folded horizontally to form a radiator for the high-frequency band. On the lower band, the antenna acts as a top-loaded vertical antenna, while on the higher band, the flat top does the radiating, rather than the vertical portion. The vertical portion, instead, acts as a quarter-wave linear transformer, matching the 6000-ohm nominal antenna impedance to the 50-ohm impedance of the coaxial transmission line.

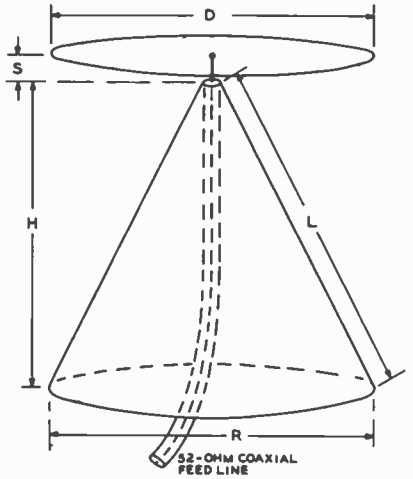
A radial ground system should be installed beneath the antenna, two or three quarter-wave radials for each band being recommended.

When operating on either band, the transmitter should be checked for second harmonic emission, since this antenna will effectively radiate this harmonic.

The Low-Frequency Discone Antenna—The *discone* antenna is widely used on the vhf bands, but until recently it has not been put to any great use on the lower-frequency bands. Since the discone is a broadband device, it may be used on several harmonically related amateur bands. Size is the limiting factor in the use of a discone, and the 20-meter band is about the lowest practical frequency for a discone of reasonable dimensions. A discone designed for 20-meter operation may be used on 20, 15, 11, 10, and 6 meters with excellent results. It affords a good match to a 50-ohm coaxial feed system on all of these bands. A practical discone antenna is shown in figure 34, with a SWR curve for its operation over the frequency range of 13 to 55 MHz shown in figure 35. The discone antenna radiates a vertically polarized wave and has a very low angle of radiation. For vhf work the discone is constructed of sheet metal, but for low-frequency work it may be made of copper wire and aluminum angle stock. A suitable mechanical layout for a low-frequency discone is shown in figure 36. Smaller versions of this antenna may be constructed for 15, 11, 10, and 6 meters, or for 11, 10, 6, and 2 meters as shown in figure 34.

For minimum wind resistance, the top "hat" of the discone is constructed from three-quarter inch aluminum angle stock, the rods being bolted to an aluminum plate at the center of the structure. The tips of the rods are all connected together by lengths of No. 12 enameled copper wire. The cone elements are made of No. 12 copper wire and act as guy wires for the discone structure. A very rigid arrangement may be made from this design, one that will give no trouble in high winds. A 4″ × 4″ post can be used to support the discone structure.

The discone antenna may be fed by a length of 50-ohm coaxial cable directly



DIMENSIONS

20, 15, 11, 10, 6 METERS	15, 11, 10, 6 METERS	11, 10, 6, 2 METERS
D= 12′ L= 18′	D= 8′ L= 12′	D= 8′ L= 9′ 6″
S= 10″ R= 18′	S= 6″ R= 12′	S= 4″ R= 9′ 6″
H= 15′ 7″	H= 10′ 5″	H= 6′ 3″

Figure 34

DIMENSIONS OF DISCONE ANTENNA FOR LOW-FREQUENCY CUTOFF AT 13.2 MHz, 20.1 MHz, AND 26 MHz

The Discone is a vertically polarized radiator, producing an omnidirectional pattern similar to a ground plane. Operation on several amateur bands with low SWR on the coaxial feed line is possible.

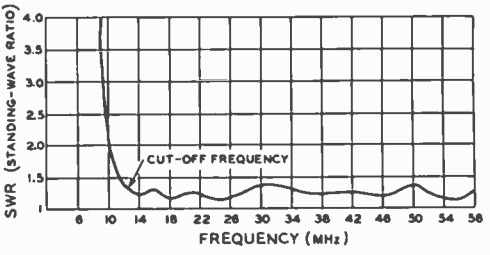
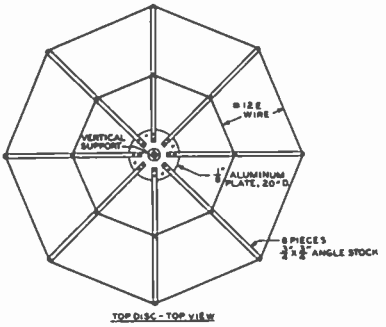


Figure 35

SWR CURVE FOR A 13.2-MHz DISCONE ANTENNA. SWR IS BELOW 1.5 TO 1 FROM 13.0 MHz TO 58 MHz

from the transmitter, with a very low SWR on all bands.

The Trap Vertical Antenna—The trap technique described in a later chapter can be employed for a three-band vertical antenna as shown in figure 37. This antenna is designed for operation on 10, 15, and 20 meters and uses a separate radial system for each band. No adjustments need be made to the antenna when changing frequency from one band to another. Substitution of a ground connection for the radials is not recommended because of the high ground loss normally encountered at these frequencies.



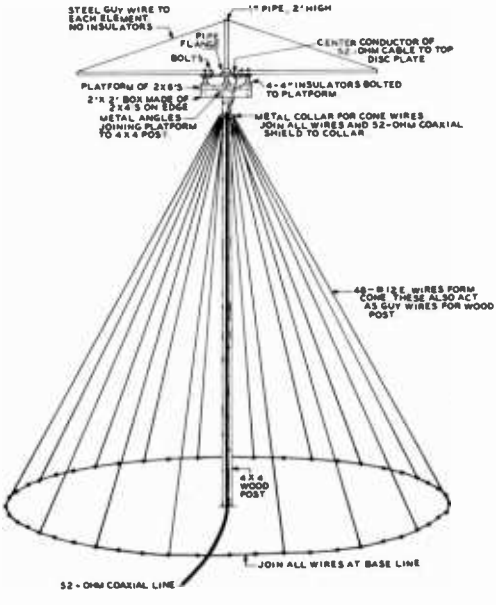


Figure 36

MECHANICAL CONSTRUCTION OF 20-METER DISCONE

Typical trap construction is discussed in the reference chapter, and the vertical radiator is built of sections of aluminum tubing, as described earlier.

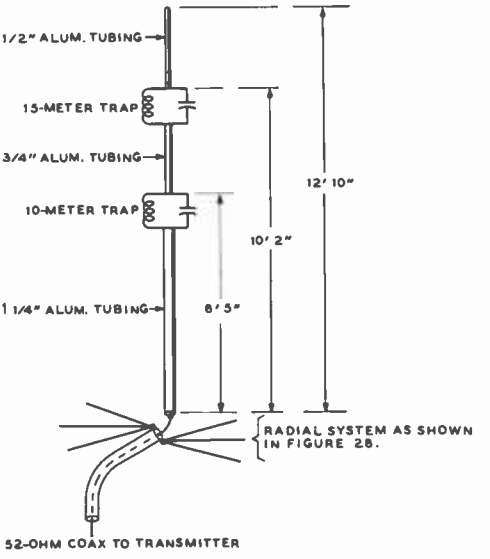


Figure 37

TRIBAND TRAP VERTICAL ANTENNA

Parallel-tuned trap assemblies are used in this vertical antenna designed for 20-, 15- and 10-meter operation. A radial ground wire set, such as described earlier in the chapter is used. Automatic trap action electrically switches antenna for proper operation on each band.

Each trap is built and grid-dipped to the proper frequency before it is placed in the radiator assembly. The 10-meter trap is self-resonant at about 27.9 MHz and the 15-meter trap is self-resonant at about 20.8 MHz. Once resonated, the traps need no further adjustment and do not enter into later adjustments made to the antenna. The complete antenna is resonated to each amateur band by placing a single-turn coil between the base of the vertical radiator and the radial connection and coupling the grid-dip oscillator to the coil. The coaxial line is removed for this test. The lower section of the vertical antenna is adjusted in length for 10-meter resonance at about 28.7 MHz, followed by adjustment of the center section for resonance at 21.2 MHz. The last adjustment is to the top section for resonance at about 14.2 MHz.