An All-Purpose 813 Amplifier

Figs. 6-69 through 6-72 show the circuit and photographs of an 813 amplifier designed for c.w., a.m., or s.s.b. operation. Provision has been made for convenient changing from one mode to another as well as to any of the bands from 80 through 10 meters.

The circuit is shown in 6-70. A turret-type grid circuit is used and the output circuit is a pi network designed to work into coax cable. The inductor is the rotary-type variable. Provision for neutralizing is included. R_1 is a parasitic suppressor.

For Class C c.w. or phone operation, S_4 is open. The 90 volts of fixed bias, furnished by a small bias supply and regulated by the VR90, is augmented by a drop of about 50 volts across the grid-leak resistor R_2 at a normal grid current of 15 ma. This brings the total bias to 140 volts. With S_4 closed, the grid leak is short-circuited and the 90 volts of fixed bias alone remains for AB_2 s.s.b. operation. (An advantage in AB_2 for c.w. operation is that it preserves the keying characteristics of the exciter better than with Class C operation.) R_3 should be adjusted so that the VR90 just ignites with no excitation.

Screen voltage is regulated at 750 volts by a string of five 0A2s for s.s.b. operation. When the grid drive is increased for Class C operation, the screen current increases, increasing the drop across the screen resistor R_5, and the screen voltage falls to 400. The regulators then lose control and the amplifier is ready for plate-screen modulation.

The screen is protected against excessive input, should the load or plate voltage be removed, by the overload relay K_1. The tripping point is set at 40 ma. by t_e variable shunt resistor R_4. If the relay trips, current through R_6 will hold the screen circuit open until plate voltage is removed. One meter, M_1, measures cathode current, while the other meter, M_2, may be switched to read either grid current or screen current.

Forced-air ventilation is always advisable for a medium- or high-power amplifier if it is buttoned up tight to suppress TVI. A surplus 100 c.f.m. blower does the job more than adequately.

Construction

The amplifier is built on a 13 × 17 × 4-inch aluminum chassis fastened to a standard 12¾ × 19-inch rack panel. The r.f. output portion is enclosed in a 12½ × 13 × 8½-inch box made of aluminum angle and sheet. The VR tubes, relay, blower and meters are mounted external to the box.

The grid tank-circuit components are mounted underneath the chassis and are shielded with a 5 × 7 × 3-inch aluminum box. A standard chassis of these dimensions might be substituted. The bias and filament transformers are in a second box measuring 6 by 3 by 3 inches. This type of construction, together with the use of shielded wire for all power circuits, was followed to reduce TVI to a minimum. Each wire was bypassed at both ends with 0.001-μf. ceramic disk capacitors. L_4 can be adjusted to series resonate with the 600-$\mu\mu$f. capacitor at the frequency of the most troublesome channel. A Bud low-pass filter completes the TVI treatment. As a result, the amplifier is completely free of TVI on all channels even in most fringe areas.

Adjustment

In the pi network, the output capacitors are fixed. However, the adjustment of the network is similar to that of the more conventional arrangement using a variable portion of the output capacitance. The only difference is that the "fine" loading adjustment is done with the variable inductor.

The inductor is fitted with a Groth turns counter, making it easy to return to the proper

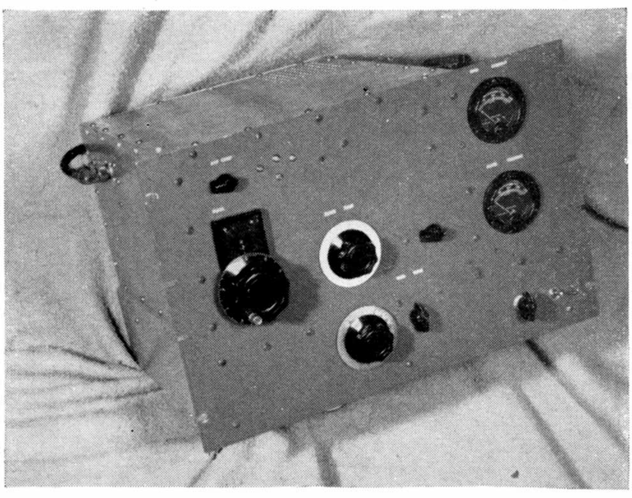

Fig. 6-69—W4SUD's all-purpose 813 amplifier. The output-capacitor switch (coarse loading) is above the turns counter for the variable inductor. Dials near the center are for the plate tank capacitor C_4 (above) and the grid tank capacitor C_1 (below). To the right of the dials are the controls for the plate padder switch S_3 (above) and the grid band switch S_1 (below). The toggle switch below the meters is the mode switch S_4 with the meter switch S_5 to the left. Ventilating holes are drilled in the cover in the area above the tube. The output connector is on the left-hand wall of the shielding box.

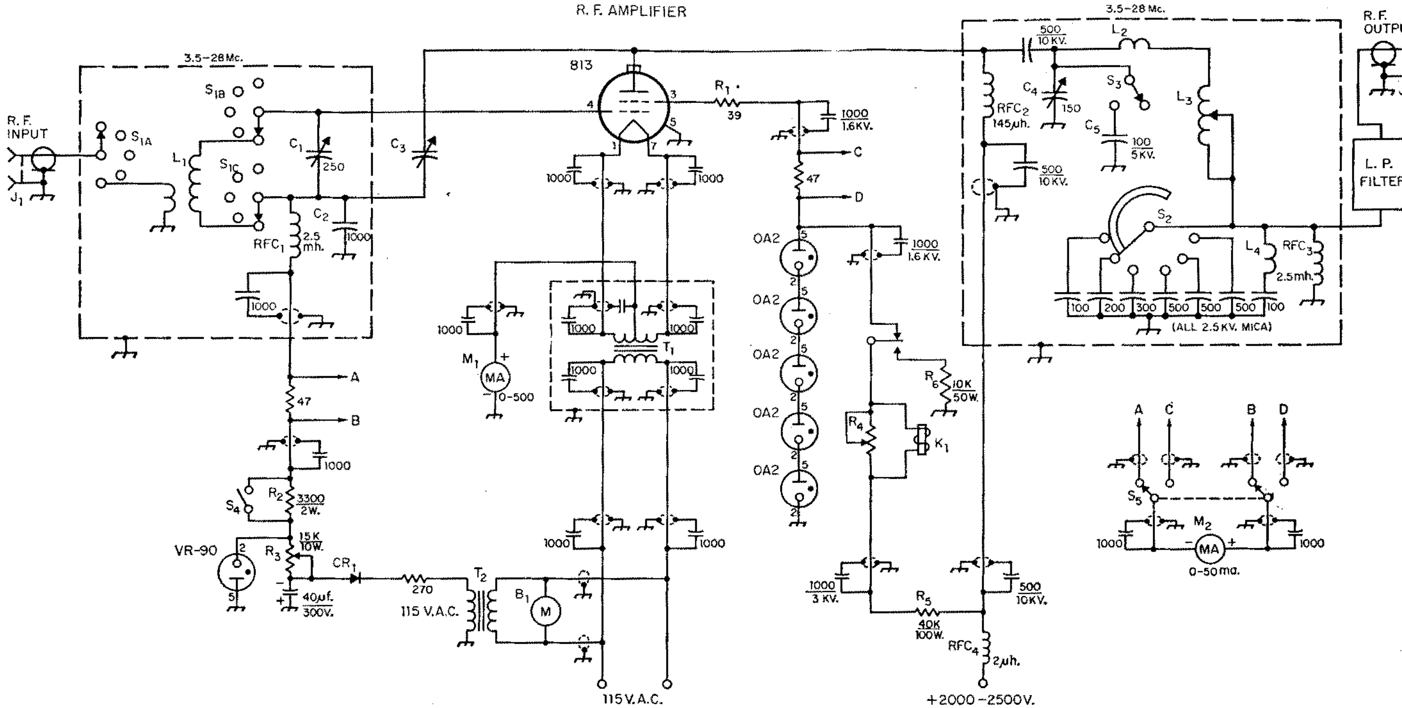

Fig. 6-70—Circuit of the all-purpose 813 amplifier. Unless otherwise designated, capacitances are in $\mu\mu$f. Capacitors marked with polarity are electrolytic. Other capacitors not listed below should be ceramic. Resistances are in ohms.

B_1—Ventilating blower, 100 c.f.m. (surplus).
C_1—250-$\mu\mu$f. variable (Hammarlund MC-250-M).
C_2—1000-$\mu\mu$f. mica.
C_3—Neutralizing capacitor, 10 $\mu\mu$f. maximum (Johnson 159-250).
C_4—150-$\mu\mu$f. 6000-volt variable (Johnson 153-12).
C_5—100-$\mu\mu$f. 5000-volt fixed capacitor (surplus vacuum Amperex VC-100, or two 200-$\mu\mu$f. 5000-volt micas in series).
CR_1—130-volt 50-ma. selenium rectifier.
J_1, J_2—Coaxial receptacle (SO-239).
K_1—Screen overload relay, 2500 ohms, 7 ma. (Potter & Brumfield KCP5).
L_1—3.5 Mc.—32 turns No. 20, 1-inch diam., 2 inches long, 5-turn link (B&W 3015 or Airdux 816).
—7 Mc.—18 turns No. 20, ¾-inch diam., 1⅛ inches long, 3-turn link (B&W 3011 or Airdux 616).
—14 Mc.—10 turns No. 18, ⅝-inch diam., 1¼ inches long, 2-turn link (B&W 3006 or Airdux 508).
—21 Mc.—7 turns No. 18, ⅝-inch diam., ⅞ inch long, 1-turn link (B&W 3006 or Airdux 508).
—28 Mc.—5 turns No. 18, ⅝-inch diam., ⅝ inch long, 1-turn link (B&W 3006 or Airdux 508).
L_2—3 turns 3/16-inch copper tubing, 1-inch diam., 1¾ inches long.
L_3—15-μh. variable inductor (B&W 3852).
L_4—See text.
M_1, M_2—3½-inch d.c. milliammeter.
R_1—39 ohms, ½-watt carbon.
R_2—3300 ohms, 2 watts.
R_3—15,000 ohms, 10 watts with slider.
R_4—2000-ohm 4-watt variable resistor (Mallory M2-MPK).
RFC_1, RFC_3—2.5-mh. r.f. choke (National R-50 or similar).
RFC_2—Plate r.f. choke (National R-175-A).
RFC_4—V.h.f. choke (National R-60).
S_1—Rotary switch: 3 wafers, 3 poles, 11 positions per pole, 5 positions used (Centralab PA-0 wafers, PA-301 index).
S_2—Rotary switch: single pole, 10 positions, progressively shorting, 6 positions used (Centralab PA-2042).
S_3—Rotary switch: s.p.s.t., ceramic (antenna link switch from BC-375 tuning unit, or Communications Products Model 65).
S_4—S.p.s.t. toggle switch.
S_5—D.p.d.t. rotary switch (Centralab 1405).
T_1—Filament transformer: 10 volts, 5 amp. (Thordarson 21F18).
T_2—Bias transformer: 120 volts, 50 ma.; 6.3 volts, 2 amp., filament winding not used; could be used for pilot light (Merit P-3045).

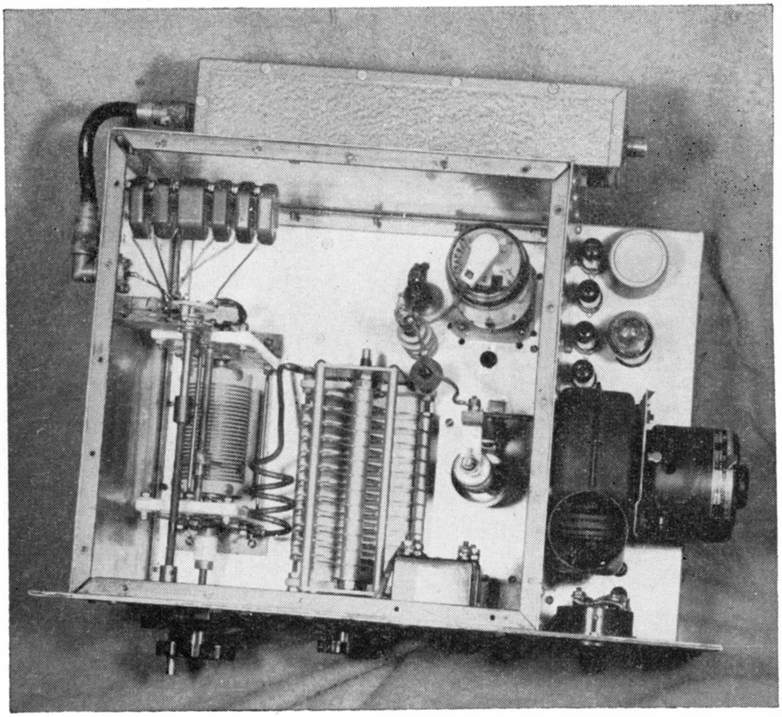

Fig. 6-71—This view shows the placement of components on the chassis. The 813 socket is mounted on spacers over a large clearance hole in the chassis. The several mica output capacitors are assembled in a stack on a threaded rod fastened to the left-hand wall of the shielding box. The neutralizing capacitor and the 80-meter plate padder are to the right of the tank capacitor. To the right of the box are the five 0A2s (the front one hidden), the screen overload relay and the VR90, the blower and meters.

setting for each band. Until the settings for each band have been found, S_3 should be turned so that all of the output capacitance is in circuit. The inductor should be set near maximum for 80, and approximately half maximum for 40. On the higher-frequency bands, the inductor should be set so that the circuit resonates with the tank capacitor near minimum capacitance. Loading should increase as the output capacitance is decreased. A change in output capacitance requires a readjustment of C_4 for resonance. When the loading is near the desired point, final adjustment can be made by altering the inductance slightly.

A 20-A or similar exciter is well suited as a driver for this amplifier on all modes. The 813 runs cool at 500 watts input on a.m. and c.w. and at 1000 watts p.e.p. on s.s.b. (Originally described in *QST* for August, 1958.)

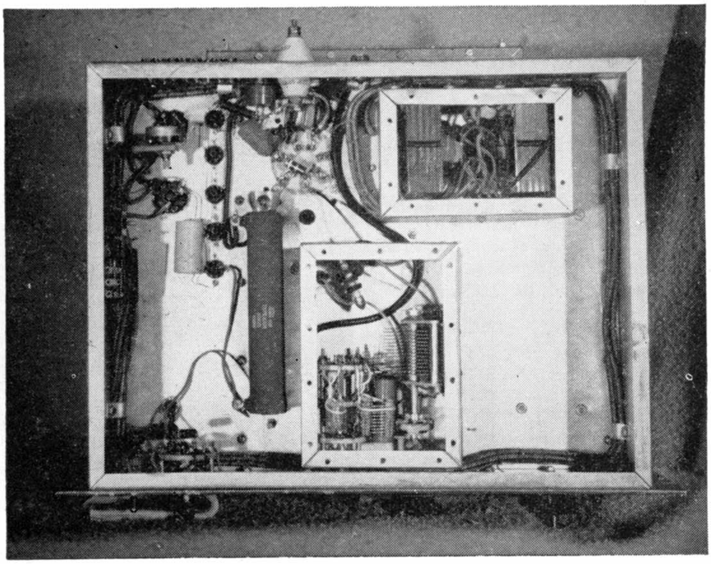

Fig. 6-72—Bottom view of the all-purpose 813 amplifier. The grid tank-circuit components within dashed lines in Fig. 6-70 are enclosed in the box at lower center. Input links are wound over ground ends of grid coils. Filament and bias transformers are in the second box. The large resistor to the left of the grid box is the screen resistor. The variable resistor in the upper left-hand corner is the relay shunt R_4. The selenium bias rectifier is fastened against the left-hand wall of the chassis