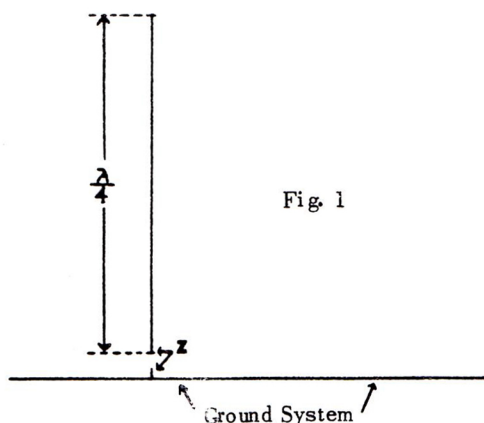


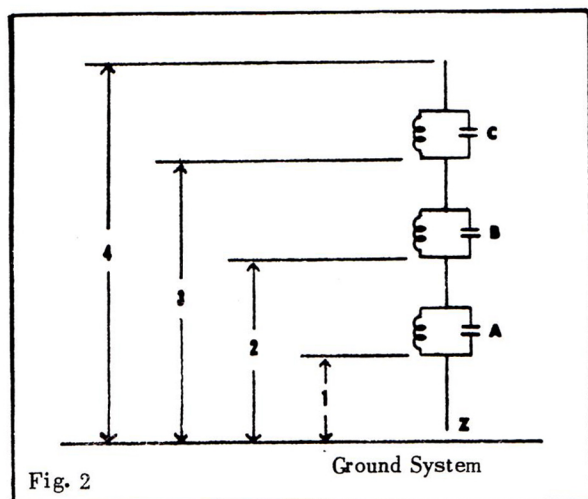
# VERTICAL ANTENNA INSTALLATION

Practically all vertical antennas, designed for use on the Ham bands, are of the *Marconi*, or resonant quarter-wave type. Such antennas must work against a good ground or counterpoise system to furnish the other quarter-wave to complete the dipole antenna. As shown in Fig. 1, when the



antenna is made one-quarter wavelength ( $\lambda/4$ ), the point Z will have an impedance of about 40 to 50 ohms. By connecting a 52 ohm coax line at this point, a good match of line to antenna is achieved over a considerable portion of the band for which the antenna is made  $\frac{1}{4}$  wavelength. This is done without tuning coils or other matching devices.

To make an antenna of this type operate on more than one band, the length may be automatically adjusted by installing parallel resonant traps at the proper points to cut the antenna *electrically* at  $\frac{1}{4}$  wavelength long. See Fig. 2. These traps offer a very high impedance at or near resonance and act as insulators placed at the end of the  $\lambda/4$



point for each band. In Fig. 2, for example, if trap A is tuned to 28 mcs., the section 1 is made  $\lambda/4$  at 28 mcs. Trap A has disconnected the upper sections of the antenna and they do not operate on 10 meters.

To make the antenna work on the 15 meter band, the coil in trap A plus the section of antenna to trap B combine with section 1 and make a  $\lambda/4$  on that band as indicated by 2.

These traps and antenna sections can be continued in this manner to the limit of mechanical practicability and coil design. The last section, 4, includes the inductance of all coils and the top antenna section for an equivalent length of  $\lambda/4$  at the lowest frequency.

## WHERE TO INSTALL

The best location for a vertical antenna—as proved by thousands of broadcast stations—is on the ground; and the closer to the ground, the better! In fact, ground that is *low*, in relationship to surrounding terrain, provides the very best location. This is quite contrary to the usual Ham idea that the antenna must be high in the air.

As shown in Fig. 1, the bottom of the antenna must be right at the ground so a 52 ohm coax line can be connected at that point. If the antenna was several feet from the ground, an appreciable length of wire would be needed to make the ground connection. Since this becomes part of the antenna, we no longer have a quarter-wavelength and the antenna will not work as intended.

Since the bottom of the antenna must be right at the ground, mounting on top of a pole is not possible unless the ground system can also be mounted at the top of the pole—as with a *ground plane* antenna. This is usually impractical on the lower frequencies and nothing would be gained, except in an area where a metal structure might be in the field of the antenna.

Installation is entirely practical on a flat or gently sloping roof, although the ground system will need more radials, and some experimenting may be necessary to achieve optimum performance.

Since the antenna may be purchased ready-made, the major problem to a good installation is the ground system.

## HOW TO INSTALL A GOOD GROUND SYSTEM

Since a ground level installation is to be preferred, such a basic system will be described first. Variations will be shown for ground installations where ground area is limited. These will also apply to other locations.

Ground systems recommended by the F.C.C. for broadcast stations consist of a minimum of 120 radials, each as long as the height of the antenna, running from the base to the perimeter of a complete circle around the antenna.

Fortunately, for the higher frequencies used by Amateurs, a minimum of *four* radials about as long as the equivalent length of the antenna will usually be adequate. See Fig. 3. If possible, more ra-

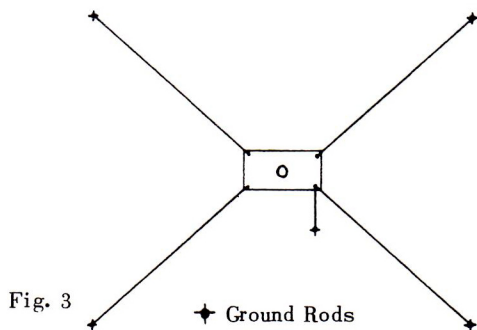


Fig. 3

dials should be installed to improve performance. All radials, preferably, should have a ground rod at each outer end. A ground rod should also be provided at the center, as illustrated. The radials may be buried in the ground or left on top. If left on top of the ground, they will usually work into the ground if not prevented from doing so.

If there is not sufficient space to install radials of the length recommended by the antenna manufacturer, the radials may be bent back slightly or cut somewhat shorter and more radials added. If space is limited to an area considerably less than that required for a normal system, the arrangement shown in Fig. 4 may be used. Dimension (A) must not be less than one-half the total antenna height.

If space is rectangular rather than square, the ground system will be satisfactory if it covers about the same area and is installed in the same manner. It is also possible to install the antenna ground system *off center* as shown in Fig. 5.

## ROOF INSTALLATIONS

All of the methods described for ground installations may also be used for roof-top installations. The multiple ground rods are not practical, but at least one should be installed. This ground should be of a heavy conductor, run to a ground rod or water pipe. This is separate from the ground that should also occur through the outer conductor of the coax line.

Metal roofs make good ground systems, provided the metal sections make good electrical contact and are not rusted or badly corroded at the joints. A short connection between antenna base and roof is necessary. The roof should be well grounded.

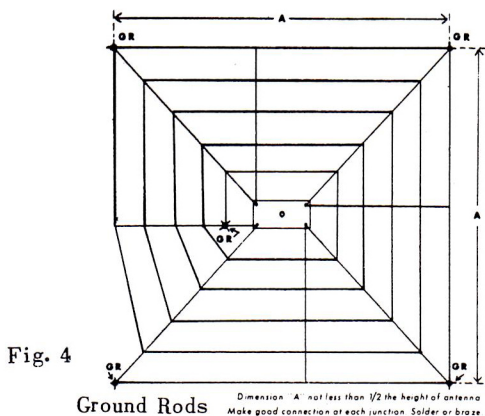


Fig. 4

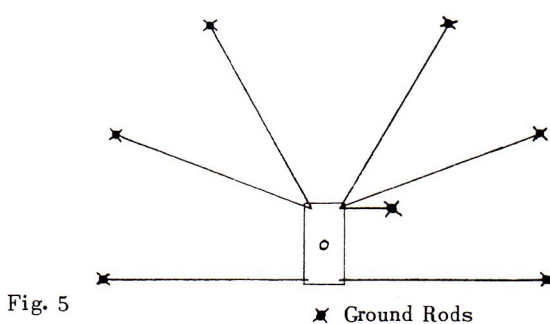


Fig. 5

## LIGHTNING PROTECTION

A properly designed and installed *horn* or *ball-gap* at the antenna base will adequately protect the building and equipment and meet underwriters' requirements. A gap of 1/8" between wires or balls will not flash over at the maximum power allowed. Fig. 6 shows a horn gap that is easy to make. A small wooden fence at the base is recommended for ground installations.

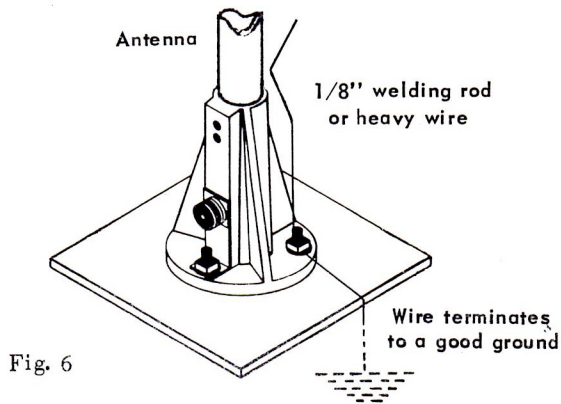


Fig. 6

## GUYING

Manufacturers' instructions for guying should be followed. Where guy lines are non-metallic, such as plastic rope, and not enough rope is supplied for an unusual installation, the guys may be extended with wire *broken* by means of insulators. Plastic rope should be used, if available. Using a building for support is not recommended, due to absorption from wiring, gutters, etc., although such an installation may be satisfactory if no other location is available.

## LINE LENGTH

Because a vertical antenna may be located close to the transmitter, the tendency is to make the transmission line as short as possible. With coax lines, this can lead to trouble on the lower frequencies due to line resonances. This can be avoided, usually, by making the line at least 1/2 electrical wavelength long at the lowest frequency. With RG coax, these lengths are; 23' for 20 meters, 45' for 40 meters and 90' for 75/80 meters.