Transmitter Tune-Up for Blind Hams

— an audible indicator for power out

James D. Burney WA4LBX
42 E. Lakeside Drive
Florence AL 35630

Blind hams have used a variety of devices to tune their transmitters, with the conversion of visual indications to audio tones being the most common approach. A blind friend, W5KUY, recently asked me to build a coupler to insert in his coax to sample the rf voltage. This voltage would be used to drive a voltage-to-frequency converter. After looking at his converter with its three transistors and two transformers, I decided to build a more up-to-date version to go with the new coupler.

The audible tuning aid described in this article operates on the assumption that maximum power trans-

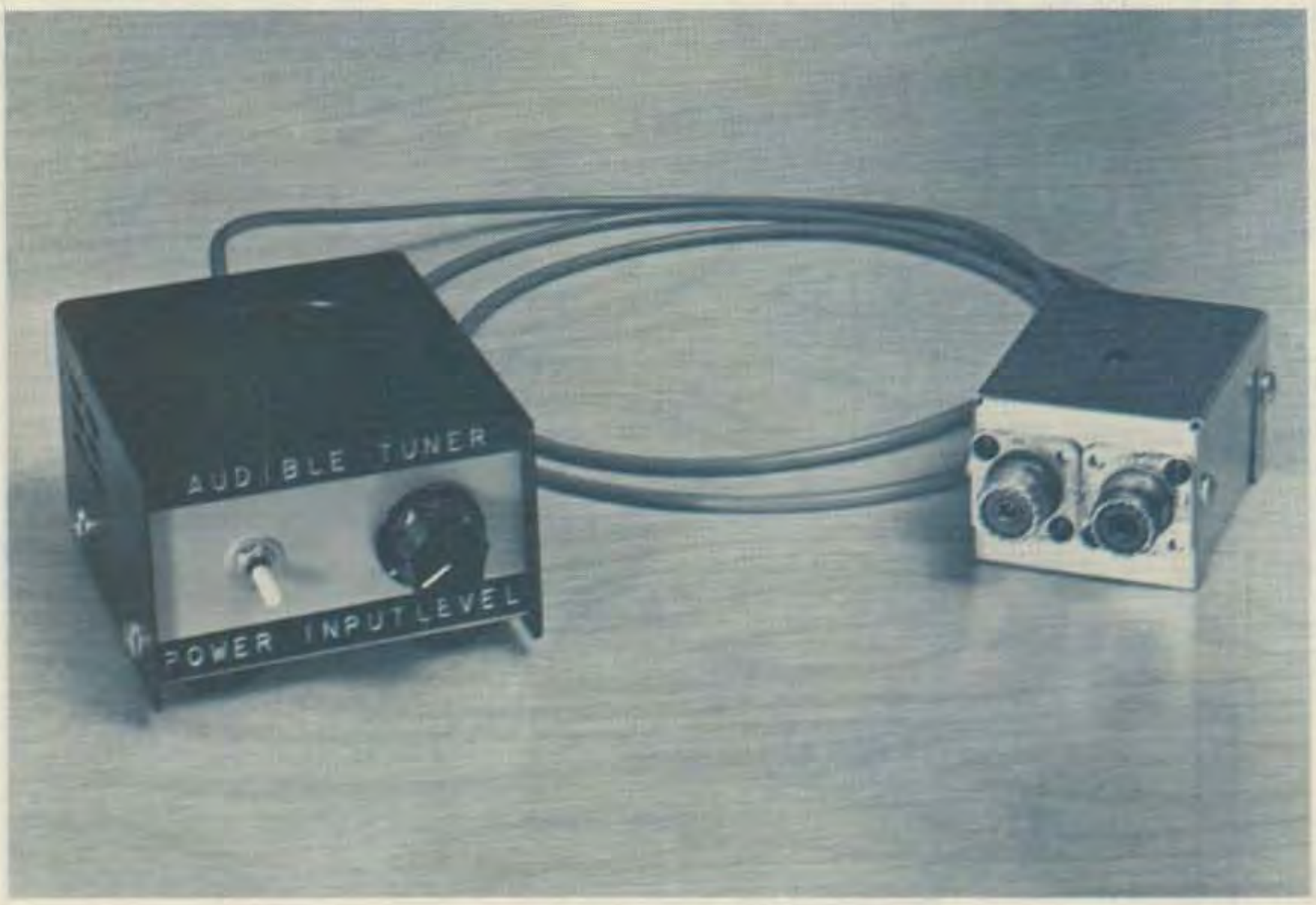

Photo A. Complete audible tuning aid.

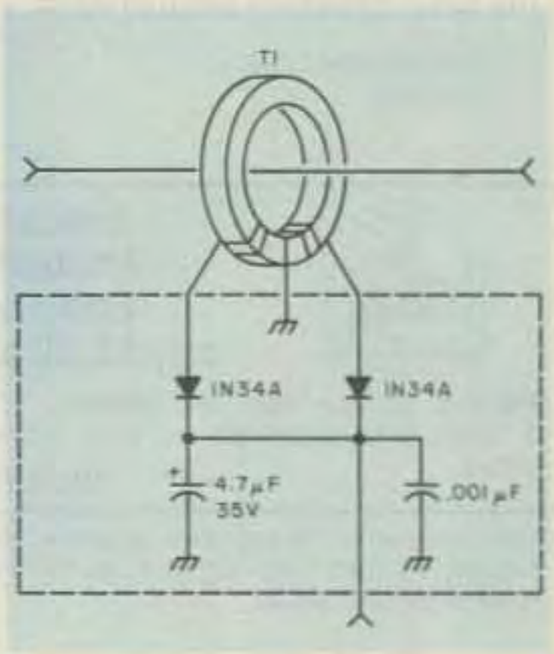

Fig. 1. Rf coupler. T1=60 bifilar turns #30 enameled wire, center-tapped, on an Amidon T-68-2 toroidal core (see text).

fer from the transmitter to the antenna will occur when the transmitter is properly tuned. Rf power is sampled by inserting a coupler similar to the ones found in wattmeters into the feedline following the transmitter or linear amplifier, if one is used. The coupler is connected by a length of shielded microphone cable to a voltage-to-frequency converter constructed around a 555 timer IC.

The circuit for the rf coupler is shown in Fig. 1. It is built in a 2-3/4" × 2-1/8" × 1-5/8" minibox. Two SO-239s are mounted next to each other in the small end of the box (Photo B). A two-inch length of center conductor and inner insulation from a piece of RG-8/U is prepared by removing a half inch of insulation from each end and bending the bare wire at right angles on each end, so that it fits into the center contacts of the SO-239s.

The rf transformer is wound on an Amidon T-68-2 core. To make the transformer, take two lengths of #30 enameled wire, each five feet long, and twist them together with about five turns per inch. Wind 60 turns of this twisted pair on the core. You will find that 30 turns will fill the core when the turns are evenly spaced. When these turns are on, continue winding the remaining 30 turns over the first layer until all 60 turns are in place. Trim the ends to about three inches and untwist them back to the core.

Scrape the insulation off of all four ends to within an inch of the core and locate the start and finish ends of each wire with an ohmmeter. Twist the start end of one wire and the finish end of the other together to form a center tap. Slip the toroid over the wire from the RG-8/U that you previously prepared; it should be a snug fit. You now have an rf transformer with the center wire constituting the primary and the secondary consisting of 120 turns, center-tapped.

Mount a three-lug terminal strip in the center of the large side of the box and an RCA phono jack and ground lug set in the end opposite the SO-239s. Solder the center wire of the transformer to the center terminals of the SO-239s. The center tap of the secondary is soldered to the center ground lug of the terminal strip, and the ends of the secondary are wrapped around the two insulated lugs.

A 1N34A diode is connected from each end of the secondary to the center terminal of the RCA jack, with the cathode band of each diode positioned toward the RCA jack. A 4.7-uF 35-volt electrolytic or tantalum capacitor and a .001 disc capacitor are also connected from the center of the jack to its ground lug, and all joints are soldered. This completes the coupler, and the other half of the minibox can be attached.

The voltage-to-frequency converter is housed in a utility box measuring 3-1/4" × 2-3/16" × 4". Fig. 2 shows the circuit of the converter. Voltages between 1.7 and 9 volts applied to pin 5 of the 555 timer IC cause the oscillation frequency to vary. With the values given, the frequency of oscillation will be about 10 kHz with less than 1.7 volts applied to pin 5. As the voltage is increased above 1.7 volts, the frequency of oscillation will decrease in a linear fashion until the voltage reaches 9 volts, at which point oscillation will stop.

Potentiometer R1 controls the voltage reaching pin 5. When R1 is adjusted to place maximum resistance between the wiper and ground, approximately 20 Watts of output power from the transmitter will begin to lower the audio tone from the converter, and 100 Watts will lower it to about 1 kHz. If higher power is used, adjustment of R1 will set the tone to a usable frequency.

All parts for the converter are mounted on a printed circuit board with the exception of R1, R2, the power switch, and the speaker. An etching pattern for the circuit board is shown in Fig. 3. Although I used a panel-mounted potentiometer for R2 (the volume control), a printed circuit type can be used with only a

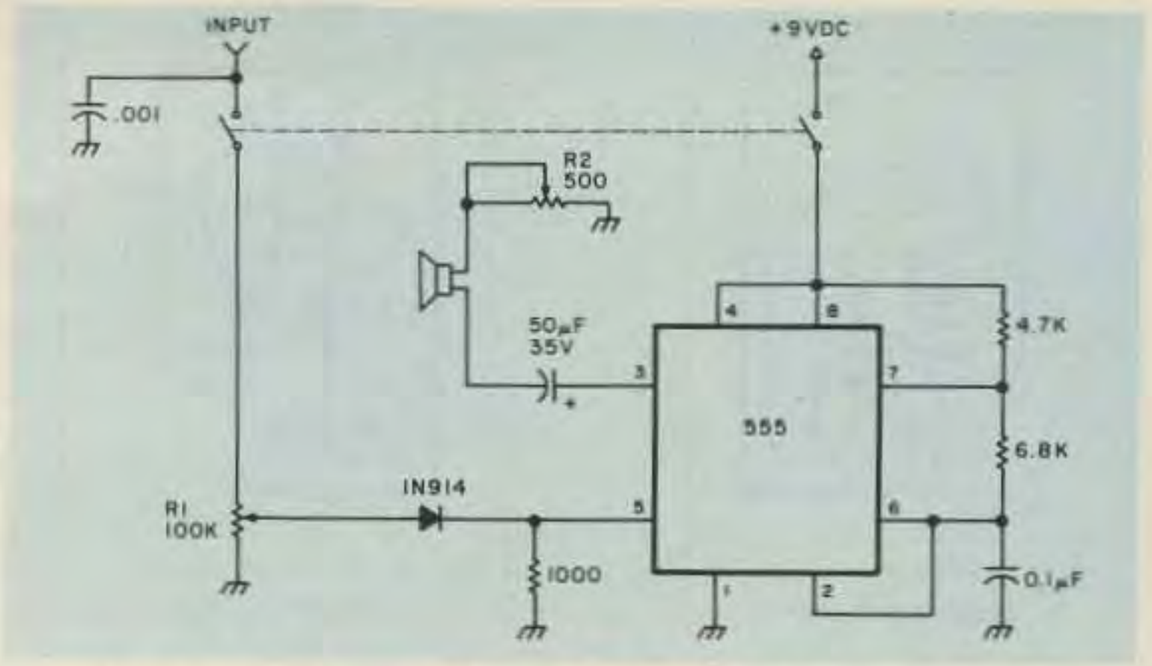

Fig. 2. Voltage-to-frequency converter schematic.

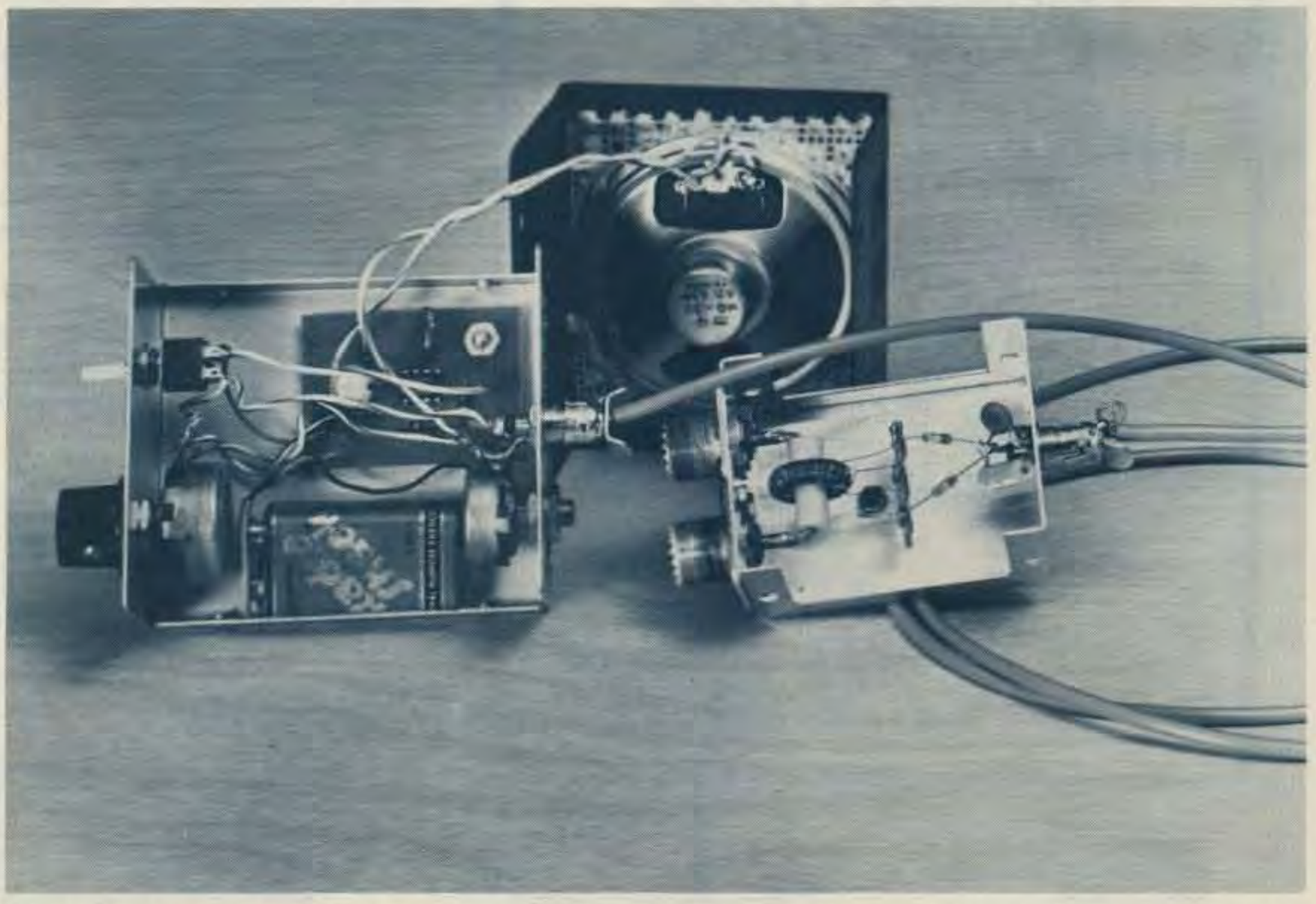

Photo B. Assembly details. Voltage-to-frequency converter is on left, rf coupler is on right.

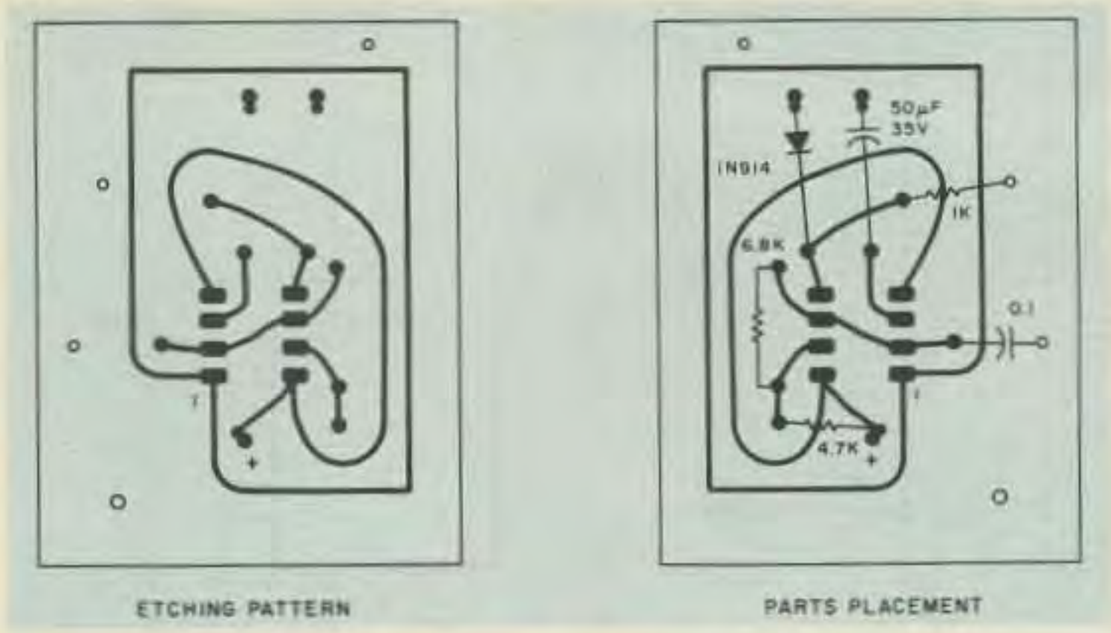

Fig. 3. PCB layout and parts placement.

minor modification to the circuit board. Input voltage from the coupler is through an RCA phono jack on the rear wall of the enclosure along with R2.

The DPDT switch shown is necessary to remove voltage from pin 5 of the IC when the converter is not in use. I failed to remove the input voltage while breadboarding the circuit, and the IC got very hot in a hurry. The resistors are all 1/4 Watt. C1 is mylar™ and C2 is either electrolytic or tantalum.

Since I did not want any bolt heads showing on the outside of the cover, I mounted the speaker by fastening it with hot-melt glue. I cut a 2" diameter hole in the cabinet top with a wing cutter in my electric drill. Next, I glued a piece of perforated aluminum to the inside of the cabinet, painted it, and then glued the speaker to the underside of the cabinet top.

I mounted the circuit board by removing the screw from the left rear foot of the cabinet and drilling out the hole to clear a 6-32 bolt. I then reattached the foot with a 1-inch-long 6-32 bolt and nut. I ran another nut about halfway down the bolt, put the circuit board on the bolt, and tightened a third nut on top of the board. Be sure to scrape the paint away from around the inside of all mounting holes to ensure good electrical contact. The battery is fastened down by making a loop of masking tape with the sticky side out and pressing it between the battery and the bottom of the cabinet.

As with any construction project today, finding the parts is a major part of the job. Most of the parts are available at Radio Shack, and I have added a parts list with Radio Shack part numbers where available to aid in locating the parts.

Operation of the audible tuning aid is very simple. Just insert the coupler in the antenna feedline and connect it to the converter with a shielded cable to prevent rf pickup. The coupler is non-directional, so either SO-239 may be connected to the transmitter input.

When the power switch is turned on, a high-pitched tone will be heard from the speaker. Adjust R2 for minimum usable volume to preserve battery life. Apply transmitter power and tune the transmitter for the lowest tone pitch from the tuning aid. For power levels up to 100 Watts or so, R1 should be set to minimum resistance between the input and pin 5 of the IC. If the tone stops during the tuning procedure, advance R1 until a high-pitched tone is reestablished. When further tuning of the transmitter results in no further lowering of the tone frequency, the transmitter is tuned for maximum output and is ready for use.

I hope this tuning aid will help amateurs with visual limitations to enjoy their hobby more. Other uses of the voltage-to-frequency converter can be made (such as audible voltmeters and other test instruments) with changes in the input circuitry. I would be interested in hearing of such uses which others find for the converter. ■

Parts List

Component	Radio Shack Part Number
50-uF, 35-volt capacitor	272-1027
0.1-uF dipped mylar™ capacitor	272-1069
0.001-uF disc ceramic capacitor	272-126
4.7-uF 35-volt capacitor	272-1012
100k-Ohm potentiometer	271-092
1000-Ohm, 1/4-Watt resistor	271-023
4700-Ohm, 1/4-Watt resistor	271-030
6800-Ohm, 1/4-Watt resistor	271-032
1N34A diodes	276-1123
1N914 diode	276-1122
555 IC	276-1723
DPDT switch	275-614
Battery clip	270-325
2-1/2" speaker	40-247
SO-239	278-201
RCA phono jacks	274-346
Minibox	270-235
Utility box	270-251

The T-68-2 toroid core is available from Amidon Associates, 12033 Otsego Street, North Hollywood CA 91607. Radio Shack does not stock a 500-Ohm panel-mount potentiometer. If the circuit board is modified for a PC-mount pot, part number 271-226 may be obtained from Radio Shack.