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The Sewerpipe Antenna

The perhaps unfortunate name for this otherwise superb antenna derives from the fact that the chromium-plated brass tubing used as a matching section (normally obtained along with some funny looks from your friendly local plumbing supply house) was originally manufactured for quite another purpose.

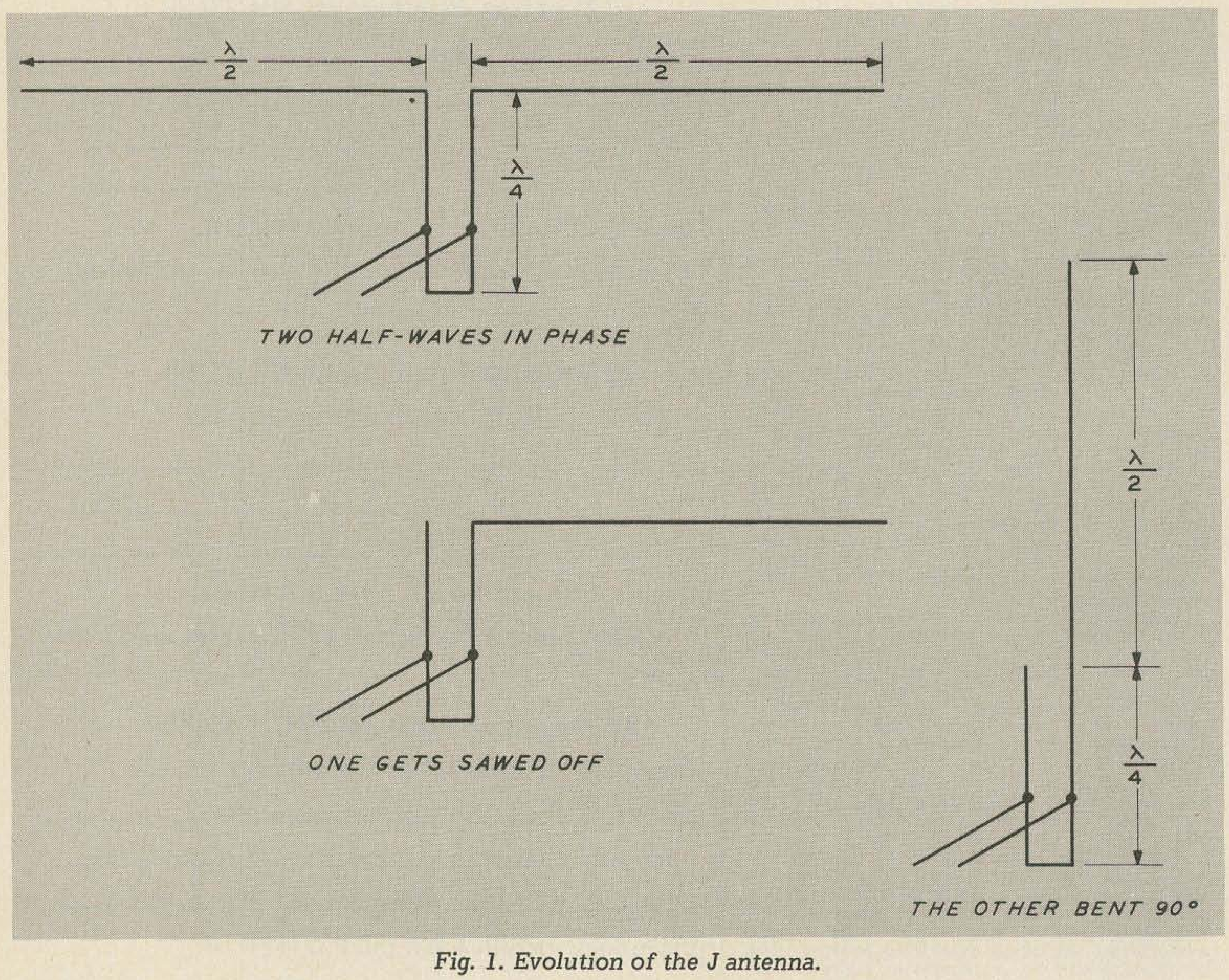


Fig. 1. Evolution of the J antenna.

It all starts with the J antenna, the evaluation of which is illustrated in Fig. 1. The J consists of a balanced quarter-wave matching stub feeding an unbalanced load as shown in Fig. 1 (C). But since balanced stubs work best with balanced loads as in Fig. 1 (A), some means of compensation must be provided to make the J workable.

Because of the unbalanced load on the matching section of a J antenna, the currents in the matching section are no longer equal and opposite, so the matching section radiates also. The resulting imbalance also couples rf currents to the supporting structure and the feedline, distorting the radiation pattern and making the antenna difficlt to match.

The step from the J to the *sewerpipe* arrangement is simple. Use an unbalanced coaxial matching section for the unbalanced half-wave load. Adjusting the antenna's impedance to 50Ω is easily accomplished as shown in Fig. 2.

Chrome-plated brass pipe of 1½ in. diameter is recommended for the matching section. If ordinary brass tubing is used, then a brass plug for the bottom can be turned to fit the tubing. Mechanical details are dependent upon the materials available, and will be left to the ingenuity of the builder. Dimensions are not critical, but things should fit together tightly. The inside depth of the matching section should be about 19 inches. Keep the plastic cap (Fig. 2 (A)) thin and use low-loss dielectric material, as this is a high voltage point. The internal feed assembly is physically similar to the gamma match used for unbalanced feed of a yagi antenna (omitting the series capacitor, of course). A clamp (Fig. 2 (B)) comples the connection from the off-center coax to the center conductor. The height of this clamp and the center-to-center spacing of the off-center member is varied to obtain a perfect match to 50Ω.

An interesting variation on the original sewerpipe antenna was developed by Prof. D. K. Reynolds (K7DBA) of the University of Washington. A different feed technique is employed, as illustrated in Fig. 3; the result is an ideal antenna for base station use. Antennas of this type are in use at Byrd VLF Substation, Longwire, Antarctica, home of the 21-mile dipole. There they use 146.76 MHz VHF/FM for both on-site and station-to-station communications.

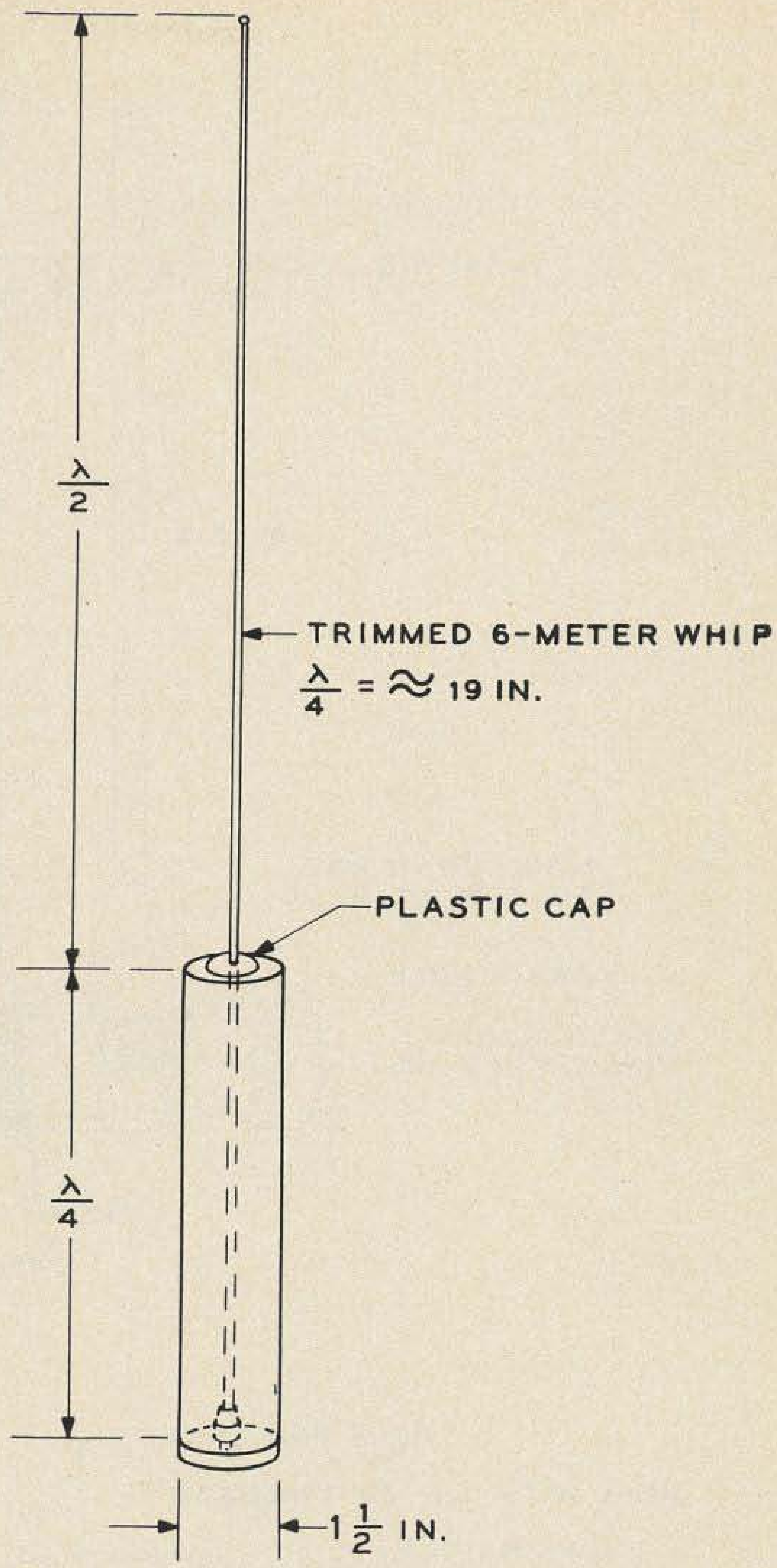
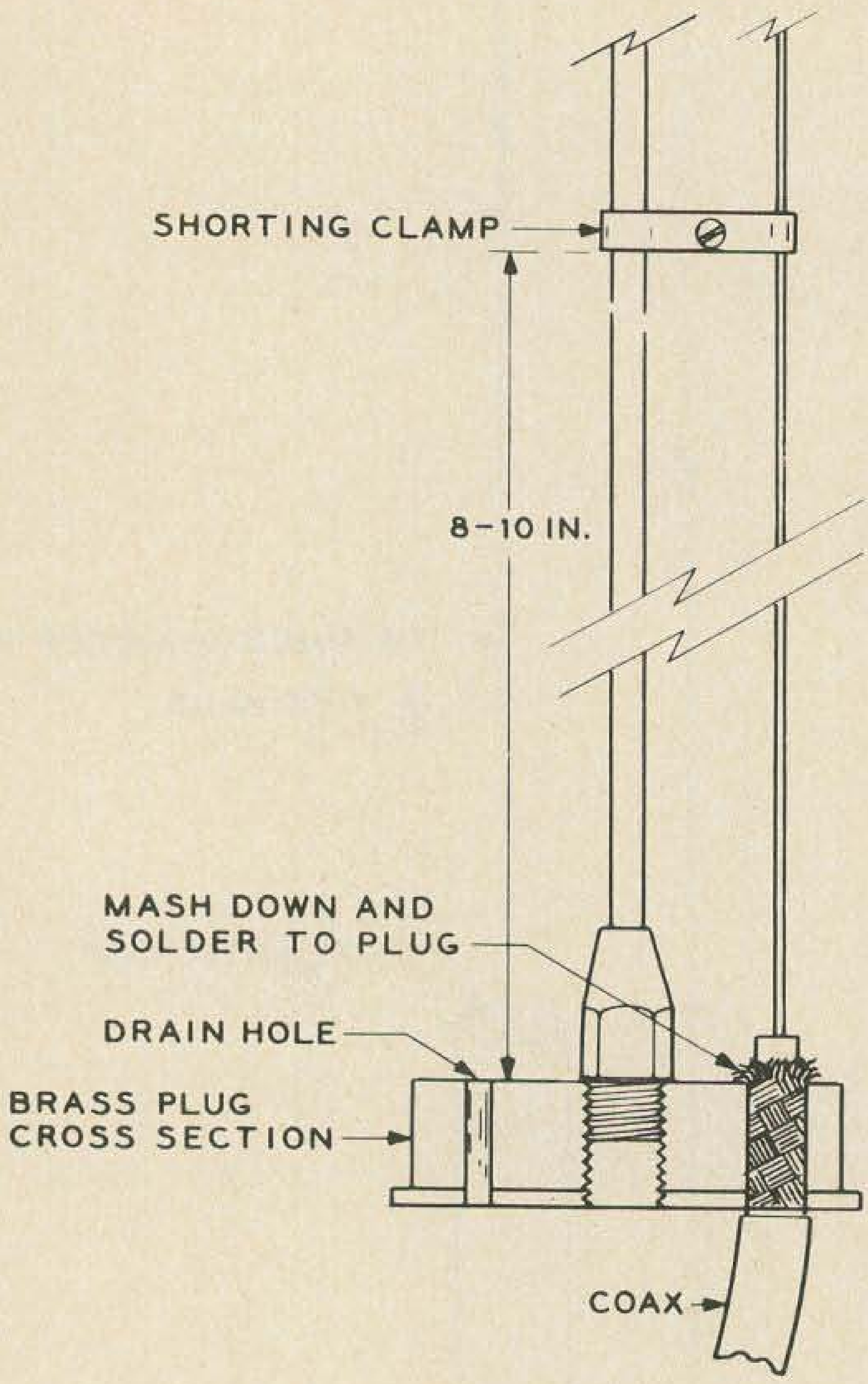


Fig. 2. The sewerpipe antenna.

Semigrid coax is used, and the 60Ω section is made by removing alternate half-inch sections of the dielectric inside the coax for about 16 inches. This raises the characteristic impedance from 50 to about 60Ω. The original version is more suitable for mobile use, however, because of its greater rigidity and mechanical strength.

Patterns taken at the University's antenna range show an almost perfect free-space dipole pattern. The measured gain over an isotropic antenna was 1.62 dB as compared



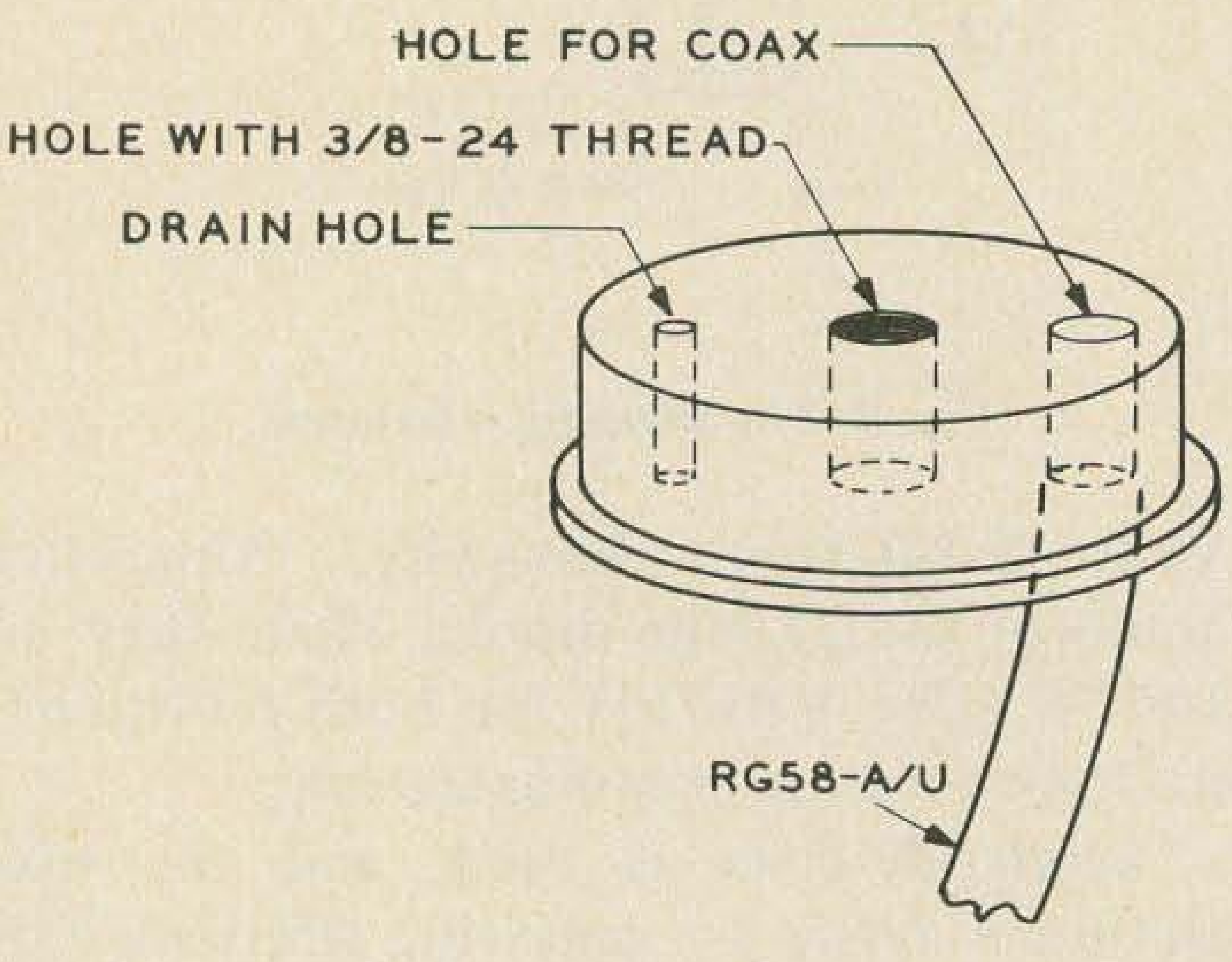


Fig. 3. Plug details.

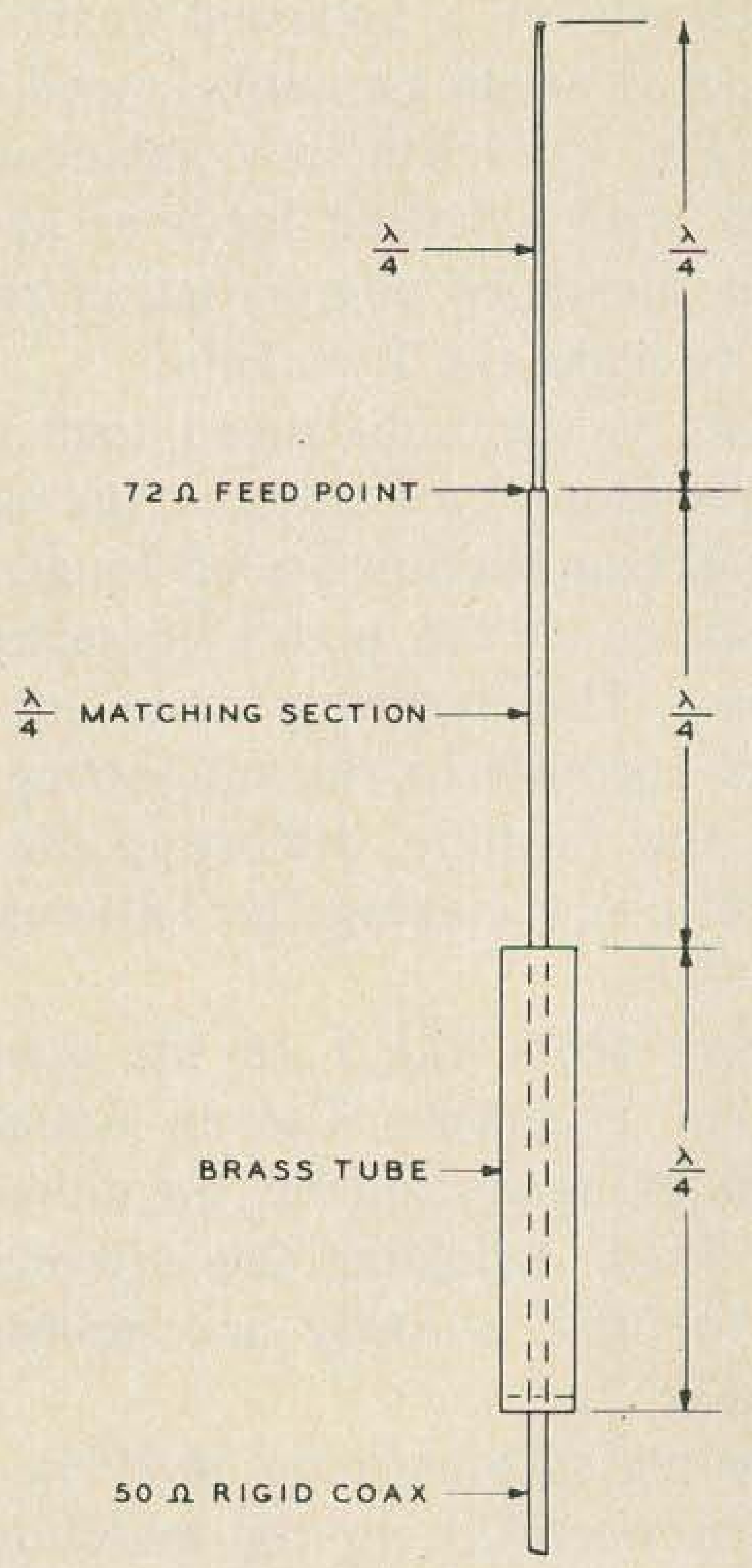


Fig. 4. Reynolds modified sewerpipe antenna.

with the theoretical value of 1.64 dB for an ideal dipole antenna. These antennas are unbelievably well decoupled from their supporting structure and are therefore a breeze to match. The only significant current is on the antenna itself.

Since no claim is made for extra gain, then where is the claimed improvement over other antennas? Basically, it is in the reduced angle of radiation. Practically speaking, most mobile antennas at two meters -- whether ¼ or 5/8 wavelength – have about the same gain toward the horizon; moreover, they all suffer to some extent *finite groundplane* effects, which act to lift the angle of maximum radiation intensity above the horizion. Thus the secret of the sewerpipe antenna's performance is its straight-out angle of radiation.

If you live in an area well covered by an accessible repeater and don't stray much, the quarter-wave whip may be just right for you. But if you need long-range capability for your mobile, give the sewerpipe a try. They have been widely used in the Pacific Northwest since 1961. The sewerpipe is ignored by all CB'ers (unlike a 5/8-wave whip), but seems to disturb the 75-meter mobile operators for some reason. Could be they think it's a new chrome-plated loading coil.

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