Radio FUNdamentals

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THINGS TO LEARN, PROJECTS TO BUILD, AND GEAR TO USE

Controlled Feeder Radiation

As every amateur knows, connecting a balanced, center-fed antenna to an unbalanced feedline results in some degree of feeder radiation. A good example is a coax line feeding a dipole (fig. 1[A]). And as every amateur also knows, this hookup will work okay, so why worry about it?

As far as the dipole goes, there's no big problem. One outcome of feeder radiation is that the classic figure-8 radiation pattern of the dipole is filled in by feedline radiation so that the result is a nearly omnidirectional pattern. That can be a big help for general all-around operation.

Since the coax outer shield is coupled to the antenna (directly at the feedpoint and indirectly by means of coupling between the coax and the antenna field), loading problems may develop. A modern, solid-state transmitter may not load properly unless the feedline is trimmed to a critical length. Moving the feedline about with respect to the antenna may help, too.

When the unbalanced coax is attached to a balanced beam (a Yagi, for example) the indirect feedline-to-antenna inductive coupling will tend to ruin the otherwise good front-to-back ratio of the beam on transmit and receive. This is all due to radiation and pickup from the outer shield of the line.

What to do? One solution is to use a balun between the feedline and the antenna (fig. 1[B]). Another solution is to make the coax line act as a sort of balun by grounding the shield of the line a quarter-wavelength below the antenna feedpoint (fig. 1[C]).

Use Feedline Radiation To Your Advantage

It is possible to make use of feedline radiation, as pointed out by B. Sykes, G2HGC, in the May 1990 issue of *Radio Communication,* an RSGB publication. He notes that using feedline radiation to fill in antenna pattern nulls can easily be achieved by moving the balun down the feeder a quarter-wave from the antenna feedpoint. This permits radiation from the top part of the feedline, while the balun stops the radiation from the rest of the line (fig. 2). He calls this technique "Controlled Feeder Radiation" (CFR) and notes that it depends upon radiation from the outer shield of the coax, which does not occur with balanced feeders or from a feeder-balun combo such as shown in fig. 1(B).

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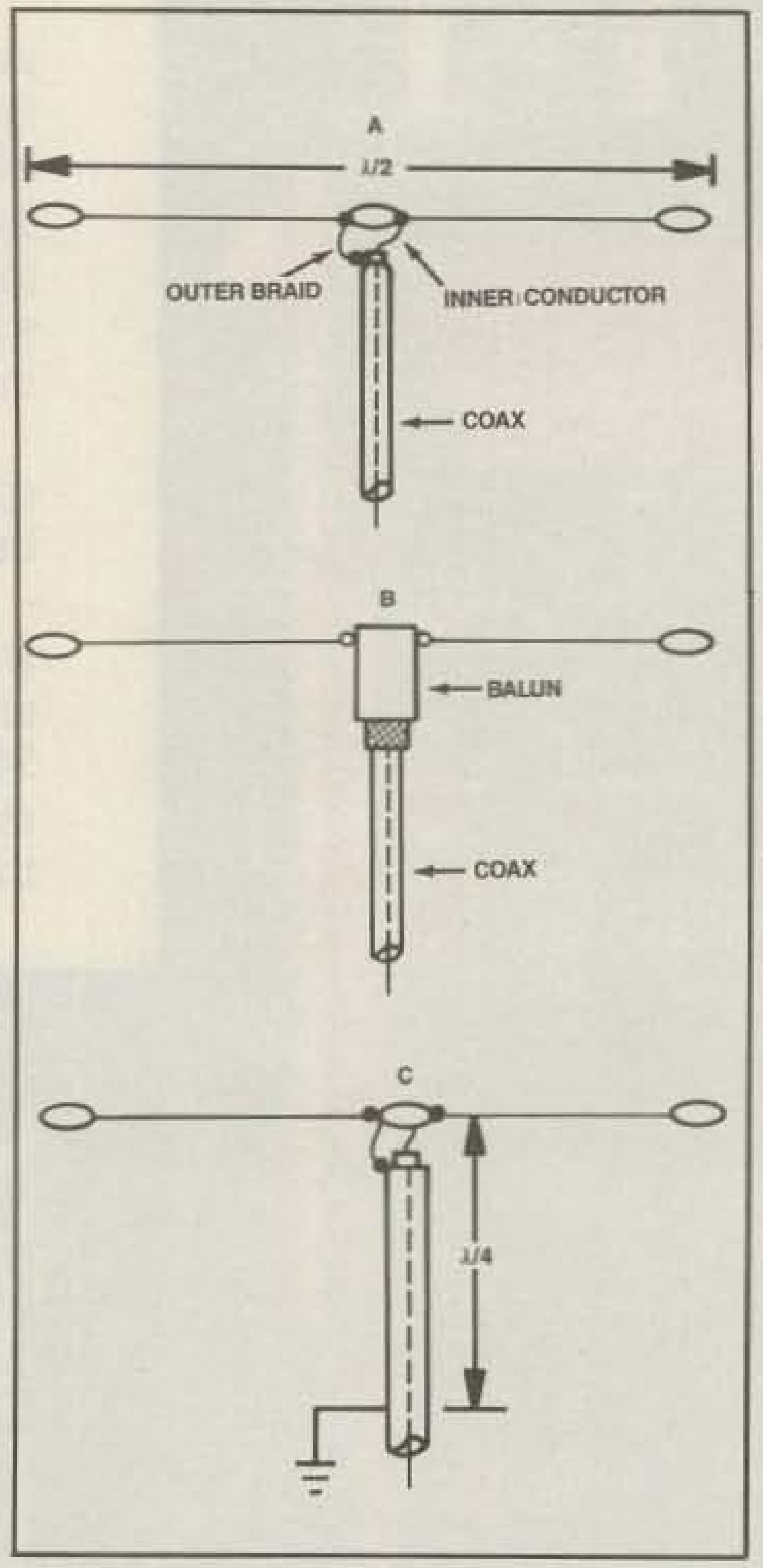

Fig 1- (A) Direct coax feed, (B) balun feed, and (C) quarter-wave grounding.

G2HGC's antenna is shown in fig. 2. It is a dipole with the balun placed 0.275 wavelength below the feedpoint. This provides an omnidirectional, vertical polarized pattern radiator combined with the standard figure-8 pattern of the dipole. The low-angle, vertical radiation is a considerable bonus, being achieved without the need for an expensive and complicated system of ground radials.

A simple variation of this idea is shown in fig. 3(A). This consists of a horizontal, end-fed quarter-wave element combined with a vertical CFR section. The antenna radiates vertically and horizontally polarized energy to produce a virtually omnidirectional signal. Straightening out this antenna results in a very useful low-impedance end-fed dipole which may be strung conveniently from the upstairs window of your station to a nearby tree (fig. 3[B]).

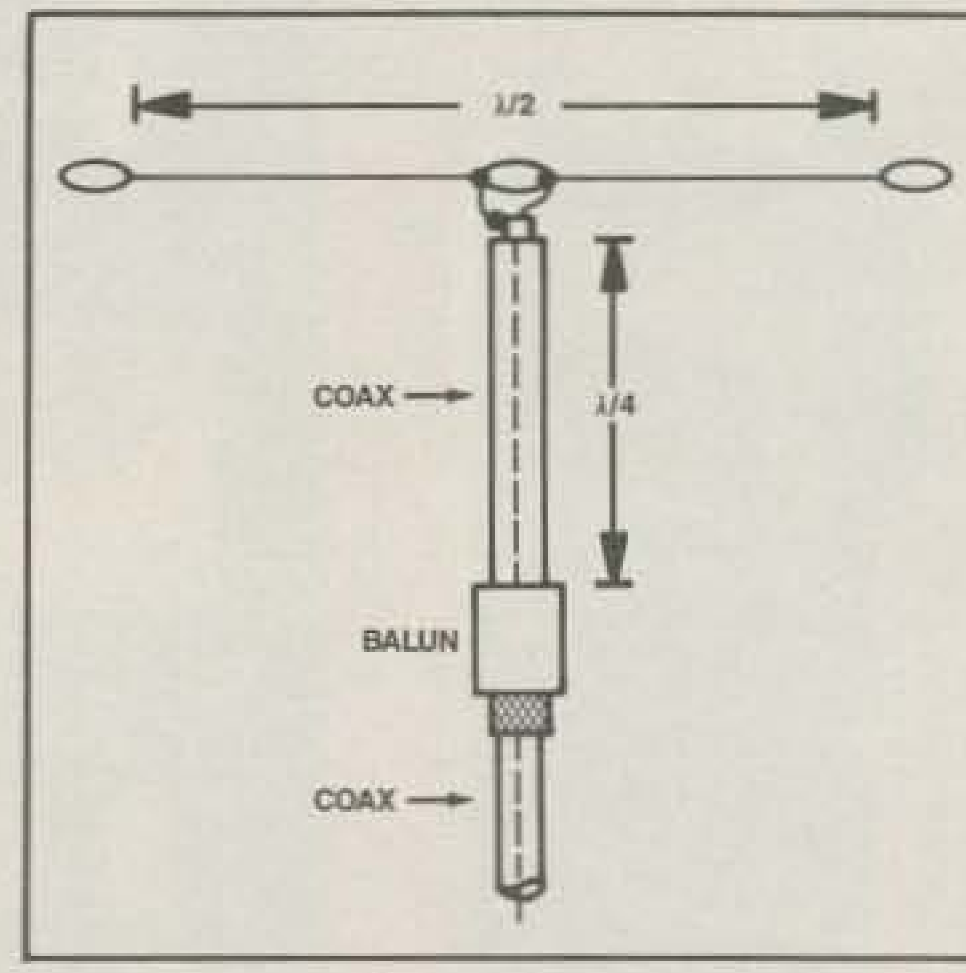

Fig. 2- The G2HCG adaptation of fig. 1(C) for controlled feeder radiation. Use 1-to-1 balun.

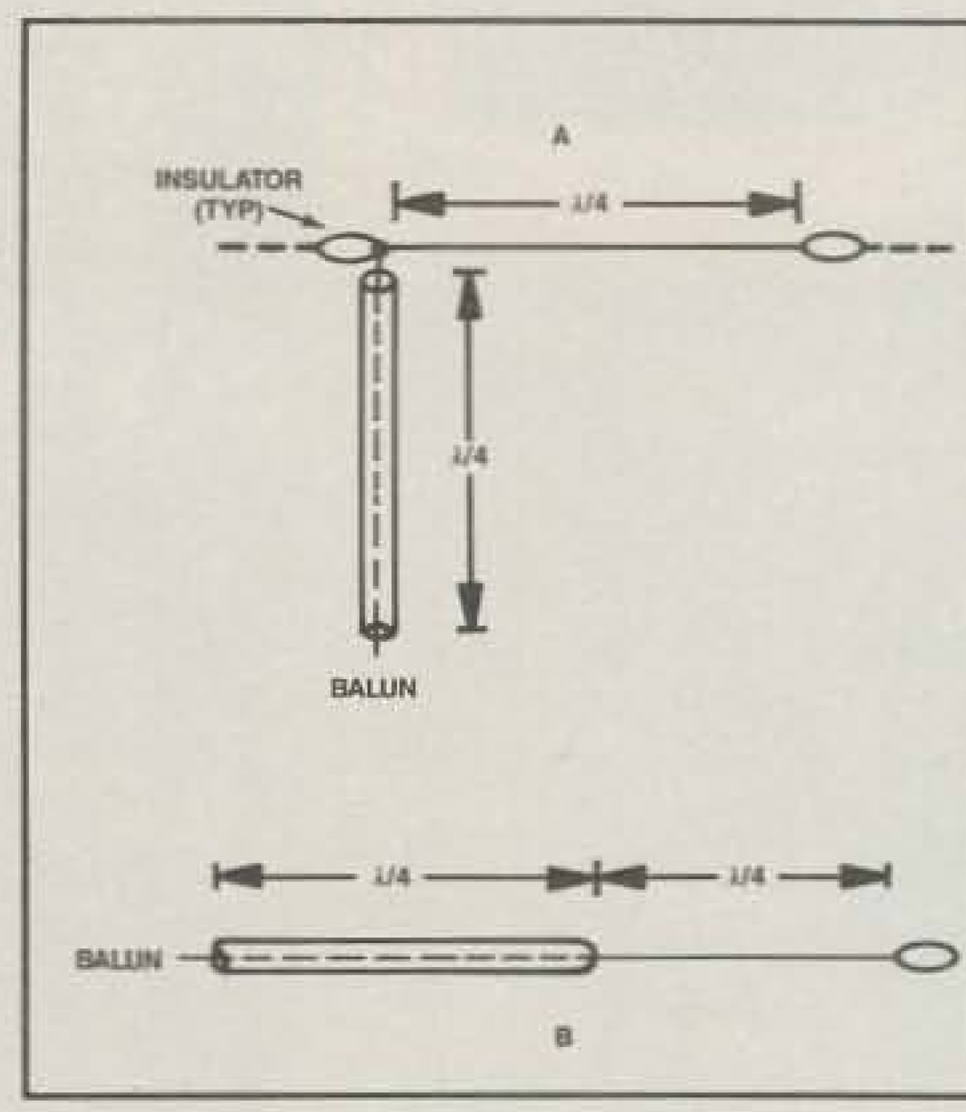

Fig. 3- (A) End-fed quarter-wave wire plus controlled radiation feeder. (B) End-fed half-wave dipole antenna.

The CFR "Bobtail" Beam And Other Ideas

The well-known Bobtail Beam of W6BCX

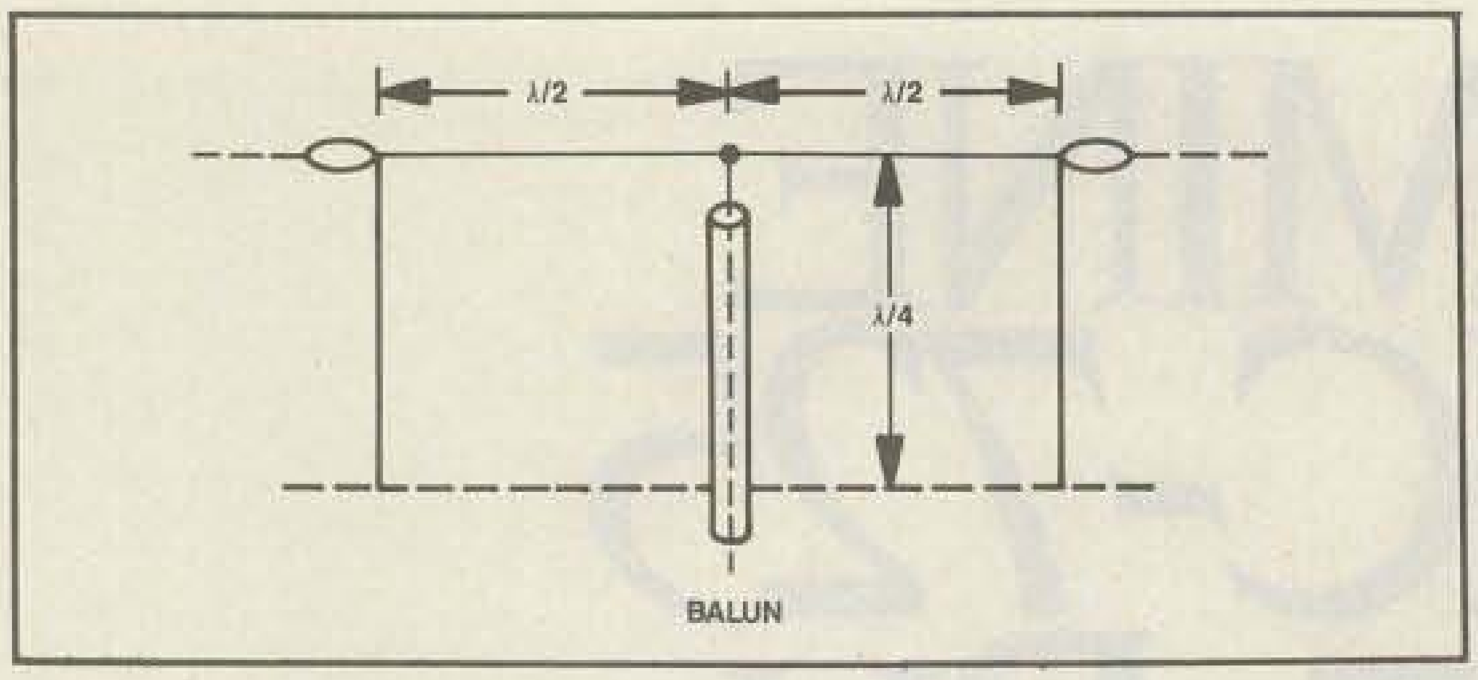

Fig. 4– The W6BCX Bobtail Beam with CFR feed system.

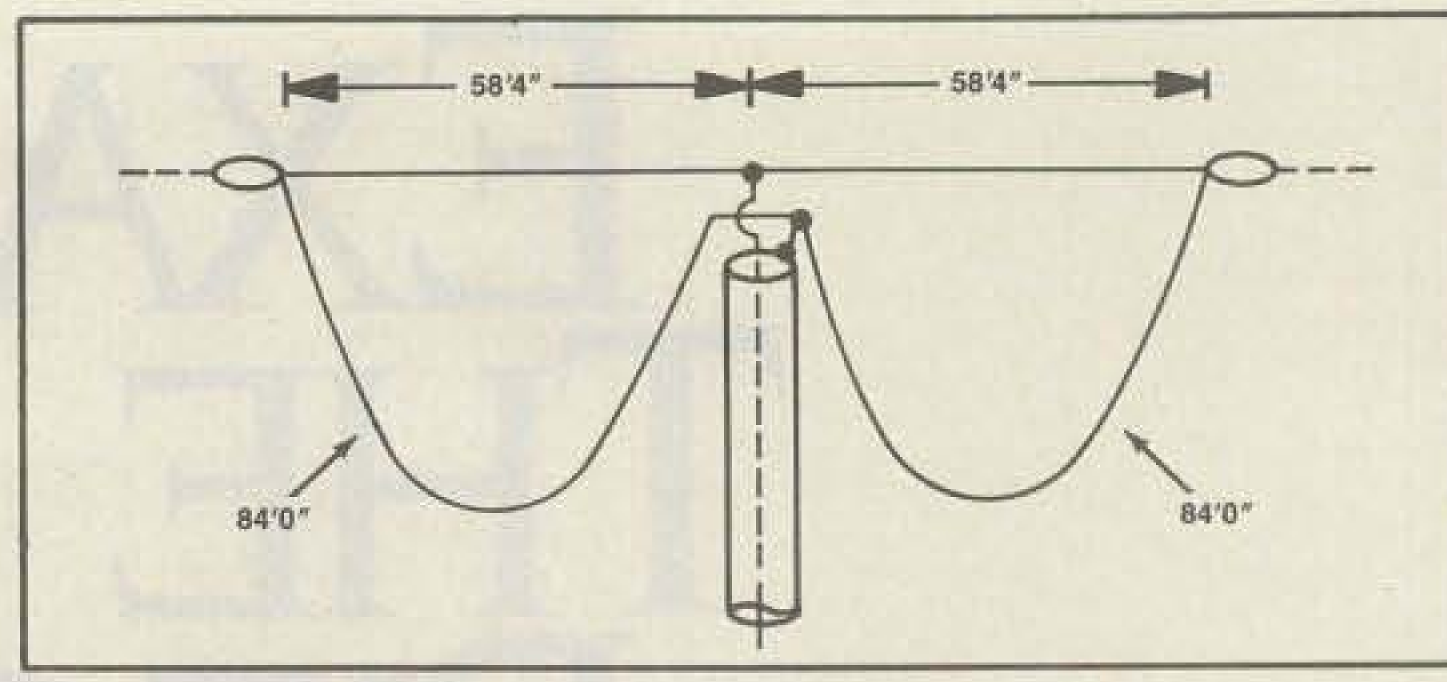

Fig. 5– Catenary double-loop quad for 40 meters.

can be modified for CFR feed (fig. 4). The standard Bobtail is end-fed at the high-impedance point at the bottom of the central radiator. This calls for a resonant, link-coupled tuner. The tuner is eliminated in the CFR design, the coax section taking the place of the tuner.

If the operator is willing to use a Transmatch at the station, he or she might consider the "Carolina Windom" design of Jim Thompson, W4THU. Jim combines a multiband Windom with a controlled radiation feeder to produce an antenna that has a generally omnidirectional pattern on all the HF bands. (More info on this can be obtained from him at Box 6159, Portsmouth, VA 23703.)

The Catenary Double-Quad Loop Antenna

A few years ago Ron MacDonald, W3GKZ/ZS5AAU, publicized an interesting 40 meter wire antenna (fig. 5). It consists of two loops in phase with their adjacent corners touching. The common top of the loops is a single horizontal wire about the length of an 80 meter dipole. The loops are suspended from this wire. They are not tied down, as the free-hanging catenary shape results in maximum area within the loop, which is directly related to the gain.

Ron has tried a balun at the feedpoint, but has not noted any change in performance when it is removed. Since the weight of the wires and coax is considerable, the balun was omitted.

The radiation pattern of this antenna is bidirectional, at right angles to the plane of the loops. As an added bonus, the an-

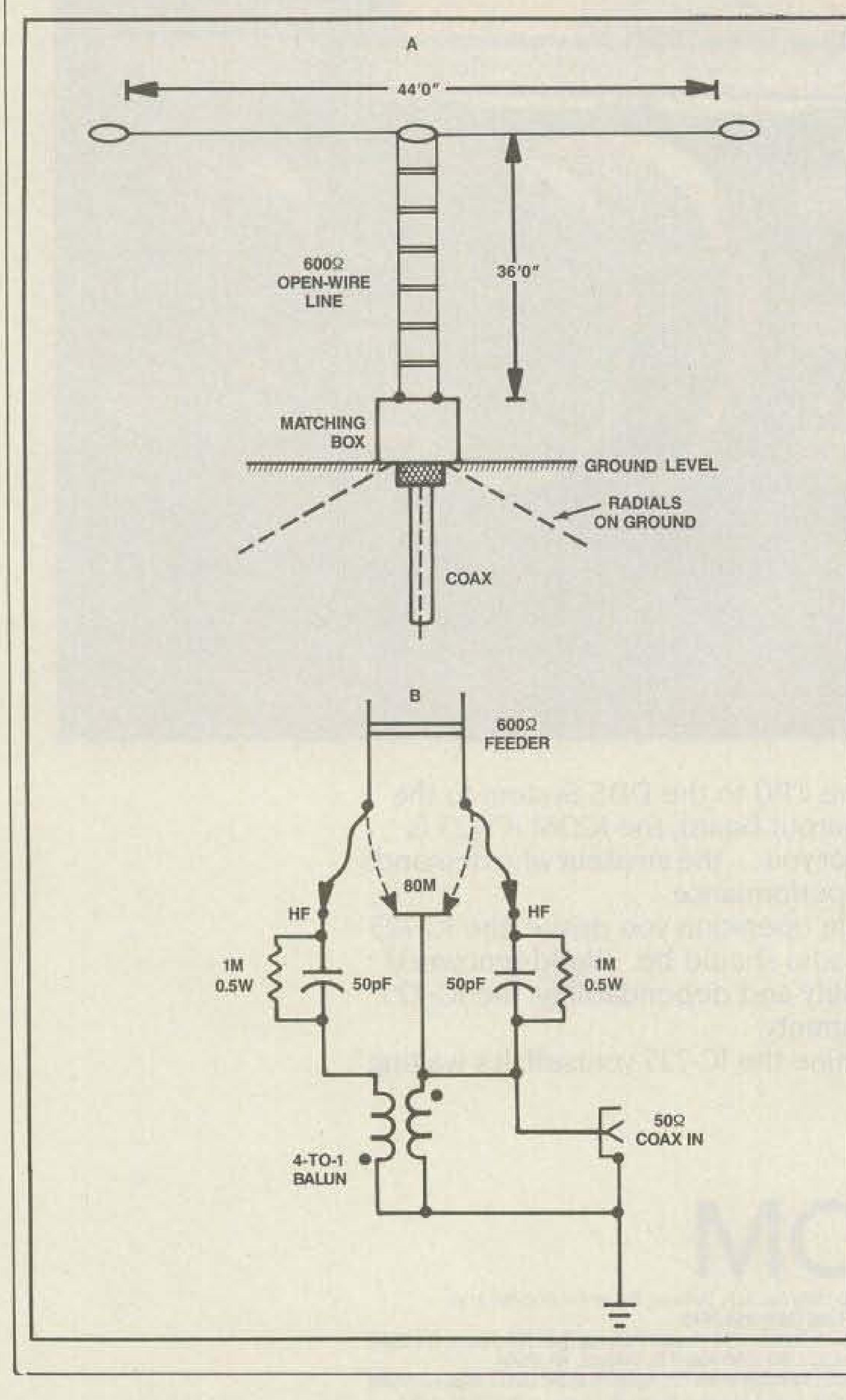

Fig. 6– (A) Multiband HF antenna of G3LNP. (B) Matching box for changing between 80 meters and the HF bands.

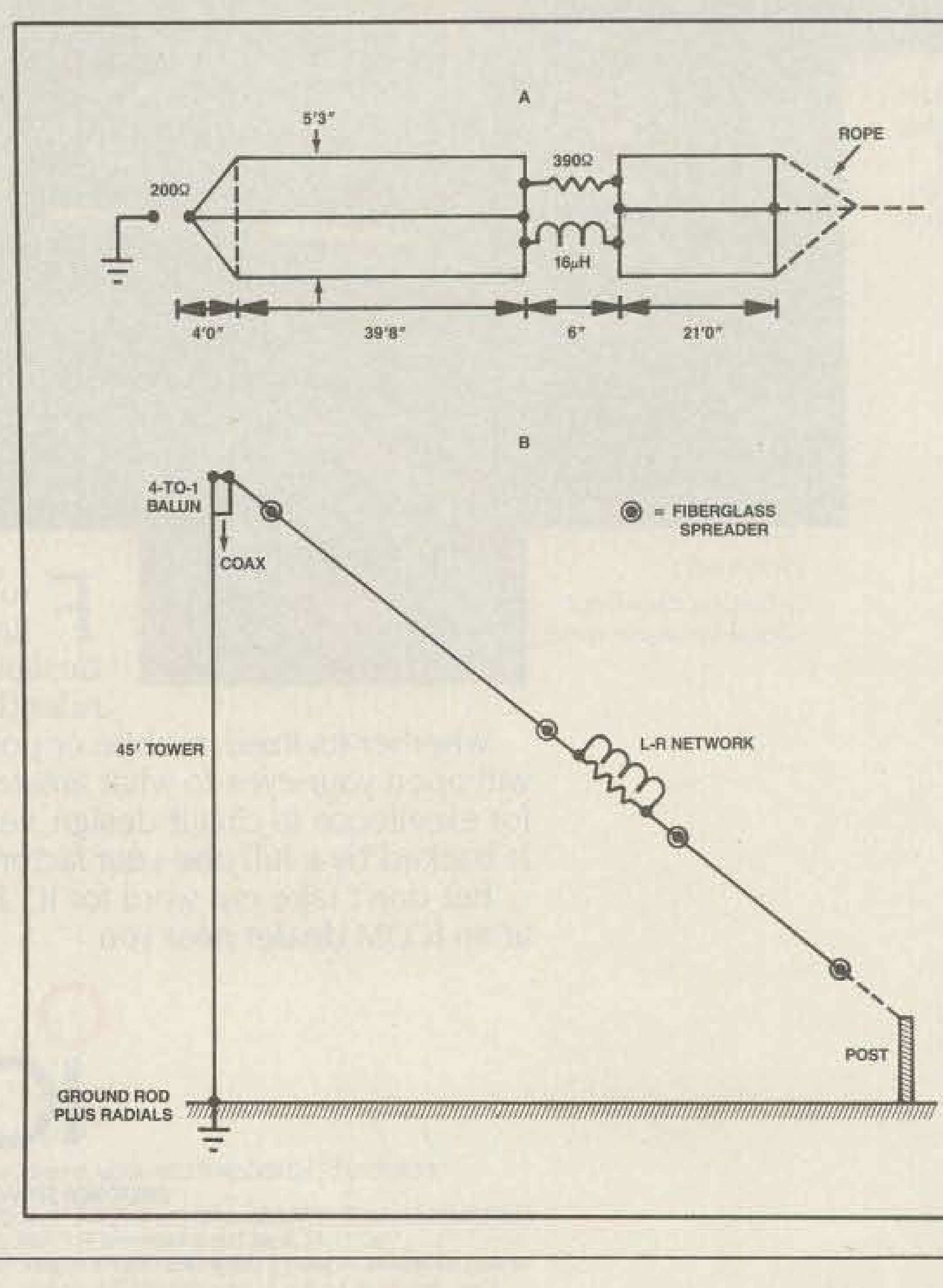

Fig. 7– (A) Electrical configuration of a sloper. (B) Plan view—L is 16 uH, 35 turns, 10 turns per inch, 2½ inch diameter.

tenna also works very well on 20 meters. SWR is below 1.5-to-1 on both bands, according to Ron. For optimum results he suggests that the antenna supports should be at least 35 feet high.

The G3LNP Multiband Antenna

Tony Preedy, G3LNP, has developed an interesting center-fed antenna that works well on the 80, 40, 20, 15, and 10 meter bands (fig. 6). This antenna was described in the March 1989 issue of *Radio Communication* (RSGB).

On 80 meters the feeders are strapped together and the antenna becomes a T-loaded quarter-wave vertical working against ground radials. Performance in this mode is dependent upon ground conductivity and the radial system. In Tony's case going from two copper ground rods and four 45 foot radials to 16 radials boosted his signal 3 dB at a point about a half-mile from the antenna.

The matching box at the base of the two-wire feeder contains a 4-to-1 ferrite balun and two 50 pF series capacitors. One megohm resistor is placed across the capacitors in order to prevent the buildup of static charges. Copper "crocodile clips" are used to manually switch between 80 meter and HF operation. The capacitors are adjusted for lowest SWR in the 40 meter band.

A Broadband HF Sloper Antenna

The "Australian Dipole" is a commercial antenna developed and sold in VK-land. It is a center-fed affair and covers 3 to 30 MHz. It is fed with coax and a 4-to-1 balun and provides less than 2.5-to-1 SWR across the operating range. (It is described in my *Antenna Handbook*, pp. 153–154, available from the *CQ* Bookstore.)

The antenna is a rather largish affair and takes up a lot of space. Rick Hill, ZL1BKR, has adapted this design into a half-length sloper that can be hung from a 45 foot tower (fig. 7).

He uses this antenna on 80, 40, 30, and 20 meters without a tuner. The SWR is less than 1.5-to-1 on all bands. The antenna is fed through a 4-to-1 balun, the opposite side of the balun being grounded to the tower.

The antenna is made of three wires held in position by four fiberglass spreader rods about 5½ feet long. The wires are connected together at the feedpoint and by jumper wires at the three lower spreaders. Insulators between the middle spreaders take the strain off the coil assembly. The coil is enclosed in a plastic container with the resistor through the center of the coil.

Rich notes there is a peak in SWR around 17.5 MHz, and a tuner is required for operation on the 18 and 15 meter bands, as his solid-state transceiver will not develop full output on those bands due to excessive SWR. He also says the antenna is great for DX, as he has worked into the US on 3.8 MHz barefoot. He uses a ground rod at the base of the tower and feels that an improvement on 80 meters may be gained if more radials are added.

Shop Talk

From time to time I hope to include topics of general interest to the equipment builder and experimenter. Sometimes nifty little devices will be discussed. Other times we will publish questions raised by readers that I can't answer. Perhaps others can answer these little problems. Okay? Here we go!

Weatherproofing Coaxial Connec-

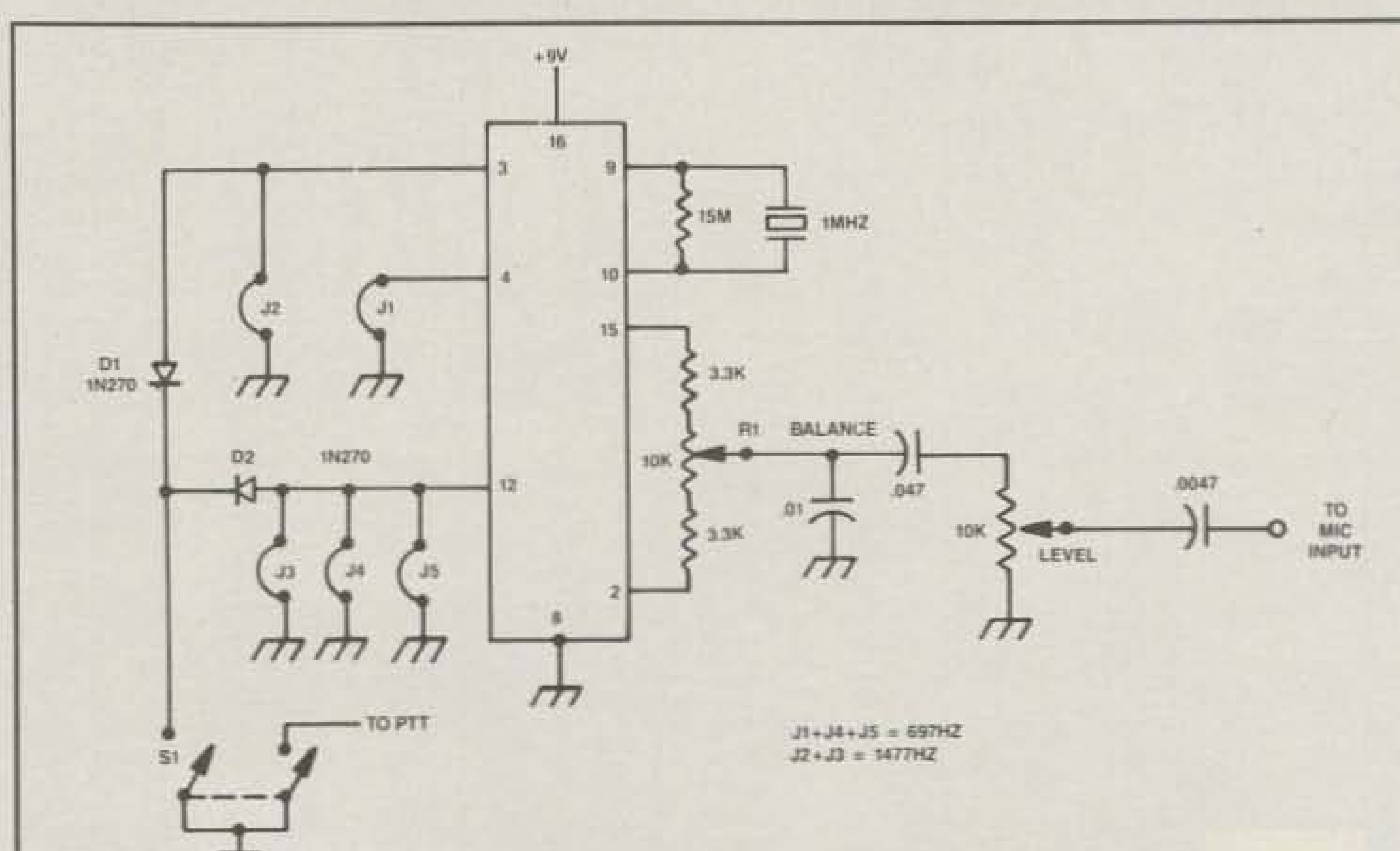

Fig. 8– Two-tone audio generator. J1–5 are jumpers. Adjust R1 for equal tone balance (equal transmitter power output).