A 200-WATT GENERAL PURPOSE AMPLIFIER

The amplifier shown in Figs. 6-52, 6-54 and 6-55 can be used as a Class AB_1 linear amplifier for s.s.b., a Class-C amplifier for c.w., and a screen-modulated amplifier for a.m. Two 6146Bs in parallel are used, with a tuned grid circuit and a pi network plate circuit. As can be seen in Fig. 6-53, the circuit diagram, the screen modulator includes a 12AX7 speech amplifier and a 6DS5 modulator. Normally the screen voltage for the 6146Bs is obtained from a regulated +210 source; on a.m. the screen voltage is dropped to +105. The control grid bias is automatic; it is correct for Class-AB_1 operation when no grid current is drawn. When the drive is increased, rectified grid current through the 12,000-ohm resistor adds additional bias for proper Class-C operation. The maximum drive requirement is less than one watt.

Two power supplies are used. The plate voltage is obtained from a bridge rectifier circuit and an 800-volt transformer, resulting in just over 1000 volts under load. While this is over the rating for the 6146B, the tubes take it easily in the services described above. The grid voltages are obtained from a voltage-doubling circuit that provides the +210 volts for the screen and the —75 for the control grid. The amplifier is placed on "standby" (or keyed for c.w.) by opening the negative return to ground of this grid supply.

Construction

A 10 × 12 × 3-inch aluminum chassis serves as the base for the amplifier, and the panel measures 10 inches wide and 8¾ inches high. Reynolds Aluminum angle stock is used for the framework that supports the Reynolds perforated-aluminum shielding.

No special construction is involved. Tie points are used liberally to support components, especially in the power supply section. Shielded wire is used for the screen and cathode connections, as well as on the a.c. leads running to S_{4B} and the transformers.

When connecting T_3 and T_4 in parallel, first connect the primaries in parallel. Then connect one high-voltage lead of T_3 to one of T_4 and connect an a.c. voltmeter to the remaining high-voltage leads. Apply a.c. to the primaries. If a voltmeter reading is obtained, the secondary connection is incorrect. The chances are even that the first try will be wrong! The 6.3-volt winding on T_3 is not used.

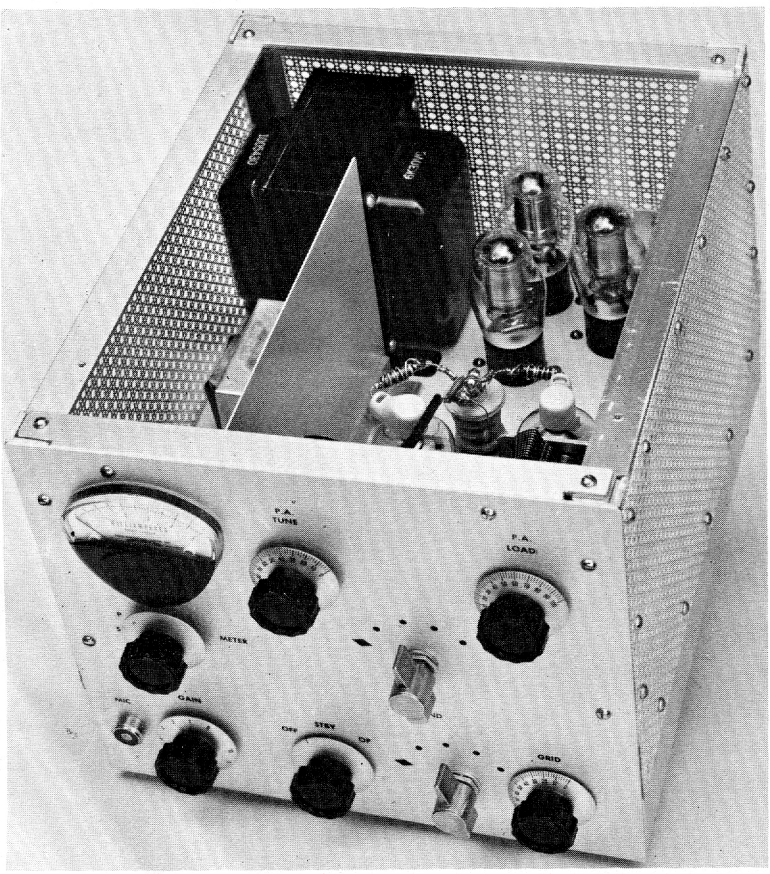

Fig. 6-52—The 200-watt amplifier with the top screen removed. Large transformer at left rear is used in plate power supply. Shield separates r.f. section from screen-modulator portion.

Controls at top are (left) plate tuning and loading. Switch in between is band switch for plate circuit; similar switch knob at bottom is in grid circuit. Knobs along bottom are (left) audio gain, off-standby-operate, and grid tuning. An amplifier-modulator toggle switch is out of sight on the left-hand side of the chassis.

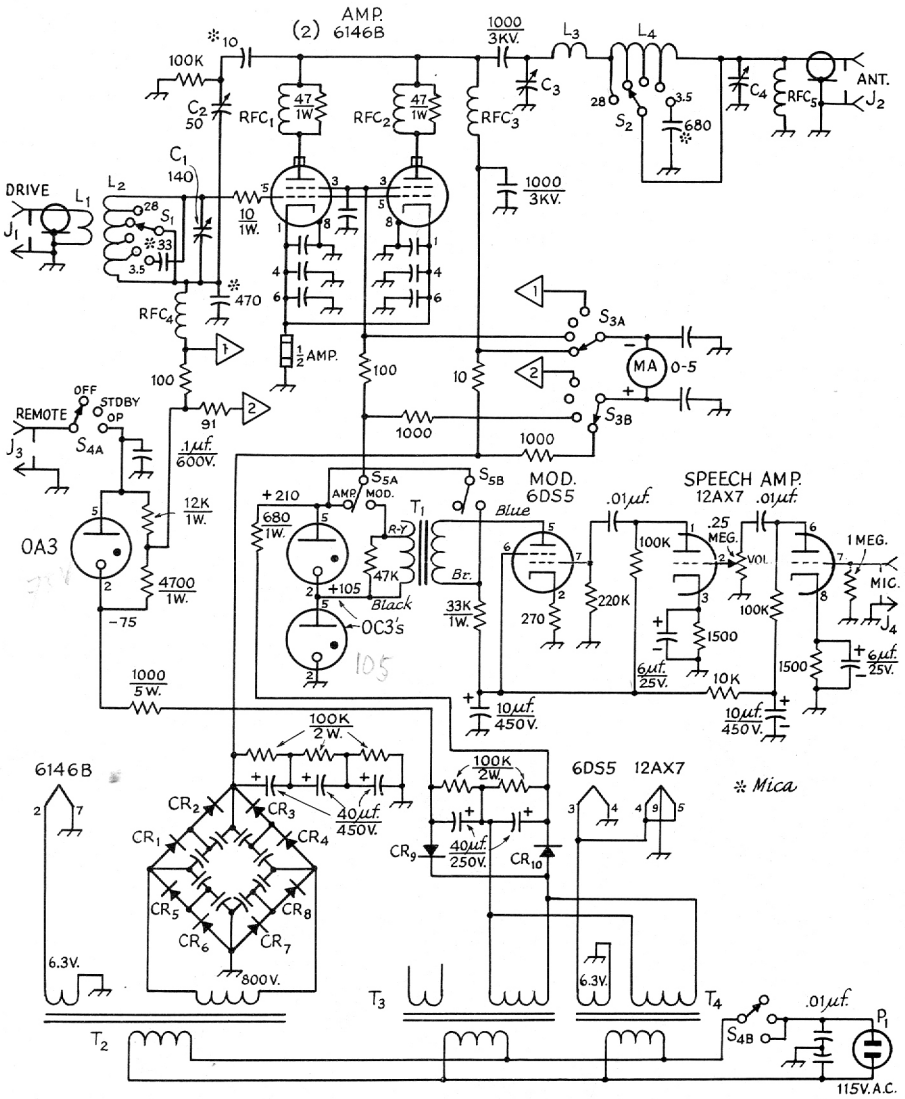

Fig. 6-53—Circuit of the 200-watt amplifier. Unless indicated otherwise, capacitances are in pf., resistances are in ohms (K = 1000), resistors are ½ watt. Capacitors with no value or designation are 1000-pf. disc ceramic.

C_1—Grid capacitor, 140-pf. (Hammarlund APC-140B)
C_2—Neutralizing capacitor, 10-50 pf. ceramic trimmer (Centralab 823-BZ)
C_3—Plate tuning, 250-pf. (Hammarlund MC-250M)
C_4—Loading capacitor, 1045-pf. (Miller 2113 with stators connected in parallel)
CR_1-CR_8—800-p.i.v. 500-ma. silicon (1N3196)
CR_9, CR_{10}—600-p.i.v. 1000-ma. silicon (GE504)
J_1, J_3—Phono jack
J_2—Coaxial receptacle
J_4—Microphone jack
L_1—3 turns insulated wire around 10th turn from grid end of L_2
L_2—37 turns No. 20, 1 inch diam., 16 t.p.i. (B & W 3015). Tapped 3, 6, 9 and 25 turns from grid end.
L_3—8 turns No. 18, ⅝ inch diam., 8 t.p.i. (B & W 3006).
L_4—18 turns No. 18, 1¼ inch diam., 10 t.p.i. (Air Dux 1010). Tapped 9, 13, 15 and 17 turns from C_4 end.
P_1—Fused plug, 3-ampere fuses
RFC_1, RFC_2—4 turns No. 18 on 47-ohm 1-watt resistor
RFC_3—1 mh. 500-ma. r.f. choke (Johnson 102-752)
RFC_4, RFC_5—1 mh. 75-ma. r.f. choke (National R-50)
S_1—1-pole 11-position (5 used) rotary ceramic (Centralab PA-1001)
S_2—1-pole 6-position (5 used) rotary ceramic (Centralab 2501)
S_4—2-pole 5-position (3 used) rotary ceramic (Centralab 2505)
S_3—2-pole 6-position (3 used) rotary ceramic (Centralab 2003)
S_5—D.p.d.t. toggle
T_1—10,000-ohm c.t. pri., 8000-ohm secondary modulation transformer (Triad M-1X)
T_2—800 v.c.t. 250 ma.; 6.3 v. 5 amp. (Knight 54A 2548)
T_3, T_4—125 v. 50 ma.; 6.3 v. 2 amp. (Knight 54A1411)

Use well-insulated wire in the 1000-volt circuit. Use every other position on S_3, to make full use of the available insulation.

The meter (Parker) has a full-scale reading of 10 ma. in the GRID position, 50 ma. in the SCREEN position, and 500 ma. in the PLATE position, with the multiplier resistors shown.

The 6146B has three pins (1, 4 and 6) connected to the cathode. Each one of these pins is bypassed directly to ground with a 0.001-μf. disc ceramic capacitor. Although Fig. 6-53 shows only one bypass for the two screen grids, in fact each screen is bypassed at the socket.

Operation

After the wiring has been checked, plug in the voltage-regulator tubes and then plug in P_1. Turn S_4 to OP and close J_3 to chassis with a milliammeter (+ to chassis). The regulator tubes should glow and the meter should indicate about 35 ma. A voltmeter (previously) connected across the high-voltage supply should show about 1050 volts. Turn off the supplies and let the high-voltage supply discharge to zero volts. Temporarily open the plate lead and the screen lead, so that the 6146s can be neutralized.

Plug in the 6146s and connect an exciter to J_1. It is best to neutralize the amplifier on 21 or 28 Mc., so put the exciter in one of those bands. Switch S_4 to OP and close J_3 with a key or shorted phono plug. With S_1 and S_2 at the band in use, switch S_3 to grid and tune S_1 for a few ma. of grid current. The proper setting of C_2 can be found either with the dip in grid current (set C_2 for minimum dip as C_3 is tuned through plate resonance) or with a sensitive output indicator at J_2 (set C_2 for minimum fed-through energy).

Turn off the amplifier and make sure the power supplies are at zero voltage before reconnecting the screen and plate circuits. Connect a suitable load at J_2. Turn the amplifier back on to STANDBY and after the tubes have warmed up, switch to OP. With no excitation, the idling plate current should be about 50 ma. If it is more than a few milliamperes above this value, it can be corrected by increasing the value of the 12,000-ohm resistor across the 0A3 by 1000 ohms or so.

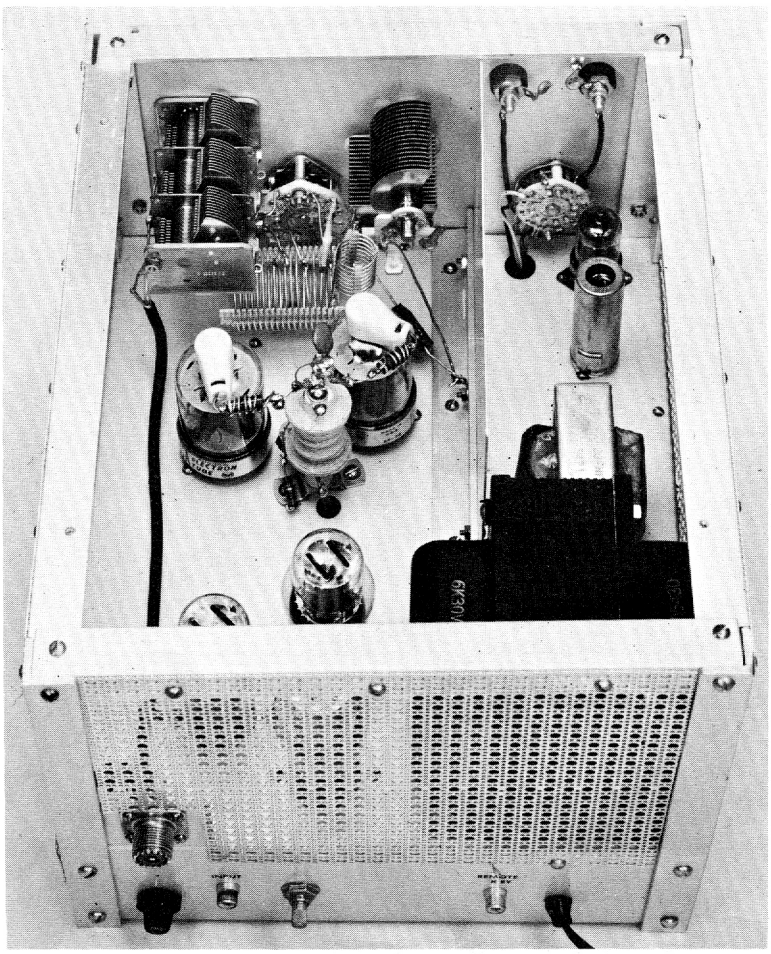

Fig. 6-54—Another view of the 200-watt amplifier. The 6146Bs are grouped around the plate r.f. choke and close to the plate and output loading capacitors. The r.f. choke hides the neutralizing capacitor, C_2.

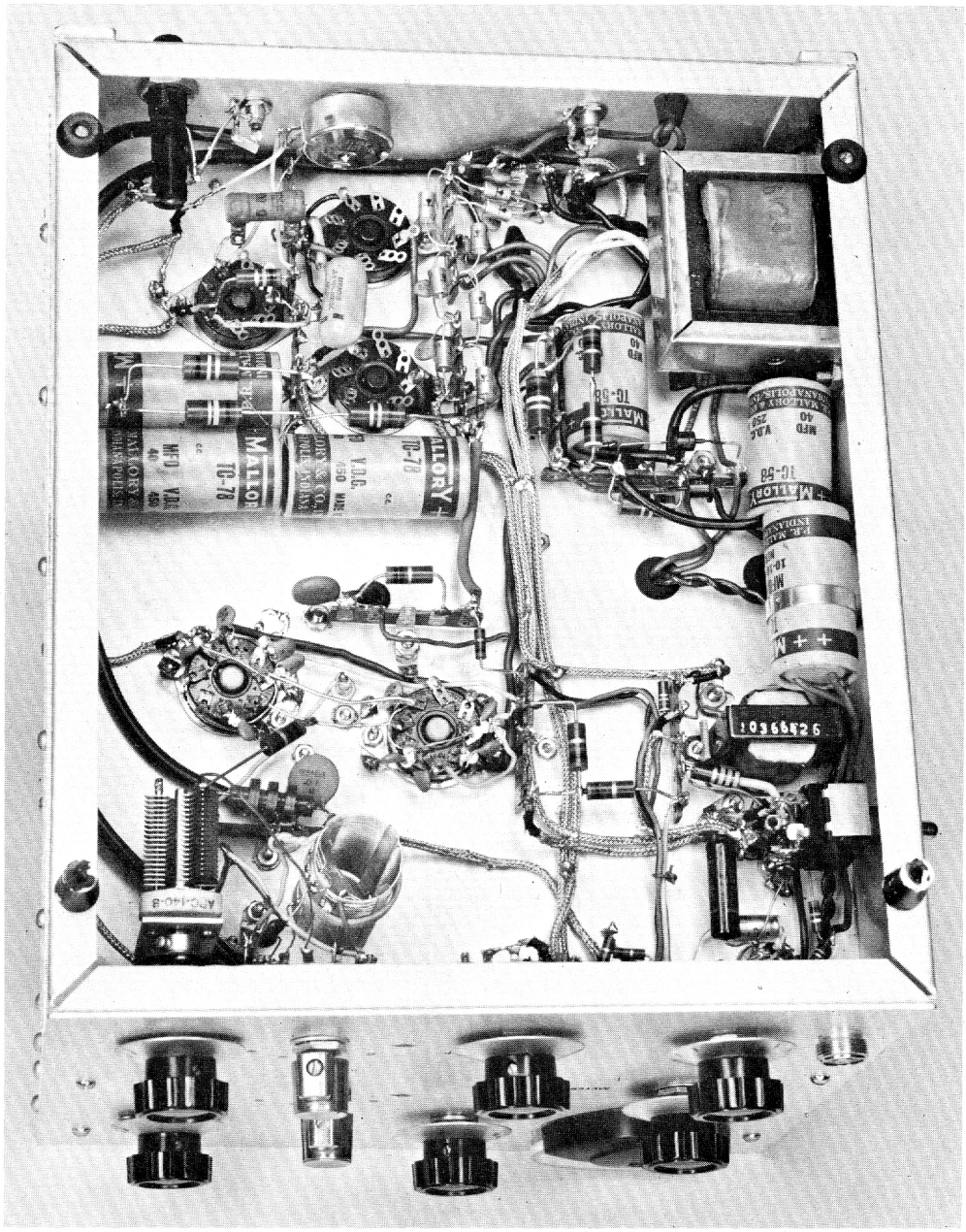

Fig. 6-55—View underneath chassis shows grid circuit (lower left), modulator (lower right), and assorted power-supply components. The potentiometer (top left) is not required; it was installed while experimenting with bias.

In linear operation, with the Parker meter, the screen current will kick up to about 2 ma. and the plate to about 100 ma. when the amplifier is properly loaded and driven. It should not, of course, be driven into grid current.

On c.w. the amplifier can be run at ½-ma. grid current, 22-ma. screen current and 250-ma. plate current. It should not, however, be run under these circumstances for long key-down periods.

On a.m. phone, switch S_5 to MOD, use enough drive for about ½-ma. grid current, and load the amplifier for 100-ma. plate current and about 2-ma. screen current. If an oscilloscope is available, the proper setting of the volume control can be found quickly. If not, it can be guessed at with receiver checks by other operators.