

AN 811-A 200-WATT GROUNDED-GRID LINEAR AMPLIFIER

The amplifier shown in Figs. 6-56, 6-58 and 6-59 requires about 15 watts of excitation power to drive it to full peak input (200 watts) on 3.5 through 30 Mc. For convenience and compactness, the amplifier is completely self-contained; silicon-diode rectifiers in the plate and bias supplies contribute materially to the small size.

Referring to the circuit diagram in Fig. 6-57, the input impedance of the grounded-grid 811-A amplifier (about 300 ohms) is stepped down through an "L" network to offer approximately 50 ohms as a load for the driver. The network makes for little or no complication, since the circuits are fixed-tuned and, once adjusted, need not be touched again. It will be noted that on the 15- and 10-meter bands no lumped capacitance is used in the network; this is because the capacitance of the length of RG-58/U running from S_{1B} is sufficient.

The filament choke, RFC_1 , is an inexpensive homemade one (described later). Since the filament winding of the power transformer has no center tap, two 22-ohm resistors are used to provide a center tap for the filament circuit. In the band-switched plate circuit, a commercial inductor (with two winding pitches) is used, and because the output capacitor is not large enough on 80 meters, on that band an additional 500 pf. is switched in by S_2 .

To meter grid or plate current, a 0-1 milliammeter is used as a 0-1 voltmeter to measure the drop across 10 ohms in the grid circuit or 2.5 ohms in the plate circuit, giving 0-100 and 0-400 ma. full-scale readings respectively.

A panel operate-standby switch, S_4 , removes the fixed grid bias during operate periods. If an external control is available, is in a VOX-controlled s.s.b. exciter, S_4 is left open and the external circuit connected through J_2 .

All of the power is derived from a single husky TV power transformer. The plate power is derived from a voltage-doubling circuit using inexpensive silicon diodes and 450-volt electrolytic capacitors. The filament voltage for the 811-A is obtained from one transformer secondary, and another 6.3-volt secondary is utilized in a voltage-doubling circuit to provide cut-off bias for the 811-A, to avoid diode-noise problems if an electronic t.r. switch is used. High-voltage filtering is furnished by four 40- μ f. capacitors connected in series.

Construction

The amplifier is built on a 10 \times 12 \times 3-inch aluminum chassis, with a panel and back panel of 0.063-inch aluminum measuring 9 \times 12 inches. One-inch aluminum angle stock is used to make side and top lips that take the perforated-

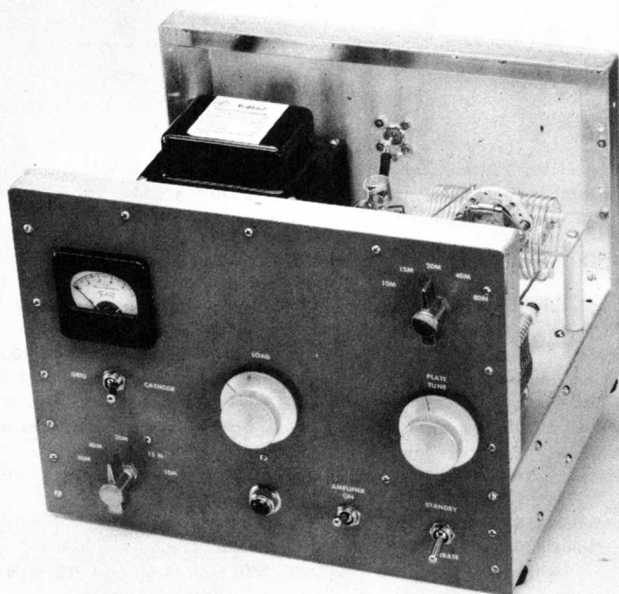


Fig. 6-56—The 200-watt grounded-grid amplifier with its perforated-metal cover removed. This compact amplifier uses an 811-A and a simple 1300-volt power supply. To simplify construction, two bandswitches are used (input at lower left, plate at upper right). The single meter can be switched to read either grid or plate current.

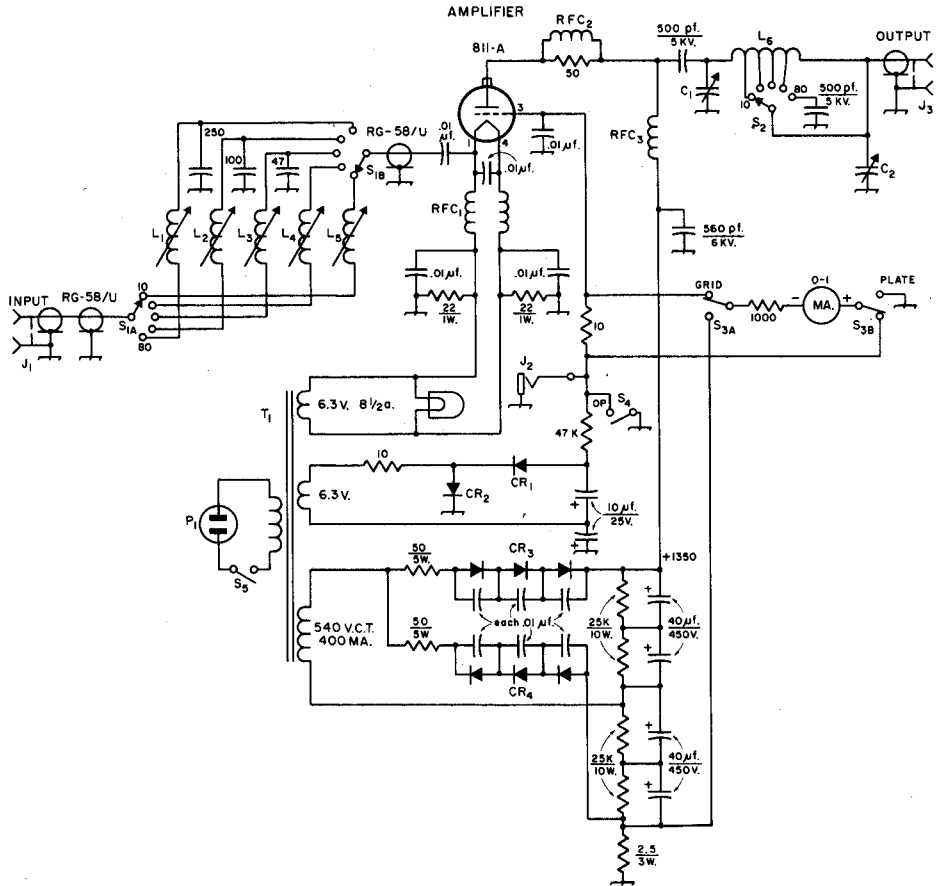


Fig. 6-57—Circuit diagram of the 200-watt grounded-grid linear amplifier. Unless specified, all capacitances are in picofarads (pf. or $\mu\text{mf.}$), all resistors are $\frac{1}{2}$ watt, all resistances are in ohms. Capacitors marked with polarity are electrolytic; 0.01- $\mu\text{f.}$ capacitors are 1200-volt disk ceramic.

C_1 —250-pf. variable, 0.045-inch spacing (Johnson type 154-1).

C_2 —3-gang capacitor, 365 pf. each section (Allied Radio 43A3522). Sections connected in parallel.

CR_1, CR_2 —200 p.i.v. 750 ma. silicon (RCA 1N3253 or equiv.).

CR_3, CR_4 —Each three 600-p.i.v. 500-ma. silicon diodes in series (RCA 1N3195 or equiv.).

J_1, J_3 —Coaxial receptacle, chassis type (SO-239).

J_2 —Open-circuit jack.

L_1 —5-9- $\mu\text{h.}$, adjustable (Miller 4505).

L_2 —3-5- $\mu\text{h.}$, adjustable (Miller 4504).

L_3, L_4 —1-1.6- $\mu\text{h.}$, adjustable (Miller 4502).

L_5 —0.4-0.8- $\mu\text{h.}$, adjustable (Miller 4501).

L_6 —22 turns No. 14, 2-inch diam., 8 t.p.i. tapped 2, 3, 5, and 10 turns from C_1 end (Air-Dux PI 1608D6).

P_1 —Mounting plate a.c. plug (Amphenol 61-M1).

RFC_1 —Dual winding, 29 turns No. 14 Formvar or Nylclad, spacewound on ferrite rod. See text.

RFC_2 —4 turns No. 14, $\frac{3}{8}$ -inch diam., $1\frac{1}{4}$ inch long, wound outside two 100-ohm 1-watt resistors in parallel.

RFC_3 —1-mh. r.f. choke (National R-154U).

S_1 —2-pole 6-position rotary ceramic (Centralab PA-2003).

S_2 —1-pole 6-position rotary ceramic (Centralab PA-2001).

S_3 —D.p.d.t. toggle.

S_4, S_6 —S.p.s.t. toggle.

T_1 —560 v.c.t. 400 ma.; 6.3 v. 8.5 a.; 6.3 v. 4.5 a. (Stancor P-8167).

Knobs are Barker & Williamson 901; bar knobs are National HRB.

aluminum cover. The cover, not shown in the photographs, is a single piece 10 inches wide bent in a broad "U" shape; it is held to the lips by sheet-metal screws.

Capacitors C_1 and C_2 are fastened to the top of the chassis by 6-32 hardware; C_1 is located far enough in from the edge so that its stator will clear the cane-metal side by $\frac{1}{4}$ inch or better. The plate bandswitch, S_2 , is supported by an aluminum bracket that is fastened to the rear of C_1 . The 500-pf. plate-blocking capacitor and the RFC_2 assembly are supported by the top of RFC_3 , and the 500-pf. 80-meter output padding capacitor is bolted to the chassis below S_2 . Plate coil L_6 is supported by two $2\frac{1}{2}$ -inch ceramic pillars. To reduce the height taken by the 811-A above the chassis, the 811-A socket is supported below the chassis by mounting it (Amphenol 49RSS4) in a recessed shell (Amphenol 61-61).

Underneath the chassis, the two toggle switches, the 6.3-volt pilot lamp, and the bandswitch S_1 are mounted on the front lip of the chassis. The input inductors, L_1 through L_5 , are clustered around the bandswitch, as are the sev-

eral capacitors associated with this circuit. Lengths of RG-58/U run from the arms of S_1 to the input jack, J_1 , and the 811-A socket. The unused socket pin (No. 2) is used as a tie point for the coaxial line and the 0.01- μ f. coupling capacitor.

The filament choke, RFC_1 , is made by winding No. 14 Formvar or Nylclad wire on a $7\frac{1}{2}$ -inch length of $\frac{1}{2}$ -inch diameter ferrite antenna core (Lafayette Radio, N.Y.C., MS-333). To obtain a high- Q coil, the two windings are wound parallel but spaced by lacing twine to give 29 turns in each coil. The coil is wound by securing the two ends and the length of spacing twine in a vise, securing the other wire ends to a 2-terminal strip held in place by a $\frac{1}{2}$ -inch diameter nylon cable clamp, and then winding the coils as the wires are stretched taut. Each turn of the core winds two turns of wire and one of twine. The twine is left on the coil, and no insulation is required between wires and core when the recommended surface covering (Formvar or Nylclad) is used. The choke assembly is supported below the chassis by 1-inch ceramic posts and the nylon cable clamps.

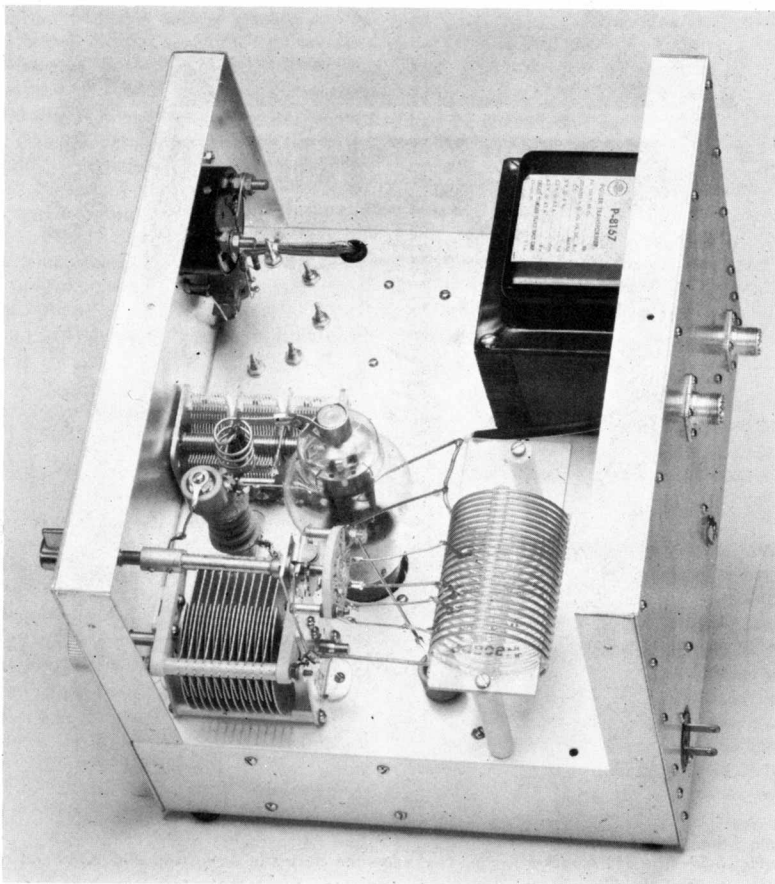


Fig. 6-58—A top view of the 811-A amplifier. The adjusting screws for the five switched input circuits project through the chassis under the meter. A bracket fastened to the back plate of the plate tuning capacitor (lower left) supports the plate bandswitch.

The bias-supply rectifiers, resistors and capacitors or mounted on a multiple tie-point strip. In the high-voltage supply, the diodes and capacitors are mounted on a 4×7 -inch piece of $\frac{1}{16}$ -inch thick prepunched phenolic terminal board (Vector 85G24EP) with push-in terminals (Vector T-28). The resistors, both 50-ohm 5-watt and 25,000-ohm 10-watt, are mounted on tie points or narrow strips of terminal board located several inches from the diode and capacitor board. The reason for this is simple: the resistors become hot and might damage the diodes if mounted too close to them. The 2.5-ohm 3-watt resistor consists of three 7.5-ohm 1-watt resistors connected in parallel.

Tuning

When the wiring has been completed and the power supply checked (+1500 volts no-load, about 1450 with the 811-A drawing idling current of 30 ma.), the amplifier can be checked on a band

with a driver capable of delivering a peak signal of 15 watts or so. A dummy load should be used during initial tests, and an output indicator (r.f. ammeter or voltmeter) is very useful. Using a c.w. signal to drive the amplifier, it should be found possible to load the amplifier so that at plate-circuit resonance the plate current is 160 ma. and the grid current is about 27 ma. As the drive is reduced the grid and plate currents should drop back at roughly the same rate. If the amplifier is not loaded heavily enough, the grid current will run proportionately higher than the plate current. There is, of course, no real substitute for a two-tone linearity test, as outlined in Chapter Eleven, but the above figures will serve as a rough guide. When the amplifier has been loaded to the figures above with a c.w. driving source, an s.s.b. signal driving it to peak output will kick the plate meter to about 80 ma. (0.2 on meter) or the grid meter to 15 ma. (0.15 on meter).

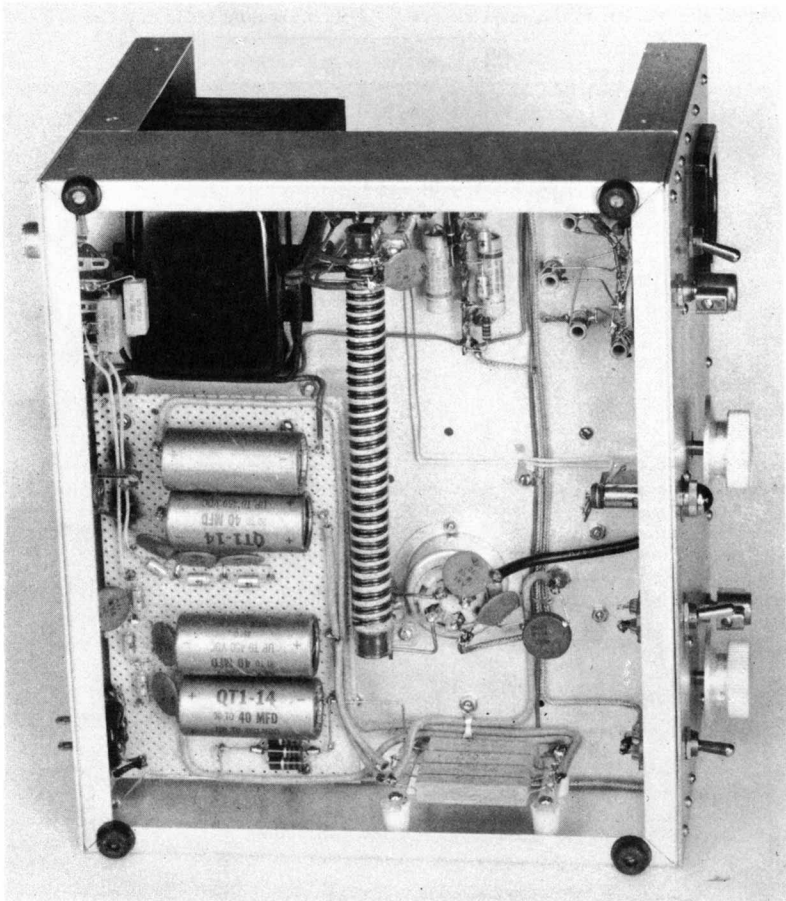


Fig. 6-59—The 811-A socket is mounted below the chassis in a recessed shell. One end of the homemade filament choke is supported near the socket, and the other end is mounted near the transformer. Four 25,000-ohm bleeder resistors (bottom) and two 50-ohm resistors (upper left) are mounted well away from the plate-supply diodes (left) and bias diodes (top center, to right of filament choke).