FAST SCAN ATV TRANSMITTER

Here's a compact 10 watt fast scan amateur television (ATV) transmitter with audio on the video carrier and T/R switching that can be built for about $120 (Fig. 6-52). The rig incorporates the video exciter described in the June 1976 issue of *73* to drive a

quasilinear 10 watt ¾ meter amplifier. No amplifier tuneup is required since it utilizes the Motorola MHW-710 sealed power module. (For theory of operation of this module in the ATV mode, refer to Nov/Dec 1975, page 37 of *73*.)

Operating at 13.8 V dc, the transmitter draws about 2.7 Amps from an external regulated power source. Linearity and frequency response performance is shown in Fig. 6-53.

As noted above, the construction details for the exciter have already been given; therefore only the amplifier circuit will be described here. Several different mounting arrangements are possible, so you may wish to deviate from the following procedure. Of course, both the amplifier and exciter can be located in the same enclosure; however, experimentalists may prefer the two-box modular approach to effect rapid exciter or amplifier interchange with future designs.

Amplifier Construction Procedure

Refer to Table 6-9 and Fig. 6-54.

1. Drill holes in chassis and heat sink per Figs. 6-55 and 6-56. Make sure that holes in heat sink line up with holes in chassis.

2. Referring to Fig. 6-57, mount all components to PC board. (Foil layout for board is shown in Fig. 6-58).

3. Using two #4-40 screws, lockwashers and nuts, bolt PC board on two "L" brackets as shown in Figs. 6-59 and 6-60.

4. Spread heat sink compound over back of heat sink and Motorola MHW-710 module. Place module on inside of chassis and

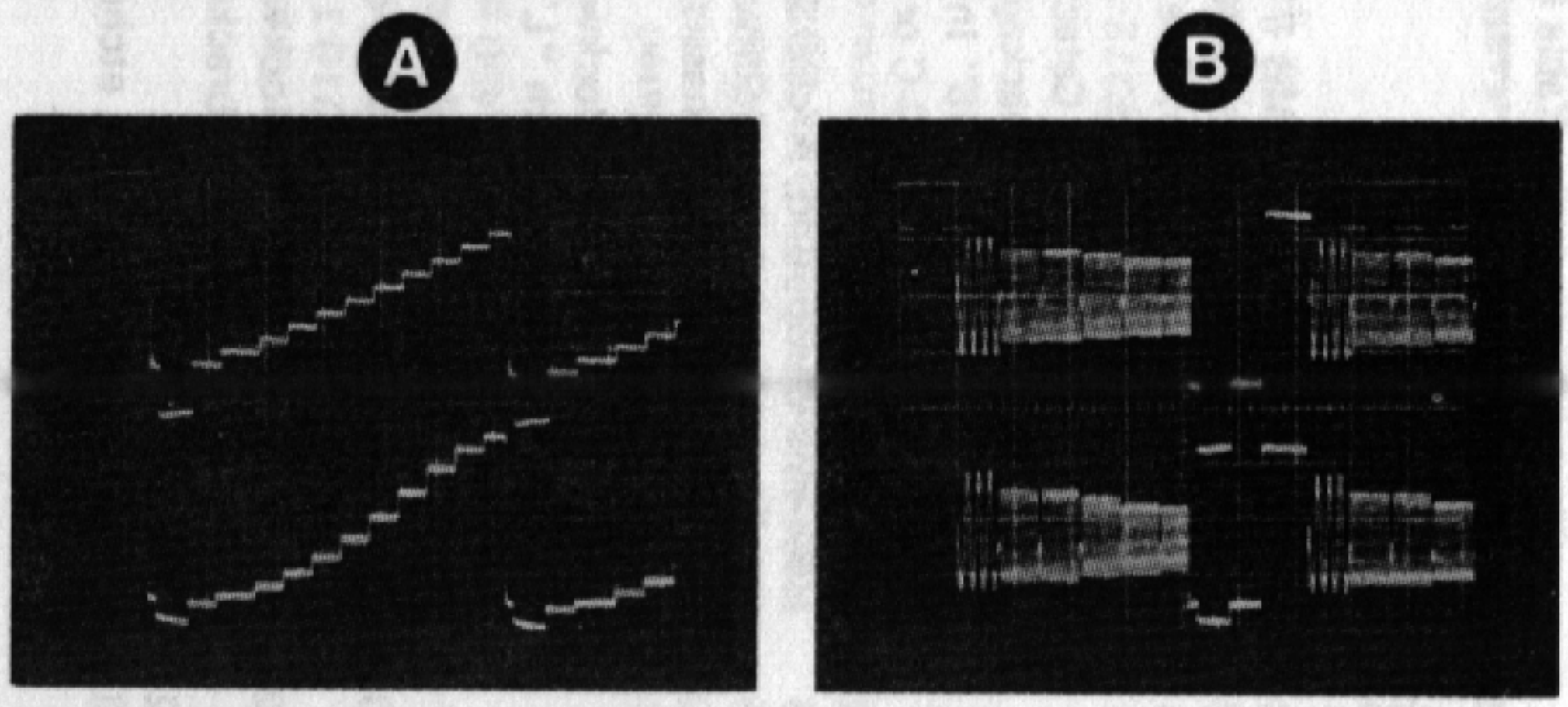


Fig. 6-53. Performance curves, 10 watt ATV transmitter. All vertical scales uncalibrated. Power: 13.8 V dc 2.7 A. (a) Linearity: top scale—video in; bottom scale—detected rf output; 10 usec/div horizontal; 10 watts out (average). (b) Frequency response: top scale—video in; bottom scale—detected rf output; 10 usec/div horizontal; burst order (in MHz)—0.5, 1.5, 2.0, 3.0, 3.58, 4.2.

Part #	Description	Qty	Unit Cost	Total Cost	Source of Supply
1	5½"x3"x1½" Chassis; LMB #139	1		$2.00	Electronic Supply Store
2	UG-1094 BNC Bulkhead Connector	3	$ .85	2.55	Electronic Supply Store
3	.001 uF feedthrough cap; Erie #327-005-X5UO-102M	1		1.62	Electronic Supply Store
4	3/8"x3/4" "L" bracket; Calectro #J4-641 (2 brackets in package)	2		.49	Electronic Supply Store
5	Heat sink, 3"x4.75"x0.46" International Rectifier HE330-C or Wakefield 623-K	1		2.72	Electronic Supply Store
6	Heat sink compound; Archer 276-1372	1		.89	Radio Shack
7	½" #8 screws, nuts and lockwashers (to mount heat sink to chassis; also for gnd lug)	5			Hardware Store
8	½" #6 screws, nuts and lockwashers (to mount MHW-710 with "L" brackets to chassis)	2			Hardware Store
9	#8 hole terminal lug; Waldom #KT-198	3			Hardware Store
10	#8 nut (to secure ground lug soldered to relay)	1			Hardware Store
11	¼" #4 screws, nuts and lockwashers (to attach PC board to "L" bracket)	2			Hardware Store
12	RG-188 cable	18"		3.00	Cable & PC Brd both from Stu Mitchell WA0DYJ, 14761 Dodson, Woodbridge VA 22193
13	Amplifier PC board; cut, etched and drilled	1		Ppd	

14	MHW-710-1 or -2 Power Amplifier Module, Motorola. The 710-1 covers 400-440 MHz; the 710-2 covers 440-480 MHz. Either device will give equivalent performance in the 435-450 portion of the band.	1		42.50	Call local Motorola sales office for source
15	#20 stranded wire, insulated	20"			Electronic Supply Store
16	Stick-on lettering kit				Stationery Store
17	DPDT relay, 12 V dc; Archer #275-206	1		3.99	Radio Shack
18	Copper foil, Circuit-stick #9252	1		1.49	Electronic Supply Store
L1	2½ turn ferrite choke; Ferroxcube VK200-20/4B		.51	1.02	Eastern Components 1407 Bethlehem Pk. Flourtown PA 19031 $10 min. order
C1	500 uF, 35 V dc, Axial #272-1018	1		.89	Radio Shack
C2	.05 disc, #272-134	1		.39	Radio Shack
C3	33 uF, 35 V dc, PC Type, Lead aluminum	1		.30	Lafayette; Elec. Supply
C4-6	4.7 pF (or 5 pF), #272-120	3	.29	.87	Radio Shack
R1	270 Ohms, ¼ Watt, 10%	1		.10	Electronic Supply Store
R2	10 Ohms, ½ Watt, 10%	1		.12	Electronic Supply Store
Z1	15 V zener, 1N4744	1		.40	Electronic Supply Store

A 13.8 V dc power supply with a rating of 4 Amps continuous is required.

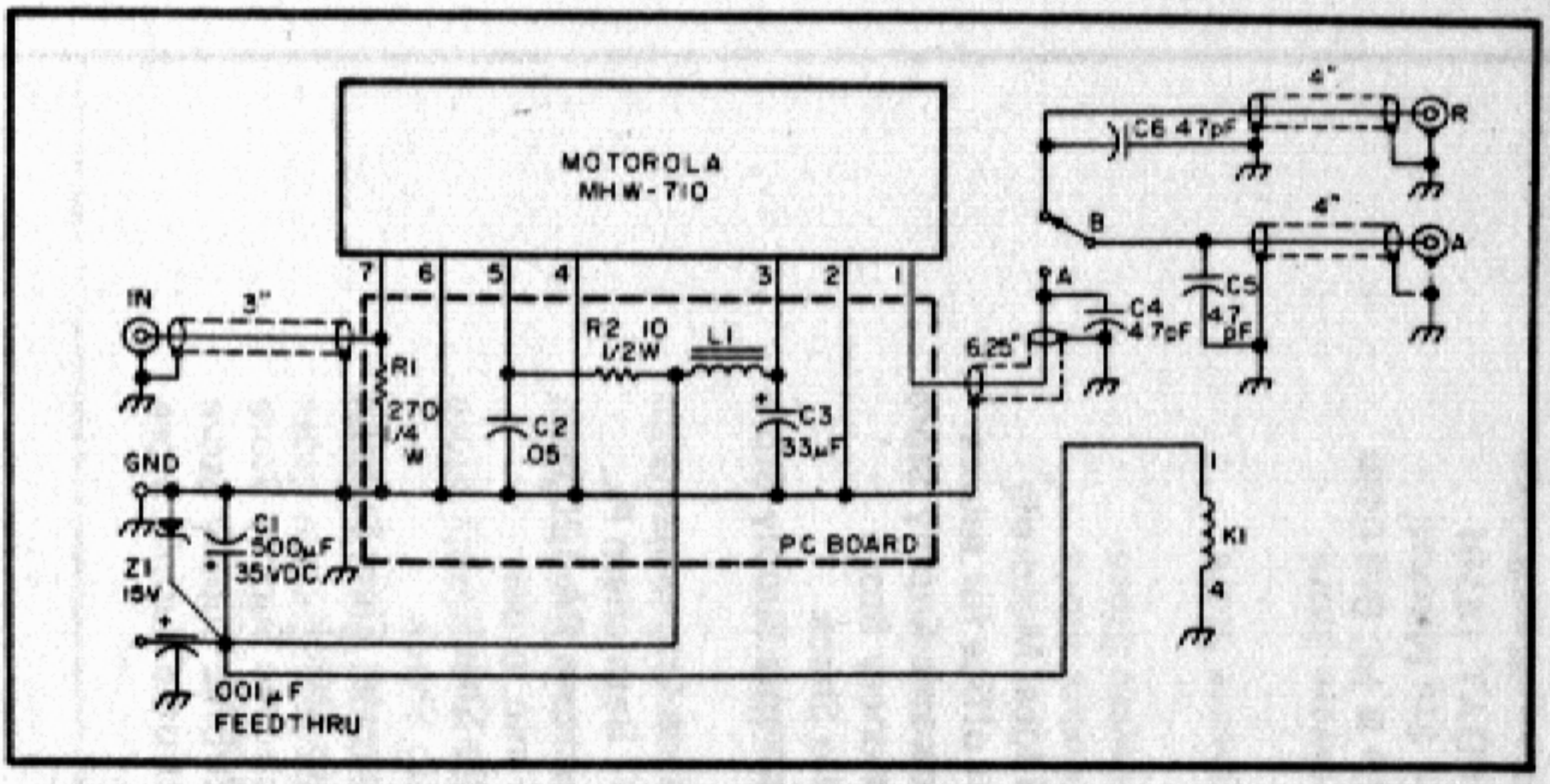


Fig. 6-54. 10 watt amplifier schematic. K1 is Archer (Radio Shack) #275-206 relay. L1 is Ferroxcube. VK200-20/4B.

heat sink on outside. Place PC board mounting brackets on module. Position brackets, module and heat sink so that all holes line up. Bolt all together with two #6-32 screws, lockwashers and nuts.

5. Using four #8 screws, lockwashers and nuts, bolt the corners of the heat sink to the chassis.

6. Solder all seven pins of the module to the PC board (pin numbers shown in Fig. 6-58).

7. Mount 3 BNC connectors, feedthrough capacitor and ground lugs to chassis. As shown in Fig. 6-60, also secure a #8 terminal lug to one of the screws holding the heat sink to the chassis. This is the relay ground lug.

Fig. 6-55. ATV 10 watt amplifier chassis drill guide. Notes: All dimensions are in inches. All measurements are from outside edge of chassis. Chassis is LMB #139. Guide is not drawn to scale.

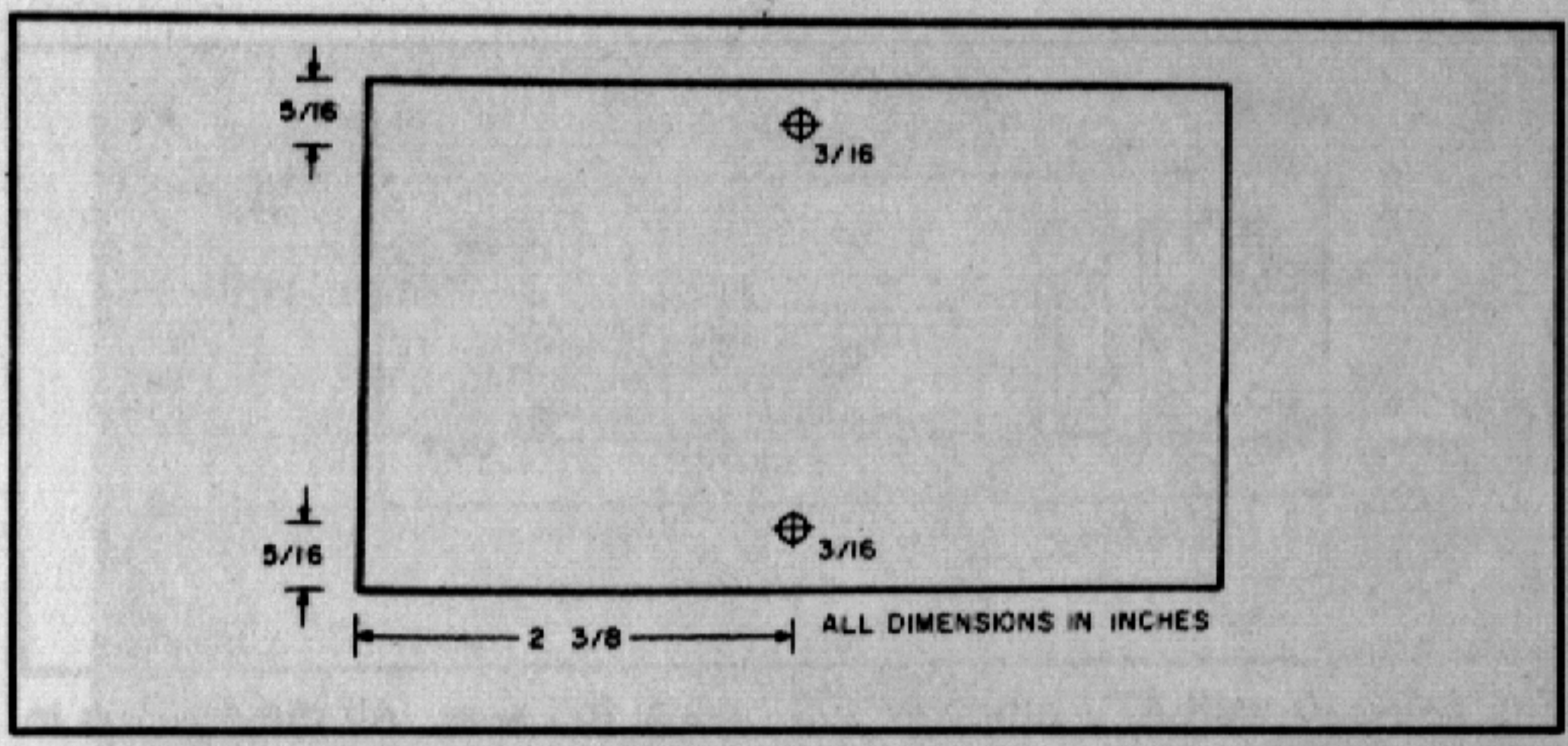


Fig. 6-56. Heat sink drill guide. Heat sink is International Rectifier HE330-C or Wakefield 623-K.

8. Run twisted #20 wires from the feedthrough capacitor and ground lug (next to feedthrough) to + and GND on the PC board respectively. Solder a 500 μF electrolytic capacitor across the feedthrough and ground lug.

9. Completely cover the transparent plastic sides and end of the relay with copper foil. Also run a .2" strip of foil across the bottom of the relay (where the contacts are). The relay socket is not used. Solder all copper foil pieces together to insure a good shield.

10. Position the relay as shown in Fig. 6-60. Terminals A and B will be up. Solder the #8 terminal to the copper foil at the end of the relay opposite from the contacts. This will partially secure the relay in place while also grounding the relay's shield.

11. Solder wire from the ground terminal to terminal #4 of the relay. Solder a wire from the feedthrough capacitor (+V dc) to terminal #1 of the relay.

12. Prepare four RG-188 cables as shown in Fig. 6-61.

13. Connect the 3" cable from the "IN" BNC to "IN" on the PC board (module pin 7). Solder the cable shield directly to the

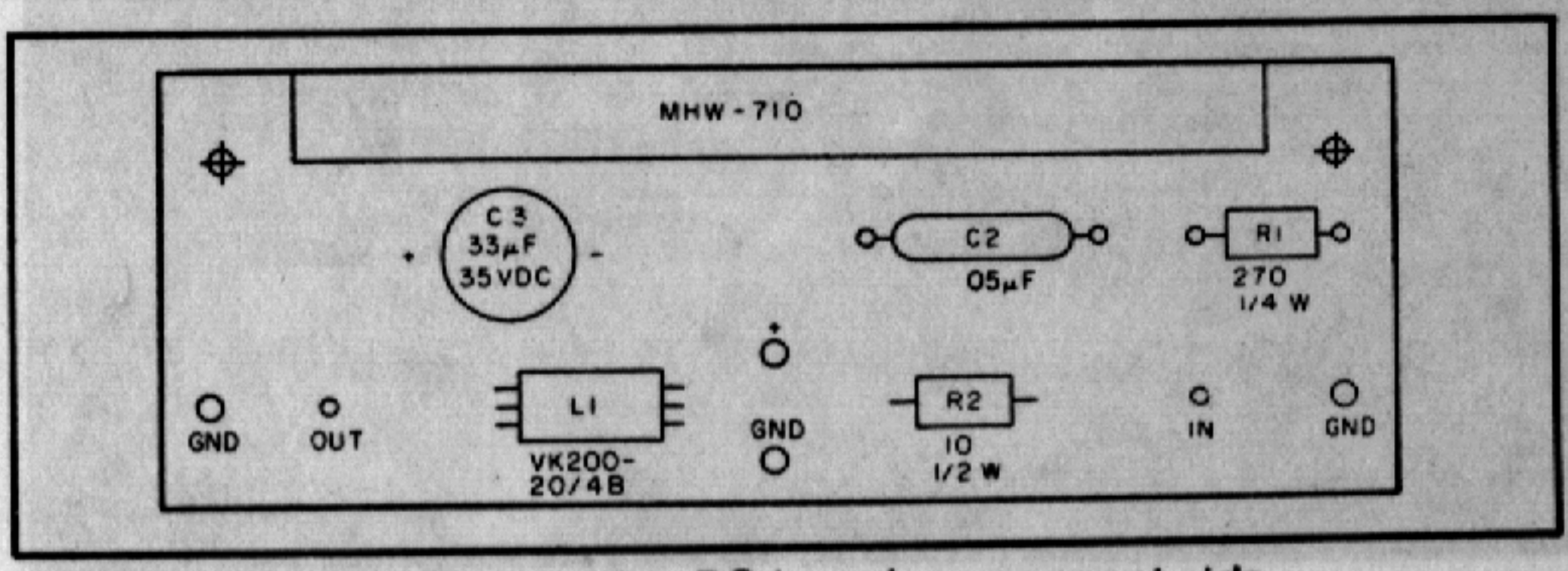


Fig. 6-57. 10 watt ATV amplifier PC board, component side.

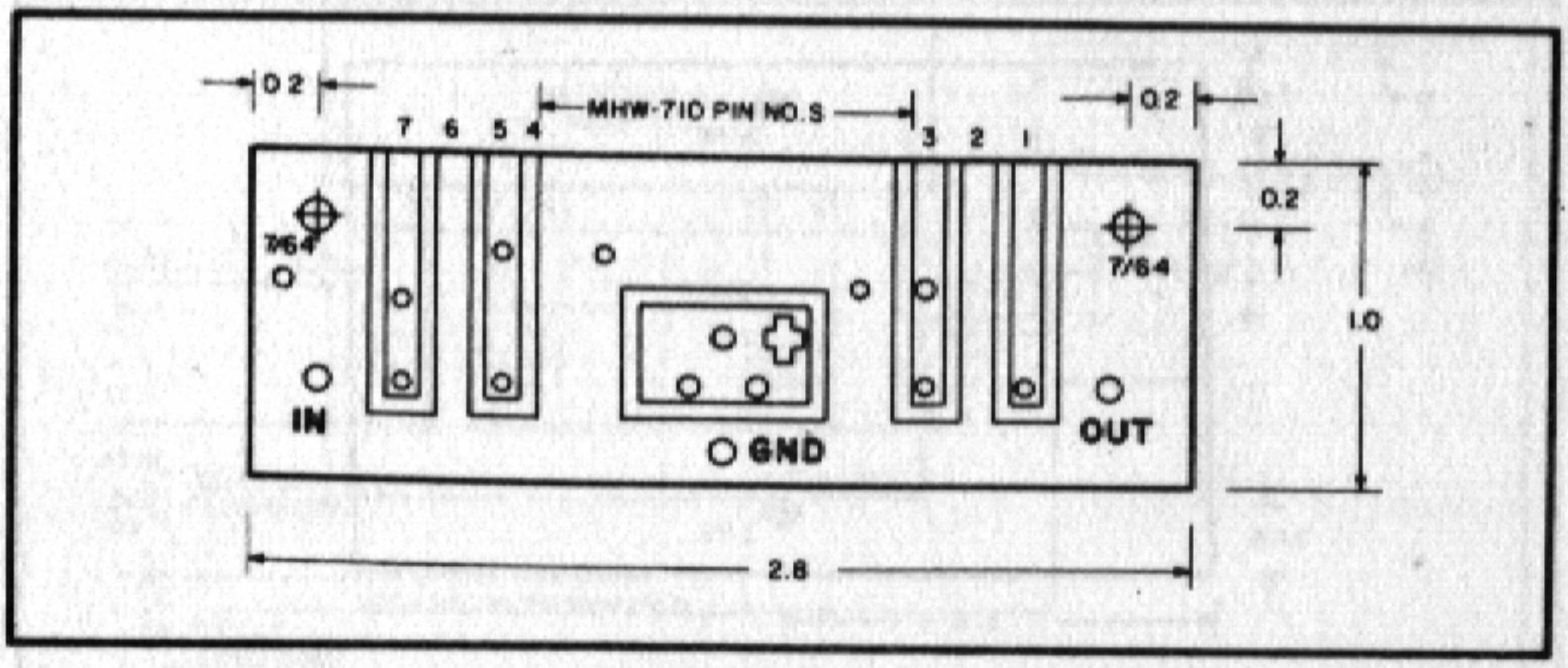


Fig. 6-58. 10 watt ATV amplifier PC board, foil side. All dimensions in inches. Board is glass.

grounded portion on the BNC connector. The other shield is inserted in the hole provided on the PC board and soldered to the foil. All shield lengths must be as short as possible.

14. Solder the ½" long center conductors and shields of the two 4" long cables to BNCs "A" and "R." Also solder the ½" long center conductor and shield of the 6¼" cable to "OUT" on the PC board (module pin 1). Again keep shield lengths as short as possible.

15. Solder the 1¼" long center conductor of the cable from the PC board to terminal A of the relay. Solder the shield to the relay's

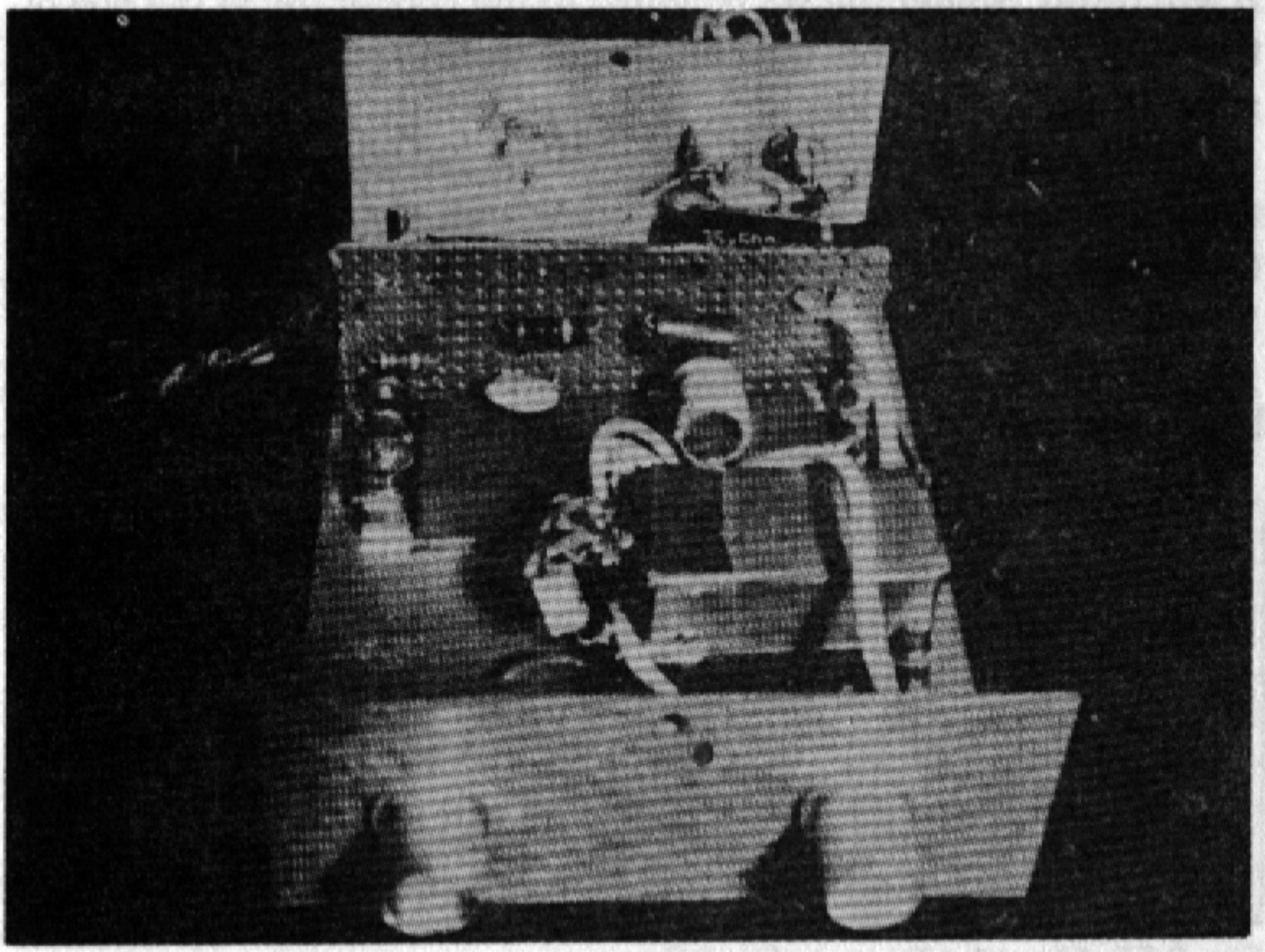


Fig. 6-59. PC board, prototype shown.

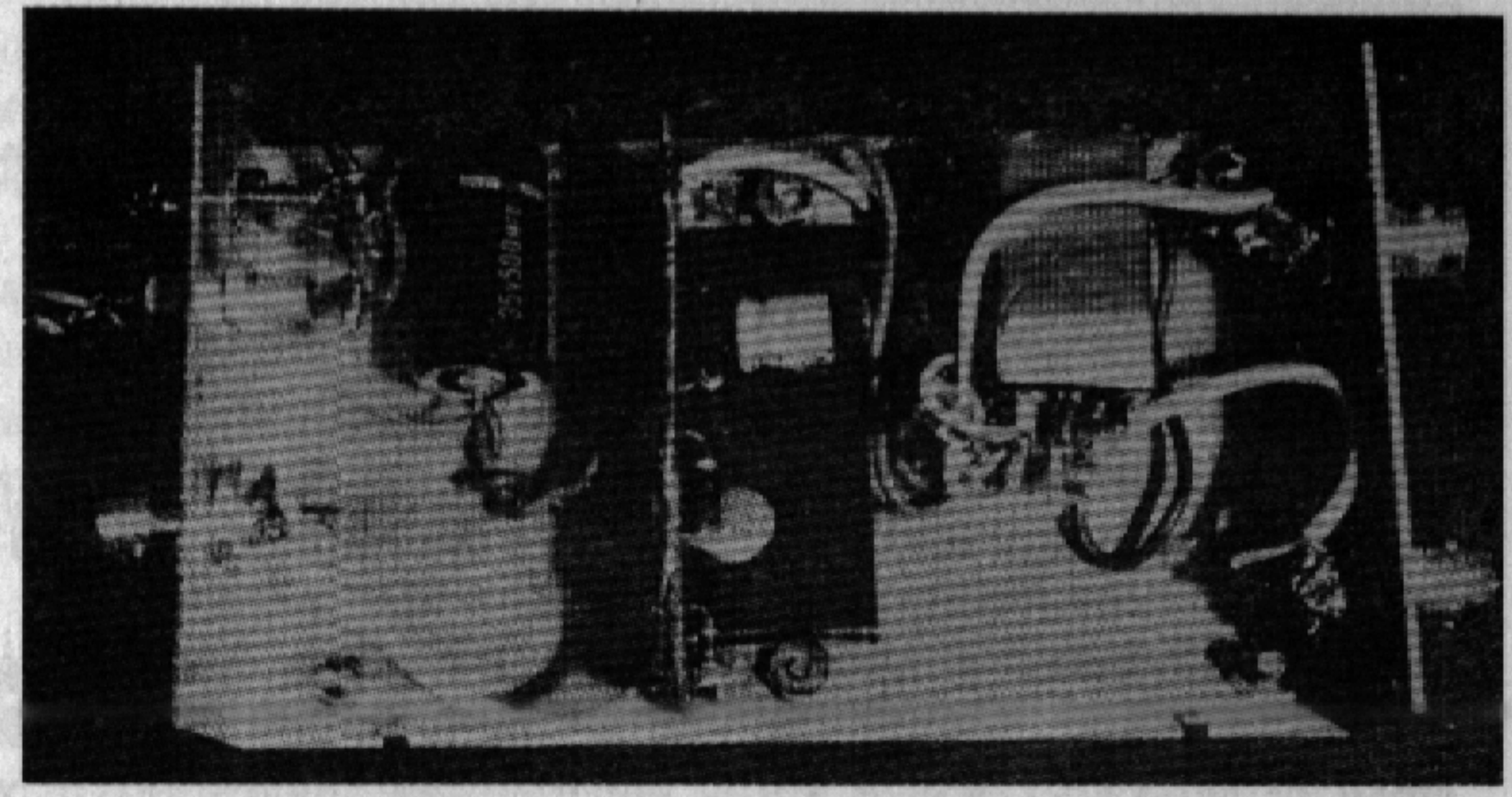


Fig. 6-60. Internal (bottom) view.

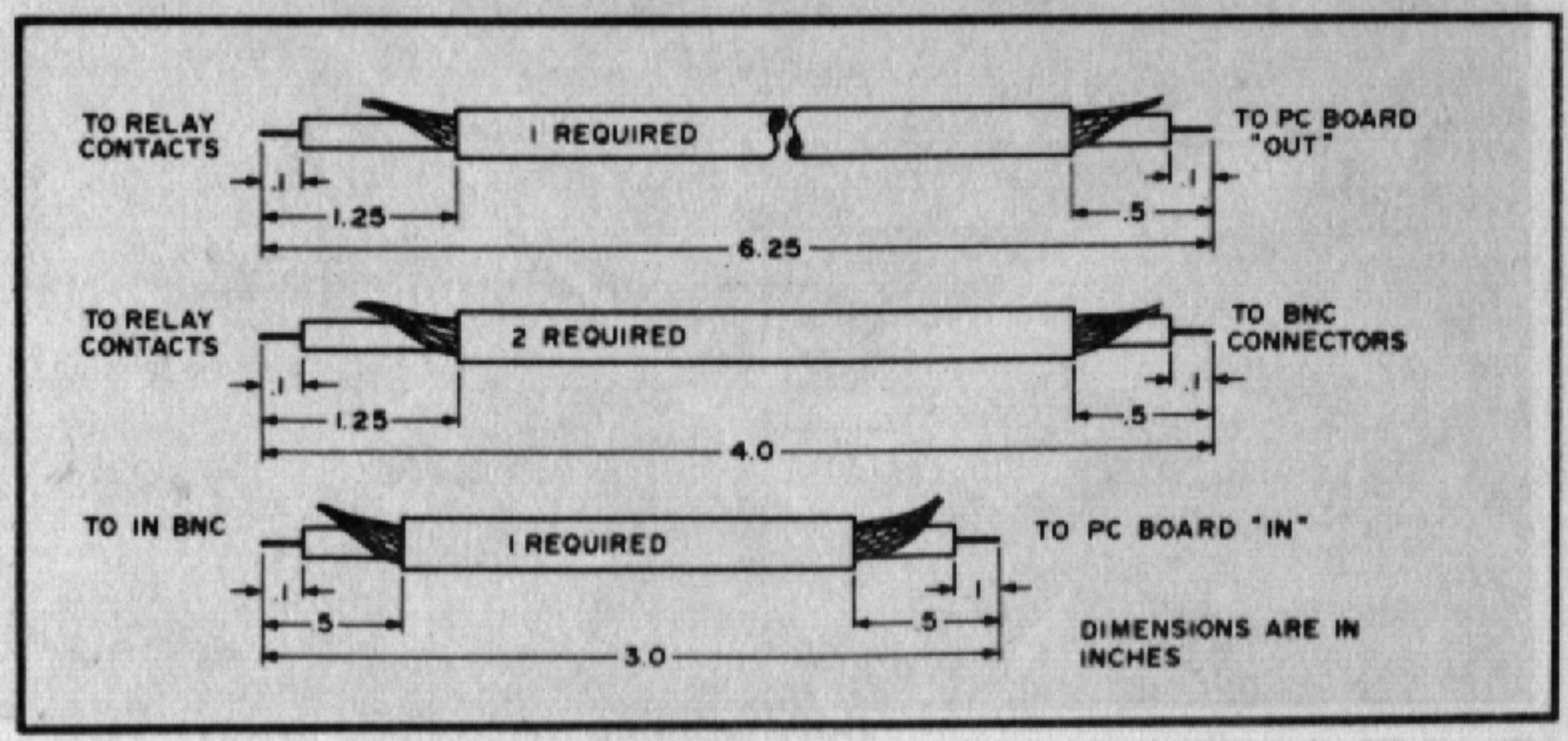
copper foil near the terminal thus creating a small loop. Solder a 4.7 pF capacitor between the grounded shield and the terminal (see Fig. 6-62). Solder the cable from BNC "A" to relay terminal B in like manner. In the same way, solder the cable from BNC "R" to the relay terminal immediately below terminal A. Again all shield lengths should be as short as possible. Also keep loops as close as possible to their respective capacitors.

16. Screw on bottom cover of chassis and label using stick-on lettering.

17. The amplifier is now complete (see Fig. 6-63).

Tune-Up With QRP Rig

Connect a short length of RG-58 coax from the "OUT" connector on the QRP transmitter to the "IN" connector of the amplifier.



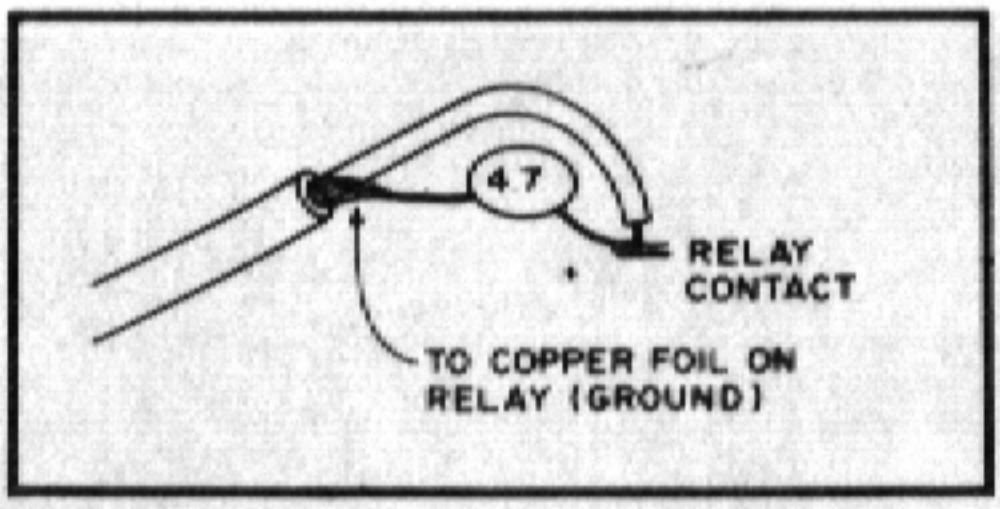


Fig. 6-62. Relay contact connection.

Also connect a through-line wattmeter and dummy load or antenna to the amplifier's output (BNC "A"). Apply 13.8 V dc from a regulated 4 amp continuous supply to both the amplifier and exciter.

Basically follow the tuneup procedure given in the QRP rig article. Of course, now you will be aiming for a good picture at about 10 watts instead of ¾ watts. The following suggestions may be of help:

☐ Remove the core from L6 on the exciter. Set the "L" (level) control fully counterclockwise. These actions will knock down the drive level which should make tune-up easier.

☐ Start with "C" (contrast) control fully clockwise.

☐ Adjust output modulation and power levels using the 4 variable capacitors in the exciter's output circuitry.

Don't rely too heavily on the picture you see on your local TV monitor since the 10 watt transmitter will probably overload it. Try to have an on-the-air station, remotely located, assist you. If you

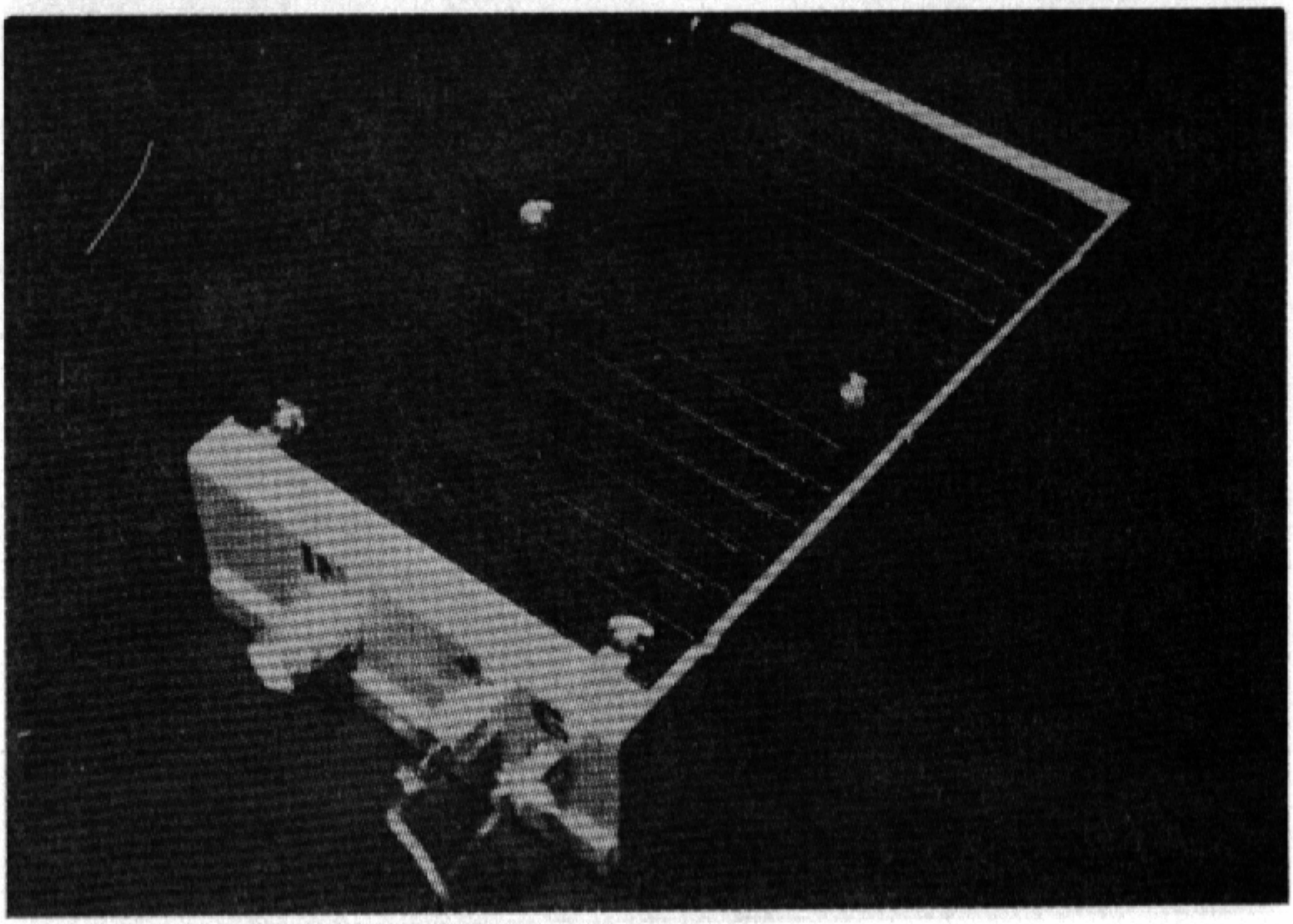


Fig. 6-63. Amplifier, top view.

use a coupler, detector and oscilloscope to tune up the rig, you may note a 15 to 20 MHz oscillation on the signal. It will generally not be observable on your TV monitor. To attenuate this parasitic signal, adjust L1 through L5 for minimum oscillation amplitude.

A complete ATV station is shown in Fig. 6-64. Be sure to use hardline and a good antenna for best performance. As explained in the QRP article, a separate receiver is required to derive audio from a signal using the audio-in-the-carrier format.

Important Design Notes

Amplifier power output is highly dependent upon power supply voltage. A 1 volt difference can result in a 3 watt difference in output power. To achieve a good video signal at 10 watts average power, 13.8 V dc must be used. Current drain will be slightly less than 3 amps. If the amplifier is driven hard into a class C mode (no video), it will be possible to initially obtain about 15 watts. You will note that as the amplifier warms up, the power output will drop. This is natural operation for the Motorola module. Also don't be alarmed if the heat sink and case get very warm. This, too, occurs in normal operation. If you should use the amplifier without video, try not to overdrive it. Use the minimum drive power necessary to achieve full output power (about 300 mW). You will generate fewer spurs while also reducing possible damage to the input of the 710 module. **Warning.** When exciting the amplifier, always make sure that BNC "A" is loaded. I smoke-tested the amplifier with about ¾ watts drive and no load and found that the amplifier self-destructed in 2 minutes. The MHW-710 is rugged and can handle short periods of misuse but don't overdo it.

When procuring the 710, you will note that two models are available: the 710-1 for 400-440 MHz and the 710-2 for 440-480 MHz. I have used both types and found that they perform equally well in the 435-450 MHz portion of the ham band.

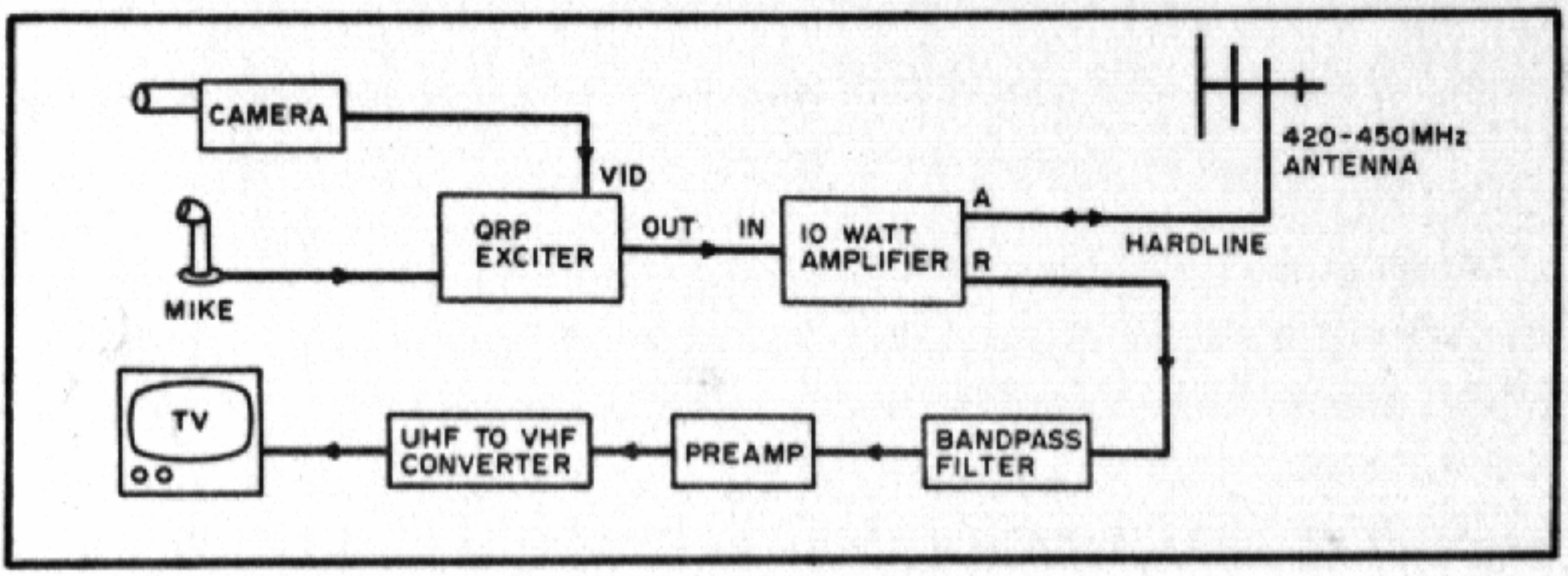


Fig. 6-64. Typical operational configuration.

If you can't get at least 15 watts from your amplifier at a cold start using 13.8 V dc, you may be experiencing high losses in the relay circuitry. To verify this, connect a cable directly from the wattmeter to "OUT" on the PC board. Normally the relay will exhibit a 1 watt loss in the 15 watt range. Relay efficiency is highly dependent upon the length of cable between the relay and PC and "OUT." If you do have a loss problem, experiment using different cable lengths.

The rig is placed in transmit by applying voltage to both the exciter and amplifier power terminals. This arrangement is rather unconventional for normal PTT use, but has been implemented here for simplicity. You may wish to use the spare set of relay contacts and mount additional feedthrough capacitors to achieve a standard switching scheme.