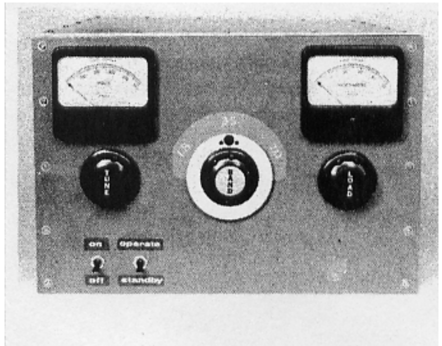

Fig. 74 — Front panel of the amplifier.

A "Universal" Three-Band Linear Amplifier

The cost for a project can be as important a goal as ultimate performance. The challenge of finding surplus or used electronic components for a project may be even greater than the challenge of actual construction. This amplifier was designed to make use of the many tubes available through surplus channels and flea markets for bargain prices. Some commercial users employ these tubes and remove them from service after a prescribed period as part of preventive maintenance. These "pulls" still offer thousands of hours of satisfactory use in amateur equipment.

This amplifier is capable of running one kilowatt of dc input on the 160-, 80- and 40-meter amateur bands. The high-frequency usefulness of the 833A in the amplifier shown limits the usage to those three bands. Pi-network values are given for various surplus tubes: 4-400A, 4-250A, 304TH and 833A (Table 6).

Table 6

Plate Voltage	*C3*	C4	*L1*
160 meters			
2000	490 pF	2987 pF	17.83 µH
2500	305 pF	2098 pF	27.59 µH
3000	222 pF	1676 pF	37.29 µH
3500	193 pF	1676 pF	42.74 µH
80 meters			
2000	252 pF	1536 pF	9.17 µH
2500	157 pF	1079 pF	14.19 µH
3000	114 pF	862 pF	19.18 µH
3500	99 pF	862 pF	21.98 µH
40 meters			
2000	114 pF	670 pF	5.03 µH
2500	71 pF	451 pF	7.77 µH
3000	52 pF	341 pF	10.48 µH
3500	45 pF	341 pF	12.02 µH

The Circuit

The power tube is used in the grounded-cathode configuration (Fig. 75). If the tube to be used is a tetrode, the screen and grid should be tied together to simulate a triode. The 0.01-uF disk capacitors from each cathode terminal to ground provide a low-impedance rf path, effectively bypassing the cathode to ground. Grid voltage is developed across a low resistance, R1, which coincidentally maintains a constant load impedance for the exciter and prevents instability.

The output circuit is a pi-network. The values for the plate-tank components depend on the plate load impedance of the tube. This is a function of the plate voltage and the plate current. To allow the builder flexibility in power-supply requirements, Table 6 lists the pi-network values needed for different plate voltages. The computed values assume the use of appropriate plate current for 1 kilowatt input at the plate voltage given. Observe the maximum tube ratings when choosing a power-supply voltage.

High voltage goes to the plate through RFC1. The choke is wound in such a way as to reduce its distributed capacitance over a conventionally wound choke. RFC3 prevents high voltage from appearing on the antenna should the plate-blocking capacitors (C1 and C2) short; it provides a dc path to ground, thereby blowing the power-supply fuse.

Operating bias for the tube sets the operation to Class AB2. D5 and D6 raise the cathode potential above ground to establish the appropriate idling current of the tube. When in the standby mode, relay contacts switch to a different bias level, reducing plate current to zero.

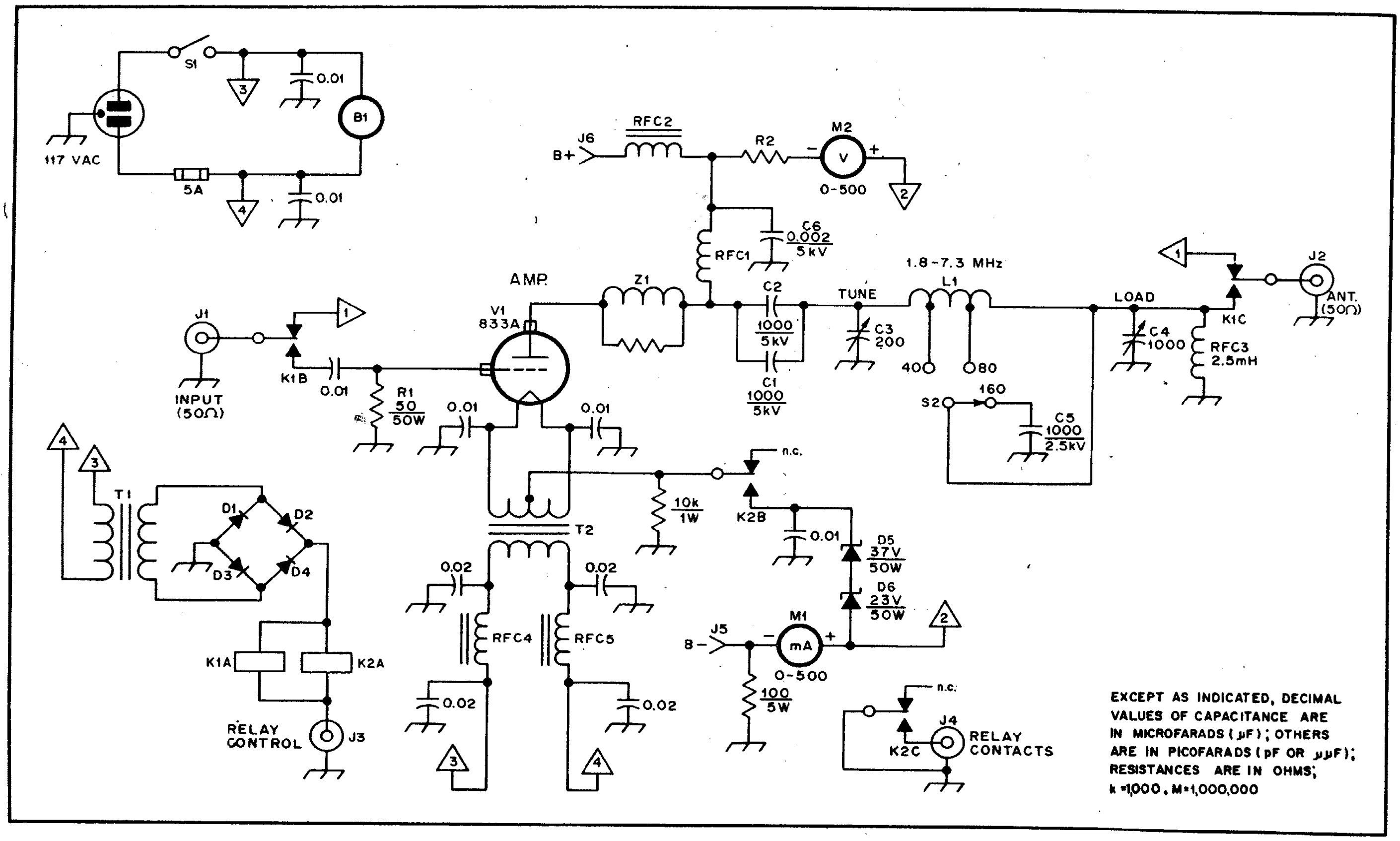

Fig. 75 — Schematic diagram of the three-band amplifier.

B1 — Muffin fan, 80 to 100 CFM suitable, 117 VAC.
C1, C2— 1000-pFtransmitting capacitor, 5000 volts (Centralab 858 series).
C3—Transmitting air variable, 200 pF, E. F. Johnson 154-0016-001 or equiv.
C4 — Transmitting air variable, 1000 pF Millen 16999 or equiv.
C5— 1000-pFtransmitting capacitor, 5000 volts, Centralab 858 series.
C6— 0.002-MF transmitting capacitor, 5000 volts, Centralab 858 series.
D1-D4, incl.— 100 PRV, 1 A.
D5 — Zener diode, 37V, 50W.
D6 — Zener diode, 23V, 50W.
J1, J2 — SO-239 chassis-mounted coaxial connector.
J3, J4 — Phono jack, panel mount.
J5, J6 — High-voltage connection, Millen 37001.
K1 — Dpdt, 5-A contacts. Coil voltage is 24 dc.
K2 — Dpdt, 2-A contacts. Coil voltage is 24 dc.
L1 — Surplus E. F. Johnson inductor in this model. Use Table 6 values. Copper tubing (0.25 inch dia.) suitable.
M1 —500 mA dc.
M2—500Vdc.
R1— 50-ohm noninductive resistor, 50W, Sage 3550M or similar.
R2 — Meter multiplier resistor made from five 1.8 Mfl, 1-watt in series.
RFC 1 — See text and Fig. 76.
RFC2— 40 turns no. 24 enam. on T-80-2 Toroid core.
RFC3 — 2.5-mH choke (Millen 34300-25000, equivalent).
RFC4, RFC5— 6 turns no. 18 enam. on FT-37-43 Toroid core.
S1— Spst toggle switch.
S2— High voltage, single-pole, three-position rotary switch, ceramic insulation (such as from surplus BC-191 or -375E transmitter).
T1— 117-volt primary; secondary 24 vac at 1.2A
T2 — 117-volt primary; secondary 10 V ct at 10 A. Hammond 167510.
V1 — 833A, see text.
Zi — Parasitic suppressor, 4 turns, no. 16 enam. wound around three 150-ohm, 1-watt resistors connected in parallel.

Construction

Construction is straightforward. While the layout shown here proved ideal for the components on hand, many builders will use parts other than the ones shown. Physical constraints may require different layout arrangements. The main considerations are to keep lead lengths to a minimum, and to ensure adequate grounds where needed.

A homemade sealed box encloses the circuitry. Three potential problem areas dictate that in this, and all rf power amplifiers, a shielded box is necessary. Safety considerations, both due to high dc and high rf voltages, RFI reduction and adequate air cooling of the tube all necessitate a sealed box. All metal-to-metal bond areas should be cleaned carefully to guarantee good electrical contact. An abundance of fastening screws hold these seams together, further "RFI-proofing" the box. Air is blown across the tube by means of a muffin fan. Plenty of cooling air not only stabilizes the tuning of the amplifier but also lengthens tube life.

Many variations in switching, metering and power supplies are possible with a unit such as this. The methods shown here are intended to be *examples* of the various possibilities. Parts availability and individual desires of the builder dictate the final design.

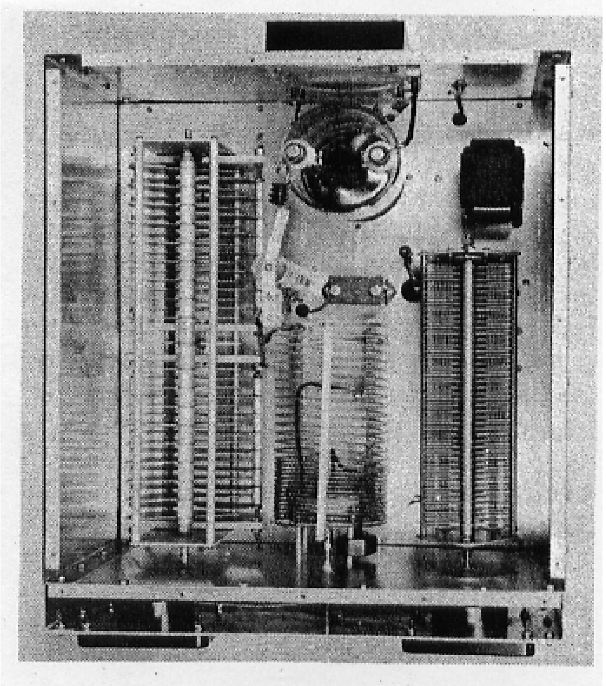

Fig. 77 — Interior view of the three-band amplifier. The band switch is mounted to the front panel inside one end of the tank coil.

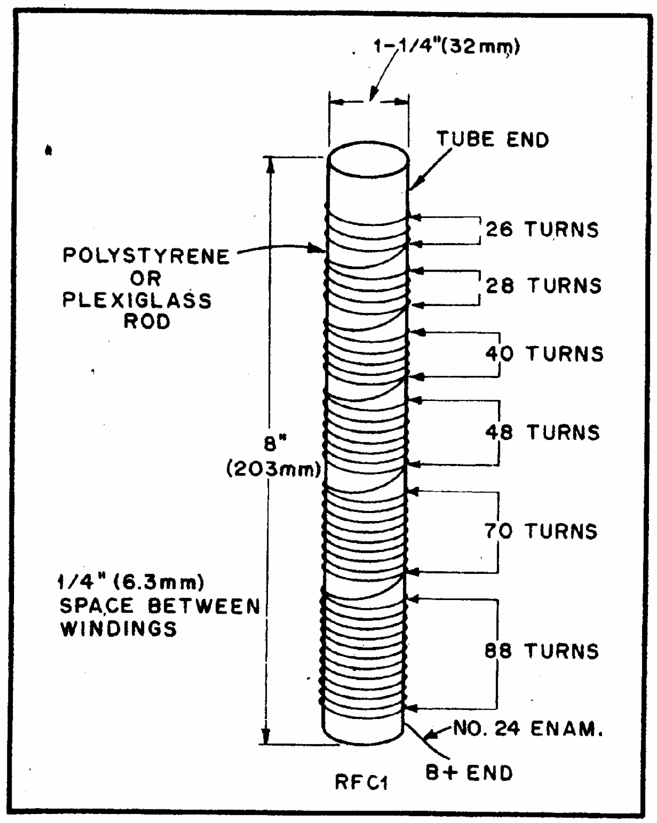

Fig. 76 — RFC1 is wound on 1-1/4 inch (32-mm) diameter polystyrene rod as depicted.

Tune-up and Operation

Because of the expected variations between different amplifiers, there are no hard and fast rules for tune-up. For initial tune-up less than full plate voltage is recommended. This permits a greater safety margin (both for the amplifier and the operator) if unexpected events occur. Increase drive slowly while making adjustments, this again providing a safety margin. *Remember, hazardous voltages are present in this amplifier, and these should be respected at all times.*

A wattmeter is helpful during tune-up. A goal of maximum output power consistent with high efficiency should be sought. Efficiency on the order of 55 to 65 percent can be expected. In order to increase tube longevity, the manufacturer's maximum ratings should never be exceeded.