• *Beginner and Novice*

The Scotsman's Delight

A 15-Meter Beam for Less Than $5.00

BY LEWIS G. McCOY* W1ICP

YES, the title is correct. This is an article describing a beam antenna for 15 meters that can be built for less than $5.00. Actually, the one shown in the photographs cost less than $3.50. However, we are allowing a "cushion" for higher prices in different parts of the country. The antenna is not a makeshift but is actually a high-performance beam that will give a very good account of itself. The detailed description given in this article is for a 15-meter beam, but dimensions for 10 and 20 meters are also included for those interested.

The beam is not a new design, being similar to the antenna popularly known as the "ZL Special."[1] However, the constructional approach in this model is different. Also, the total construction time, from raw materials to completed installation, was only two and a half hours in our case.

Fig. 1 shows a sketch of the antenna. It consists of two folded dipoles spaced a little over 0.1 wavelength and fed approximately 135 degrees out of phase. The feed-point impedance makes a passably-good match for either RG-11/U or RG-59/U coaxial cable.

Materials

The beam elements and the phasing line are made from 300-ohm twin line. When purchasing the twin line, by all means get a reputable brand. There is a considerable amount of poor-quality line on the market, so you should be careful when buying it.

Bamboo poles are used to support the elements. One source of these is sporting-goods houses that sell fishing poles. However, most furniture dealers who sell rugs usually accumulate a supply of bamboo poles, because it is customary for rug manufacturers to roll the rugs on bamboo poles for shipping purposes. We called several local dealers and found that all of them had poles which they were willing to sell for practically pennies. In fact, some of the dealers give the poles to Boy Scouts for scouting projects. (Dress up the jr. op. as a Scout and send him out collecting poles!) The poles usually come in 12- to 15-foot lengths, which is more than adequate for our purpose.

The poles are supported on 2 × 3s, 8 feet long, which are mounted on a boom made from a 2 × 4. The poles were secured to the 2 × 3s with plastic electrical tape. One large roll of electrical tape is sufficient for the entire project. Taping the poles to the supports may seem like an insecure method of mounting, but we had one such antenna up for over a year and didn't experience any trouble with it. If desired, the poles could be secured with some homemade metal clamps.

The method of mounting the beam will depend on your own preference. However, we'll pass along our system for those that are interested. The boom of the beam was mounted on a 5-foot length of 1-inch pipe, and a 4-inch floor flange was used to hold the boom on the pipe. The pipe was mounted on two wall-type standoff brackets commonly used for TV antenna installations. These brackets are available from any radio distributor, and the type we used provided a 12-inch mounting distance from the wall. An-

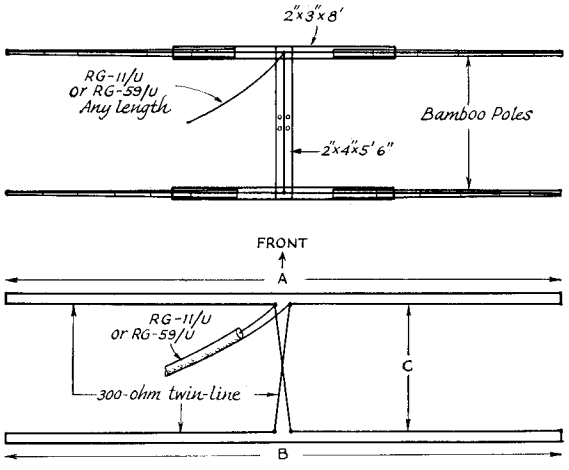

Fig. 1—Shown at the top are the mechanical details for constructing the beam. At the bottom is the electrical circuit. The element and phasing line lengths are given in Table 1.

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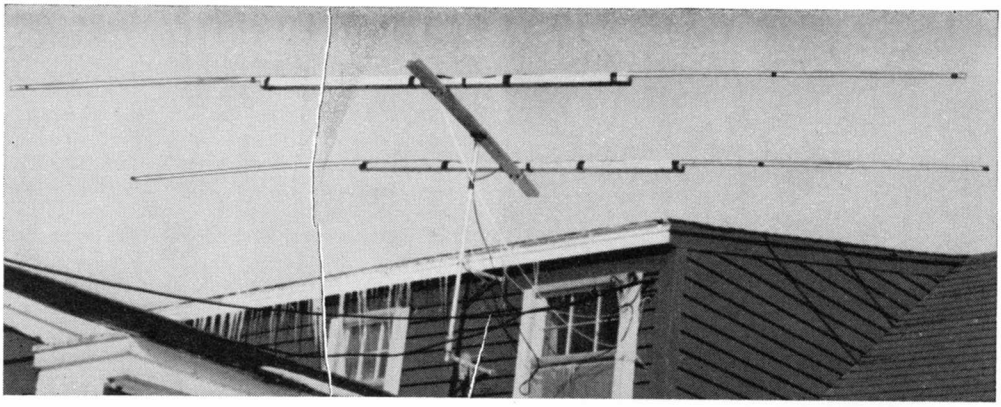
[1] The ARRL *Antenna Book*, ninth edition, second printing, page 214.



Here is the completed installation. The boom was made slightly longer than required, to provide for the future installation of a 20-meter beam.

other piece of pipe, about 4 inches long and large enough to slip over the mast, was used as a bearing. A hole was drilled through the mast large enough to take a ¼-inch-diameter bolt 3 inches long. This rested on the bearing. A nylon cord was tied to each end of the boom and brought into the shack through a hole in the wall, and the beam was then rotated by the "armstrong" method. If desired, a TV rotator could be installed to rotate the beam as the entire assembly is light enough for such a rotator.

Construction Details

Table I gives the dimensions for the elements and phasing line for c.w. and phone frequencies in each of the bands for 20 through 10. If you make a beam for the c.w. frequencies, or vice versa, it doesn't mean the beam won't work at the other end of the band. The antenna will work across the entire band, but will give optimum performance at the frequency it is cut for.

When cutting the 300-ohm twin line into element lengths, allow about one inch extra for each element. At each end of the element skin back about ½ inch of insulation and solder the two leads together. Cut one of the conductors at the exact center of the element and carefully remove the insulation about ½ inch either side of the cut. When making the phasing section, also allow an extra inch for lead lengths. The coax line was skinned back about an inch to give sufficient lead length to connect to the beam. Solder all connections together and then tape the joints.

Table I

Mc.	*A*	*B*	*C*
14.05	31′ 2″	31′ 10″	7′10″
14.25	30′ 9″	31′ 5″	7′ 9″
21.1	20′ 9″	21′ 2″	5′ 2½″
21.3	20′ 7″	21′ 0″	5′ 2″
28.1	15′ 7″	15′ 11″	3′ 10″
28.7	15′ 3″	15′ 7″	3′ 10″

The above lengths are obtained from the following formulas, which apply to any frequency:

A = 438 ÷ Mc.; B = 447 ÷ Mc., C = 110 ÷ Mc.

Mount the 2 × 3 crossarms on the boom, using nuts and bolts to secure them. Two bolts are sufficient for each crossarm. The bamboo poles can then be taped to the crossarms. After the poles are mounted in place, the antenna elements can be taped to the poles. Be sure to have the half twist in the phasing line before taping the elements to the poles.

The antenna can now be mounted in its permanent location. We mounted the wall brackets and pipe mast in place first and then bolted the floor flange to the boom. The accompanying photographs show the installation.

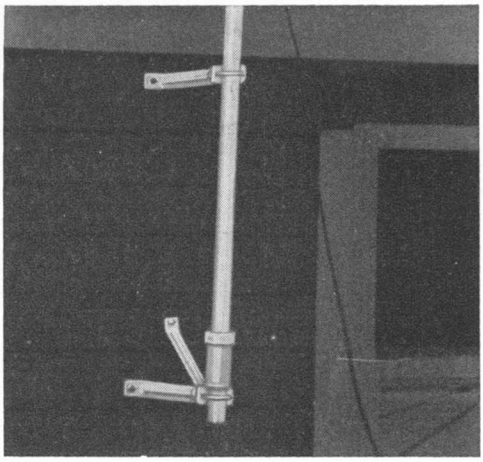
Performance

After the antenna was installed we made several contacts with both local and distant hams to check the front-to-back ratio, and were pleasantly surprised to find that the beam was as good or better in this respect as many other antennas we have tried. One station about 20 miles away gave us S9 on the front of the antenna and down in the noise level off the back. S-meter readings don't necessarily provide any conclusive decibel figures, but the readings can certainly be impressive. What is more important, several local stations all gave strong reports off the front with

Table II

S.W.R. Readings on 21 Mc.
Using dimensions for 21.3 Mc. shown in Table I

21.0 Mc.	— 4.5 to 1
21.1	— 3.8 to 1
21.2	— 3.5 to 1
21.25	— 2.7 to 1
21.3	— 1.9 to 1
21.35	— 1.75 to 1
21.4	— 2.3 to 1
21.45	— 4.7 to 1



This photograph shows the mounting details of the mast which supports the boom. TV mast stand offs are used for the purpose. The standoffs come in various sizes but it was necessary to use the 12-inch size in order to clear the eaves of the house.

extremely weak signals off the back. On distant or skip stations, the front-to-back ratio wasn't as pronounced, running 2 to 3 S-units.

One word of advice to the newcomer who has never used a beam before: local checks with an antenna can show extremely good front-to-back, but skip signals usually don't show the same ratio. Depending on the angle at which a skip signal reaches the antenna, the front-to-back ratio can be considerably less than with local stations.

We haven't said anything about forward gain of the antenna because it is difficult to make gain measurements that mean anything. The power gain of this type antenna is probably in the neighborhood of 3 db. If, for example, you have a Novice input of 75 watts and are getting 50 watts output from the rig to the antenna, a 3-db. gain would mean the equivalent of 100 watts in the antenna. You can't hardly beat that kind of signal improvement for less than $5.00! QST

Strays

Looking for "rare" Washburn County, Wisconsin? K9YRA and WA9ENA will be operating from there 20 and 40 s.s.b., June 8 to Aug. 16. QSL to K9YRA.

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More about W6TC. May 29th was his 65th birthday, whereupon he promptly retired from the TV station where he has labored. His new QTH is 352 Crosby Drive, Sun City, Calif. To top it all off, he won the *QST* Cover Plaque Award for March.

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W3OR, Glenn Mills, Pa., makes a specialty of working 50-Mc. mobile stations. As of the end of March, he had run his total up to more than 1500 different mobiles on 6. (From *Cheese Bits*, published by the Mt. Airy V.h.f. Club.)

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This is True

Butch Morgan, W1FEA, working on a new project in the lab, needed a 160-meter crystal in a hurry. Checking by telephone with a local "ham-radio" store, the following conversation took place:

Butch: Do you stock 160-meter crystals?

Clerk: Sure, we have all kinds. What channel do you want?

B: No, you don't understand. I want a crystal anywhere in the 160-meter ham band.

C: Oh, yes, I understand. How about one for channel 11? That's very popular.

B: You're sure you stock 160-meter crystals?

C: We have the best supply around here.

B: Fine, I'll drop by and pick up one.

Anyone who can't guess how many 160-meter crystals Butch got at that store?

W4HTF was in charge of a Navy unit in the Antarctic which was engaged in communications and electronics work. All twenty-seven men participated in code and theory classes, and now all of them are licensed hams. W4QVJ, who sent us this info, thinks this may be the only military unit ever to have every man in it, including the c.o., be a ham.

June 1938

. . . There was an article describing the work of OE3AH (Anton Hapsburg) in the 1938 DX Contest. His rig was described and there was a photo of the airplane from which he made his in-flight 28-Mc. DX record in December, 1937.

. . . W1GBE described a light-weight, battery-operated transmitter which he carried along on a hunting trip in the Maine woods! He and his party used a Philco two-volt broadcast set covering the short wave bands as a receiver, and 120 feet of No. 20 enamelled wire and 2 ten-cent insulators for the antenna.

. . . W9RSO was announced as the 1937 winner of the Maxim Memorial Award.

. . . Results of the Fourth ARRL Copying Bee were reported. There were 240 copies of the 25 w.p.m. transmission submitted, but only 4 of these were perfect copies of the text, which consisted of trick letter combinations, misspelled words, punctuation, plain language groups, figure groups, and unusual word combinations!

. . Technical articles included an extended double Zepp antenna, a c.w. and phone station freqmeter-monitor and modulometer with cathode ray tube, a new type of frequency-checking device for use in the high-frequency spectrum, and a gang-tuning system for the multi-stage transmitter. QST