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GENERATION OF DECIMETER AND CENTIMETER WAVES

[A Digest]

The basic idea of this book is a unified concept for "generators of electronic oscillations," which was stated by the author in his doctor's dissertation, "Principles of the Kinematic Theory of Generating Electronic Oscillations". The work on this dissertation was done from 1939 to 1943 and some of the material therein was used in discussing a number of problems, especially in Chapters V and VI. Other source material used by the author came from the following: (1) courses which he taught from 1941 to 1948 to radio-physics students of Saratov, Leningrad, and Rostov universities; (2) a scientific radio-physics seminar conducted in the author's laboratory in 1942 - 1943; and (3) a number of dissertations submitted from 1939 to 1946. The author was aided in surveying and formulating the notes by Candidates of Physico-mathematical Sciences V. L. Patrushev and G. M. Gershteyn, senior scientific collaborators attached to the radio-physics laboratory "NIIMF (Scientific Research Institute of Microwave [?] Physics), Saratov State University.

In Chapter I, the author compiles a table listing the oscillation bands, resonance frequencies, tank circuits (butterfly, "semibutterfly," etc.), operating frequencies, and the stability for the following oscillator tubes: 316-A, 368-A, 703-A, 464 ("lighthouse"), and 6F4. The material on tank circuits and cavity resonators given in Chapter I seems to follow that given in similar books published in the US.

Chapter II discusses the usual tubes used for ultrahigh frequencies, plus a few Soviet tubes. A table listing the results obtained by Devyatkov, Gurevich, and Khokhlov with the experimental tube DTs-21 is given in the

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discussion on tubes employing negative feedback. The DTs-21 will be adapted to mass production shortly in the form of a metal tube, the DTsM-1. Tests of this megatron have shown that it can be used as a low-power oscillator for 20-25 centimeter waves with 200 volts on the plate. More powerful oscillations (from 1 to 5 watts) can be obtained for 30-60 centimeter waves. It may also be used as a high-frequency amplifier in these bands.

In the section on magnetrons in Chapter II, mention is made of the work done by N. Kuz'min in 1941 and V. I. Kalinin and I. I. Vasserman in 1946 on multisegment magnetrons. The Soviet scientists N. Alekseyev and D. Malyarov were the first to construct magnetrons having the oscillating circuit in the form of a cylindrical cavity in a solid block of cuprite, with the intra-anode space connected by a narrow slot. Alekseyev and Malyarov obtained up to 300 watts power for 9-centimeter waves using a water-cooled sectional magnetron with four resonant cavities. A solderless tube of the same construction developed over 100 watts power for the same wave length under operating conditions. Finally, using the same type magnetron, it was possible to obtain a wave length of 2.6 centimeters with power of about 2 watts.

The basic results obtained by Alekseyev and Malyarov for various types of magnetrons are listed in a table. N. A. Kuz'min ("Excitation of Ultrahigh Frequency Electromagnetic Oscillations in Multiphase Systems," Candidate's dissertation, Leningrad State University, 1941) built "group radiators," which are magnetron systems with anodes consisting of a certain number of very short-wave oscillatory circuits forming a cylindrical surface. In designs intended for obtaining very short waves, these circuits are resonance dipoles built up into voltage nodes by one carrying ring, the filament being placed along the axis of the ring. The whole unit makes up one "polar periphery." A system with two polar peripheries is similarly constructed. Using units of this type with up to 12 and 18 dipoles, wave lengths of .4, 2.6, 3.2, and 3.4 centimeters have been obtained with intensity sufficient for laboratory purposes. Operating characteristics are given for the MM-11 (one polar periphery) and the MM-18 (two polar peripheries) tubes. The section on velocity-modulated oscillators includes diagrams of klystron designs by Yu. A. Katsman which were probably developed in 1946.

Chapters III, IV, V, and VI are devoted to theoretical calculations involved in the design and operation of ultrahigh-frequency tubes. No further data relating to actual Soviet tubes or their applications is included. The last chapter develops a similar discussion for electron trajectories, currents, power, etc., in magnetron oscillators.

TABLE OF CONTENTS

- E N D -