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10m Junk Box Amp

More tube-type fun!

A few months ago, I was trying to communicate with my son Mike KC4DQR on 10 meters. While he could hear my 100 watt rig, I could never hear his 25 watt Realistic HTX-100. We live about 50 miles apart, and that was just a little too far away for his 25 watt ground wave and dipole antenna to get through. I figured there must be a solution to this problem, and started to dig into the ol' junk box. Since Radio Shack sold the HTX-100 to lots of hams, I decided to share with you my solution, the 10m Junk Box Amp.

I wanted the amplifier to be easy to work with, simple to build, and rugged. With this in mind, I chose a tube-type circuit. Since the old 807 tubes are still quite popular as drivers in many AM broadcast transmitters, they are easy to come by and fairly inexpensive. If you use two of them in a parallel configuration, they also will produce about 100 watts, the power I was looking for. Another plus was that my junk box contained two of them!

Construction

The hardest part of the construction was building a suitable chassis out of a piece of aluminum which I also happened to have on hand. After much beating, hammering, drilling, and a few pop rivets, I had a 17- x 5- x 12-inch box that looked a lot like a chassis. Instead of building on the outside like most of the older tube-type projects, I built the amplifier inside the box.

The box of junk produced a suitable power transformer with a secondary of 550 volts @ 450 mA, which was rectified through a bridge circuit consisting of eight 2.5 amp, 1000 PIV diodes. I wanted it to last!

The most expensive part of the project turned out to be the filters. I used three 100 µF @ 450 VDC in series. Such capacitors are not easy to find now, since most projects are solid state and use low voltage capacitors. These little jewels cost $7.50 each.

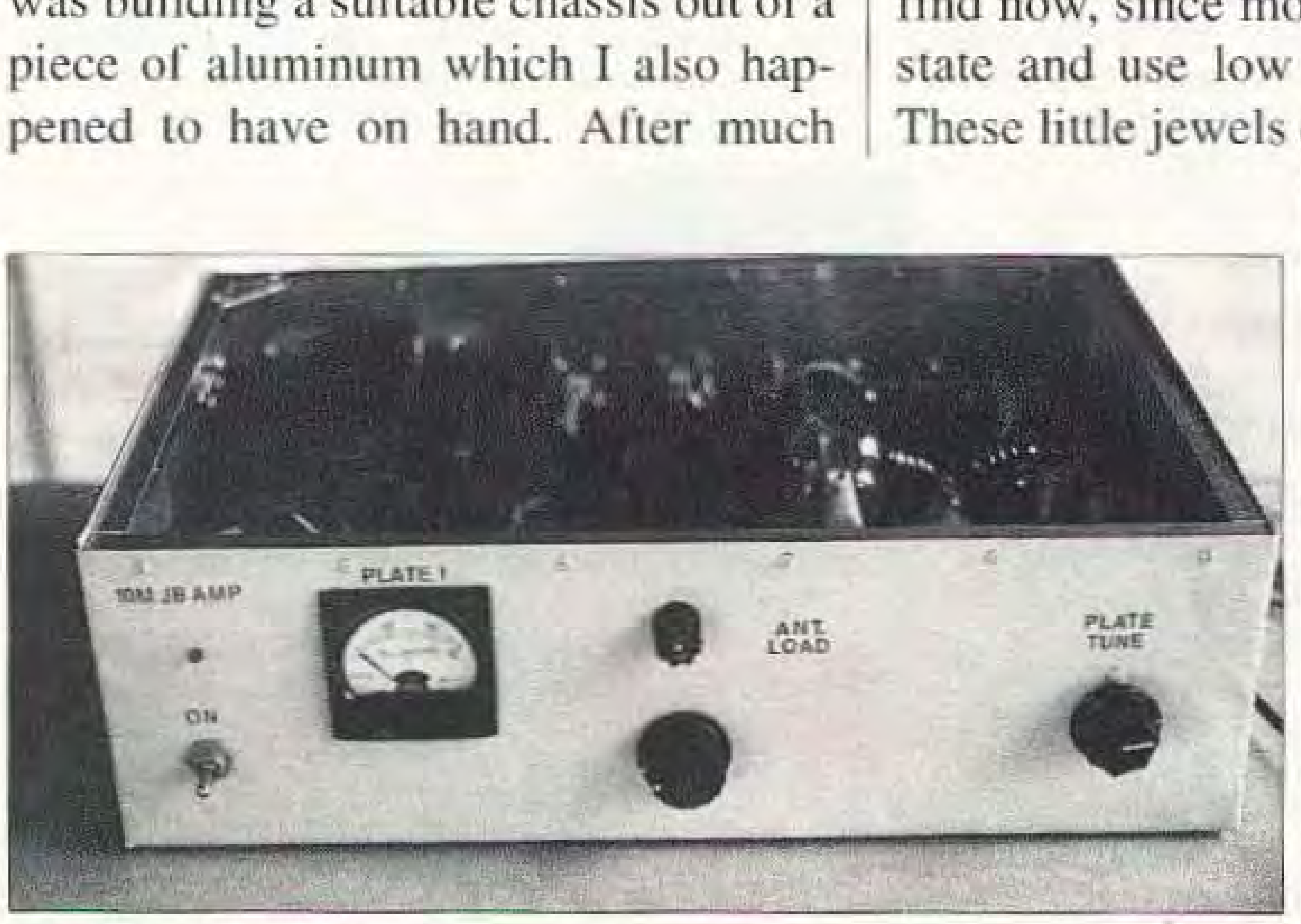

Photo A. Front view.

The three resistors, R3–R5, serve to equalize the voltage across the capacitors, and also as bleeder resistors to discharge the capacitors when the unit is turned off. The high voltage circuit produced a no-load voltage of 590 volts, and about 560 volts under load.

A word of caution: *Keep your fingers clear of this when the unit is on.* These voltages, producing nearly half an amp, can be dangerous. Practice safety at all times.

In order to make the unit as efficient as possible, I used a tuned circuit to drive the tube's grids. This consists of L1, L2, and C7. Since tubes like to see negative voltage on the grids, C6 was used to block the negative DC from the tuned circuit. To generate the negative grid bias voltage, I used a 6.3 volt filament transformer connected in reverse to the 5.0 volt rectifier filament winding, and used what was the primary winding as the supply. This was rectified by another bridge connected with the positive side to ground, and filtering the output with C2's positive lead to ground. The voltage produced here was exactly what was needed, biasing the tubes to cut off when no signal was applied. This prevented the need for any kind of switching to turn the amplifier off and on, since the plate current remained at zero when no signal was applied to drive the circuit.

The resistor R2 provides a small load to keep the voltage stable, and C1

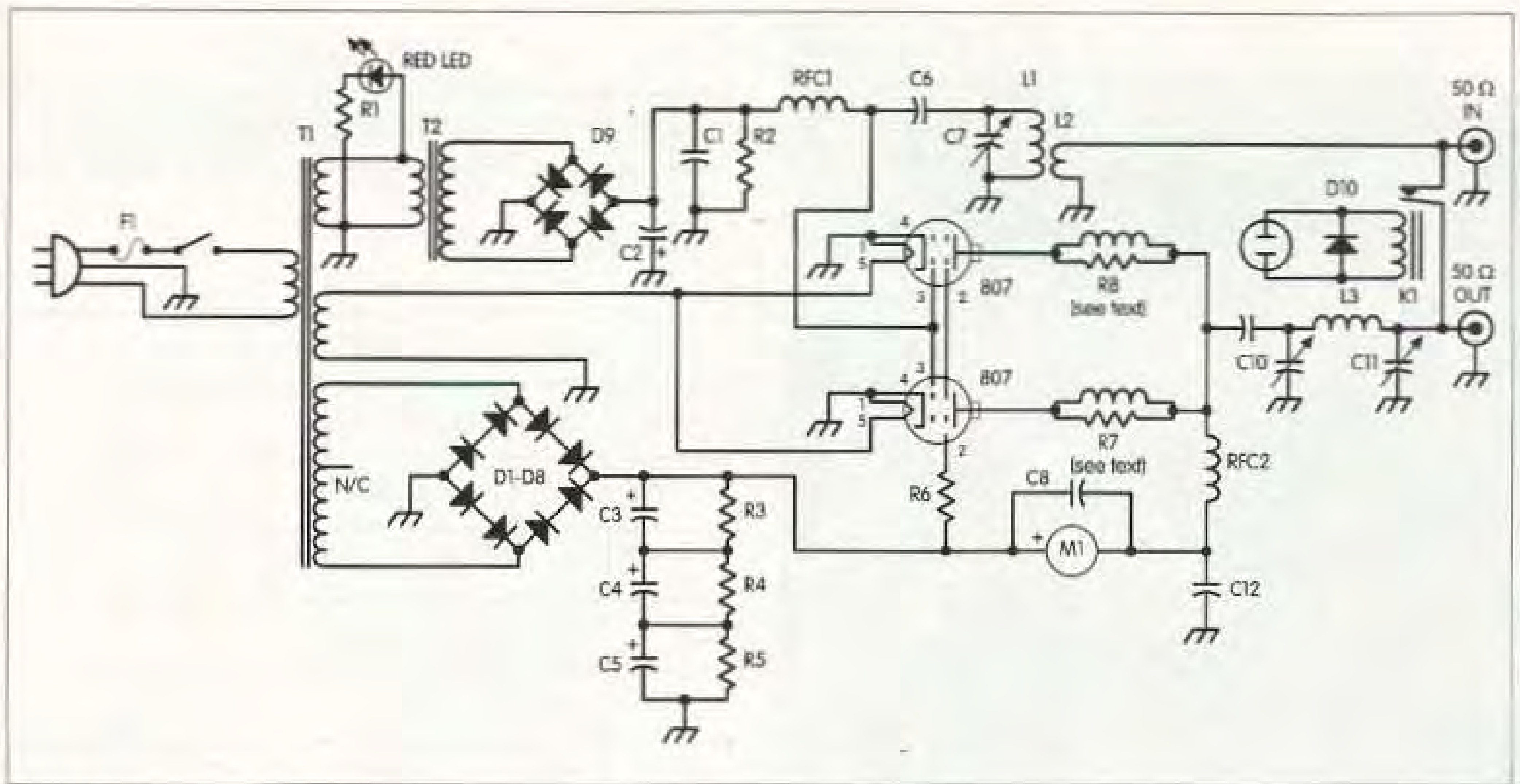

Fig. 1. Schematic.

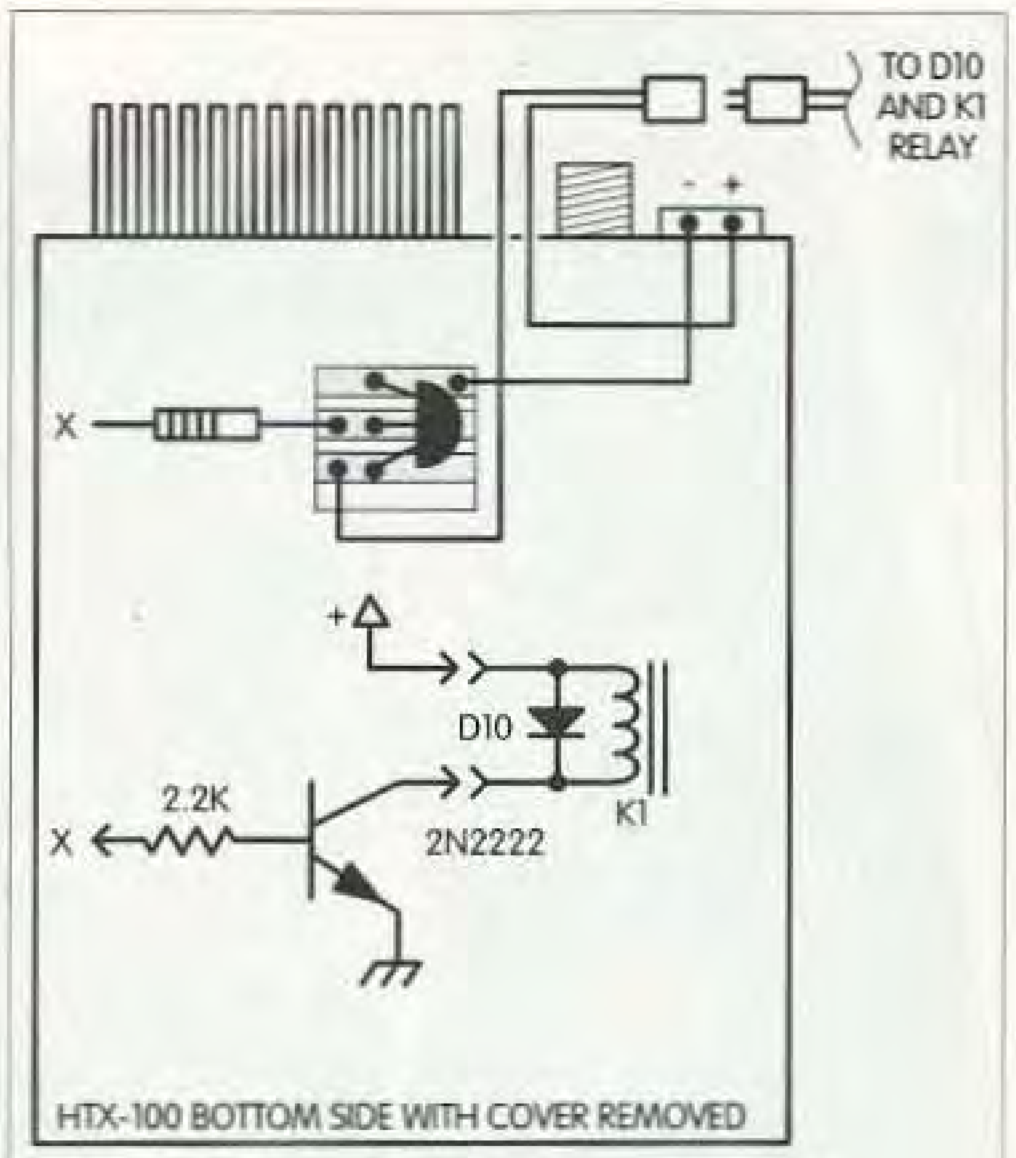

Fig. 2. Keying circuit modification for the Realistic HTX-100.

shorts any RF to ground that may have sneaked through RFC1. The screen grids were supplied through R6, which gave a little higher voltage than the specs on the tube called for, but since you can run the plate voltage at up to 750 volts, this did not seem to be a problem.

The parasitic suppressors in the plate circuit consist of 56 ohm, 2 watt carbon resistors, with three turns of #16 wire wound around them. I used the TLAR method to figure these values. What's the TLAR method? That Looks About Right! The output is a standard pi network consisting of C10, C11, and L3. I used a door knob capacitor, C9, to block the high voltage off the pi network, and antenna. The RF choke, RFC2 and C12, block the RF from the power supply. The plate current meter is a 300 mA unit, shunted by C8 for RF suppression.

HTX-100 Mod

Since it is not practical to design a simple RF sensing circuit that will respond to an SSB signal, I decided to modify the HTX-100 with a keying circuit for the 10m JB Amp. With the bottom cover removed, I looked for a place on the PC board that would go high when the mike was keyed, and remain high. Several places were found. I used a triangular land in the left-hand corner at the "x", which went to a positive 12 VDC when the mike was keyed.

In order not to place any significant load on the HTX-100 circuit, I coupled that point through a 2.2k 1/2 watt resistor to a simple relay driver using a 2N2222 NPN transistor. The transistor was mounted on a small PC board etched with only three strips, as shown. From the collector a wire was routed through an existing hole in the rear of the HTX-100, and a second wire from the (+) side of the power plug on the radio was routed through

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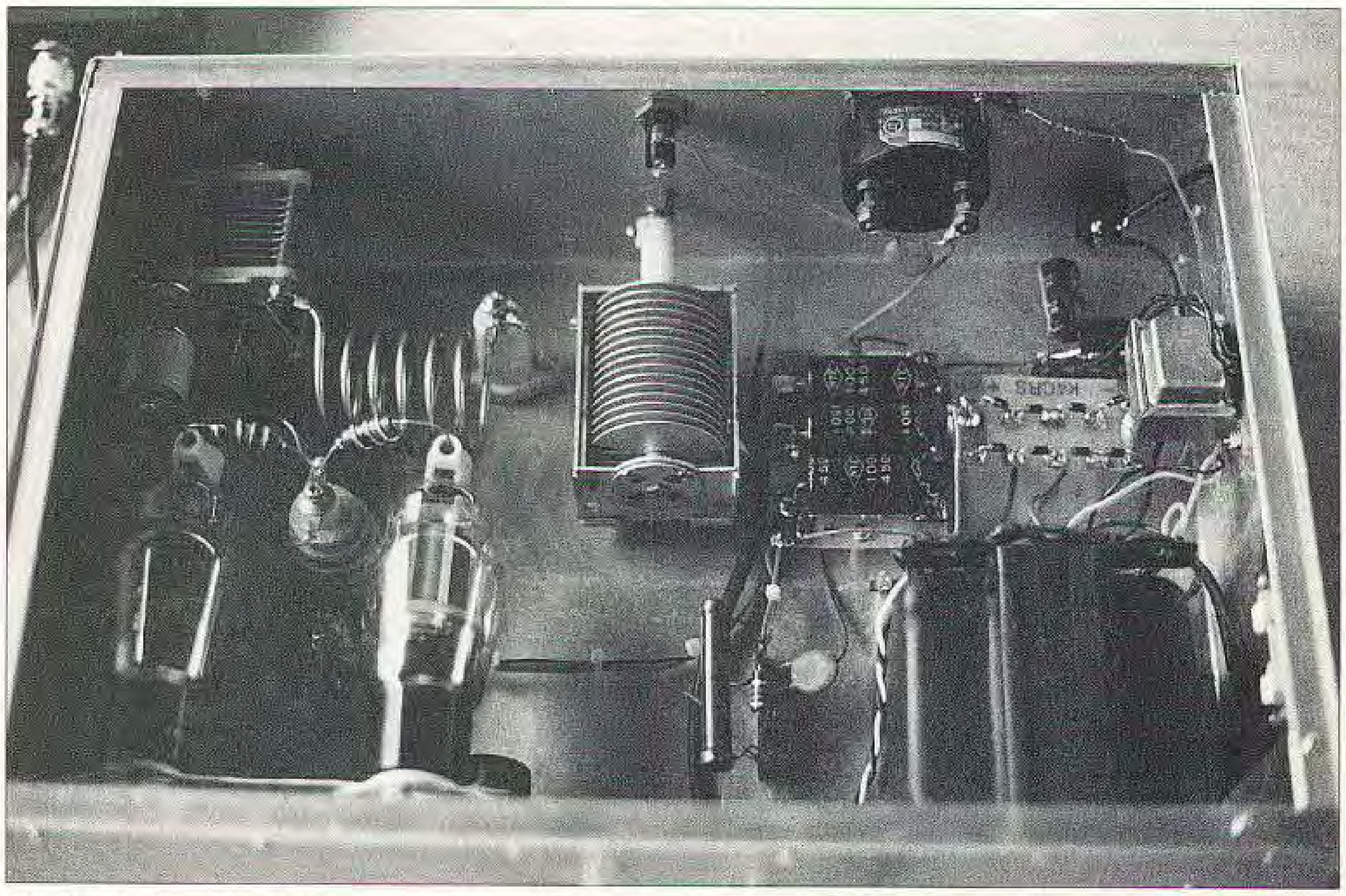

Photo B. Interior view.

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the same hole and attached to a plug for quick disconnect.

The mating plug from the amplifier feeds the relay K1. A 1N914 diode was connected across the relay to act as a shorting device to protect the 2N2222 from voltage generated by the K1 coil when the relay is turned off.

Keying the radio turns on the 2N2222 and closes the relay in the amplifier. Since the radio's speaker is mounted on the bottom cover, care must be exercised to mount the transistor's circuit board so that it doesn't short against the back of the speaker.

Tuneup

Tuneup was straightforward, first tuning the pi network for maximum power into a Bird wattmeter and dummy load, then tuning C7 in the grid circuit, and retouching the pi network. When properly tuned, the amplifier produced about 95 watts output, with the plate running about 250 mA. Of course, this was done with the radio in the CW mode. All amateur transmitting equipment must be able to send CW — ARRL rule number 1!

During the 1999 Field Day contest, I used this system to make many 10 meter contacts that ranged from Florida to

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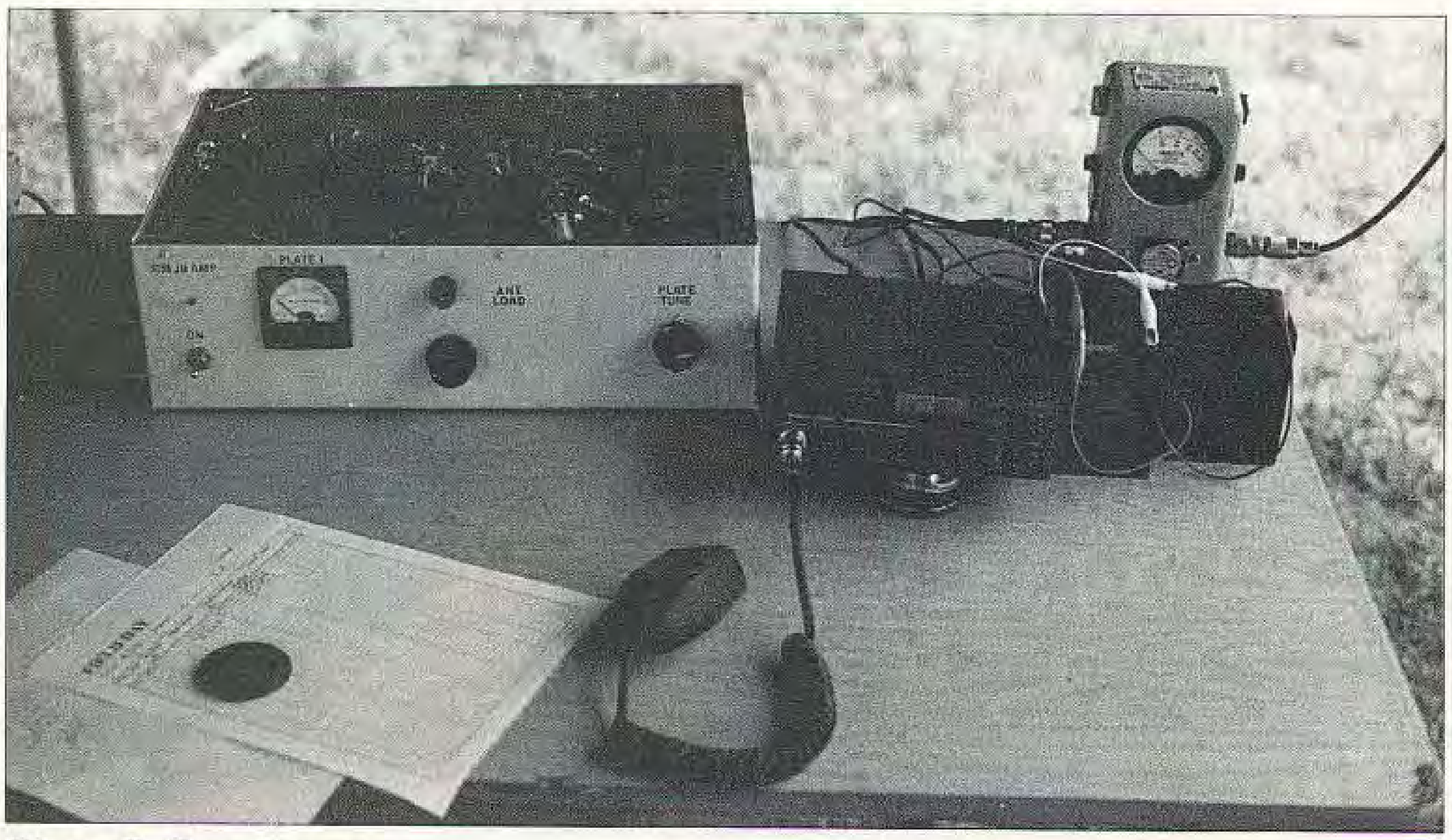

Photo C. Complete setup.

Parts List

Part	Description
C1, 6, 8, 12	0.01 µF @ 1 kV
C2	50 µF @ 150 VDC
C3–5	100 µF @ 450 VDC
C6	0.01 µF @ 1 kV
C7	50 µF variable
C9	500 pF door knob
C10	150 pF variable
C11	1000 pF variable
D1–8	1 kV PIV @ 2.5 A
D9	200 V PIV @ 1A
D10	1N914
K1	SPDT relay 12 VDC coil
L1	6T #18 wire 1/2-in. diam. spaced 1 turn width
L2	3T #18 wire 1/2-in. diam. spaced 1 turn width on cold end of L1
L3	5.5T #10 wire 1-5/8-in. diam. 2 in. long
M1	0–300 mA meter
R1	200 Ω 1/2 W carbon
R2	47 k, 2 W carbon
R3–5	100 k 1/2 W carbon
R6	2 k 5 W wirewound
R7–8	56 Ω 2 W carbon
RFC1	2.5 mH RF choke
RFC2	2.5 mH 600 mA RF choke
T1	117 VAC primary, secondary 550 VAC CT @ 300 mA, 6.3 VAC @ 2A, 5.0 VAC @ 2 A
T2	117 VAC primary, 6.3 VAC secondary, hooked up in reverse with 6.3 side connected to 5.0 output of T1
Miscellaneous	
SPST toggle switch	
2 x SO-239 connectors	
Red LED	
2 x 807 tubes	
Line cord and plug	
Any kind of insulated 2-conductor plugs (keying circuit)	
5 x 5-terminal solder lugs	
Porcelain standoff	
2 x PCB for D1–D8 and capacitor bank	
17- x 5- x 12-inch chassis	

Table 1. Parts list.

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Canada, and as far west as Nebraska, using a simple halfwave dipole antenna. It has also served the purpose for which it was designed: To be able to communicate with KC4DQR, my son, Mike.

In this day of amateur radio equipment being mostly plug-in appliances, I found a great sense of joy and pride in being able to make those Field Day contacts on a rig that I, at least in part, designed and built. After all, isn't that what amateur radio is all about? 73