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Improvement of Efficiency of T. W. T by Velocity Convergence

Yoshio NAGAI*

The purpose of this thesis is to improve the efficiency of Traveling Wave Tube. The method is to get rid of the energies which are consumed in the form of heat at the collector. For this purpose I must make the velocities of electrons go to zero at the collector. But as the electrons after used have random velocities, even if I give a definite retarding electric field, I can not make the velocities of all electrons go to zero.

So previously I must converge various velocities upon one velocity. It is called the velocity convergence. I have used a traveling electric field for the velocity convergence, because there is the output of Traveling Wave Tube. Then I assume that the velocity modulation of electron beam after used is expressed by $v = v_0 + v_1 \sin \varphi$ and density modulation by $\rho = \rho_0 + \rho_1 \sin \xi$. And let each phase relation, depth of velocity modulation v_1/v_0 , depth of density modulation ρ_1/ρ_0 and amplitude of traveling electric field A which is adequate to let the electron beam to velocity convergence by traveling electric field $E = A \sin (T - X + \theta)$, using analog computer. The conclusion is that the phase of velocity modulation must advance $\pi/2$ to that of density modulation and the smaller v_1/v_0 , the bigger ρ_1/ρ_0 and the bigger amplitude of traveling electric field are better.

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