

Mullard's 520 Circuit

(Continued from page 68)

EL34. It is necessary, in this type of output stage, that the cathodes be bypassed to ground even when a common cathode resistor is used.

The power supply is conventional and uses a Mullard GZ32 or GZ34 indirectly-heated, full-wave rectifier with capacitor input filter.

The driver stage uses a Mullard ECC83 twin-triode and fulfills the combined function of phase splitter and driver amplifier. It is of the cathode-coupled type and enables a high degree of push-pull balance to be obtained.

The first stage is a high-gain pentode voltage amplifier using an EF86 low-hum pentode. High-stability carbon resistors are used in plate, screen-grid, and cathode circuits and give appreciable improvement in measured background noise level as compared with ordinary carbon resistors. This stage is d.c.-coupled to the input grid of the phase splitter in order to minimize low-frequency phase shift in the amplifier and improve low-frequency stability when feedback is applied.

Despite the high degree of negative feedback used in the present design, an adequate margin of stability has been achieved. Complete stability is maintained under open-circuit conditions in this circuit. An increase in feedback of at least 10 db, obtained by reducing the value of R_{12} , should be possible before signs of high-frequency instability occur. The loop gain, overall frequency response, and phase shift characteristics of the whole amplifier are shown in Fig. 4.

The harmonic distortion of this amplifier at 400 cps, measured without feedback under resistive load conditions, is shown in Fig. 5. The distortion curve towards the overload point is also shown for feedback conditions. At the 20-watt level the distortion level without feedback is well below 1% and with feedback applied falls to below 0.05%. Harmonic distortion at 400 cps reaches 0.2% at approximately 36 watts output. The loop gain characteristics are such that at least 20 db feedback is maintained from 15 to 25,000 cps.

Measurement of intermodulation products has been made, using a carrier frequency of 10,000 cps, and a modulating frequency of 40 cps, with a ratio of 40 to 10,000 cps amplitudes of 4:1. With the combined peak amplitude of the mixed output at a level corresponding to the peak sine wave amplitude at 36 watts r.m.s. power, intermodulation products expressed in r.m.s. terms totaled 0.8% of the 10,000 cps carrier amplitude.

The sensitivity of the amplifier is approximately 0.3 volt for 36 watts output. The background level in this amplifier was 89 db below at 36 watts, measured with a source resistance of 10,000 ohms.