Chapter 15

Portable Antennas

For many amateurs, the phrase "portable antennas" may conjure visions of antenna assemblies that can be broken down and carried in a backpack, suitcase, golf bag, or what-have-you, for transportation to some out-of-the way place where they will be used. Or the vision could be of larger arrays that can be disassembled and moved by pickup truck to a Field Day site, and then erected quickly on temporary supports. Portable antennas come in a wide variety of sizes and shapes, and can be used on any amateur frequency.

Strictly speaking, the phrase "portable antenna" really means *transportable antenna*—one that is moved to some (usually temporary) operating position for use. As such, portable antennas are not placed into service when they are being transported. This puts them in a different class from mobile antennas, which are intended to be used while in motion. Of course this does not mean that mobile antennas cannot be used during portable operation. Rather, true portable antennas are designed to be packed up and moved, usually with quick reassembly being one of the design requisites. This chapter describes antennas that are designed for portability. However, many of these antennas can also be used in more permanent installations.

Any of several schemes can be employed to support an antenna during portable operation. For HF antennas made of wire, probably the most common support is a conveniently located tree at the operating site. Temporary, lightweight masts are also used. An aluminum extension ladder, properly guyed, can serve as a mast for Field Day operation. Such supports are discussed in Chapter 22.

A SIMPLE TWIN-LEAD ANTENNA FOR HF PORTABLE OPERATION

The typical portable HF antenna is a random-length wire flung over a tree and end-fed through a Transmatch. Low power Transmatches can be made quite compact, but each additional piece of necessary equipment makes portable operation less attractive. The station can be simplified by using resonant impedance-matched antennas for the bands of interest. Perhaps the simplest antenna of this type is the half-wave dipole, center-fed with 50 or 75-Ω coax. Unfortunately, RG-58, RG-59 or RG-8 cable is quite heavy and bulky for backpacking, and the miniature cables such as RG-174 are too lossy.

A practical solution to the coax problem, developed by Jay Rusgrove, W1VD, and Jerry Hall, K1TD, is to use folded dipoles made from lightweight TV twin-lead. The characteristic impedance of this type of dipole is near 300 Ω, but this can easily be transformed to a 50-Ω impedance. The transformation is obtained by placing a lumped capacitive reactance at a strategic distance from the input end of the line. **Fig 1** illustrates the construction method and gives important dimensions for the twin-lead dipole. The twin-lead is shorted at each end of the dipole.

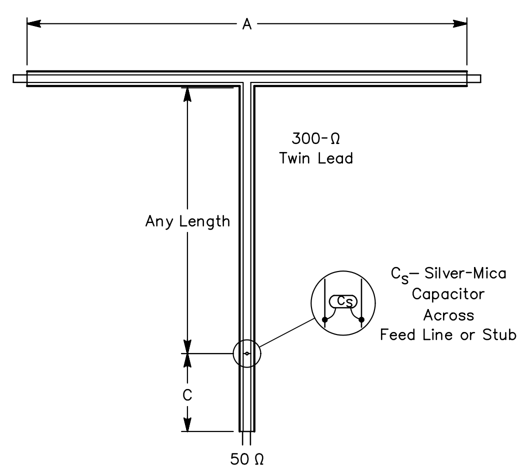

Fig 1—A twin-lead folded dipole makes an excellent portable antenna that is easily matched to 50-Ω equipment. See text and Table 1 for details.

A silver-mica capacitor is shown for the reactive element, but an open-end stub of twin-lead can serve as well, provided it is dressed at right angles to the transmission line for some distance. The stub method has the advantage of easy adjustment of the system resonant frequency.

The dimensions and capacitor values for twin-lead dipoles for the HF bands are given in **Table 1**. To preserve the balance of the feeder, a 1:1 balun must be used at the end of the feed line. In most applications the balance is not critical, and the twin-lead can be connected directly to a coaxial output jack—one lead to the center contact, and one lead to the shell.

Because of the transmission-line effect of the shorted radiator sections, a folded dipole exhibits a wider bandwidth than a single-conductor type. The antennas described here are not as broad as a standard folded dipole because the impedance-transformation mechanism is frequency selective. However, the bandwidth should be adequate. An antenna cut for 14.175 MHz, for example, will present an SWR of less than 2:1 over the entire 14-MHz band.

Table 1
Twin-Lead Dipole Dimensions and Capacitor Values

Frequency	*Length A*	*Length C*	*C_S*	*Stub Length*
3.75 MHz	124′ 9½″	13′ 0″	289 pF	37′ 4″
7.15	65′ 5½″	6′ 10″	151 pF	19′ 7″
10.125	46′ 2½″	4′ 10″	107 pF	13′ 10″
14.175	33′ 0″	3′ 5½″	76 pF	9′ 10½″
18.118	25′ 10″	2′ 8½″	60 pF	7′ 9″
21.225	22′ ½″	2′ 3½″	51 pF	6′ 7″
24.94	18′ 9″	1′ 11½″	43 pF	5′ 7½″
28.5	16′ 5″	1′ 8½″	38 pF	4′ 11″

ZIP-CORD ANTENNAS

Zip cord is readily available at hardware and department stores, and it's not expensive. The nickname, zip cord, refers to that parallel-wire electrical cord with brown or white insulation used for lamps and many small appliances. The conductors are usually #18 stranded copper wire, although larger sizes may also be found. Zip cord is light in weight and easy to work with.

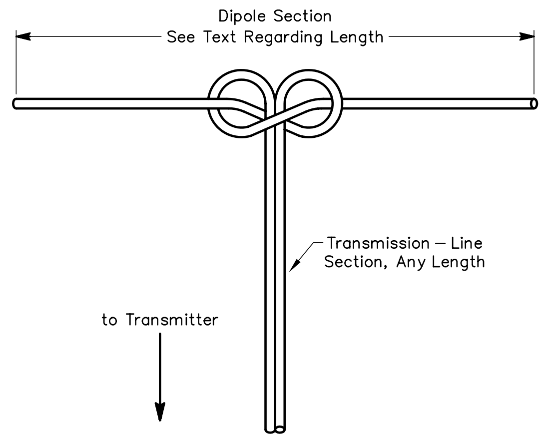

Fig 2—This electrician's knot, often used inside lamp bases and appliances in lieu of a plastic grip, can also serve to prevent the transmission-line section of a zip-cord antenna from unzipping itself under the tension of dipole suspension. To tie the knot, first use the right-hand conductor to form a loop, passing the wire behind the unseparated zip cord and off to the left. Then pass the left-hand wire of the pair behind the wire extending off to the left, in front of the unseparated pair, and thread it through the loop already formed. Adjust the knot for symmetry while pulling on the two dipole wires.

For these reasons, zip cord can be pressed into service as both the transmission line and the radiator section for an emergency dipole antenna system. This information by Jerry Hall, K1TD, appeared in *QST* for March 1979. The radiator section of a zip-cord antenna is obtained simply by "unzipping" or pulling the two conductors apart for the length needed to establish resonance for the operating frequency band. The initial dipole length can be determined from the equation $\ell = 468/f$, where ℓ is the length in feet and f is the frequency in megahertz. (It would be necessary to unzip only half the length found from the formula, since each of the two wires becomes half of the dipole.) The insulation left on the wire will have some loading effect, so a bit of length trimming may be needed for exact resonance at the desired frequency.

For installation, you may want to use the electrician's knot shown in **Fig 2** at the dipole feed point. This is a "balanced" knot that will keep the transmission-line part of the system from unzipping itself under the tension of dipole suspension. This way, if zip cord of sufficient length for both the radiator and the feed line is obtained, a solder-free installation can be made right down to the input end of the line. (Purists may argue that knots at the feed point will create an impedance mismatch or other complications, but as will become evident in the next section, this is not a major consideration.) Granny knots (or any other variety) can be used at the dipole ends with cotton cord to suspend the system. You end up with a light-weight, low-cost antenna system that can serve for portable or emergency use.

But just how efficient is a zip-cord antenna system? Since it is easy to locate the materials and simple to install, how about using such for a more permanent installation? On casual examination, zip cord looks about like 72-Ω balanced feed line. Does it work as well?

Zip Cord as a Transmission Line

In order to determine the electrical characteristics of zip cord as a radio-frequency transmission line, a 100-foot roll was subjected to tests in the ARRL laboratory with an RF impedance bridge. Zip cord is properly called parallel power cord. The variety tested was manufactured for GC Elec-tronics, Rockford, IL, being 18 gauge, brown, plastic-insulated type SPT-1, GC cat. no. 14-118-2G42. Undoubtedly, minor variations in the electrical characteristics will occur among similar cords from different manufacturers, but the results presented here are probably typical.

The characteristic impedance was determined to be 107 Ω at 10 MHz, dropping in value to 105 Ω at 15 MHz and to a slightly lower value at 29 MHz. The nominal value is 105 Ω at HF. The velocity factor of the line was determined to be 69.5%.

Who needs a 105-Ω line, especially to feed a dipole? A dipole in free space exhibits a feed-point resistance of 73 Ω, and at heights above ground of less than $^1/_4$ wavelength the resistance can be even lower. An 80-meter dipole at 35 feet over average soil, for example, will exhibit a feed-point resistance of about 35 Ω. Thus, for a resonant antenna, the SWR in the zip-cord transmission line can be 105/35 or 3:1, and maybe even higher in some installations. Depending on the type of transmitter in use, the rig may not like working into the load presented by the zip-cord antenna system.

But the really bad news is still to come—line loss! **Fig 3** is a plot of line attenuation in decibels per hundred feet of line versus frequency. Chart values are based on the assumption that the line is perfectly matched (sees a 105-Ω load as its terminating impedance).

In a feed line, losses up to about 1 dB or so can be tolerated, because at the receiver a 1-dB difference in signal strength is just barely detectable. But for losses above about 1 dB, beware. Remember that if the total losses are 3 dB, half of your power will be used just to heat the transmission line. Additional losses over those charted in Fig 3 will occur when standing waves are present. (See Chapter 24.) The trouble is, you can't accurately use a 50 or 75-Ω SWR instrument to measure the SWR in zip-cord line .

Based on this information, we can see that a hundred feet or so of zip-cord transmission line on 80 meters might be acceptable, as might 50 feet on 40 meters. But for longer lengths and higher frequencies, the losses become appreciable.

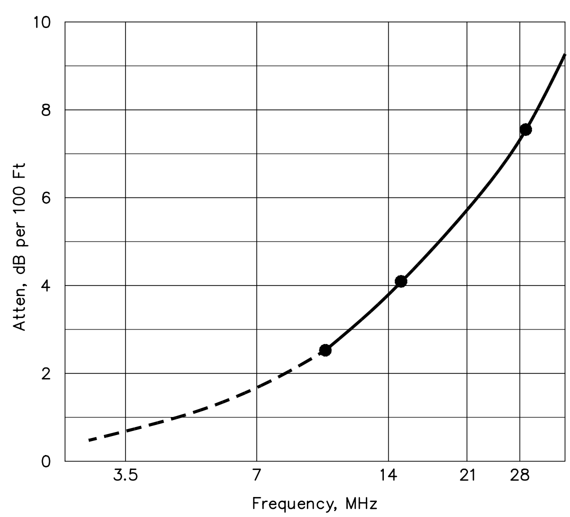

Fig 3—Attenuation of zip cord in decibels per hundred feet when used as a transmission line at radio frequencies. Measurements were made only at the three frequencies where plot points are shown, but the curve has been extrapolated to cover all high-frequency amateur bands.

Zip Cord Wire as the Radiator

For years, amateurs have been using ordinary copper house wire as the radiator section of an antenna, erecting it without bothering to strip the plastic insulation. Other than the loading effects of the insulation mentioned earlier, no noticeable change in performance has been noted with the insulation present. And the insulation does offer a measure of protection against the weather. These same statements can be applied to single conductors of zip cord.

The situation in a radiating wire covered with insulation is not quite the same as in two parallel conductors, where there may be a leaky dielectric path between the two conductors. In the parallel line, it is the current leakage that contributes to line losses. This leakage current is set up by the voltage potential that exists on the two adjacent wires. The current flowing through the insulation on a single radiating wire is quite small by comparison, and so as a radiator the efficiency is high.

In short, communication can certainly be established with a zip-cord antenna in a pinch on 160, 80, 40, 30 and perhaps 20 meters. For higher frequencies, especially with long line lengths for the feeder, the efficiency of the system is so low that its value becomes questionable.

A TREE-MOUNTED HF GROUNDPLANE ANTENNA

A tree-mounted, vertically polarized antenna may sound silly. But is it, really? Perhaps engineering references do not recommend it, but such an antenna does not cost much, is inconspicuous, and it works. This idea was described by Chuck Hutchinson, K8CH, in *QST* for September 1984.

The antenna itself is simple, as shown in **Fig 4**. A piece of RG-58 cable runs to the feed point of the antenna, and is attached to a porcelain insulator. Two radial wires are soldered to the coax-line braid at this point. Another piece of wire forms the radiator. The top of the radiator section is suspended from a tree limb or other convenient support, and in turn supports the rest of the antenna.

The dimensions for the antenna are given in **Fig 5**. All three wires of the antenna are $^1/_4$ wavelength long. This generally limits the usefulness of the antenna for portable operation to 7 MHz and higher bands, as temporary supports higher than 35 or 40 feet are difficult to come by. Satisfactory operation might be had on 3.5 MHz with an inverted-L configuration of the radiator, if you can overcome the accompanying difficulty of "erecting" the antenna at the operating site.

The tree-mounted vertical idea can also be used for fixed-station installations to make an "invisible" antenna. Shallow trenches can be slit for burying the coax feeder and the radial wires. The radiator itself is difficult to see unless you are standing right next to the tree.

A TWO-BAND TRAP VERTICAL ANTENNA FOR THE TRAVELING HAM

This antenna can be built to cover two amateur bands in the following pairs: 10 and 14 MHz, 14 and 21 MHz, or 21 and 28 MHz. The original version was designed for 14 and 21 MHz by Doug DeMaw, W1FB, for operation from an RV camper or on a DXpedition. The antenna was described in *QST* for October, 1980.

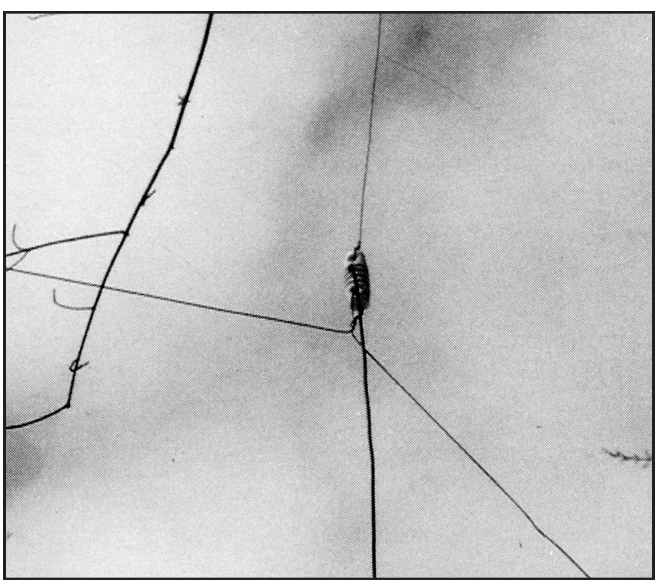

Fig 4—The feed point of the tree-mounted groundplane antenna. The opposite ends of the two radial wires may be connected to stakes or other convenient anchor points.

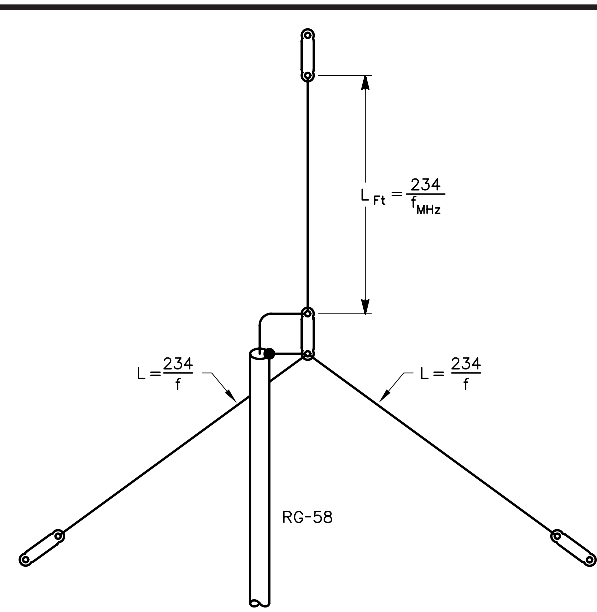

Fig 5—Dimensions and construction of the tree-mounted groundplane antenna.

Short lengths of aluminum tubing that telescope into one another are used to fabricate the antenna. A 2-inch ID piece of aluminum tubing or a heavy-duty cardboard mailing tube will serve nicely as a container for shipping or carrying. Iron-pipe thread protectors can be used as plugs for the ends of the carrying tube. The antenna trap, mounting plate and coaxial feed line should fit easily into a suitcase with the operator's personal effects.

Six lengths of aluminum tubing are used in the construction of the antenna. The ends of these tubing sections are cut with a hacksaw to permit securing the joints by means of stainless steel hose clamps. The trap is constructed on a form of PVC tubing. It is held in place by two hose clamps that compress the PVC coil form and the $^{1}/_{2}$-inch aluminum tubing sections onto $^{1}/_{2}$-inch dowel-rod plugs. See **Fig 6**.

Strips of flashing copper (parts identified as G in Fig 6) slide inside sections B and C of the vertical. The opposite ends of the strips are placed under the hose clamps, which compress the PVC coil form. This provides an electrical contact between the trap coil and the tubing sections. The ends of the coil winding are soldered to the copper strips. Silicone grease should be put on the ends of strips G where they enter tubing sections B and C. This will retard corrosion. Grease can be applied to all mating surfaces of the telescoping sections for the same reason.

A suitable length of 50 or 75-Ω coaxial cable can be used as a trap capacitor. RG-58 or RG-59 cable is suggested for RF power levels below 150 W. RG-8 or RG-11 will handle a few hundred watts without arcing or overheating. The advantage of using coaxial line as the trap capacitor is that the trap can be adjusted to resonance by selecting a length of cable that is too long, then trimming it until the trap is resonant. This is possible because each type of coax exhibits a specific amount of capacitance between the conductors. (See Chapter 24 for a table that lists coaxial cable characteristics.)

The trap (after final adjustment) should be protected against weather conditions. A plastic drinking glass can be inverted and mounted above the trap, or several coats of high-dielectric glue (Polystyrene Q-Dope) can be applied to the coil winding. If a coaxial-cable trap capacitor is used, it should be sealed at each end by applying non-corrosive RTV compound.

Tune the trap to resonance prior to installing it in the antenna. It should be resonant in the center of the desired operating range, that is, at 21.05 MHz if you prefer to operate from 21 to 21.1 MHz. Tuning can be done while using an accurately calibrated dip meter. If the dial isn't accurate, locate the dipper signal using a calibrated receiver *while the dipper is coupled to the coil and is set for the dip*.

A word of caution is in order here. Once the trap is installed in the antenna, it will not yield a dip at the same frequency as before. This is because it becomes absorbed in the overall antenna system and will appear to have shifted much lower in frequency. For this two-band vertical, the apparent resonance will drop some 5 MHz. Ignore this condition and proceed with the installation.

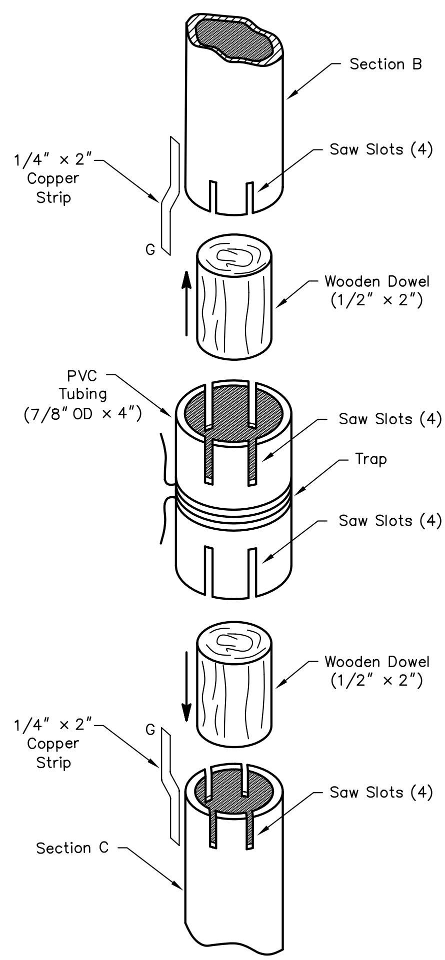

Fig 6—Breakdown view of the PVC trap for the two-band vertical. The hose clamps used over the ends of the PVC coil form are not shown.

The Tubing Sections

The assembled two-band vertical is shown in **Fig 7**, and dimensions for the tubing lengths appear in **Table 2**. The tubing diameters indicated in Fig 7 are suitable for 14 and 21-MHz use. The longer the overall antenna, the larger should be the tubing diameter to ensure adequate strength.

A short length of test-lead wire is used at the base of the antenna to join it to the coaxial connector on the mounting plate, as shown in Fig 7. A banana plug is attached to the end of the wire to permit connection to a UHF style of bulkhead connector. This method aids in easy breakdown of the antenna. A piece of PVC tubing slips over the bottom of section F to serve as an insulator between the antenna and the mounting plate.

If portable operation isn't planned, you may use fewer tubing sections. Only two sections are needed below the trap, and two sections will be sufficient above the trap. Two telescoping sections are necessary in each half of the antenna to permit resonating the system during final adjustment.

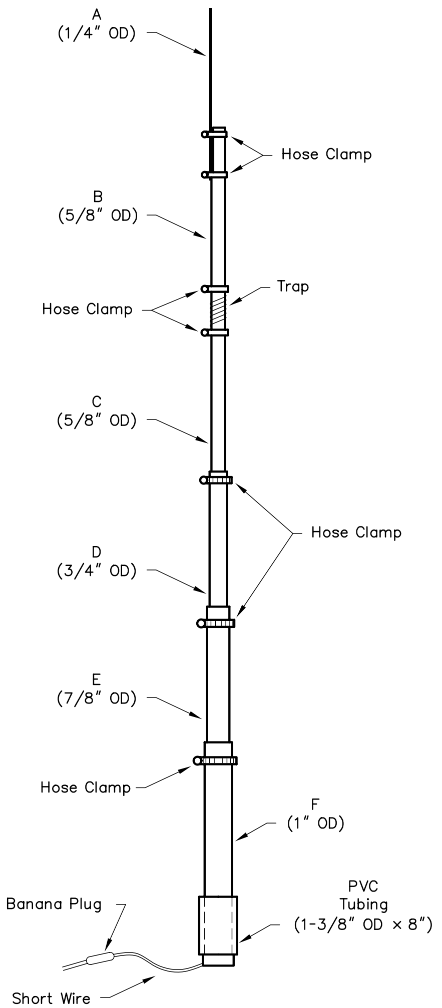

Fig 7—Assembly details for the two-band trap vertical. The coaxial-cable trap capacitor is taped to the lower end of section B. The aluminum tubing diameters shown here are suitable for 14 and 21-MHz use (see text).

Table 2
Tubing Length in Inches for Various Frequency Pairings, Two-Band Trap Vertical

Bands (MHz)	*Tubing Section A*	*B*	*C*	*D*	*E*	*F*	*C1 (pF)*	*L1 (Approx µH)*
10 & 14	42	42	54	54	54	49	39	3.25
14 & 21	38	33	37	37	37	33	25	2.25
21 & 28	25	16	25	25	25	33	18	1.70

Note: Tubing sections are identified in Fig 7.

Other Bands

One additional band can be accommodated by using a top resonator, that is, a coil and a capacitance hat at the top of the antenna. This is equivalent to "top loading" the vertical antenna. Assume you have completed the antenna for two bands but also want to use the system on 7 MHz. One way to do this is to construct a 7-MHz loading coil that can be installed as shown in **Fig 8**. A number of commercial trap verti-

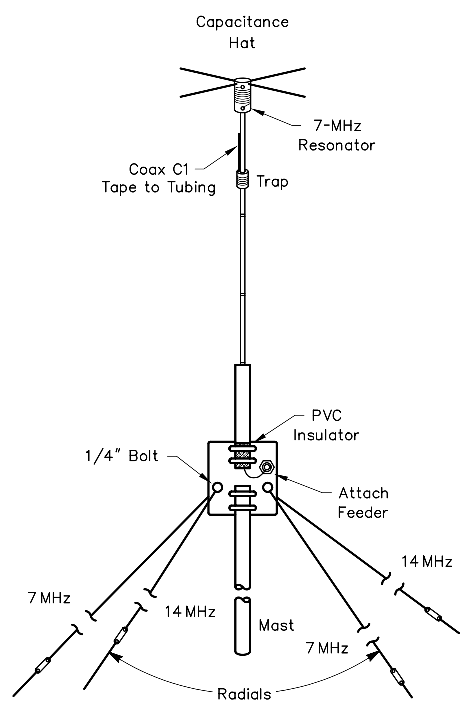

Fig 8—The assembled trap vertical, showing how a resonator can be placed at the top of the radiator to provide operation on an additional band.

cals use this technique. Another technique is to use a short rod of stiff, solid wire above the loading coil, rather than the capacitance hat, following the idea of commercial mobile-antenna resonators.

The loading assembly is called a "resonator" because it makes the complete antenna resonant at the lowest chosen operating frequency (7 MHz in this example). The coil turns must be adjusted while the antenna is assembled and installed in its final location. The remainder of the antenna must be adjusted for proper operation on all of the bands *before* the resonator is trimmed for 7-MHz resonance.

If you use capacitance-hat wires and they are short (approximately 12 inches), you can assume a capacitance of roughly 10 pF, which gives us an X_C of 2275 Ω. Therefore, the resonator will also have an X_L of 2275 Ω. This becomes 51 µH for operation at 7.1 MHz, since $L_{\mu H} = X_L/2\pi f$. The resonator coil should be wound for roughly 10% more inductance than needed, to allow some leeway for trimming it to resonance. Alternatively, the resonator can be wound for 51 µH and the capacitance-hat wires shortened or lengthened until resonance in the selected part of the 7-MHz band is obtained. If you use a vertical rod above the coil instead of the capacitance hat, you can prune either the number of coil turns or the rod length (or both) for resonance.

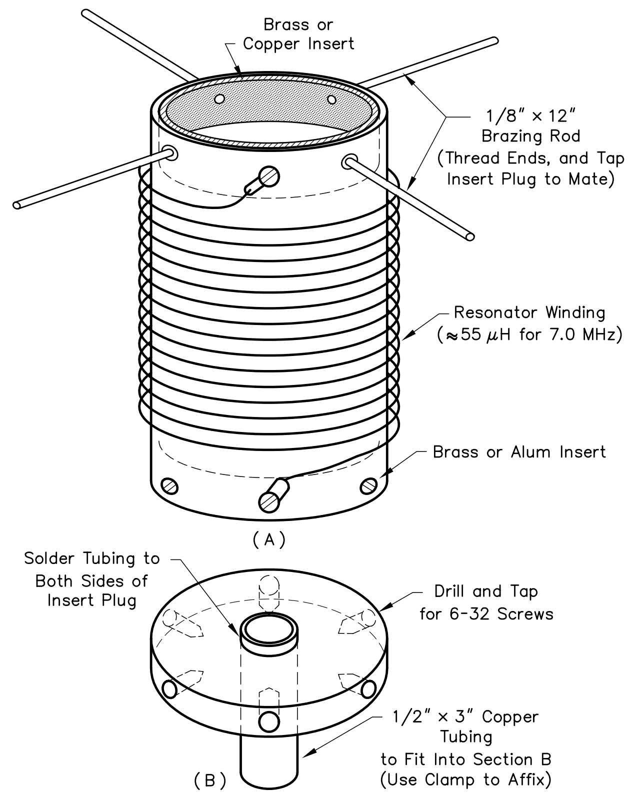

Fig 9—Details for building a resonator—a homemade top-loading coil and capacitance hat. The completed resonator should be protected against the weather to prevent detuning and deterioration.

As was true of the traps, the resonator coil should be wound on a low-loss form. The largest conductor size practical should be used to minimize losses and elevate the power-handling capability of the coil. Details of how a homemade resonator might be built are provided in **Fig 9**. The drawing in Fig 8 shows how the antenna would look with the resonator in place.

Ground System

There is nothing as rewarding as a big ground system. That is, the more radials the better, up to the point of diminishing returns. Some manufacturers of multiband trap verticals specify two radial wires for each band of operation. Admittedly, an impedance match can be had that way, and performance will be reasonably good. So during temporary operations where space for radial wires is at a premium, use two wires for each band. Four wires for each band will provide greatly improved operation. The slope of the wires will affect the feed-point impedance. The greater the downward slope, the higher the impedance. This can be used to advantage when adjusting for the lowest SWR.

A DELUXE RV 5-BAND ANTENNA

This antenna was designed to be mounted on a 31-foot Airstream travel trailer. With minor changes it can be used with any other recreational vehicle (RV). Perhaps the best feature of this antenna is that it requires no radials or ground system other than the RV itself. This section contains information by Charles Schecter, W8UCG, and was published in *QST* for October 1980.

The installation involves the use of a Hustler 4BTV vertical with the normal installation dimensions radically changed. See **Figs 10** and **11**. The modified antenna is mounted on a special mast that is hinged near the top to allow it to rest on the RV roof during travel.

The secret of the neat appearance of this installation is the unusual mast material used to support the antenna. Commonly known as Unistrut, it is often used by electrical contractors to build switching and control panels for industrial and commercial installations. The size selected is $1\frac{5}{8}$ inch square 12-gauge U channel. The open edges of the U are folded in for greater strength; the material is an extremely tough steel that resists bending (as well as drilling and cutting!). The U channel is available with a zinc-plated, galvanized or painted finish to prevent rust and corrosion; it may be repainted to match any RV color scheme.

The supporting mast is secured to the rear frame or bumper of the RV by means of $\frac{3}{8}$-inch diameter bolts. A $\frac{3}{4}$-inch wrap-around strap was attached at the RV center trim line. Any brackets mounted higher detract from the neat appearance and will necessitate a complete change of dimensions for proper tuning. Install the antenna on the curb side of the vehicle to hide the lowered antenna behind the awning and provide greater safety to the person raising the antenna. This precaution is primarily for safety when stopping alongside a highway to meet a schedule. (Caution—beware of overhead power lines!)

Mounting the Hustler

The 4BTV base is U bolted to a 19-inch piece of $1\frac{5}{16}$ inch OD galvanized steel pipe (1-inch water pipe). This is inserted into and welded along the edges of a short piece of Unistrut, which is attached to the lower portion of the mast by means of a heavy duty, welded-on hinge. It is not feasible to bolt these pieces together, as the inside of the pipe must be completely clear to accept the end of a 54-inch piece of $\frac{1}{2}$-inch water pipe ($\frac{7}{8}$ inch OD) that is used as a removable raising fixture and handle. This handle is wrapped with vinyl tape at the top end and also about 12 inches back. The tape forms a loose-fitting shim that provides a better fit inside the 1-inch water pipe. At 15 inches from the top end, a thicker wrap of tape acts as a stop to allow the handle to be inserted the same distance

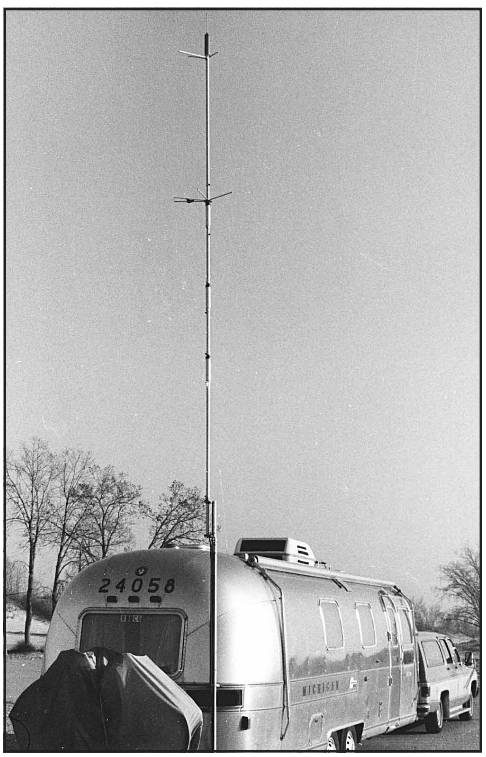

Fig 10—Ready to go! The W8UCG deluxe RV antenna is shown mounted at the rear of a 31-foot Airstream.

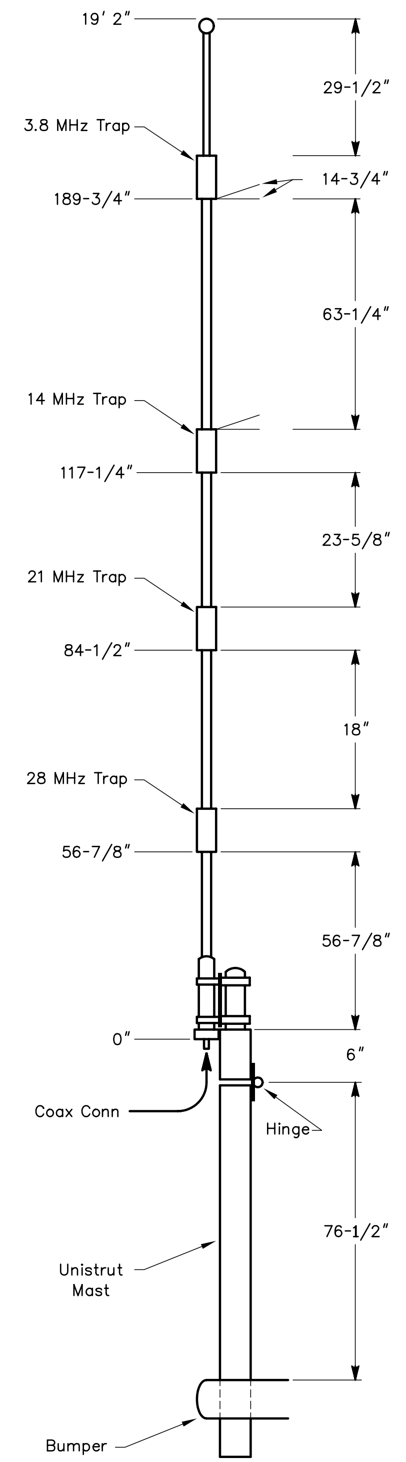

Fig 11—The dimensions of the modified Hustler 4BTV antenna. Refer to the text concerning the SWR bandwidth of the antenna on 3.8 MHz.

into the base support pipe in every instance. A short projecting bolt near the bottom end of the handle provides a means of lifting it off the lock pin (a bolt) which is mounted inside the Unistrut on an L-shaped bracket. See **Figs 12** and **13**.

The top-hat spider rods should be installed only on one side of the antenna so as not to poke holes in the top of the trailer. No effect on antenna performance will be noted. Bring the coaxial cable into the trailer at a point close to the antenna. This is preferable to running it beneath the trailer, where it can be more easily damaged and where ground-loop paths for RF current may be created. Be sure to use drip loops at both the antenna and at the point of entry into the RV. Silicone rubber sealant should be used at the outside connector end and at the RV entry hole. Clear acrylic spray will provide corrosion protection for any hardware used. Lock washers and locknuts should be used on all bolts; good workmanship will result in first-class appearance and long, trouble-free service.

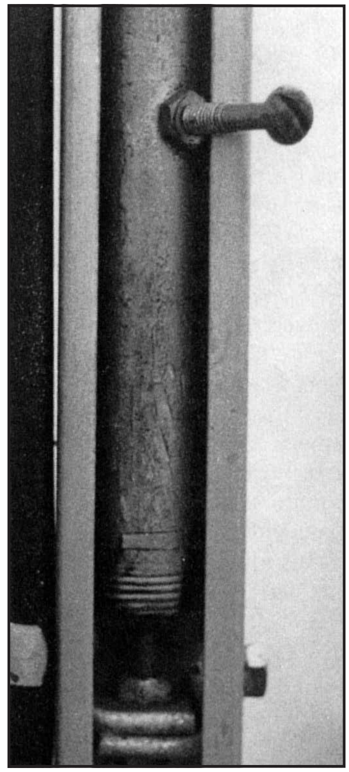

Fig 12—The handle and raising fixture, seated on the lock pin.

Fig 13—In this photo the open edges of the Unistrut channel are facing the viewer. The locking pin is visible in the middle of the channel.

To ensure optimum results, great care should be taken to obtain a good ground return from the antenna all the way back to the transceiver. Clean, tight connections, together with heavy duty tinned copper braid, should be used across the mast hinge, the mast-to-RV frame and to bond the frame to the equipment chassis. This is absolutely necessary if the vertical quarter-wave antenna is to work properly.

Antenna Pruning and Tuning

The antenna must be carefully tuned to resonance on each band starting with 28 MHz. The most radical departure from the manufacturer's antenna dimensions (for home use) takes place with the 28-MHz section. There, a 30-inch length of tubing is cut off. Only 3 inches need be removed from the 21-MHz section. The 7-MHz (top) section must be lengthened, however, because of the radical shortening of the 28-MHz section. The easiest way to do this, short of buying a longer piece of $1^{1}/_{4}$ inch OD aluminum tubing, is merely to lengthen one of the top-hat spider rods. A $15^{1}/_{2}$ inch length of $^{1}/_{2}$-inch diameter aluminum tubing (with one end flattened and properly drilled) can be held in place under the RM-75S resonator. It is a good idea to start with a longer piece of tubing and trim as necessary to obtain resonance at 7.15 MHz.

Installing, grounding and tuning of the antenna as described here resulted in an SWR of 1.0:1 at resonance on the 3.8, 7, 14, and 21-MHz bands. At the lower end of the 28-MHz band, the SWR is 1.05:1. These low SWR values remain exactly the same regardless of whether or not the RV is grounded externally.

Exclusive of 10, 18 and 24 MHz, this system design also provides full band coverage on the 7 through 28-MHz bands with an SWR of less than 2:1. Band coverage on 3.8 MHz is limited to approximately 100 kHz because of the short overall length of the resonator coil and whip. The tip rod is adjustable to enable you to select your favorite 100-kHz band segment.

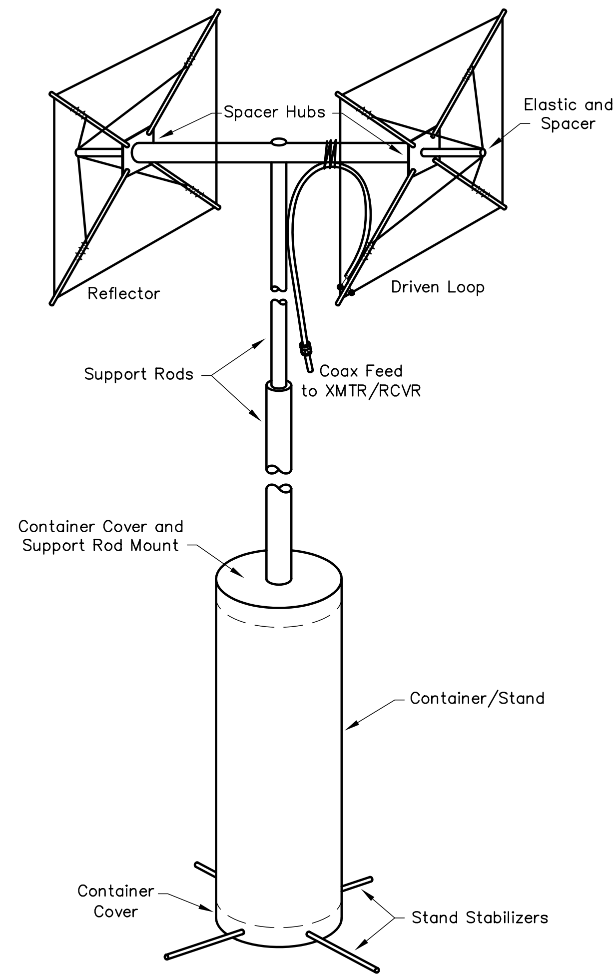

Fig 14—The basic portable quad assembly. An element spacing of 16 inches is used so the quad spacers will fold neatly between the hubs.

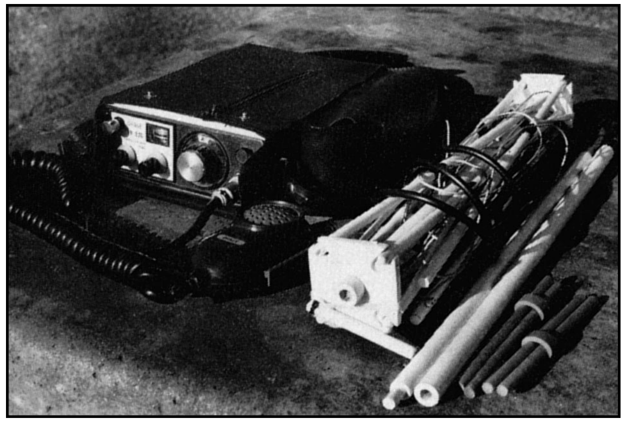

Fig 15—The portable quad stowed and ready for travel. Two long dowels are used as support rods. Four smaller dowels are used to stabilize the container when it is erected as a support stand.

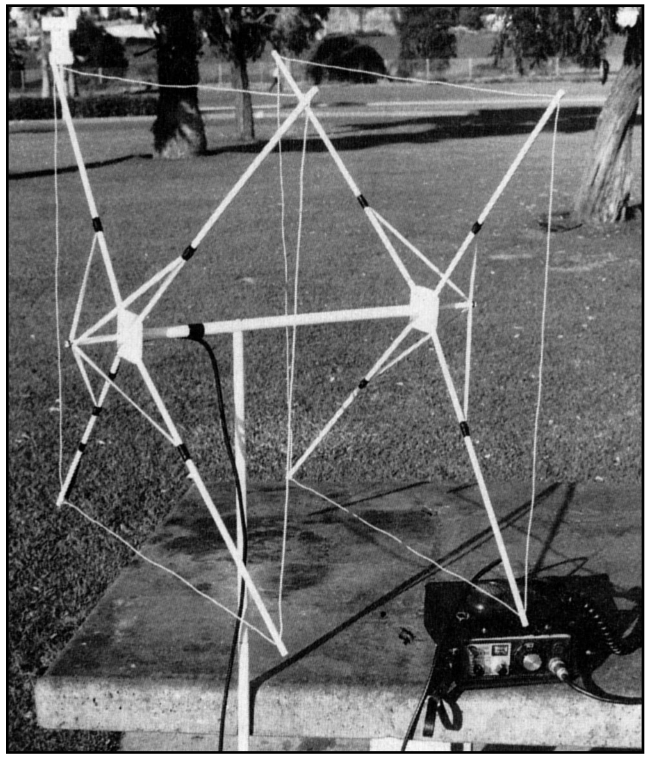

Fig 16—This version of the portable quad uses mechanical stops machined into the hub; elastic bands hold the spacers open.

A PORTABLE QUAD FOR 144 MHz

Figs 14 and **15** show a portable quad for home construction. This collapsible design was the product of Bob Decesari, WA9GDZ, and was described in *QST* for September 1980 and June 1981.

Both the driven and reflector elements of this array fold back on top of each other, resulting in a package about 17 inches long. When collapsed, the wire loop elements may be held in place around the boom with an elastic band. To support the antenna once it has been erected, the container is used as a stand. To provide more stability, four small removable struts slip into holes in the base of the container. Both the support rods and the struts fit inside the container when the antenna is disassembled.

Figs 16 and **17** show a method of attaching the spreaders to the boom. A mechanical stop is machined into the hub, and elastic bands are used to hold the spacers erect. The bands are attached to an additional strut to hold the spacers open. When not in use, the strut pulls out and sits across the hub, and the spacers can be folded back. Details are shown in Fig 17.

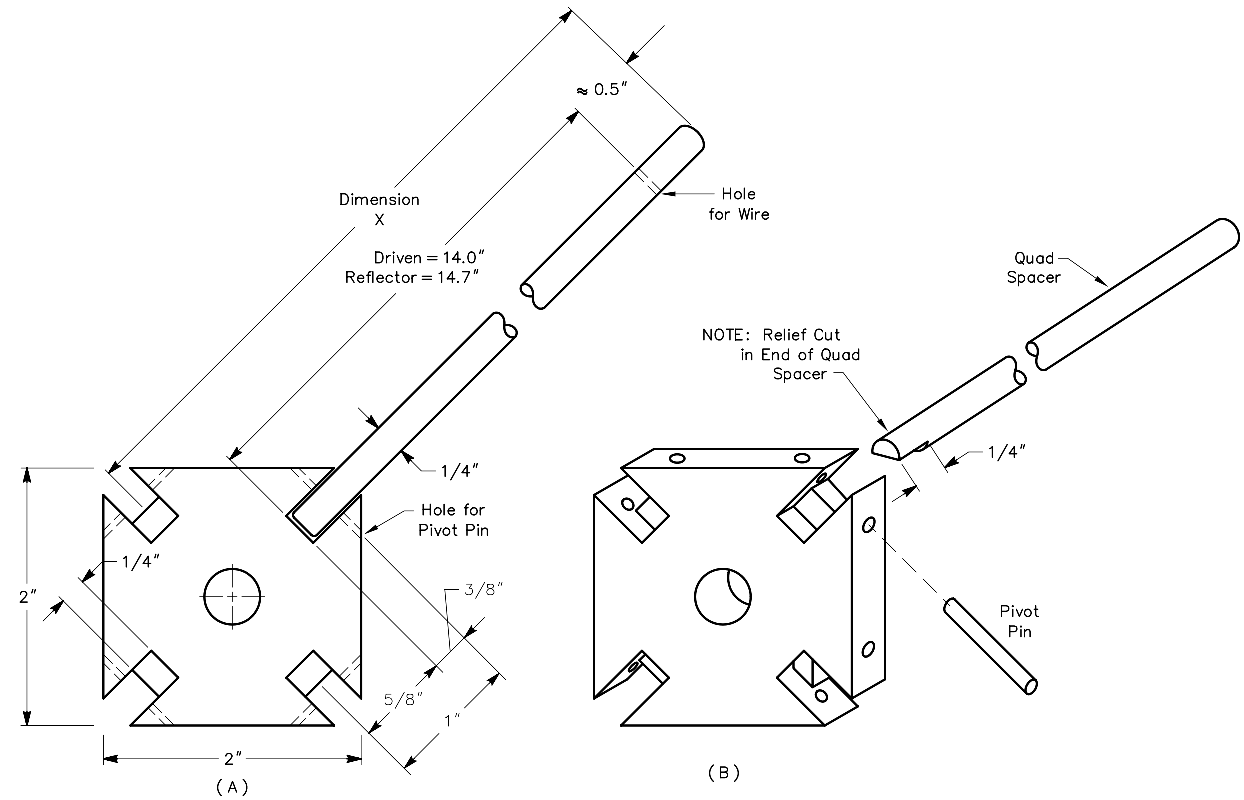

Fig 17—At A, details of the spacer hub with spacer lengths for the director and reflector. The hub is made from 1/4-inch plastic or hardwood material. The center-hole diameter can be whatever is necessary to match the diameter of your boom. B shows details of the mechanical stops.

Building Materials

The portable quad antenna may be fabricated from any one of several plastic or wood materials. The most inexpensive method is to use wood doweling, available at most hardware stores. Wood is inexpensive and easily worked with hand tools; 1/4-inch doweling may be used for the quad spacers, and 3/8 or 1/2-inch doweling for the boom and support elements. A hardwood is recommended for the hub assembly, since a softwood may tend to crack along its grain if the hub is impacted or dropped. Plastics will also work well, but the cost will rise sharply if the material is purchased from a supplier. Plexiglas is an excellent choice for the hub. Fiberglass or phenolic rods are also excellent for the quad elements and support.

The loops are made with #18 AWG copper wire. If no insulation is used on the wire and wood doweling is used for the spacers, a coat of spar varnish in and around the spacer hole through which the wire runs is recommended. The loop wire is terminated at one element by attaching it to heavy gauge copper-wire posts inserted into tightly fitting holes in the element. For the driven element, three posts are used to allow the RG-58 feed-line braid, center conductor and matching capacitor to be attached. A single post is used on the reflector to complete the loop circuitry.

Fig 18 shows how to calculate the quad loop

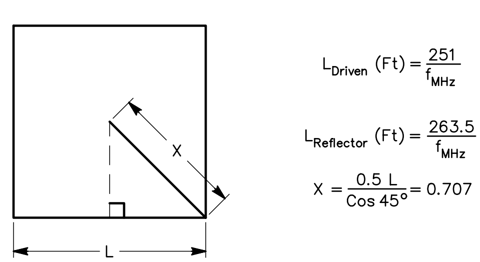

Fig 18—Quad loop dimensions. Dimension X is the distance from the center of the hub to the hole drilled in each spacer for the loop wire. At 146 MHz, dimension X for the driven element is 1.216 feet (14.6 inches), and dimension X for the reflector is 1.276 feet (15.3 inches).

dimensions. The boom is 16 inches long. The feed-point matching system is detailed in **Fig 19**. The matching system uses a 3 1/2 inch length of 300-Ω twin-lead as a shorted stub. Adjustment of the match is made at the 9 to 35-pF variable capacitor that is connected in series with the coaxial feed line.

The storage container shown in the photographs was made from a heavy cardboard tube originally used to store roll paper. Any rigid cylindrical housing of the proper dimensions may be used. Two wood end pieces were fabricated to cap the cardboard cylinder. The bottom end piece is cemented in place and has four holes drilled at 90° angles around the circumference. These holes hold the 4-inch struts that provide additional support when the antenna is erected. The top end piece is snug fitting and removable. It is of sufficient thickness (about 5/8 inch) to provide sufficient support for the antenna-supporting elements. A mounting hole for the supporting elements is drilled in the center of the top end piece. This hole is drilled only about three-quarters of the way through the end piece and should provide a snug fit for the antenna support. One or more antenna support elements may be used, depending on the height the builder wishes to have. Keep in mind, however, that the structure will be more prone to blowing over at greater heights above the ground! Doweling and snug-fitting holes are used to mate the support elements and the antenna boom.

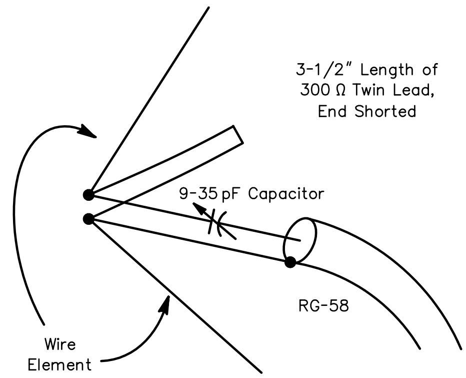

Fig 19—Matching system for the portable quad. The stub may be taped to the element.

BIBLIOGRAPHY

Source material and more extended discussion of topics covered in this chapter can be found in the references given below.

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