VII. TRAVELING-WAVE TUBES

A. THREE-CM TRAVELING-WAVE AMPLIFIER TUBES

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Of the two completed 3-cm tubes mentioned in the last progress report, one had a poor vacuum and some broken leads, making it unsuitable for use.

Some measurements were made on the second tube, and its performance appears quite promising. A beam current of about 8 ma to the collector is easily obtained. The net gain of the tube has on occasion reached 15 db though this figure cannot always be achieved. At gains of about 13 db the tube has a tendency to break into oscillation. The output of the tube when oscillating is some 15 or 20 db higher than its amplified output, the frequency being in the 3-cm region, although erratic. The amplification value at which the tube tends to become unstable was increased from 9 db to 13 db by hanging a "curtain" of lossy cloth across the inside of the focussing coil. More serious attempts to eliminate the instability have not yet been made although they are planned for the future. The frequency characteristic of the gain of the tube has not yet been measured, but cold tests indicate about 600 Mc/sec between half-power points. A more complete and systematic series of measurements is now being made.

Two other tubes were constructed, and although they are mechanically good, they show poor performance. These tubes will be slightly modified to provide better magnetic shielding of the electron-gun region, and thereby to improve their performance.

The probe measurements of the fields along a cold helix have been concluded. An approximate Fourier analysis of the standing wave pattern indicated the presence of four waves along the helix: incident and reflected waves traveling with the velocity of light, and incident and reflected waves of the slow helix mode. The results confirmed previous experience which showed that a gradual transition from the antenna (launching the helix wave) to the turns of the helix is more favorable to the excitation of the slower mode and tends to suppress the faster one. The radial attenuation characteristics of the faster mode and comparison with the field produced by an antenna alone both indicate that this faster wave is associated with the helix and is not merely a radiation field.

VII. B. SEVEN-MM TRAVELING-WAVE OSCILLATOR

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The iris-loaded waveguide used to slow the phase velocity of the traveling wave down to about one-tenth of the velocity of light has been assembled by clamping alternate molybdenum discs and spacers in a molybdenum tube. A K-Monel plug threaded into the end of the waveguide nearest the cathode exerts the clamping force. A microscope has been arranged to examine the interior of the structure after assembly to make sure that none of the discs is shorting. The structure described above was satisfactory in this respect after vacuum-fired at 850°C. The waveguide output block has been completed, and two alternative window designs are being made in the shop. One is a ceramic window using a disc of Alsimag No. 243 ceramic 0.015 in. thick by 5/32 in. in diameter which will be brazed into a copied more or less directly from the waveguide outputs used on 1.25-cm magnetrons. Since the tube is ready to be assembled now, the magnetron type of window (glass in a kovar cup) will be used on the first trial. (glass in a kovar cup) will be used on the first trial.

A dummy tube was made up to test the electron-gun assembly. It consisted of the 2C39 cathode-grid assembly, an anode block with a 0.210-in. diameter hole, 1 in. long, and a collector. Satisfactory cathode emission and grid control were obtained. Because of the liberal use of kovar, however, magnetic focusing was not too helpful. The actual tube will have magnetic material only in the 2C39 gun (kovar) and at the output window.