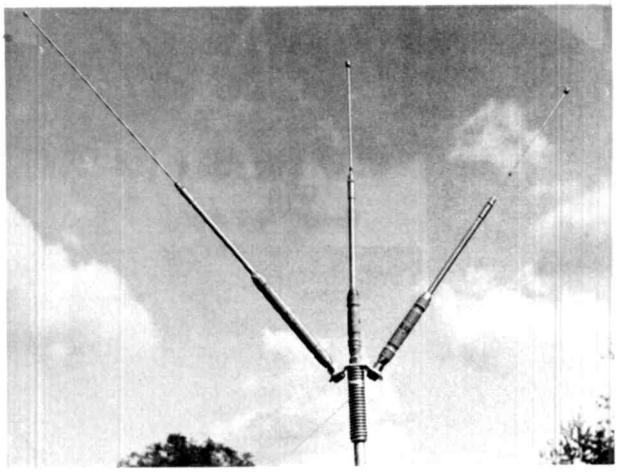
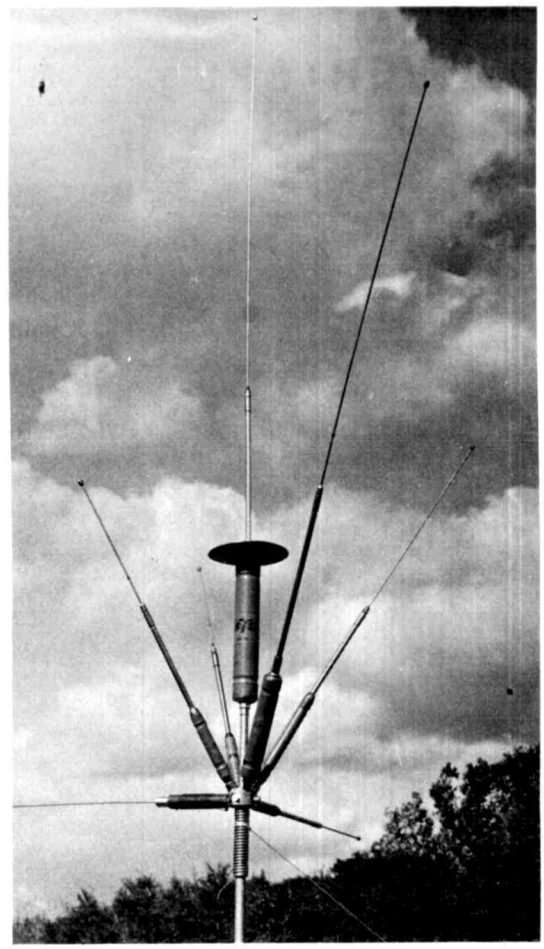
Modifications to a popular mobile antenna for multiband operation

Nine-resonator antenna with seven resonators in place (right). Those for 10, 15, 20, 40, and 80 meters are pointing upward. The two horizontal elements are for the new WARC 10-18 MHz bands. Below, complete assembly of the three-band antenna.





refinements to a mobile high-frequency antenna

Ten months to retirement! During the countdown, all my free time was devoted to getting a mobile CW station working in my car. No way would I go on an extended trip without ham radio. An FT 101-B would be my transceiver, and for the radiator I chose the Hustler mobile antenna. I had been going to roll my own, but time was running out.

At first I purchased only the 40-meter resonator with the antenna and mount. This gave me a chance to run some tests and determine the capabilities of such a short antenna mounted on the bumper of the car. **Fig. 1** shows the original installation. The results amazed me! In a few days I worked WAC on 7 MHz from the highways in eastern Pennsylvania. This mobile operating opened up a new dimension for me. I then purchased the four other resonators, tuned them up, and off we went on a two-week trip to Florida. I had more fun working mobile than sightseeing.

During a memorable QSO on 21 MHz, the DX station informed me that 28 MHz was wide open, and he asked me to change frequency, as we needed to make contact only on 10 to complete a five-band exchange. This band change required stopping the

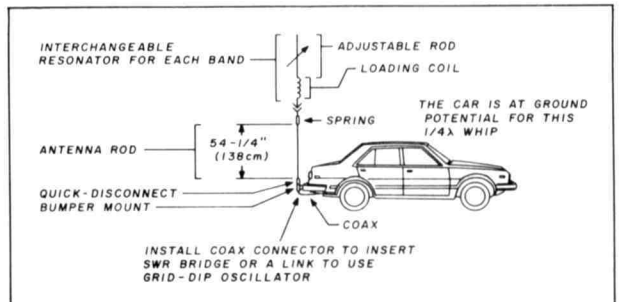


fig. 1. Author's original mobile installation showing bumper-mounted Hustler antenna. Quick disconnect allows easy insertion of test equipment.

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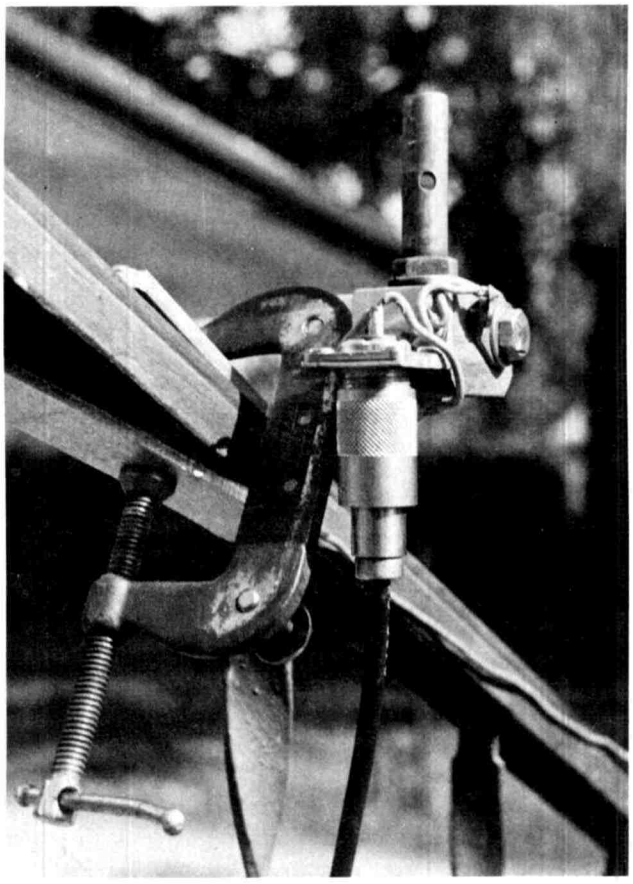


Universal C-clamp mount for the nine-resonator mobile antenna. (The male half of a quick disconnect points up.) Small aluminum pads 1/8-inch (3-mm) thick are installed on each side of railing. Screws in C clamp are for connecting radials.

car, unscrewing the 15-meter resonator, and putting the 10-meter resonator in place. It's not much of an operation, but it was raining. Full of true ham spirit, I made the band change. The contact was completed on 10 meters, which gave me great satisfaction.

This one band change convinced me that all was not ideal with the original setup. Some changes would have to be made if I were to come up with a mobile multiband antenna. This could be a nifty retirement project. I had a feeling that several resonators could be connected together at the bottom end. Here's how I did it.

three-band design

Fig. 2 shows a small bracket that holds three resonators at the same time and reduces their mutual inductive coupling. The 15/10/20 meter resonators were assembled as shown. A Jones Micromatch (SWR bridge) was installed into the feed line. Only a slight adjustment was needed to bring the SWR on the three bands to 1.1 or better. **Table 1** shows the

table 1. Lengths of elements for the three high-frequency bands measured from element end to locking nut.

	amateur band (MHz)		
	28	21	14
single resonator at end of antenna, inches (mm)	7-5/16 (186)	8 (203)	14 (356)
three resonators mounted for three-band operation, inches (mm)	6-1/2 (165)	7-5/8 (194)	13 (330)

length of the tuning stubs measured from the very end to the end of the locking nut.

I made field-strength measurements on 28 MHz with all three resonators in place, then with only the 28-MHz resonator in place. I detected no change in field strength. But then a friend asked, "What are you going to do about 40 and 80, and what about the new WARC bands?"

nine-resonator design

After a few days in my workshop I came up with a new creation. **Fig. 3** shows the details of a new, lightweight, low-profile adapter that will accept a total of nine resonators. It was made up by using only a small bench lathe and a drill press.

Fig. 4 shows the arrangement of the resonators, including the change in length of the tuning stub. I omitted the 80-meter setup since I could purchase

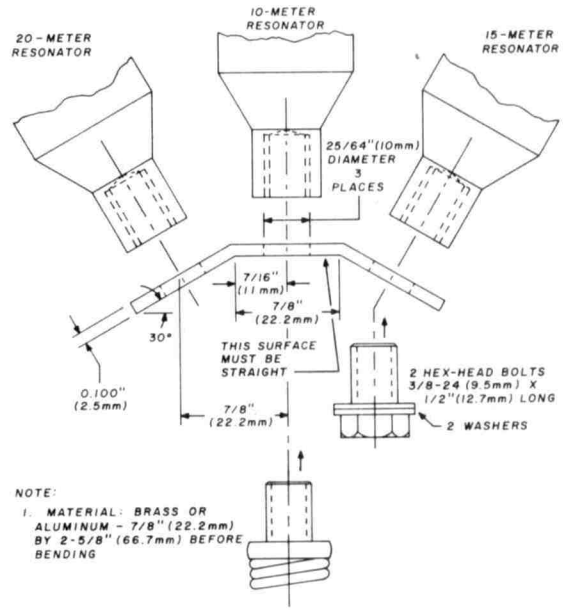


fig. 2. Three-band mobile antenna showing adapter bracket to hold three resonators to the antenna rod (whip) of *fig. 1*.

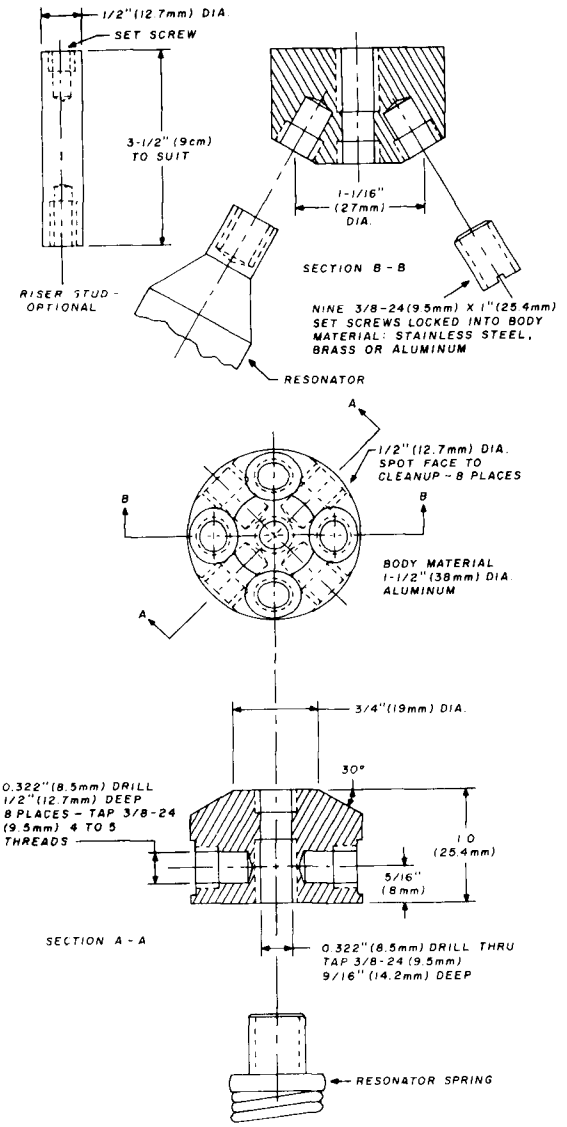
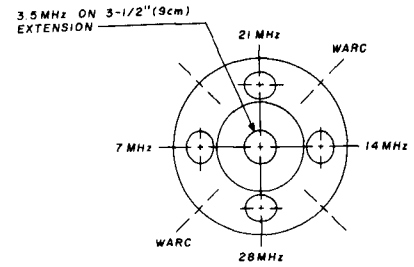


fig. 3. Mechanical details for constructing a nine-resonator adapter.



	AMATEUR BAND (MHz)			
	28	21	14	7
SINGLE RESONATOR, INCHES (mm)	7-5/16 (186)	8 (203)	14 (356)	23-1/2 (597)
FIVE RESONATORS ON ADAPTER, INCHES (mm)	6-1/2 (165)	7-1/2 (190)	12-3/4 (324)	20-5/8 (324)

fig. 4. Arrangement of the different resonators. Table shows lengths of the elements when using a single resonator and when using the resonators and the adapter.

only the resonator for the 75-meter phone band and had to improvise to work on the low end of 80 meters to bring the resonator to frequency. I also installed a disk 4 inches (10 cm) in diameter above the 80-meter loading coil to improve the SWR and also to reduce the length of the tuning stub. The SWR for all five bands is better than 1.15:1.

There is no guarantee that the resonators for the new bands will perform in conjunction with the present-band resonators. There might be too much interaction between some of the loading coils. At one time, I installed two 40-meter resonators. I wanted one tuned to 7025 kHz and the other to 7225 kHz. However, I never was able to accomplish this.

160-meter mobile antenna

It was impossible for me to purchase a resonator for the 160-meter band. I either had to make one myself or just forget about 160-meter operation from the car. I not only wanted to work 160, but was also curious to see what could be done on that band while rolling along. **Fig. 5** shows the details of my 160-meter loading coil. Many experts will have misgivings about using PVC tubing. Since I had nothing else, I tried it, and it has been working just great with the FT 101-B; no breakdowns!

An old telescoping automobile antenna serves as tuning stub, with an aluminum disk 7 inches (18 cm) in diameter between the tuning stub and loading coil.

The adjustment on 160 meters must be precise: usable bandwidth is only 6 kHz. For 1805 kHz, my tuning stub is adjusted to a length of 44-1/8 inches (112 cm) from the coil to the end of the stub.

notes on the directivity of the antenna

While in Florida, I had biweekly schedules with N3WW (distance 1,000 miles). I always had the rear of the car facing toward Pennsylvania. (The antenna is mounted on the rear bumper). We always managed our CW contacts, but at times copy was marginal. One morning a side road was blocked off and I had to

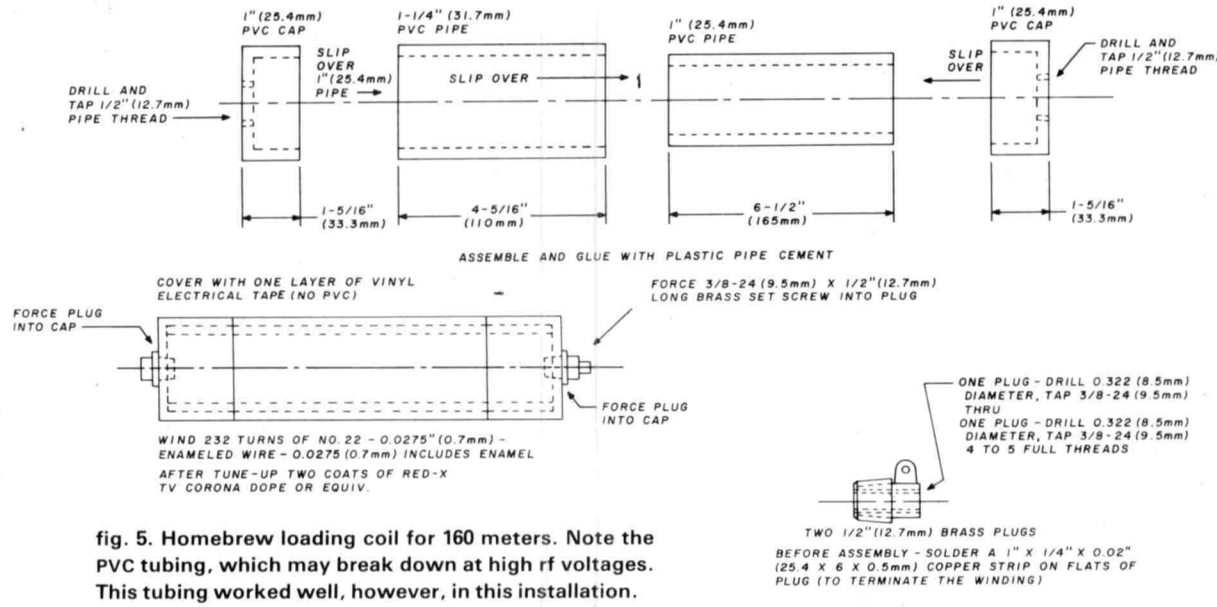


fig. 5. Homebrew loading coil for 160 meters. Note the PVC tubing, which may break down at high rf voltages. This tubing worked well, however, in this installation.

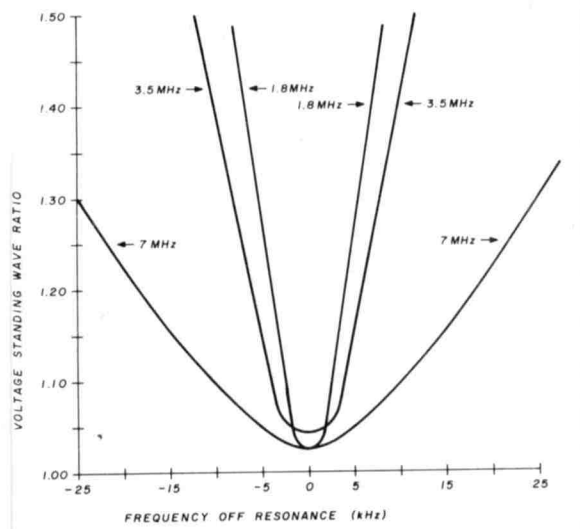
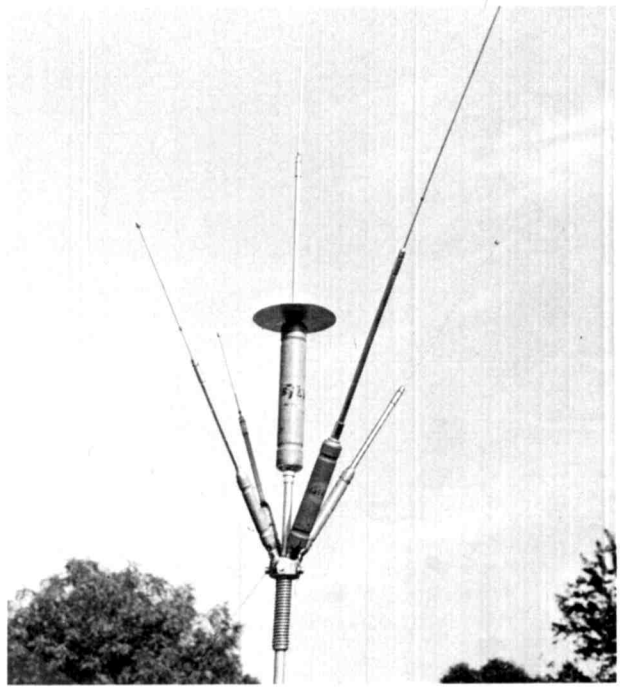


fig. 6. Plot of standing-wave ratio as a function of off-resonance frequency for three bands. Plot for the 160-meter antenna was made separately. Not bad considering the mechanical constraints involved.

make a U turn. I was amazed! The signal from N3WW went from S5 to 20 dB over S9. N3WW started to ask questions about the tremendous increase in signal strength. I made a few more circles with the car. The results were always the same: maximum signal when the front of the car was facing in the direction I was working.

The 160-meter loading coil with 7-inch (18-cm) diameter disk. Tuning stub at top of disk is used to reduce the total height of the antenna to 10 feet (3 meters).



Ready to roll with the five-band mobile antenna. (All resonators tuned to 25 kHz from the low ends of the bands: 10, 15, 20, 40, and 80 meters.)

We made the same tests on 21 MHz. The results were more pronounced: from S5 to 30 dB over S9.

The very same evening we met on 7 MHz and obtained similar results. However, the difference in signal strength was only 2-1/2 S units, and on 80 meters the difference was 1 S unit.

I ran a few tests with some DX stations (3000+ miles). The difference in signal strength was not nearly as spectacular, but a difference was noted.

Every time I now work mobile I feel that I am sitting inside a good beam antenna. I hope I never get carried away and make a U turn on a freeway.

Can anything be worked mobiling on 160? During the 160-meter ARRL contest I was on the beach at Daytona Beach, Florida. In 45 minutes I worked 35 stations. Enough said!

Fig. 6 shows SWR versus frequency for three bands. I had no desire to try the 160-meter antenna in conjunction with any of the others; it's big enough by itself!

No one should have to stay off the air for lack of an antenna. The photo shows a forged C clamp that can be used in various places and situations; for example, on a railing, picnic table, fire escape, rain gutter. However, an effective ground should be provided.

I wish all of you happy mobiling! At least five bands are available by the flip of the radio's bandswitch.

ham radio