BETTER SIGNALS

ANTENNAS AND SIGNAL IMPROVING ACCESSORIES

BY ED NOLL W3FQJ

W9INN 160-80-40M Broadbander

The low-band ham antenna is a problem in today's world of townhouses and tract developments. A second aggravation can be the use of more than one antenna to cover all three bands along with separate cables to the radio room. The W9INN 160-80-40M Broadbander offers effective solutions to the above. An attractive feature of this antenna is good and matched performance on some of the shortwave broadcast bands as well. Basic operation and a typical installation are covered in this column. In a subsequent column several innovations are covered that can be used with the basic W9INN and other wire antennas to add additional matched shortwave broadcast and ham bands to their capability.

The restrictive mounting site problem has been handled in two ways by W9INN. The antenna legs are only an electrical quarter-wavelength long worked against ground like a quarterwave vertical. Thus the feed point is at ground level, Fig. 1. The ground can be as simple as a 5 ′ stake driven into the ground or, radials can be added to improve low vertical angle DX and make the entire antenna less susceptible to changing ground conditions. An antenna worked against a good ground is usually the better way to go with low height antennas as compared to a low dipole when DX'ing is your aim. The low angle results improve with more radials. In fact sixteen of them is a worthwhile objective for the low-band DX'er.

W9INN uses a unique coil he has named a resonactor to decrease the required length of the quarterwave 160 meter leg, Fig. 1. It functions as a loading coil to obtain resonance on 160M and has a high reactance untuned trap-like performance on 80 meters. The 80-160M leg extends from the antenna end to the coaxial SO-239 receptacle at the feed point. The ground space occupied by the antenna is approximately 75 ′.

On the feed point side of the mast, two spreaders space the 40M quarterwave element a proper distance from the 80-160M leg. Both ends are soldered to the inner conductor of the SO-239. As shipped, the antenna is assembled completely except for the attachment of the spreaders. Even these are dressed and can be positioned correctly with ease.

When you order the antenna you can choose three preferred resonant frequencies, one on each band. These will bring you in the ball park even though you do not erect your antenna exactly as shown in Fig. 1. However, ground-system conductivity, height, and angle between the two sides of the 80/160M leg have their influence on the exact resonance points. Mast here was only 23 ′ high and the ground length of the antenna then approached 90 ′. I had to increase the length at all three antenna ends as marked in Fig. 1 to hit the center resonant frequencies of 1.85, 3.8 and 7.22 MHz. The SWR at each frequency was dropped to 1.1-to-1. The 160M 2-to-1 bandwidth was 120 kHz; 80M, 270 kHz. A ratio of less than 1.6-to-1 was maintained over the entire 40M band, and a ratio of 1.2-to-1 over the 15M band. In fact on the latter band the 40M leg operates as a three-quarter wavelength element. The cable length here was 90 ′ and in addition to the ground stake I used three 40M radials. The 160-80-40M Broadbander worked out well on all four bands. It was a joy to be able to operate on all four bands just by retuning the transceiver.

On 80 and 160M and on the other bands too there was no problem in bringing the SWR down to 1.1-to-1 over each of the bands with a tuner. Of course the tuner is only really necessary on 80 and 160 meters when you wish to operate over the entire band. As a bonus the antenna functioned

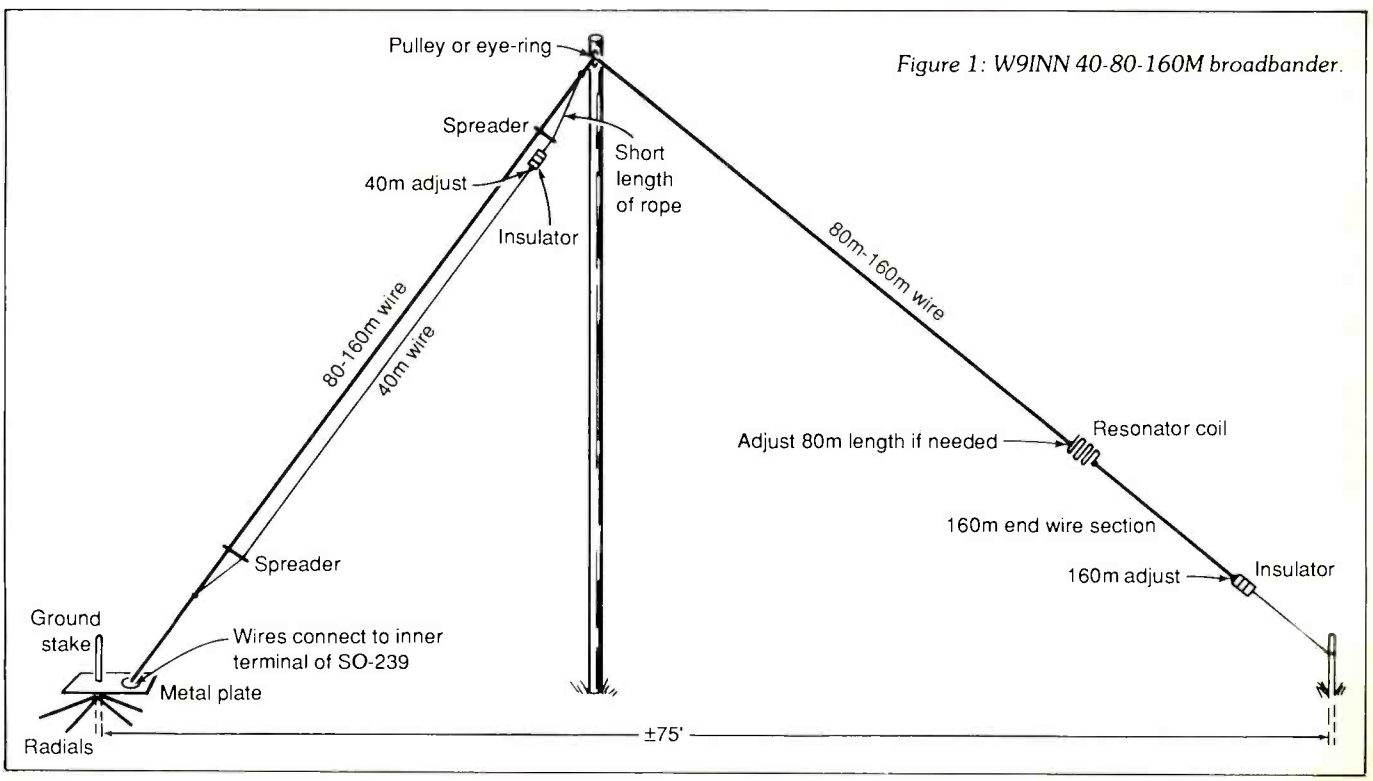

Figure 1: W9INN 40-80-160M broadbander.

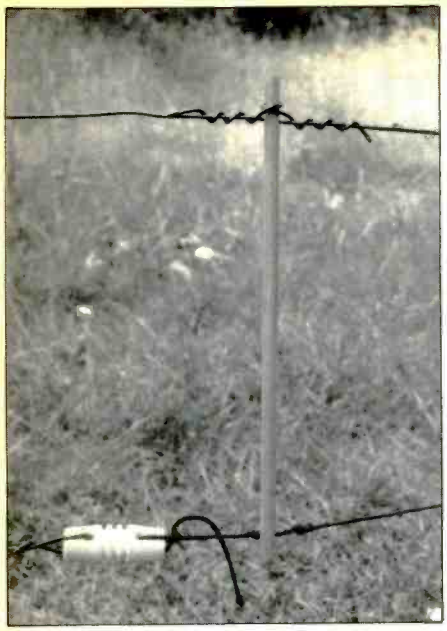

Figure 2: Spreader attachment before erection; 80-160M wire at top of spreader; end of 40M wire at bottom.

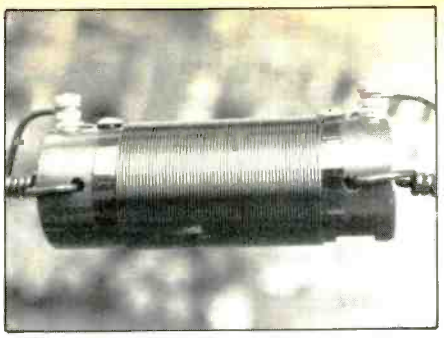

Figure 4: Resonactor coil.

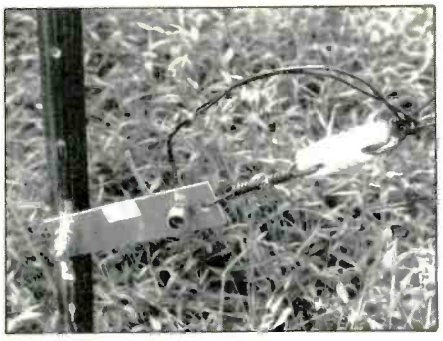

Figure 5: Feed point arrangement.

Figure 6: Antenna bridge at work.

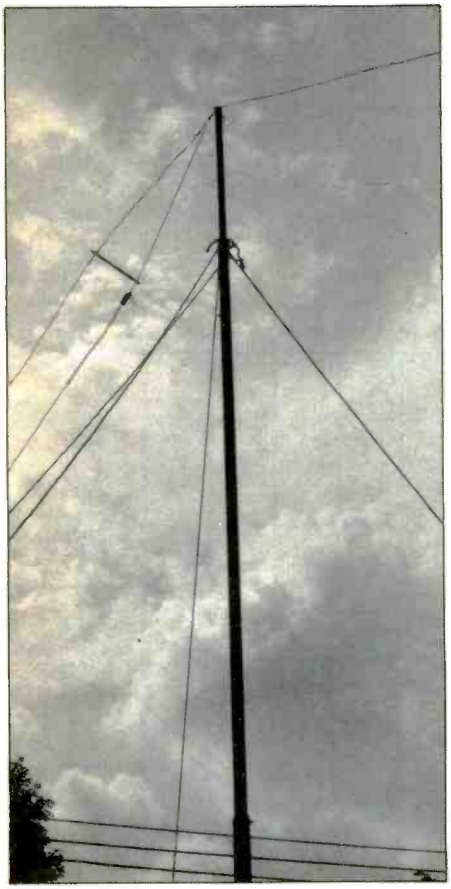

Figure 3: Antenna in position on top of plastic mast.

well as a general purpose shortwave broadcast antenna with some additional boost in performance on the 13, 19, 31, 41 and 75M bands.

The first construction procedure is to stretch out the antenna along the mounting site. Next the spreader near the feed point was attached about 3′ from the feed point, Fig. 1. The top spreader was assembled at ground level, Fig. 2. In the photograph note that the top 80-160M wire passes around the spreader but is held in position by the looped wires that are a part of the spreader assembly. The bottom 40M wire is held to the spreader by a flexible rope, also supplied. The looped wire on the left of the insulator can be used to adjust the 40M wire to resonance. Fig. 3 shows the antenna raised to the top of the mast. The 80-160M wire extends to the right away from the mast.

Similar looped tuning wires are located on the 80M side of the resonactor, Fig. 4, and, for 160M, ahead of the 160M end insulator, Fig. 1.

The feed point assembly is shown in Fig. 5. Note that the two antenna wires are joined and attached to the inner conductor SO-239 receptacle at the rear. All of this is supplied already assembled. The mounting plate itself is grounded to the metal stake. The three 33′ 4″ 40M radials I supplied are attached to the same bolt/nut assembly that holds the plate to the stake.

In my installation I used an MFJ-204B antenna bridge, Fig. 6, to tune the antenna to the three exact center frequencies I desired. This can be done without applying any power to the antenna using the bridge and the receiver part of the transceiver. As mentioned previously I was able to get SWR down to 1.1-to-1. This technique avoids inconsistancies. The antenna becomes resonated in its mounting situation. When you tune the antenna first, the influence of the coaxial line on the SWR readings at the transmitter is minimized. Stated another way, the actual length of the line has a minimal effect on the SWR readings.

W9INN Antennas can be reached at P.O. Box 393, Mt. Prospect, IL 60056.

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Band and Bandwidth Antenna Improvisations

In general, low-band antennas for ham and SWB operation have limited bandwidths. For example, in ham application, a tuner is often needed to obtain entire-band matching on 80 and 160 meters, and, sometimes, on 40 meters, too. A tuner is an added expense and must become a part of the tune-up procedure for the transmitter. An antenna cut as a dipole on one band performs poorly on two adjacent bands be they ham or tropical SWB bands. A tuner can help in matching an antenna but does little in improving the performance of a miscut antenna itself.

There are ways of using jumpers and add-ons to devise more benefits from a given antenna with good results. In this column, we will use the W9INN-40-80-160M broadbander, Fig. 1, as an example. This antenna was detailed in the column of the previous issue. The same ideas covered this month can also be used with other low-band ham, SWB and MW/LW antennas.

Operation At Both Ends Of A Ham Band

In the first example, a jumper of proper length will be added to the 40M wire of the W9INN antenna which will permit low SWR, no-tuner operation on the CW portion of the 40M band. If you recall, our W9INN antenna was cut for sideband operation with a mid-frequency of 7.22 MHz. In the modification, the first step is to place an insulator, Fig. 2, into the 40M wire about 9′ up from the feed point. A jumper directly across the insulator permits sideband operation in accordance with a frequency centered about 7.225 MHz.

The 40M wire is made resonant at the CW end of the band by removing the jumpers and substituting a 20″ stiff wire loop across the insulator, Fig. 3. An antenna bridge can be used to advantage in cutting this loop for resonance on a specific CW center frequency. The set up is ideal for the SSB operator who, on occasion, likes to do a bit of CW DX'ing. Similar ideas can be used to do some occasional DX'ing on the 80M and 160M CW bands. On 80 meters, a straight 1′10″ length of stiff wire is clipped to the 80/160 wire at the resonactor, Fig. 4, for CW operation. Use a stepladder or lower the antenna wire a bit by releasing the rope that pulls up on the antenna at the end stake.

Keep the loop and the add-on you make.

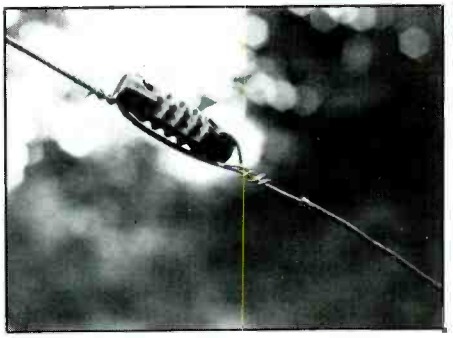
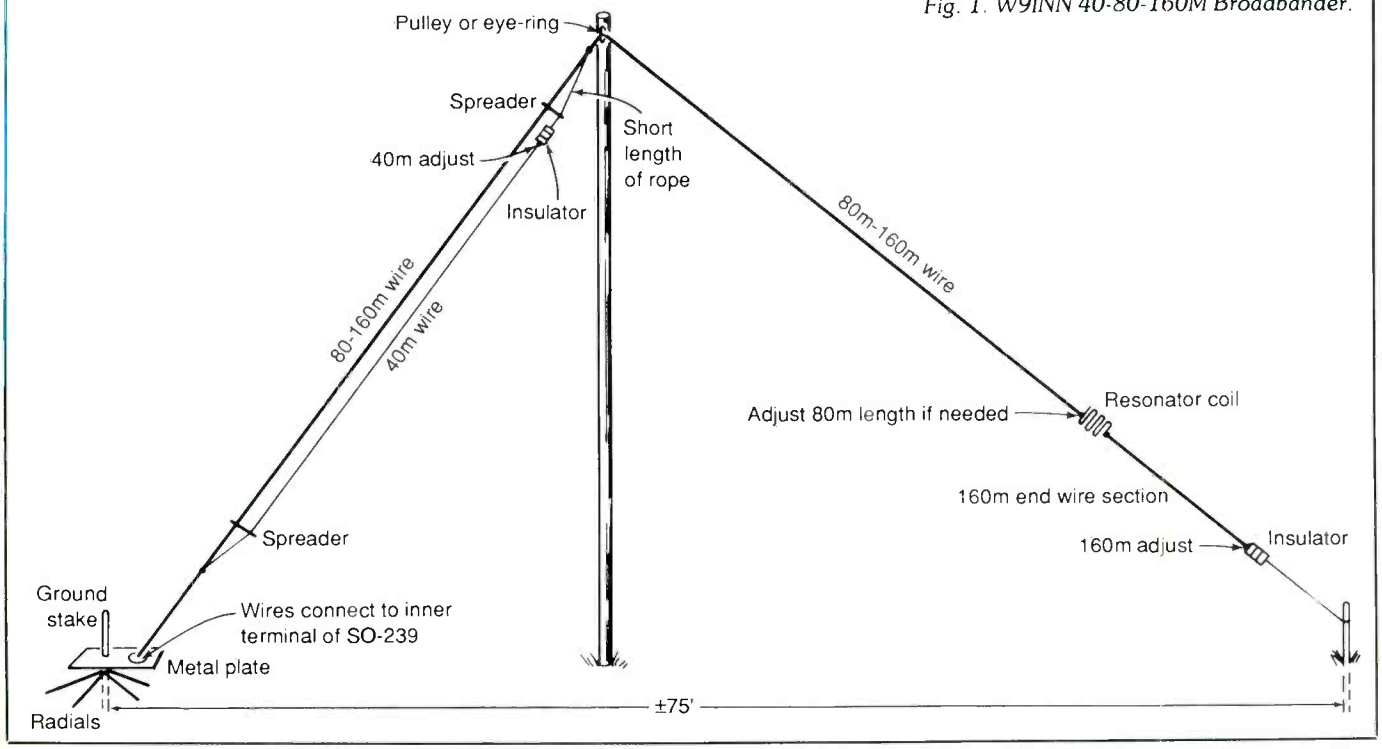


Fig. 2. Insertion of insulator in 40M wire.

Anytime you want to do some CW operation you will have the items that will permit you to operate on the ends of the bands with a low SWR and no tuner.

In the installation, a permanent set up was made for 160M operation. First, the wire end was cut back and resonated to 1950 kHz at the high-frequency end of the 160M band. An appropriate jumper and clip was prepared, along with an experimental length of wire, and attached to the end insulator, Fig. 5A. The opposite end of the wire was attached to a second insulator,

Fig. 1. W9INN 40-80-160M Broadbander.



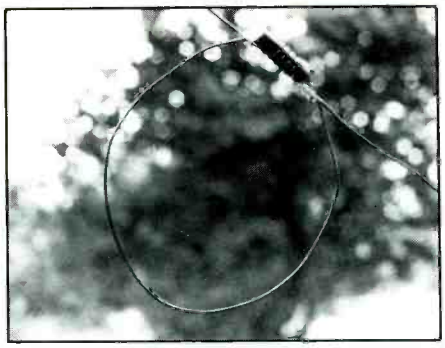


Fig. 3. CW loop across insulator

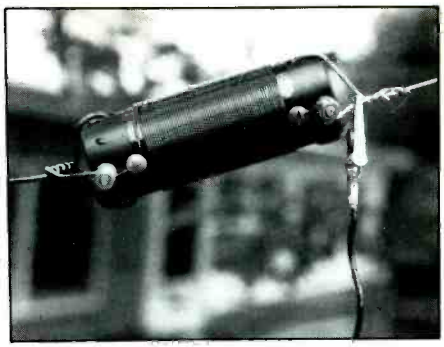


Fig. 4. Clip-on wire for tuning 80M wire to CW portionof band.

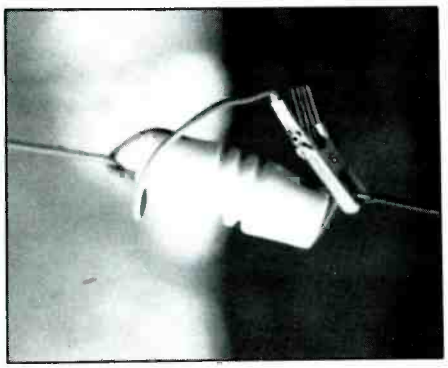


Fig. 5A. Use of jumper to lower resonant frequency on 160.

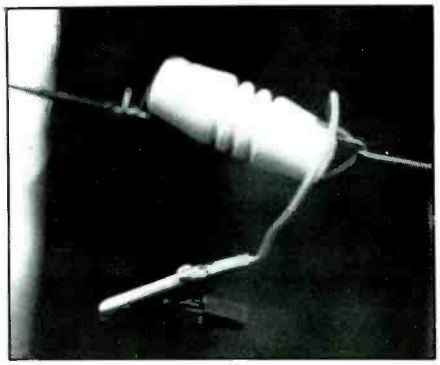


Fig. 5B.

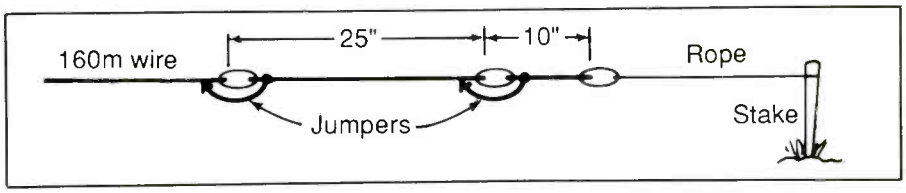


Fig. 6. Jumpers for selection of three portions of the 160M band.

Fig. 6. A length was chosen experimentally to resonate the antenna to 1845 kHz with the jumper closed, Fig. 5B. Finally, a third insulator was attached in the same way to permit low-SWR CW operation at the very low frequency end of the 160M band. An antenna bridge such as the MFJ-204B is a big assist in cutting the wire for a particular band segment.

Adding 20M To The W9INN Antenna

The addition of a 20M wire permits operation on this DX band and sets up a good performing 15, 20, 40, 80 and 160M antenna system. With wires resonated on the appropriate sideband frequencies you can change bands by only retuning your receiver. You will have a low SWR on each of the bands and each antenna will be tuned for resonance.

The 20M antenna operates as a 3/4 wavelength element against ground and has a physical length of 51'7". Our exact resonant frequency was 14.225 MHz. The 20 meter addition was mounted on a second plastic pipe the same height as the first one, Fig. 7, and was spaced approximately 7' from the first mast. The presence of the 20M wire had no influence on the W9INN 80-160M wire. The resonant frequency of the 40M wire was shifted slightly an unimportant amount.

Shortwave BroadcastResults

The basic W9INN antenna performs well as a receiving antenna on the 13, 41 and 75M SWB bands because each is on, or near, to the resonant 80, 40 and 15M ham bands. Results are good on the 120M band as well when the 80/160M wire is resonated near the high frequency end of the 160M band. Also, 80/160M wire has odd-order harmonics that produce resonance and fine performance on the 19M and 31M SWB bands. The presence of the 20M wire also helps to frequency spread the SWB reception capability of the antenna.

It is possible to peak the 49 or 60M pick up, if you wish to do so, by temporarily adding either an 8'4" or 12'3" length, respectively, across the 40M wire at the newly installed insulator for adding CW capability on 40M, Fig. 3. By adding one of the two wires you can set up a quarter wavelength wire on

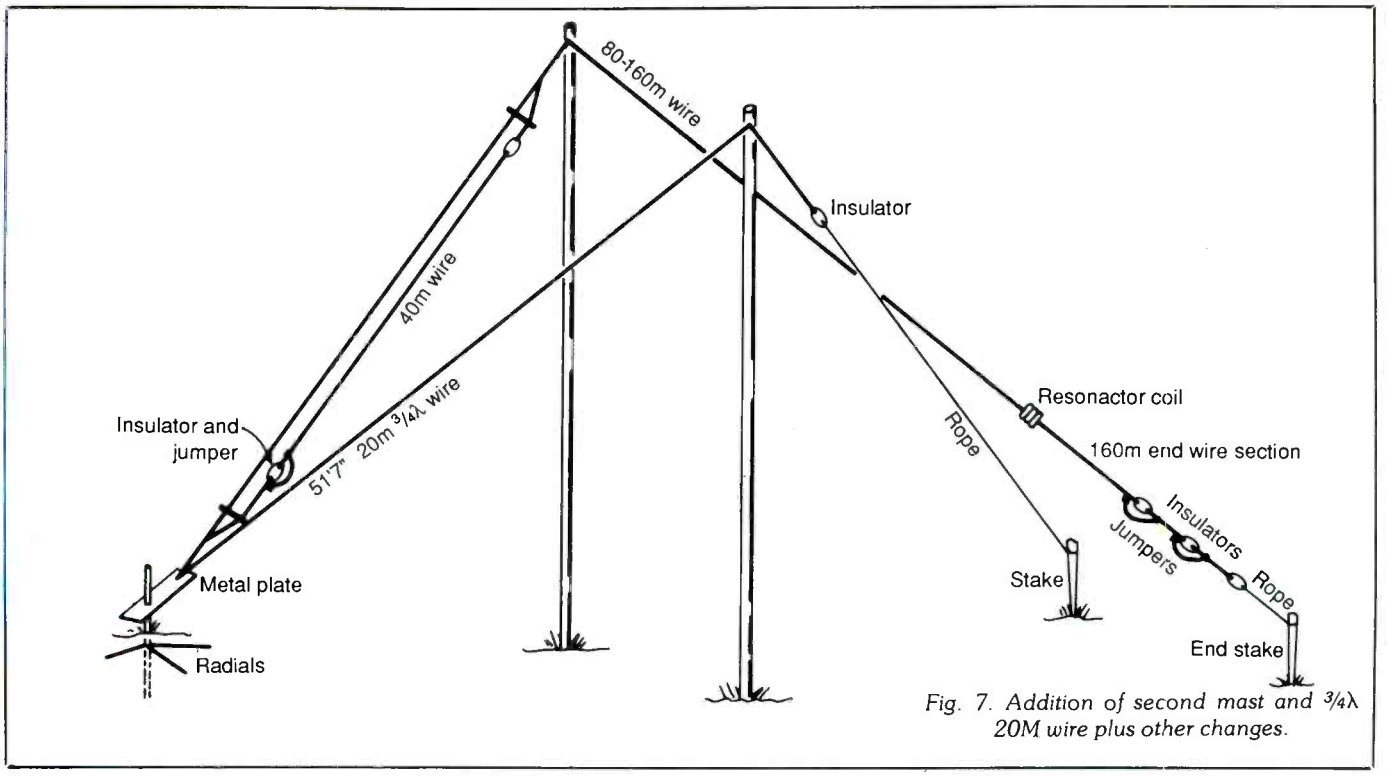


Fig. 7. Addition of second mast and 3/4λ 20M wire plus other changes.

either the 49M or 60M SWB bands. You can use two short wooden stakes to set up a small triangular support for the wires as they come away from the insulator ends. Don't let the wires curl or lay on the ground.

Broadcast Band (BCB) Reception

If you are a BCB enthusiast you can easily add broadcast band capability to the antenna. As you know, more people now share an active interest in all-band radio reception, and ham radio, than ever before. It is a good thing. The AM broadcast band addition to the installation is a wire that connects to the very end insulator of the 80/160M wire with a jumper, Fig. 8. What you see is the last insulator of the three associated with the 160M band operation, Fig. 6. A jumper clip is associated with a length of #16 plastic covered hook-up wire. This wire is wrapped tightly around the rope that extends between the last insulator and the support stake, Fig. 8. A 25′ length of wire is wrapped tightly around the rope attaches to the end support stake, Fig. 7. When all the clips associated with the end antenna are closed, the antenna resonates well up into the broadcast band. You have a resonant antenna on the AM broadcast band which is good in picking up the weaker broadcast signals for identification.

The total length occupied by this modified antenna from feed point to end stake is 116′. It's really an all-bander. PC

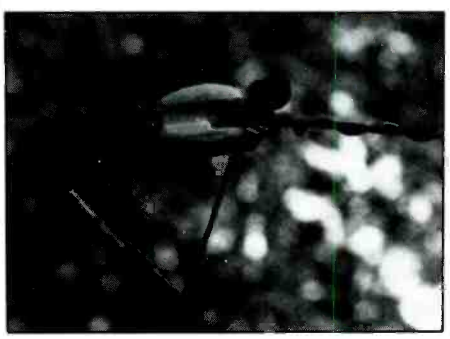


Fig. 8. Adding BCB capability to the 160-80-40 broadbander.