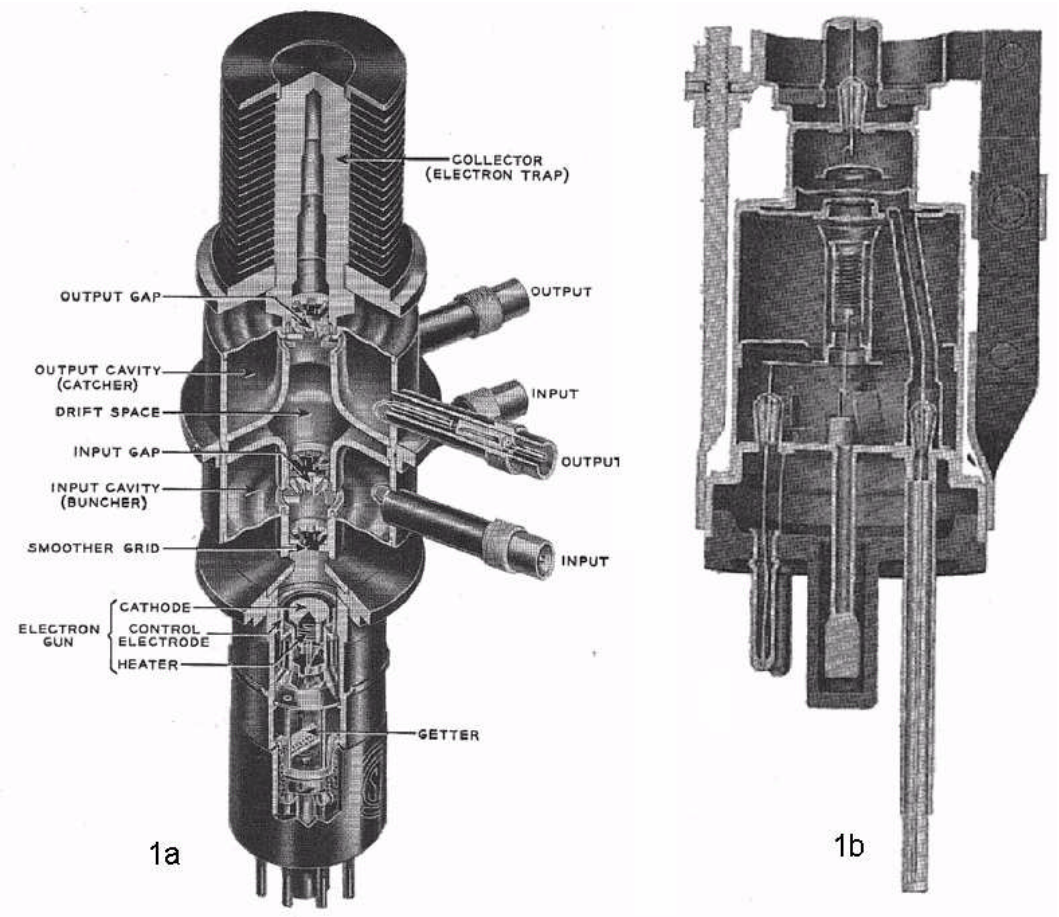

Fig 1 – 1a shows the internal view of a 410R two cavity klystron, which can be used either as amplifier or as oscillator. 1b shows the interior of a 2K25, a reflex klystron, used as X-band oscillator.

Referring to the two resonator klystron of fig. 1a, the electron beam generated by the gun in its travel toward the collector passes through the input gap of the buncher cavity. Under the effect of the oscillating electric field in the gap, the velocity of some electrons is increased, while being decreased for other electrons; subsequently there is a bunching effect on the electron flow in the drift space. The bunched electrons induce oscillations in the catching cavity when passing through the output gap. In the reflex klystron, fig 1b, there is just one cavity, which acts as buncher for electrons emitted by the gun and attracted by the shell; bunched electrons are then forced back, by the negative potential applied to the repeller (top cap), to cross again the resonator, now seen as catcher.

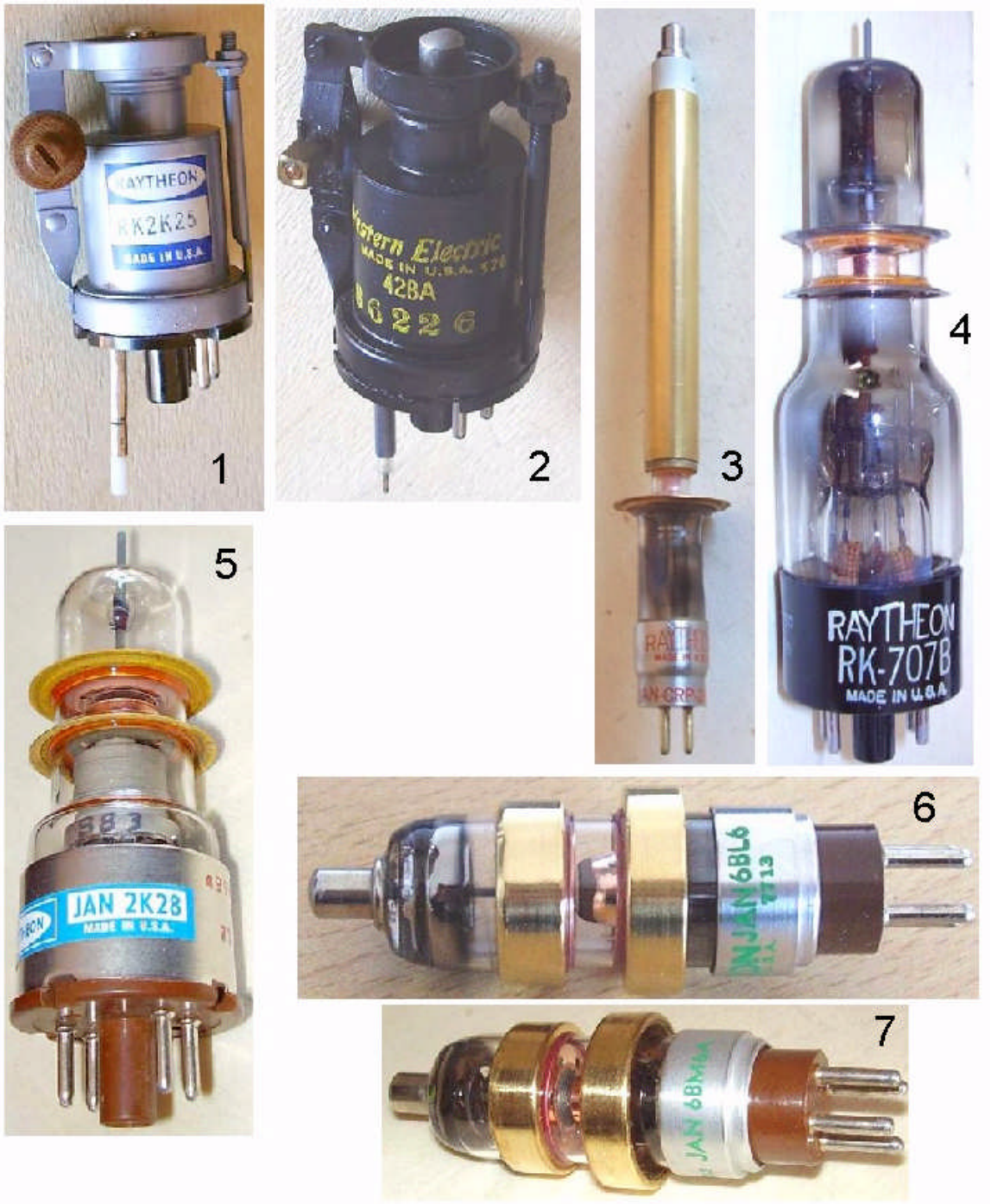

Table I – Pic. 1: 2K25, X-band reflex klystron, 25mW over 8.5 to 9.7GHz. **Pic. 2:** WE 428A tunes from 6.4 to 7.2GHz, fot television microwave relay. **Pic. 3:** 2K48 Raytheon covers from 4.3 to 10.75GHz with external waveguide resonator. **Pic. 4:** 707B is a disk-seal reflex klystron which tunes from 2.5 to 3.75GHz depending upon the external cavity. **Pic. 5:** 2K28 is similar to 707B and can be tuned from 1.2 to 3.75GHz delivering 125mW in output. **Pic. 6:** 6BL6 tunes from 1.4 to 6.5GHz with an external cavity. **Pic. 7:** 6BM6 is very similar, designed to cover from 0.55 to 3.8GHz.

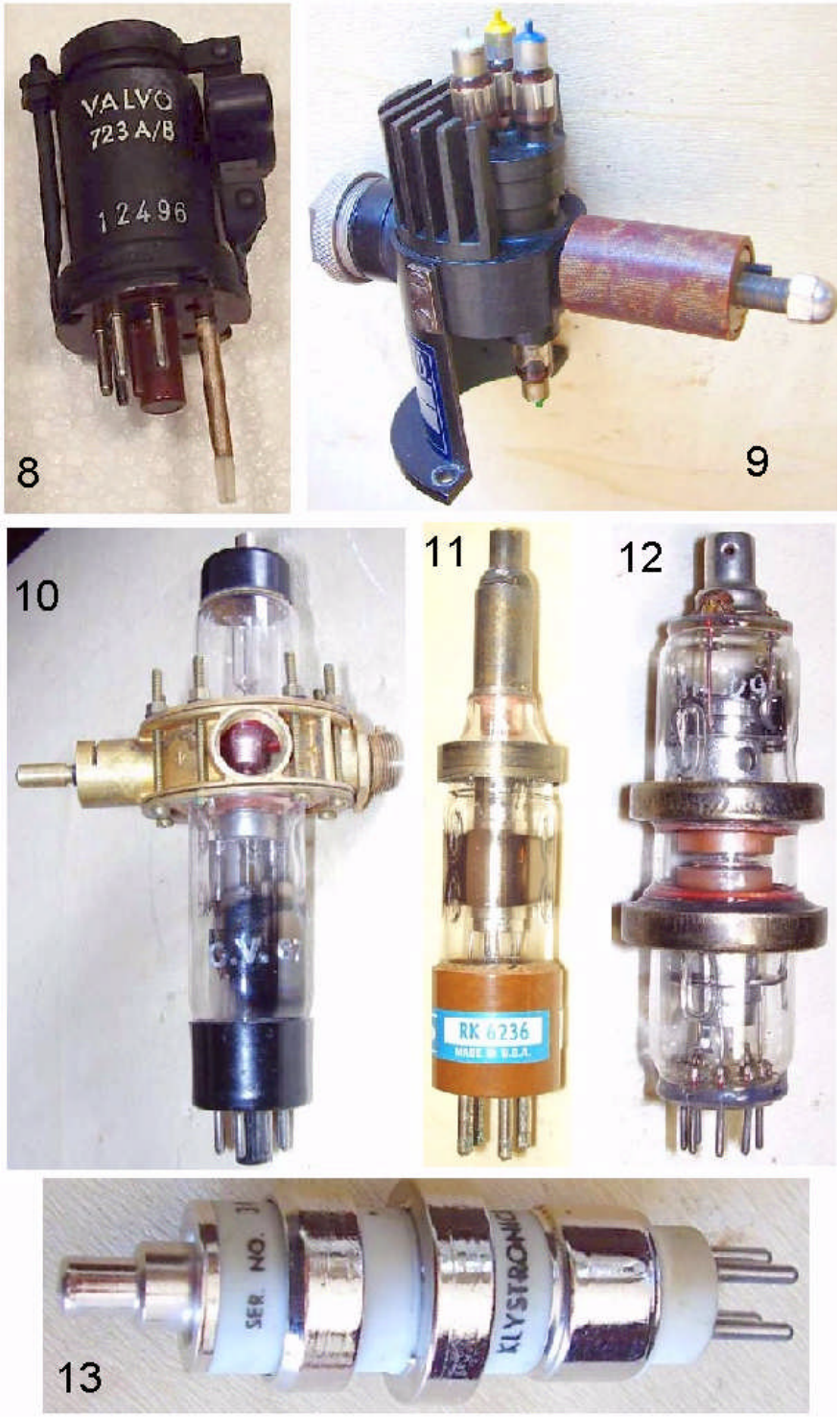

Table II - Pic. 8: 723A/B was the predecessor of 2K25. **Pic. 9:** 8RK8 from Elliot-Litton, GB, is a K-band reflex klystron. **Pic. 10:** CV67 was one of the typical WWII British klystrons, witk the factory assembled external cavity. **Pic. 11:** 6236 tunes from 3.8 to 7.6GHz. **Pic. 12:** EMI VX5089 tunes from 1.8 to 4.5GHz with external cavity. **Pic. 13:** ZV1009 'Velocitron' from Polarad is a ruggedized version of the 6BL6, tunable from 1.5 to 6GHz.

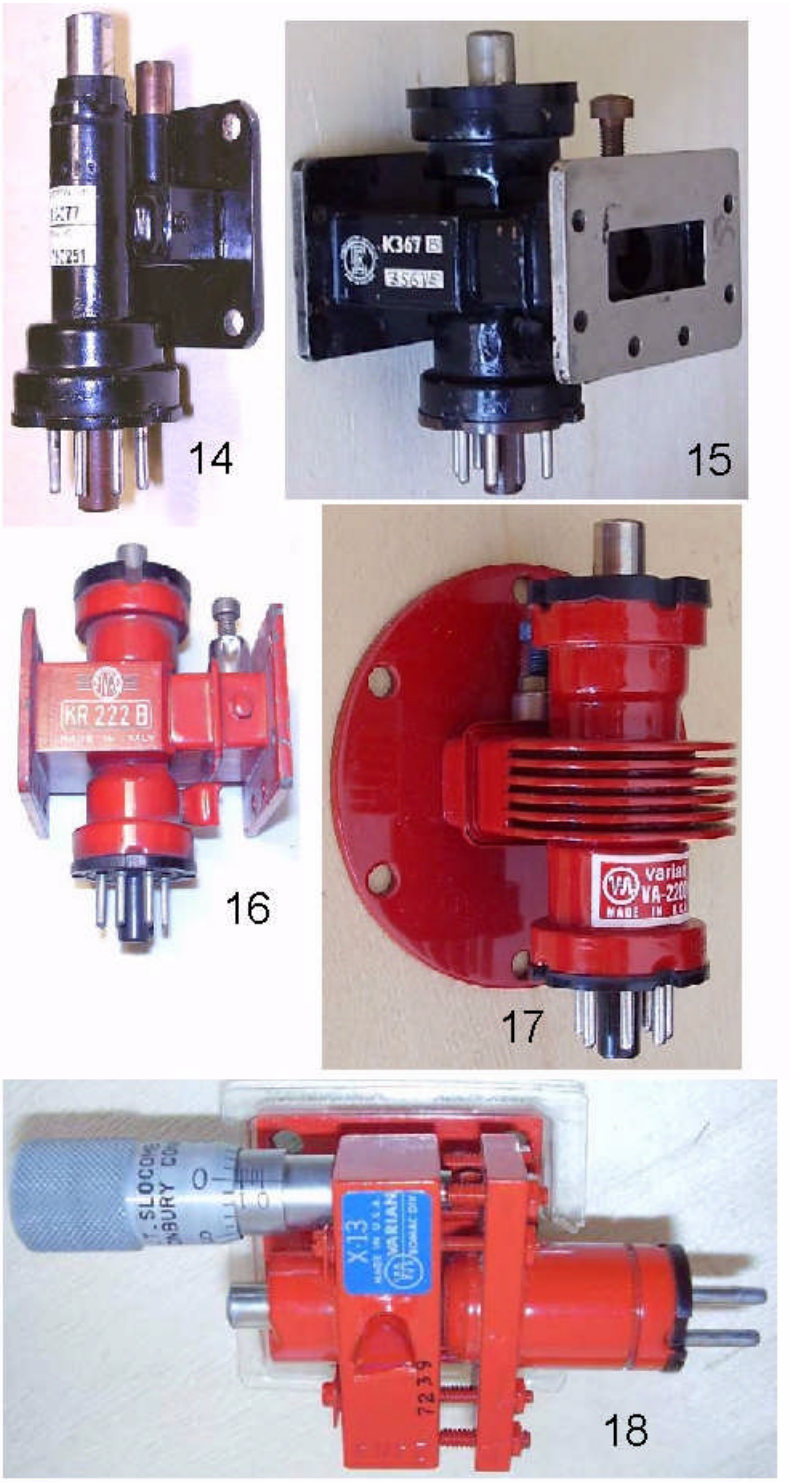

Table III – Pic. 14: EEV K3077 X-band oscillator for doppler use. **Pic. 15:** EEV K367B is a reflex oscillator used in communication relay links. **Pic. 16:** Fivre KR222B is another klystron for microwave relay; 1W at 7125 to 7425MHz. **Pic. 17:** Varian VA220D**,** a further klystron for microwave relay sistems. **Pic. 18:** Varian X-13 is a precision X-band oscillator, with micrometric tuning.

Table IV – A Survey of Sperry Klystrons.
Pic. 19, 20, 21: 417A through C, also manufactured by Westinghouse, were integral cavity klystrons tunable from 2.65 to 3.33GHz. **Pic. 22:** SRL7 was intended for radio-relay use; 10W out at 1.85 to 2.16GHz. **Pic. 23:** SRL17 klystron; 1.8W at 750 to 990MHz. **Pic. 24:** SRU55A, 14 to 17.5GHz, 60mW.