Patterned after a classic antenna construction article written by an amateur radio icon over 50 years ago, this simple directional antenna utilizes readily available materials, and it only costs $21.37 to construct, using do-it-yourself tools.

A One-Element Rotary for 18 MHz

BY JOHN LINDHOLM,* W1XX

Perhaps one of the most popular antenna construction articles ever written was published in the January 1955 issue of *QST* and entitled "A One-Element Rotary for 21 Mc."[1] by Lewis G. McCoy, W1ICP. It appeared just two months after I received my Novice license, and with the help of my dad I built the antenna. It utilized inexpensive electrical conduit as the radiator for a shortened rotary dipole. The antenna could be rotated from inside the shack through a series of clothesline-type pulleys and a tightly stretched cord. My first contact using the 15-meter antenna was with a DX station in Trieste, then a rare DXCC country.

"Lew" McCoy was an icon to the Novices of the day because he had an uncanny knack for making the complex understandable. His "transmatch" series is legendary. I had the distinct pleasure and honor of later becoming a colleague

*CQ WW VHF Contest Director
48 Shannock Road, South Kingstown, RI 02879
e-mail: <w1xx@cq-amateur-radio.com>*

Photo A– W1XX's 17-meter adaptation of the classic "One-Element Rotary for 21 Mc." antenna designed by Lew McCoy, W1ICP, in the mid-1950s. The antenna was placed on a push-up mast and rotated with a TV-type rotator. Many QSOs resulted. (Photos by the author)

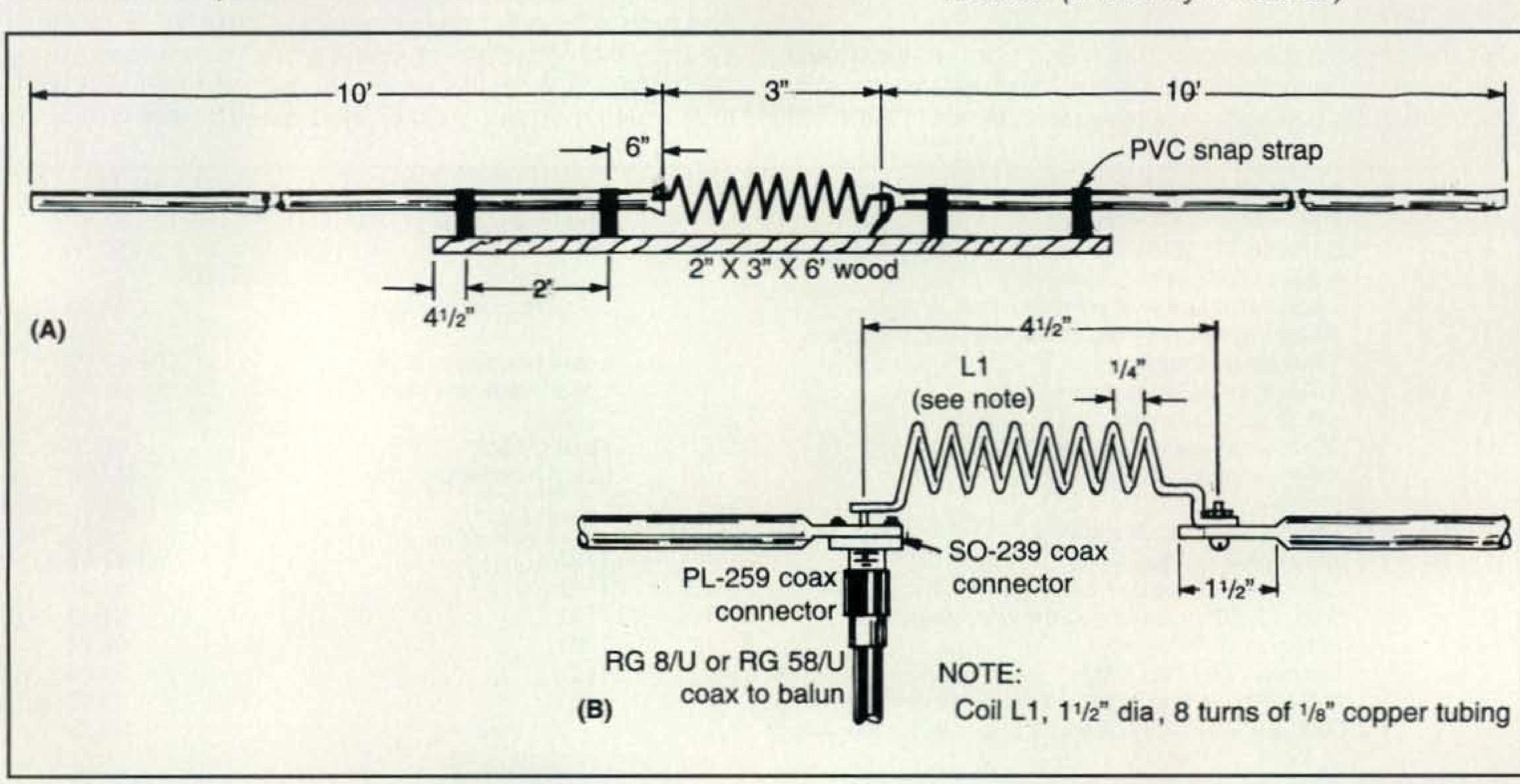


Fig. 1 – (A) Diagram of the antenna. The EMT conduit is held in place with four PVC snap straps. Different antenna mounting options are described in the text. (B) A more detailed drawing of the coil and SO-239 coax connector. A coax choke is connected to the antenna.

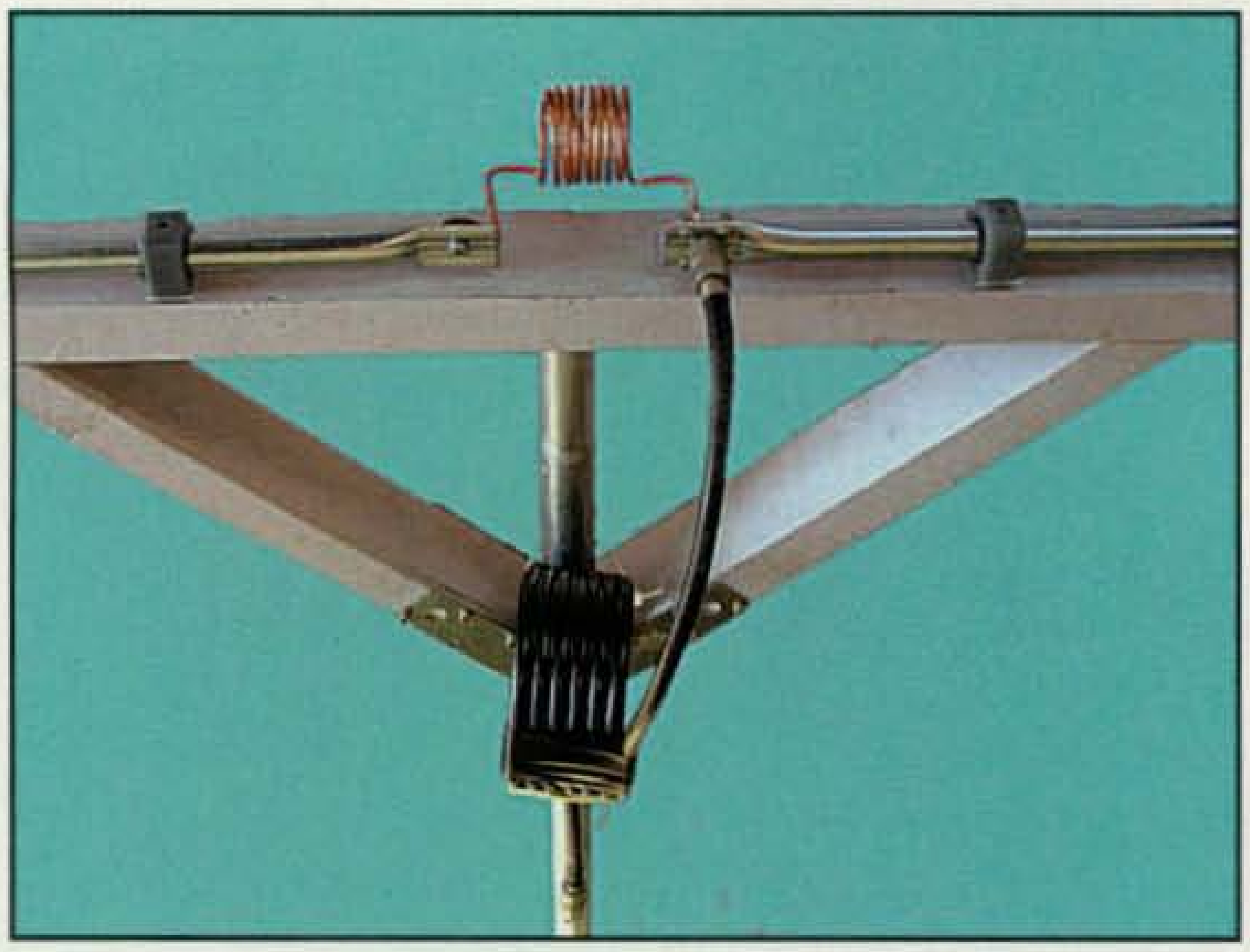


Photo B– A close-up view of the coil, coax choke connection, and PVC snap straps holding the conduit in place. The Y-bracket brace was used here for mounting the antenna to a section of RadioShack® mast.

of his on the ARRL staff. We both belonged to the same contest club. The "real McCoy," a Silent Key now for many years, fittingly closed out his illustrious technical writing career on the pages of *CQ*. His "21 Mc. One-Element Rotary" was the inspiration for my decision to adapt an up-to-date version for the 17-meter band (see photo A).

During many days over the past several months the daytime maximum usable frequency (MUF) fell short of the 15-meter band, but included 17 meters. As we now start the slow, steady climb from the depths of the sunspot minimum, 18 MHz takes on an increased operational importance—good for both DXing and ragchewing.

Objectives

Like the original, this antenna is made from material available from local sources: the hardware store, electronics shop, and today's big-box home-improvement centers. This results in a very low-cost antenna. Not counting any support structure, the antenna, using only more expensive yet more durable stainless-steel hardware, was built for just $21.37. It can be constructed with simple do-it-yourself tools. Except for a wattmeter that measures forward and reflected power, no electronic measuring equipment is needed. Many transceivers meter the standing wave ratio (SWR), which accomplishes the same thing.

Construction

As with the original 15-meter version, the antenna is made from two pieces of 1/2-inch electrical metal tubing (EMT) available in 10-foot lengths from your home-improvement center or electrical-supply shop. It is incredibly inexpensive at $1.97 each compared to aluminum tubing, which is lighter in weight but costs much more. To compensate for the approximate 10 percent shortening of the original antenna and to provide for a closer match to 50 ohms, McCoy used a copper-tubing coil of inductance to bring the antenna into resonance. For 18 MHz, the antenna is short by about twice that amount, or 20 percent short of the formula length. Thus, a coil of approximately twice the inductance is needed. It took just three trial-and-error attempts to fashion a coil producing proper resonance, as measured with a wattmeter. Following these exact construction instructions should allow duplication of these results.

The conduit must first be prepared for later attachment of the feedline. A mounting point is made by flattening about 1 1/2 inches of one end of each conduit using a vise or hammering it on a flat surface. Measuring 3/4 inch from the flattened end (i.e., in the center of the flattened section), drill a 3/16-inch hole in one conduit and a 5/8-inch hole in the other to accommodate an SO-239 female coax receptacle. Since I did not have a metal drill bit that large, I found a local machine shop with a drill press that did a neat job for a nominal fee. Four 9/64-inch holes accommodate four 6-32 × 1/2-inch Phillips pan-head stainless-steel screws with lock washers and nuts to hold the coax connector in place. A single 10-24 × 3/4-inch stainless machine screw is threaded through the drilled hole in the other conduit and secured with a lock washer, fender washer, and nut. The coil is attached

Qty.	Description/Part No.	Source	Price each
2	10-ft. 1/2-in. EMT conduit	The Home Depot (THD)	$1.97
4	Carleton 1/2-in. PVC one-hole conduit snap strap	THD	$0.50
4	6-32 × 1/2-in. stainless steel (ss) Phillips pan-head screw w/washer & nut	Local hardware store	$0.45
1	10-24 x 3/4-in. ss machine screw w/lockwasher, fender washer & nut	Local hardware store	$1.00
4	#10 × 2-in. ss wood screw	Local hardware store	$0.49
1	6-ft. 2 × 3 wood stud	THD	$1.53
1	SO-239 female coax connector	RadioShack	$3.69
5 ft.	1/8-in. copper tubing	Local plumbing supply	$1.09/ft.
Additional Mounting Parts as Required			
1	1/2-in pipe flange	THD	$2.56
1	1/4 × 3-1/2-in. ss hex bolt w/cut washers & nut	THD	$1.30
2	5/16 × 2-1/2 in. ss lag screw w/cut washer	THD	$1.43
2	Simpson 66 "L" strap	THD	$2.64
3	Simpson TP57 tie plate	THD	$1.25
2	1/4 × 2-in. ss bolt w/cut washers, lock washer & nut	THD	$0.92
2	DXE-SAD-175A 1-3/4-in. ss U-bolt & saddle clamp	DX Engineering	$8.15*

DX Engineering: <www.dxengineering.com>

**Less expensive U-bolts without saddles available from THD.*

Table I– Antenna parts list.

Photo C– The balun is made with RG-8/U-type coax. The author suggests putting a PL-259 on each end and connecting the feedline through a barrel connector.

between this screw and the center pin of the SO-239.

As shown in fig. 1 and the photographs, the two pieces of tubing are supported by four 1/2-inch PVC one-hole conduit snap straps. These are made by Carleton and available in the electrical-parts department of the big home-improvement retail centers. They insulate the conduit element from the rest of the support system. The original antenna used beehive ceramic insulators, which are no longer easy to find. The snap straps are inexpensive and easy to work with. Since the conduit is slightly too small in diameter and slides loosely in the PVC straps, you'll need to fill the gap for a tight grip. I used some old 1-inch diameter car radiator hose, stripped off the red covering, and cut four 3/4-inch wide pieces for a perfect fit, holding the conduit firmly in place in the PVC straps. Black electrical tape would accomplish the same result. The PVC straps were closed on the conduit by squeezing them in a vise.

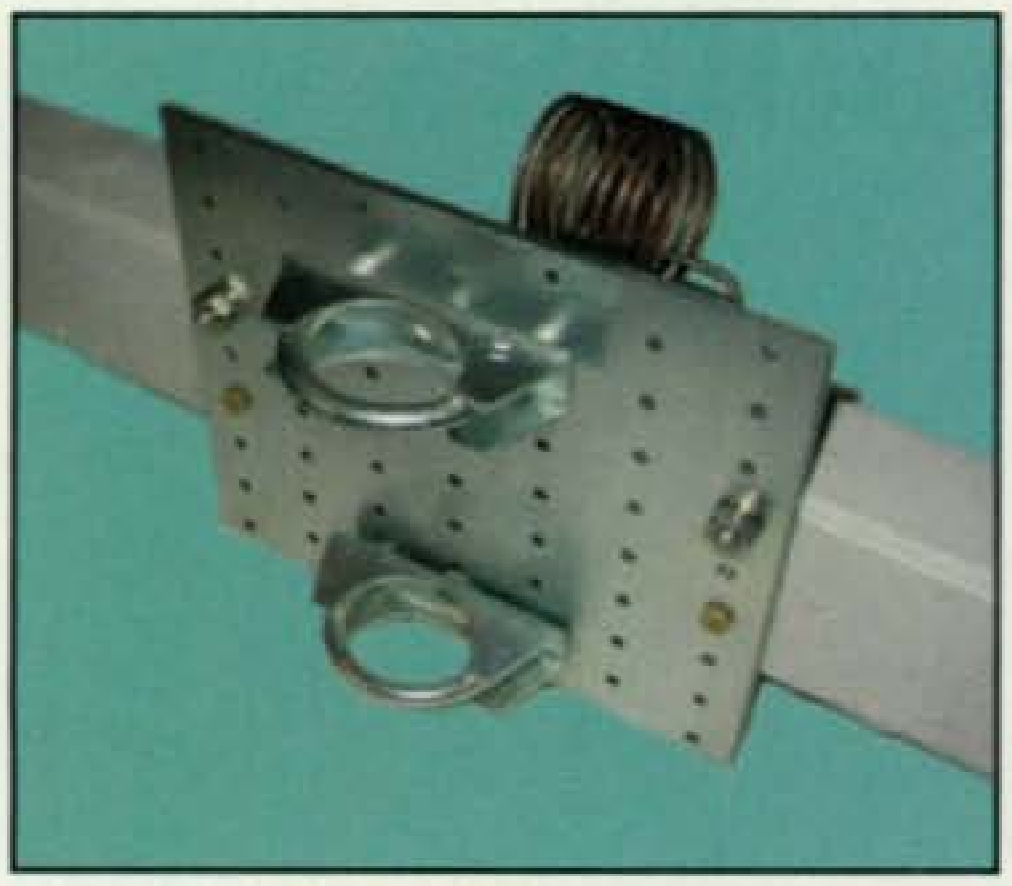
The conduit is supported on the wide side of a 6-foot 2 × 3 wood stud, which previously was stained gray to take on a metallic appearance. Align the "tall" side of the straps with the edge of the wood, securing the straps with four #10 2-inch stainless wood screws in the "short" holes. Do not use the holes on the "tall" side through which the conduit passes. See fig. 1 for the mounting dimensions.

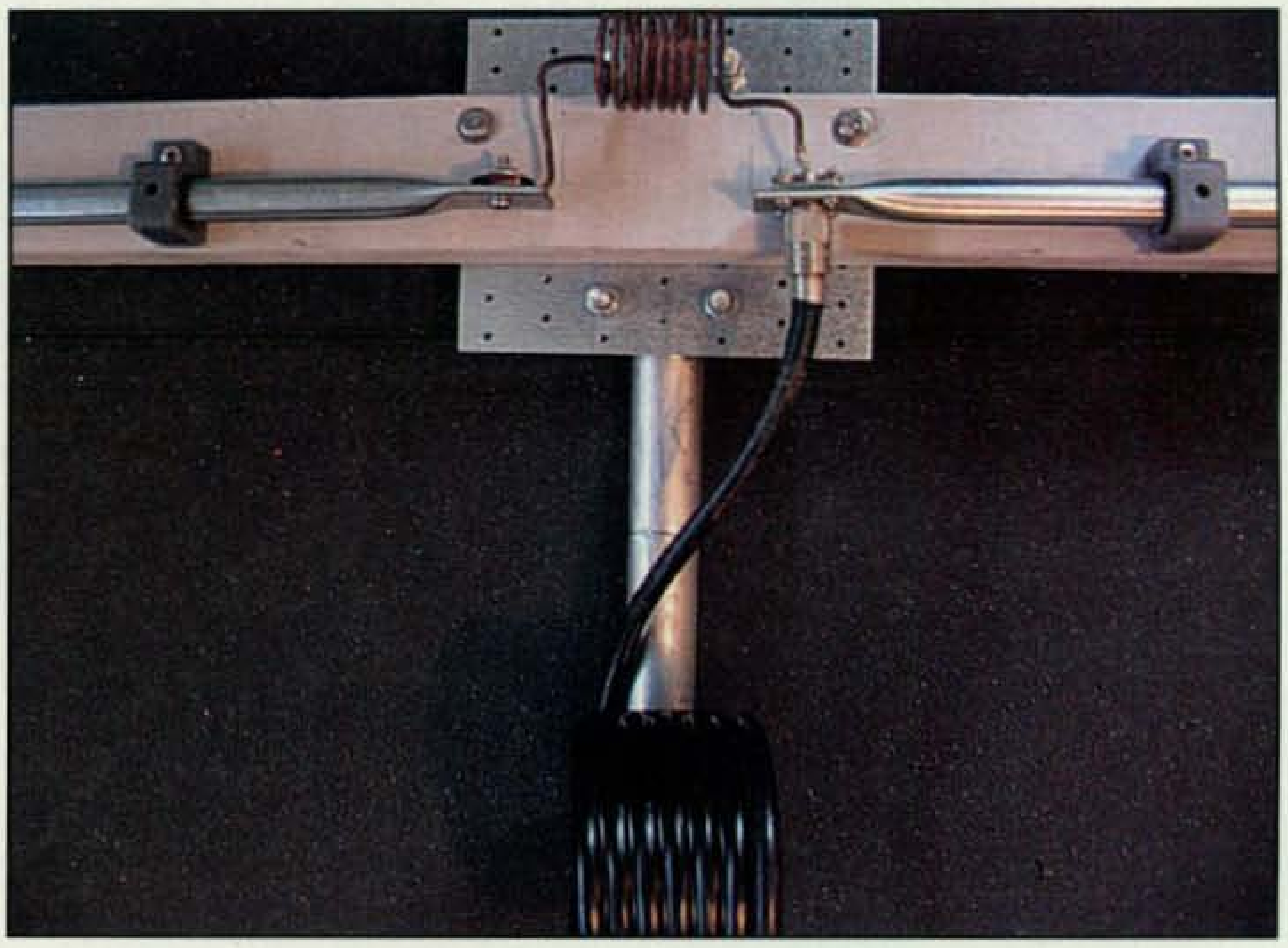
The coil, L1, is made from 1/8-inch diameter copper tubing. It consists of eight turns spaced 1/4 inch apart and a 1 1/2-inch inside diameter. I found 1/8-inch tubing at two local hardware stores, but not at the big-box home center. To make the coil, I wound a 52-inch length of tubing, using a Dap© Patch Stick spackling plastic container as a form. Leave about one inch extra on one end to wrap around the fender washer on the conduit. The coil is connected in series with the center pin of the coax connector and the other half of the antenna. Solder to the center pin of the SO-239 coax receptacle and wrap around under the fender washer on the other half of the antenna and securely tighten the screw and nut. See photo B.

The Balun

A dipole antenna is a *balanced* antenna, but I wanted to feed it with an inherently *unbalanced* coax line. Further, the feedline may not be routed symmetrically away from the antenna itself. Either or both of these conditions can result in common-mode currents in the feedline, which is detrimental to the proper operation of the antenna. This condition can be improved by the insertion of a choke or balun (derived from *bal*anced to *un*balanced) at the feed point. It reduces common-mode currents while making a transition from unbalanced coax to the balanced load of the antenna. For more information about common-mode currents, consult any edition of *The ARRL Antenna Book.*[2]

For this project, a simple coax choke can be made from a 7-foot length of RG-8/U-type coax (e.g., RG-213). Wind six





Photos D1 & D2– Here's a mast-side view (D1, above) of another mounting option using standard deck hardware for an antenna support-to-mast plate and stainless-steel U-bolts with saddles. Photo D2 (right) shows the antenna-side view of the same configuration with the balun attached.

turns on a 4-inch form, such as white PVC plastic sewer pipe. For best performance, wind each turn neatly adjacent to the next, and use copious amounts of good-quality black electrical tape to hold it together. Use either male PL-259 connectors at each end with a barrel (double female) connector to the feedline, or simply form the choke at the antenna end of the continuous feedline. The former is recommended should you ever need to change the feedline for any reason. See photo C.

How to Mount the Antenna

This will be a matter of individual choice, depending on each individual's present antenna-support setup. Here are three possible options.

The original McCoy article described perhaps the simplest. Mount a round plumbing floor flange directly on the bottom center of the 2×3 wood support and thread a length of water pipe directly into the flange. This then can be mounted on a roof tripod, a push-up mast, tower, etc. A simple TV-type rotator can be used to rotate the antenna (see photo A).

Option two: Since I had some Radio Shack® TV-type masting from a previous project, I constructed a Y-bracket from two 16-inch 2×3s. Mitered at each end at 45°, each is attached to the main wood support with a $\frac{5}{16} \times 2\frac{1}{2}$-inch stainless lag screw and cut washer. Each side of the Y-bracket is buttressed at the right angle with a Simpson© 66L deck strap and secured with several $1\frac{5}{8}$-inch coated deck screws. Carpenters glue is used at each wood-to-wood contact. The mast section passes through the base of the Y through a $1\frac{1}{4}$-inch hole, seated in a $\frac{1}{2}$-inch deep hole on the bottom of the 2×3 support. The mast is pinned through both brackets near the base with a $\frac{1}{4} \times 3\frac{1}{2}$-inch stainless hex bolt with nut and lock washers, as shown in photo B.

Another option presented here is to fabricate a more conventional boom-to-mast plate, again using Simpson© deck hardware. Use a triple thickness of "TP57 Tie Plate" for added strength, drilling out the two-inches-on-center starter holes to accommodate U-bolts for attachment to a mast. Stainless U-bolts with saddles, such as DXE-SAD-175A from DX Engineering, are recommended. Use two $\frac{1}{4} \times 2$-inch stainless hex bolts and two 1-5/8-inch deck screws to attach the triple tie plate to the center underside of the 2×3 wooden support with the driven element of the antenna facing away from the mast. See photos D1 and D2.

Performance

In testing the prototype, the antenna was secured atop an 8-foot ladder while the SWR was checked at each end of the 100-kHz wide band. With 85 watts forward power and less than one watt reflected, the DXpedition to the Marquesas Islands, FO/OH1RX, was heard on CW. I called him on a lark and he came back on the first call! CT1BOL was then worked on SSB, receiving an S7 to S9 with QSB, again on the 8-foot ladder.

Since the band is such a small sliver of spectrum, an SWR close to 1:1 should be achieved across the entire band. If you find the SWR increases significantly at the top end of the band, the copper coil is slightly too big. If the SWR is higher at the bottom end of the band, the coil is too small.

The antenna was then mounted atop a 25-foot push-up mast with a TV-type rotator. Still running just 85 watts, the first stations worked were G4HUV, HK7AAG, VP6PR, FJ/G3TXF, 9Q1EK, and E51WWA with good reports received. A wonderful SSB ragchew with 4X4BL in Haifa followed. Cracking the VP6DX pile-up on both phone and CW was fun. Signal-strength measurements on both receive and transmit were made rotating the antenna from broadside to end on. Signals were three S-units, or about 9 dB stronger on my radio with the antenna broadside to the station worked compared to end on, proving the value of rotating the antenna. That's the equivalent of increasing your power by a factor of eight! Being a bi-directional antenna, only 180° of rotation are needed.

In Closing . . .

I would like to close with slightly modified words from a half-century ago: "The simplicity of the antenna and the low cost, together with the improved performance over a fixed antenna, make it a worthwhile project for an amateur interested in '17-meter' operation."[3]

Thanks to Clarke Greene, K1JX, who reviewed the manuscript for technical accuracy, and Lew McCoy, W1ICP, to whom this article is dedicated *in memoriam*.

Notes

1. *QST*, January 1955, pp. 30–32.
2. *The ARRL Antenna Book*, American Radio Relay League, Inc., Newington, Connecticut.
3. *QST*, January 1955, p. 32.