

6.1 - Velocity Modulated Tubes: Heil tubes

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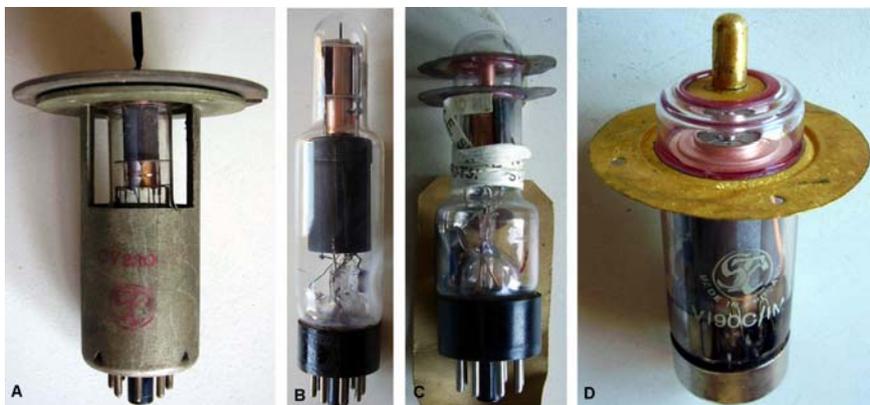
Even if magnetron structures were described since the twenties, a more systematic investigation on velocity modulated or VM tubes started around the mid thirties, to overcome the severe frequency limitations due to the transit time of electrons in conventional space charge amplifiers. VM tubes include several families, differing from each other for their operating principle, or the way to exchange energy from the input port to electrons and back, from electrons to the output port. Basically we have Heil tubes, klystrons, magnetrons and traveling wave tubes, also known as TWTs.

6.1 - Heil tubes

The little known Heil tubes are velocity modulated (VM) tubes, intended to operate as oscillators in the microwave region. They were devised before klystrons, in the mid thirties, by Oskar Heil and his wife Agnessa Arsenjeva. With very few exceptions, Heil tubes were manufactured by British STC and mainly used in their microwave communication links. Operating principles and summarized history of Heil tubes can be read in the [appendix A](#).

Heil oscillators were capable of RF output usually under 1 W, even if more powerful devices were designed. Their use after the war was confined in microwave telecommunication relays as transmitter and/or as local oscillator in the associated receivers. Very few uses were made during the war in radar or other microwave applications, where klystrons and magnetrons were preferred. This can be explained because of the quite low efficiency and the need for a focusing magnet in addition to the resonating cavity for Heil oscillators to operate. Nevertheless some types were designed to operate up to the X-Band, likely to investigate on possible uses as local oscillator in radar receivers.

The collection includes very rare samples of Heil oscillators made by British STC in the war and other samples made in the fifties.



- Samples of Heil oscillators made during the war. [CV230](#) was also known as DV55 or V230C/1D. It looks to be capable of remarkable output power. B) [DV27](#) is a medium power oscillator capable of operation in the S-band region. Likely used around 1943 or 1944 in a super secret experiment on FM barrage radar jamming technique. C) According to the label, [DV57](#) was a variant of DV55 for operation in the X-band. D) [V190C/1M](#) was a Heil oscillator designed to operate at relatively low frequencies, up to 1000 MHz.



Fig. 6.2 – Some Heil tubes made in the fifties by British STC. From left: V233A/1K, V239C/1K, V241C/1K, V243A/2FS, V247C/1K.

Another microwave oscillator was derived from the Heil oscillator, replacing the resonating external cavity with an integral section of flanged waveguide. It is the H-Wave oscillator. In the photo below a sample of [V261C/1M](#).



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