6 – HIGH-FREQUENCY TRANSMITTERS

A Medium-Power Tetrode Amplifier

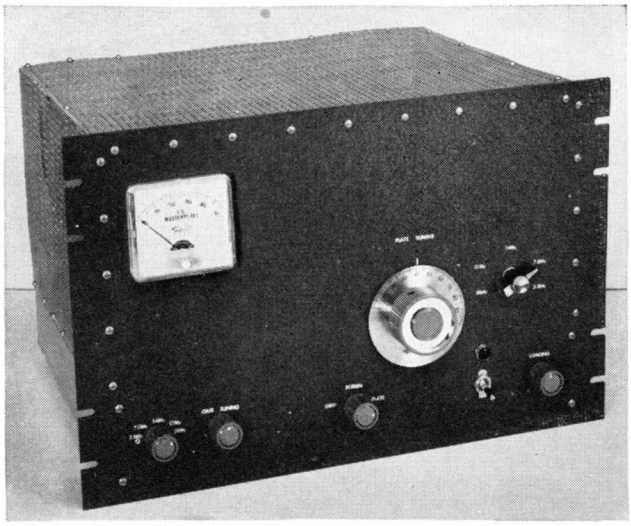

Fig. 6-73—This medium-power tetrode amplifier is assembled on a 17 × 12 × 3-inch aluminum chassis with a 19 × 12¼-inch rack panel. Controls along the bottom of the panel are for the grid band switch, grid tuning capacitor, meter switch, a.c. power, and pi-network loading capacitor. Above are the controls for the plate tank capacitor and plate band switch. The sides and back of the shielding enclosure are a single piece of Reynolds perforated aluminum sheet "wrapped" around the chassis. A 1-inch lip is bent along the three top edges so that the top cover can be fastened on with sheet-metal screws.

Figs. 6-73 through 6-76 show photographs and circuit diagram of an amplifier using an RCA 7094 tetrode that will handle up to 500 watts input on c.w. or 330 watts with plate-screen modulation. Construction has been simplified by the use of manufactured subassemblies — a Harrington Electronics GP-50 multiband grid tank and a B & W type 851 bandswitching pi-network inductor. The amplifier is neutralized by the capacitive-bridge method. R_1 and L_5 are adjusted to suppress v.h.f. parasitic oscillation. The single milliammeter M_1 may be switched to read either grid or plate current. The shunt R_2 multiplies the original 50-ma. scale by 10, giving readings up to 500 ma. when the meter switch S_3 is in the plate-current position. Forced-air ventilation is provided by a small blower B_1. Shielded wire is used in all power circuits and terminal leads are bypassed for v.h.f. as they enter the chassis.

Construction

The plate blocking capacitor is threaded onto one of the plate tank-capacitor stator rods. Plate-circuit leads are made of ½-inch copper strip. Screen and filament bypasses are connected directly between the tube-socket terminals and the perforated sheet. Each of the three screen terminals is bypassed with a 1000-μf. 1600-volt disk ceramic capacitor. The grid-tank unit is spaced from the front wall of the chassis on 1-inch pillar insulators to provide space for an insulating shaft coupling.

Along the rear wall of the chassis are the coax

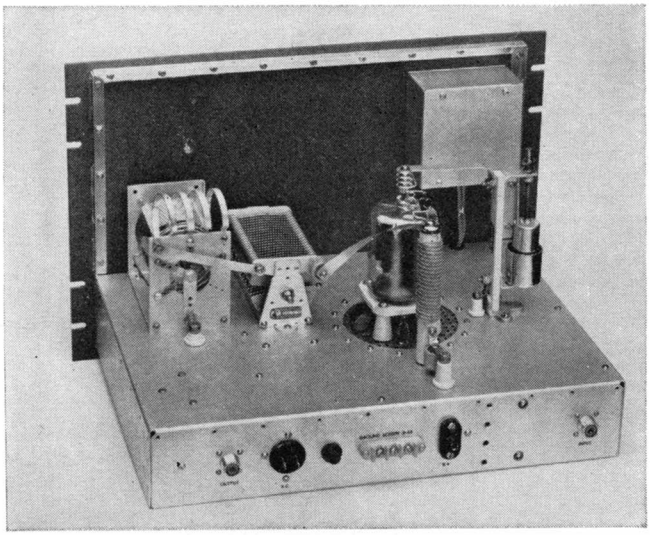

Fig. 6-74—Rear view of the medium-power amplifier. The shafts of the plate band switch and plate tuning capacitor are 2¾ and 6¼ inches from the left-hand end of the chassis in this view. A ventilating hole somewhat larger than the tube socket (829-B type) is centered 6½ inches from the right-hand end of the chassis and 6 inches from the rear. A piece of perforated aluminum covers the hole and supports the tube socket mounted on 1-inch ceramic cones. Feed-through insulators carry connections to the bottom terminals of the plate tank-coil unit, the plate r.f. choke and the neutralizing capacitor. The meter is enclosed in a 4 × 4 × 2-inch aluminum box.

Medium-Power Tetrode Amplifier

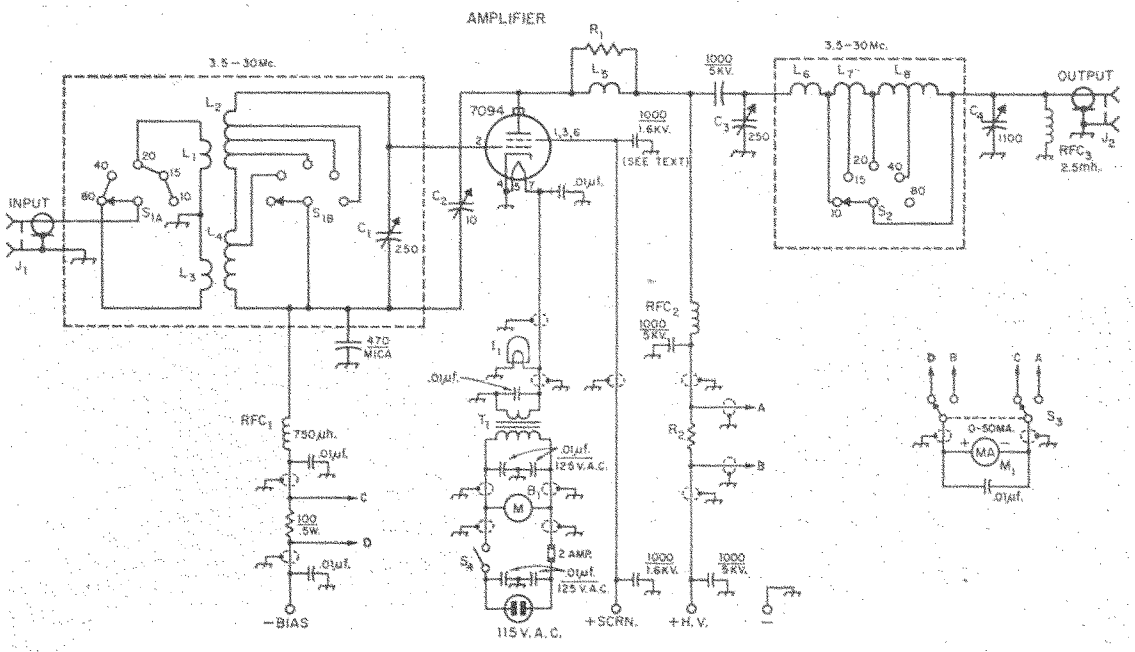

Fig. 6-75—Circuit of the 7094 amplifier. Unless specified otherwise, capacitances are in $\mu\mu$f. All fixed capacitors rated at less than 5 kv. are disk ceramic. The 5-kv. capacitors are TV-type ceramics (Centralab 858). Dashed lines in grid circuit enclose components of Harrington GP-50 multiband tank unit. Those in the plate circuit enclose components of the B & W 851 pi-network inductor.

B_1—Blower (Allied Radio Cat. No. 72P715).
C_1—250-$\mu\mu$f. midget variable (special).
C_2—Neutralizing capacitor—11 $\mu\mu$f. max. (Johnson N125).
C_3—250-$\mu\mu$f. 3000-volt variable (Johnson 250E30).
C_4—1100-$\mu\mu$f. variable—triple-gang broadcast replacement type, 365 $\mu\mu$f. (or more) per section, sections connected in parallel.
I_1—6.3-volt dial lamp.
J_1, J_2—Coax receptacle (SO-239).
L_1—2 turns No. 16, 1 inch diam., over ground end of L_2.
L_2—14 turns No. 16, ¾ inch diam., 2 inches long.
L_3—3 turns No. 16, 1 inch diam., over ground end of L_4.
L_4—38 turns No. 22, ¾ inch diam., 1½ inches long.
L_5—3 turns No. 12, ⅜ inch diam., 1 inch long.
L_6—4 turns ⅜ × ⅜-inch copper strip, 1⅜ inches diameter, 2½ inches long.
L_7—4¼ turns No. 8, 2½ inches diam., 1¾ inches long, tapped at 3 turns from the L_8 end.
L_8—9½ turns No. 12, 2½ inches diam., 1½ inches long, tapped at 6 turns from the output end (see text).
Note: L_7 and L_8 are mounted close together on the same axis; L_6 is mounted at right angles.
M_1—D.c. milliammeter, 0–50-ma. scale—3⅜-inch rectangular (Triplett Model 327-PL).
R_1—Three 150-ohm 1-watt carbon resistors in parallel.
R_2—Approx. 32 turns No. 24 on a ¼-inch diam. form (see measurements section for method of adjustment).
RFC_1—750-μh. r.f. choke (National R-33).
RFC_2—Plate r.f. choke 120μh (Raypar RL-101).
RFC_3—2.5-mh. r.f. choke (National R-50).
S_1—Two-wafer 5-position ceramic rotary switch.
S_2—Special heavy-duty 5-position rotary switch (component of B & W inductor unit).
T_1—Filament transformer: 6.3 volts, 3.5 amps. minimum (Thordarson 21F11).

output connector, a.c. power connector, fuse, screen-voltage, bias and ground terminals, high-voltage connector (Millen) and the coax input connector. Strips of ½-inch aluminum angle fastened to the panel provide a means of fastening the shielding enclosure to the panel. Paint should be removed where the angle rests against the panel so that there will be good electrical contact between the two.

Preliminary Adjustment

To maintain a tank Q of 10 at 4 and 7.3 Mc., 4 turns should be removed or shorted out at the front end of the B&W unit, and the 40-meter tap should be moved one turn toward the rear. (For operation at less than maximum ICAS ratings, see pi-network charts earlier in this section.)

Before applying excitation, the amplifier should be checked for v.h.f. parasitic oscillation as described earlier in this section. A resistor of about 20,000 ohms should be connected between the bias terminal and ground. Full plate voltage may be applied, but the screen should be operated from an adjustable 50,000-ohm 50-watt series resistor connected to the plate supply. The grid band switch should be turned to the 10-meter position and the plate switch to the 80-meter position. With the meter switched to read plate current, the screen resistance should be reduced until the plate power input is about 100 watts. The meter should then be switched to read grid current and the recommended procedure followed. The objective is to suppress the parasitic oscillation with the smallest possible coil to keep the parasitic-circuit

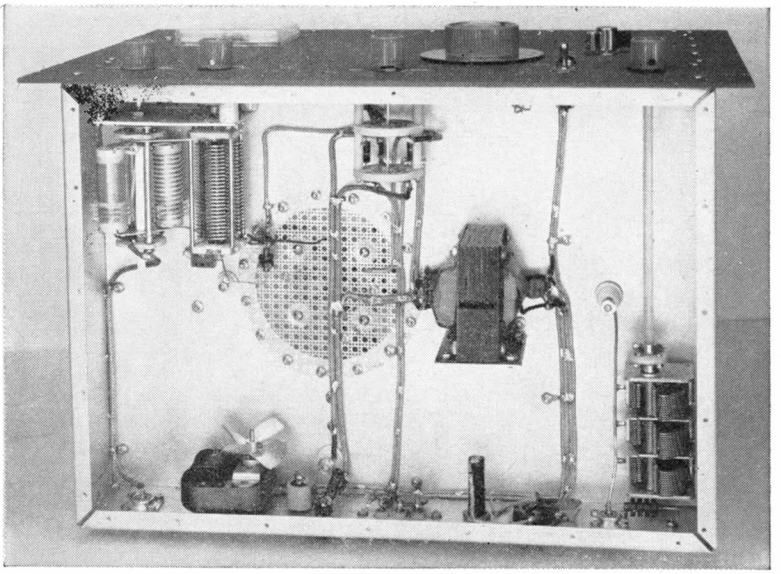

Fig. 6-76—Bottom view of the 7094 amplifier. The grid-tank assembly in the upper left-hand corner and the output loading capacitor in the lower right-hand corner are placed so that the shaft of the latter and the shaft of the grid band switch are 1½ inches from the ends of the chassis. Spacers between the chassis and the output capacitor bring its shaft level with those of the grid-tank unit. The meter switch is at the center. The filament transformer is mounted on an aluminum bracket. The ventilating fan is bolted against the rear wall of the chassis.

resonant frequency between the two v.h.f. TV bands. If oscillation is detected, additional loading resistors should be tried first. If this does not work, another turn should be added to the coil, or the turns squeezed closer together. With the parasitic coil described, the resonant frequency of the circuit is about 100 megacycles.

Neutralizing

Neutralizing should be done with excitation applied to produce rated grid current. The input and output circuits should be tuned to the same frequency. Plate and screen voltages should be disconnected at the transmitter terminals. The neutralizing capacitor should then be adjusted until a point is found where there is no change in grid current as the plate tank circuit is tuned through resonance. The output capacitor should be set at maximum capacitance for this check. After plate and screen voltages have been applied and the amplifier loaded, the neutralizing capacitor should be given a final adjustment to the point where minimum plate current and maximum grid and screen currents occur simultaneously.

Power Supply

Maximum ICAS ratings on the 7094 are 1500 volts, 330 ma. on c.w., 1500 volts, 200 ma. (max.) Class AB_1 s.s.b., and 1200 volts, 275 ma. for a.m. phone. However, the tube will work well at plate voltages down to at least 700 volts, provided appropriate values are used in the pi network as mentioned previously. The recommended screen voltage is 400 for all classes of operation at screen currents up to 30 ma., depending on the type of operation. Therefore a regulated screen voltage can be obtained using a pair of 0D3s and one 0C3 in series. If screen voltage is obtained from the plate supply, an adjustable 100-watt 75,000-ohm series resistor should be used and the value adjusted to obtain the desired operating plate current after initial tuning adjustments have been made.

Biasing

A fixed biasing voltage of 50 is required for s.s.b. operation. Batteries should last indefinitely. The biasing voltage may also be obtained from a voltage divider across a VR tube with suitable series resistor. A biasing voltage of 130 is recommended for plate-modulated Class C service, and 100 volts for c.w. operation. Recommended grid current is 5 ma. If the screen is operated from a fixed-voltage source, a source regulated by an 0A3 should provide plate-current cut off. The balance of the required operating bias may be obtained from a grid leak (5000 ohms for c.w. or 11,000 ohms for phone). In case the screen is supplied through a dropping resistor from the plate supply, fixed biasing voltages of 100 for c.w. or 130 for phone (no grid leak) should provide reasonable protection for the tube in case of failure of excitation.

The rated driving power is 5 watts, easily furnished by a 2E26 without pushing it. Existing transmitters using a 6L6, 6146 or 807 in the final may be used if provision is made for controlling the output of these units by adjustment of screen voltage.