Ike Kerschner
RD 1 Box 181-A
Kunkletown, PA 18058

Complete assembly instructions on how to build...

A Simple Directional Antenna for the HF Bands

In response to the many requests I have received for a better shortwave antenna, this month's column will describe the famous W8JK flat top beam, an antenna which is an excellent choice for the SWL or new radio amateur.

It is easy and inexpensive to construct, is not too large for the average lot, has a 4 dB gain both transmitting and receiving when compared to an ordinary dipole antenna, and it is bi-directional; that is, it sends or receives signals best in two directions (broadside to the flat top).

The flat top beam can be mounted either horizontal or vertical to the ground. If mounted horizontally, try to keep both ends elevated at least 25 feet. Vertical mounting has the advantage of requiring only one support and it can be rotated to take advantage of the directive characteristics.

DIRECTIVITY AND AIMING

Usually we assume directive antennas must be pointed very precisely at the station to be worked; that is not the case with the W8JK beam as the lobe of maximum gain is at least 45 degrees wide.

If a station on the east coast of the U.S. aims the antenna northeast, most of Europe and a good part of North Africa will be within the lobe of maximum gain on one side of the beam.

The other side of the beam will cover the western U.S., Central America and much of the Pacific. Erecting a second array at right angles to our northeast antenna will cover the balance of the earth.

PHYSICAL LAYOUT

Figure 1 shows a view of the W8JK beam from the top. As you can see, the antenna is made up of two dipoles spaced a specific distance apart and connected to each other by two wires that cross over each other to establish proper phase relationships between the dipoles so their signals will enhance each other, providing gain and directivity.

SOME SIMPLE COMPUTATIONS

The W8JK can be designed for any frequency using the following formulas: The length in feet = 468/frequency in MHz; and the spacing in feet = 117/frequency in MHz.

$$\ell_{ft} = \frac{468}{F_{MHZ}} \qquad S_{ft} = \frac{117}{F_{MHZ}}$$

As an example let's assume you want to receive signals on a frequency of 20 MHz. The length of the dipoles would be 468/20 MHz or 23.4 feet (23'5"). The spacing between dipoles is 117/20 MHz or 5.85 feet or (5'10"). Dimensions are not extremely critical--plus or minus a few inches will not hurt anything.

Using an antenna tuner the 20 MHz antenna will produce good gain and directivity up to 40 MHz; it will also work fine on frequencies lower than 20 MHz but will not produce gain or directivity below that design frequency.

A GOOD MULTIBAND DESIGN

An excellent multiband flat top can be constructed for 10-30 MHz, using a length of 46 feet and spacing of 11.5 feet. (NOTE: you must use an antenna tuner designed to tune balanced feeders with this antenna.)

MATERIAL

The W8JK is considerably heavier than the usual dipole or long wire and requires strong wire for the element; use 14 or 12 gauge copper-clad steel wire. The phasing section (crossed wires that connect to feed-line) can be made of lighter wire if you wish.

Spacers should be one inch square straight-grained pine, redwood, high quality spruce, or heavy 3/4-inch-diameter bamboo for beams designed for frequencies above 12 MHz. Lower frequency beams should use 1" x 2" pine or 1" diameter bamboo.

If you are fortunate enough to find bamboo wrap each of the sections with fiber strapping tape. Whatever material you use give it two coats of spar varnish or shellac. NOTE: Do not use metal of any type for the spacers! PVC is OK for spacings of less than six feet but will not stand up to stresses of larger spacing.

If the antenna is to be used only for receiving use whatever you have on hand for insulators. If you are an amateur and want to transmit it is imperative that high quality ceramic insulators be used!

The center insulator will require a piece of insulating material such as plastic or varnished wood at least 1/4" thick and 4-1/2" x 3" (figure 2).

A length of good quality 300 ohm TV twinlead is used to feed the antenna.

BUILD IT

A flat top beam consists of two one-half-wavelength dipoles spaced one-eighth wavelength apart. Calculate the dipole length from the formula, allow three additional feet of wire for connecting to the insulators and cut two lengths of wire.

If you antenna is cut for 10 MHz you will need two lengths of wire 49 feet long. Cut one length in half (24-1/2 feet) and attach an insulator to each end; take up the excess wire through the insulator (9 inches on each end) and wrap several turns around the long portion of the wire and solder carefully. Repeat for the other 49 foot length of wire.

You now should have four lengths of wire 23 feet long with an insulator at each end. Set them aside for now.

CENTER INSULATOR

Figure 2 illustrates construction of the center feed line insulator. There are four holes in the wide part; the upper hole on each side should be large enough to clear the wire used for the cross-over lines. One of these holes must be about one-half inch higher than the other so the wires will clear each other.

The holes beneath these upper holes are for machine screws--3/16" will clear number 10 hardware. If you choose smaller screws make the holes an appropriate diameter.

Cut a hole at the marked location large enough to clear the width of the spacer you are using. Now, cut the slots in the lower part of the insulator; these slots are a strain relief for the feedline and they must be large enough to just clear the wire you will use to feed the antenna. ▶

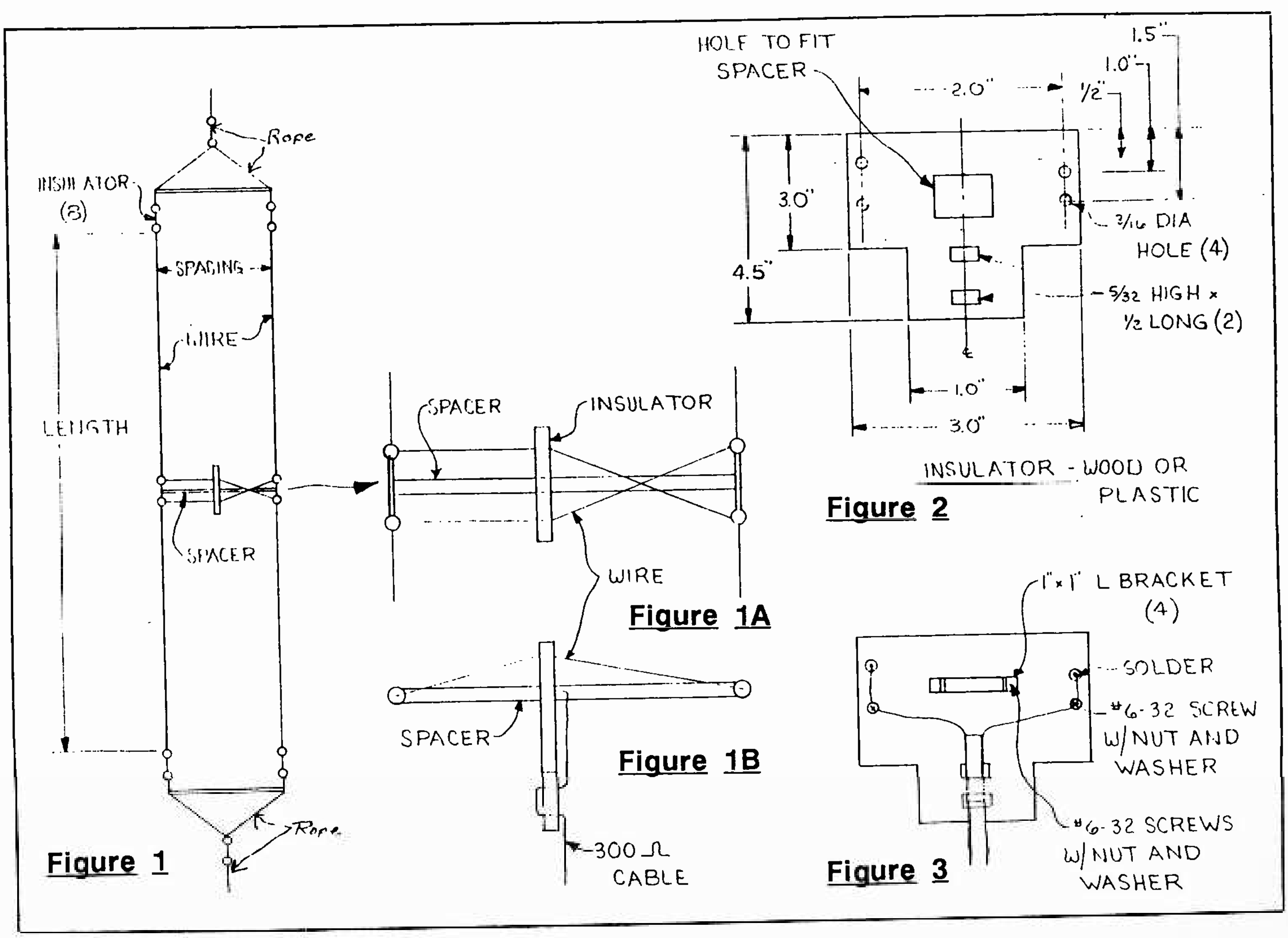


Figure 1

Figure 1A

Figure 1B

Figure 2

Figure 3

Cut the insulator to the indicated shape or leave it rectangular if you like.

Place the insulator on your center spacer and slide it 4 or 5 inches from the center and secure it with the L brackets. You can also use pieces of wood screwed and glued in front and back of the insulator to hold it in place.

SPACERS

Begin by preparing the center spacer. If you are building the 10 MHz version this spacer should be12 feet long. Measure in three inches from each end and drill a hole large enough to pass the wire used for the elements (see fig. 4).

Measure three inches in from the end of the two end spacers and mark the wood; do not drill any holes.

ASSEMBLY

Lay the components together on the ground so they look like figure 1. Run a piece of wire one foot long through the holes you drilled in the center spacer; use this wire to connect the insulators at the center of each dipole together and draw the insulators up against the wood spacer.

Wrap the wire around the insulator just as you did on the dipole sections and solder. The spacer should be snug between the insulators (fig. 4). Repeat for the other dipole.

Wrap and solder a one-foot-length of wire to reach end insulator. Now wrap the wire around an end spacer tightly where you made the mark three inches from one end (solder the ends).

Repeat this procedure on the other side of the spacer. Be sure the dipoles are even and do the other spacer the same way.

FEED SYSTEM ASSEMBLY

Run a wire from the one side of center of a dipole through the insulator and to the opposite wire of the dipole on the other side (see fig. 1A), solder these wires at the dipole as you connect them. Repeat for the other half.

Prepare the 300 ohm twinlead by splitting it back about two inches from one end and inserting this end through the slots (figs. 1B & 3); strip the end wires and mount solder lugs on them.

Solder two wires two inches long to each of the wires that pass through the center insulator, mount solder lugs on these wires and secure the lugs from the crossover wires and the lugs from the feedline with a machine screw (fig. 3).

Loop the feedline from the bottom of the insulator to the center of the wooden center spacer and tape it securely in place keeping the strain off the fragile insulator. The feedline should hang down from the center of the antenna.

ERECTING

Make a rope yoke at each end spacer as shown in figure 1. Secure the rope by wrapping it around the spacer and tying it tightly. Use epoxy glue to prevent slippage.

Tie a rope to the center of each yoke at the balance point; use this rope to secure the array to the towers or supports. It may be necessary to use light ropes from the ends of the spacers to ensure the antenna remains horizontal (spacers parallel to the earth).

Figure 5 illustrates other feed methods. The method on the left is good for only one band of frequencies while the other will allow operation over a wide range of frequencies similar to the center fed method. Use one of these end feeds if the antenna is used vertically.

There is a great deal more to the W8JK story and the following two books will provide information on other W8JK arrays that produce even higher gain:

ARRL Antenna Handbook, available from ARRL (225 Main St., Newington, CT 0611), or

Radio Handbook by William I. Orr, W6SAI, available from Howard W. Sams & Co. (4300 West 62nd St, Indianapolis, IN 46268).

Good luck with your flat top; I know it will do a find job for you. Keep the letters and cards coming. ∎

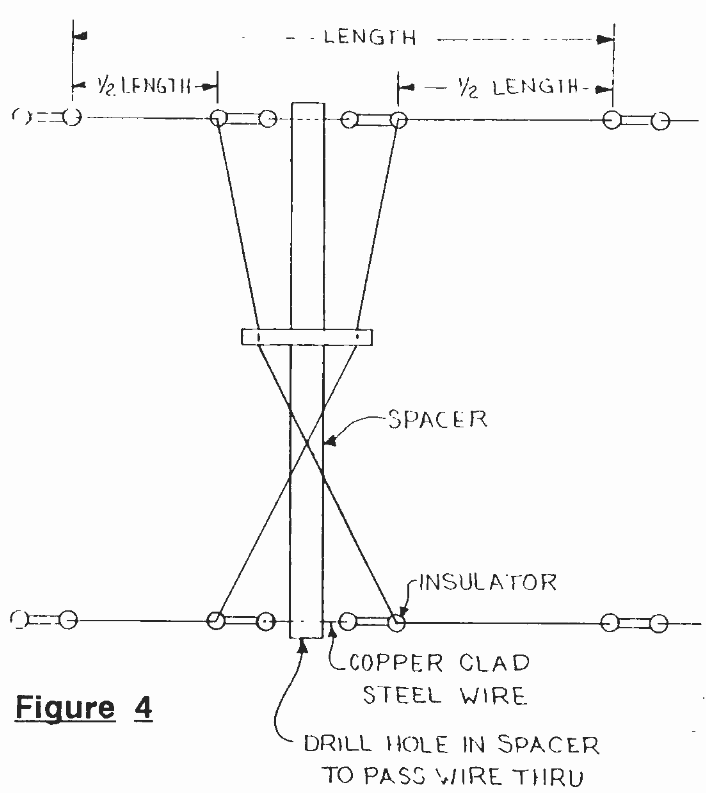
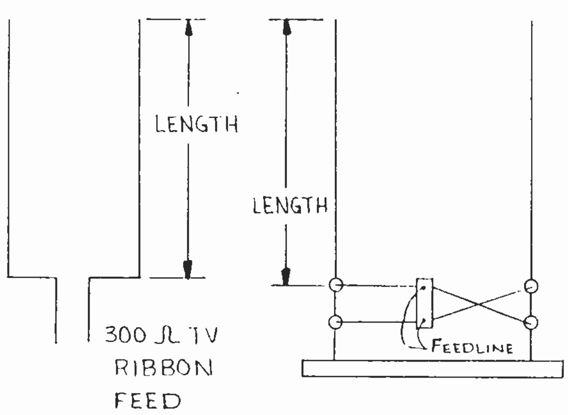


Figure 4



END FEED METHODS

Figure 5