

# Try the GHz Getter

## — a marvelous microwave antenna you can build

I have always been interested in antenna design, and the amateur microwave bands permit experimentation with scaled-down antennas. The short wavelengths permit the testing of designs without a hundred-acre antenna farm. However, a lack of activity limits the testing and application of the antennas. Recently, MDS television ser-

vice was added to this area, providing a reliable, constant-power microwave signal for antenna testing.

The transmitting antenna is located several miles away—hence it approximates a far field source. (My microwave-antenna range is a second-story window.) The frequency, 2.15 GHz, is high enough to keep the antenna size down to a

practical level yet not so high as to make construction tolerances beyond amateur capabilities. Gain comparisons are made by placing an attenuator between the microwave converter and the television receiver and noting how much attenuation must be added or removed to maintain a constant signal level.

The first antenna I tried was the popular coffee-can horn. Since then, it has become my standard to which all other antennas are compared. Other horn and helix antennas have been constructed and tested, but have one major drawback:

their long length. I decided to try a more compact planar antenna. Collinears and other phased arrays were ruled out because of problems with the phasing lines. Digging through my file on antennas, I ran across the short backfire and constructed the antenna shown in Fig. 1. Several feeds were built and tested. The first used a microstrip disk and offered no better gain than the coffee can. The final feed is the one used on the original design.<sup>1,2</sup> It consists of a slot-fed dipole with a small disk-shaped reflector. The dimensions shown are in terms of wavelength, making frequency-scaling to 1296, 2304, or other frequencies easy.

The ground plane is made from a 300-mm (1-foot)-square piece of single-sided PC board. Other materials, including screen wire, could have been used. Another piece of single-sided board 35 mm by 864 mm (1 3/8" by 34") was formed into a circle and the ends butted together. A small piece of board is epoxied so that it overlaps the joint. After curing, the ring was edge-soldered to the ground plane, forming

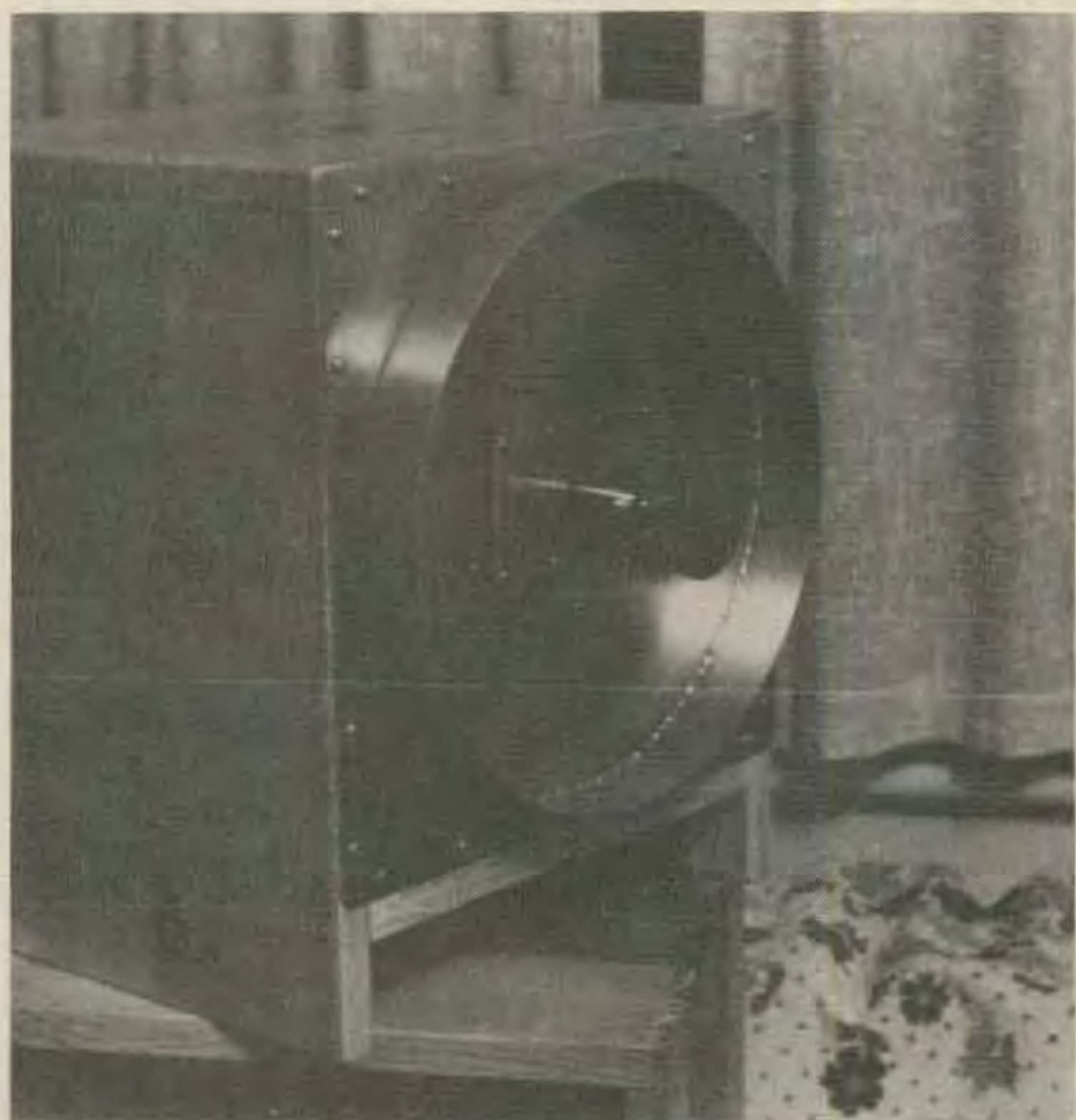


Photo A. Antenna on a test mount.

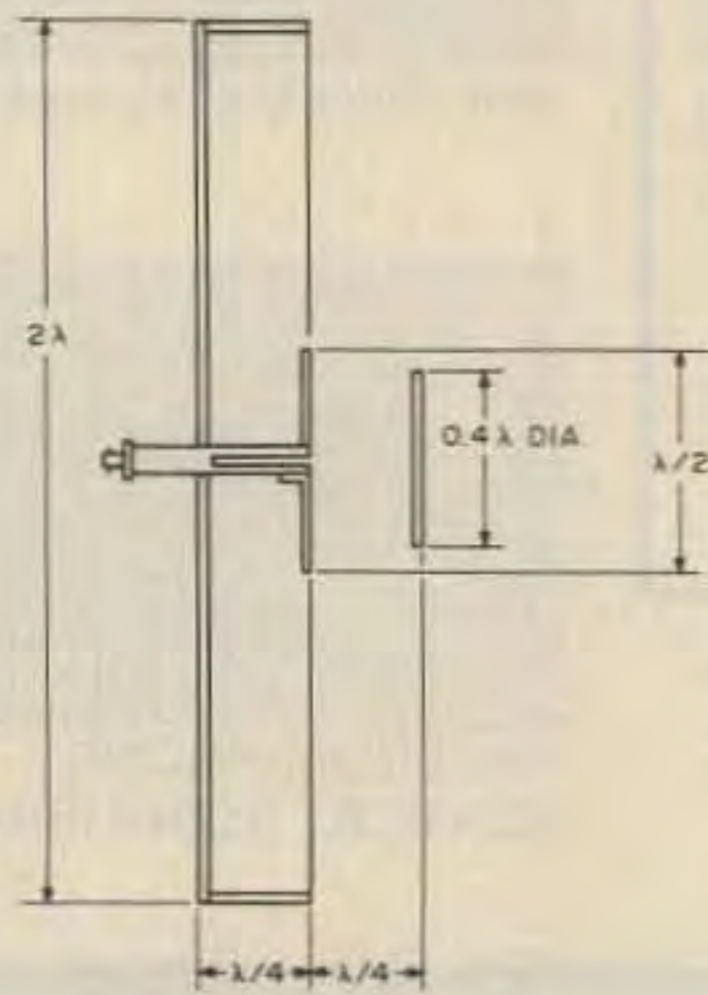


Fig. 1. Short backfire antenna.

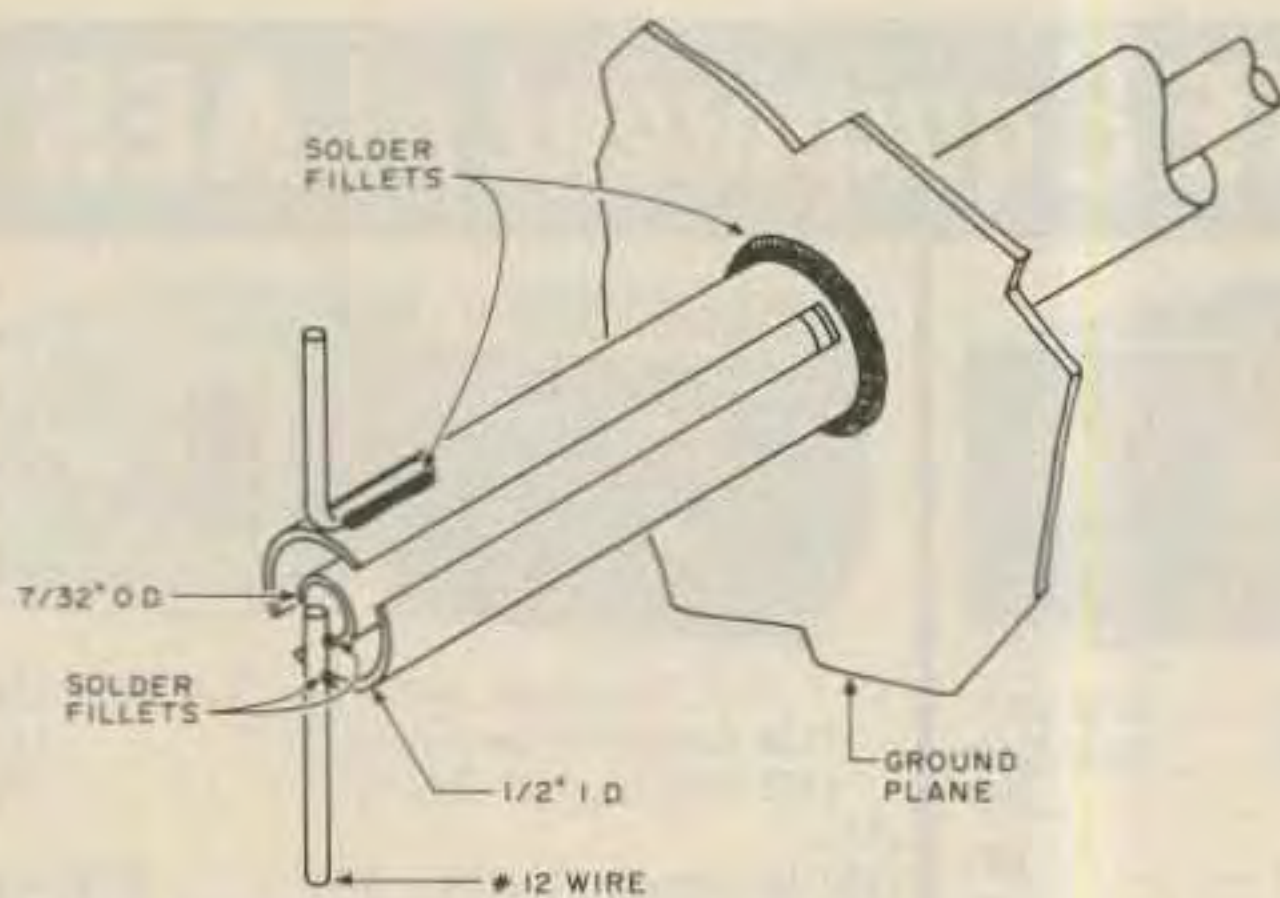


Fig. 2. Dipole-feed details.

an open cavity two wavelengths in diameter and one-quarter wavelength deep. I drilled a hole pattern in the cavity center to allow experimentation with different feeds or rotating the feed polarization. The radiation pattern is symmetric with a half-angle response of 30 degrees to the -10-dB level.

The dipole feed is formed from two concentric pieces of thin-wall brass tubing that comes in telescoping sizes at a local hobby shop. The outer conductor has an internal diameter of one-half inch. The inner conductor has an outer diameter of seven thirty-seconds inch. The construction details of the dipole and the connector are shown in Figs. 2 and 3, respectively. Note that one dipole element shorts the inner and outer conductors together. The other stops at the outer conductor.

The dipole feed is assembled by first sawing through the outer sleeve of a BNC bulkhead feedthrough and discarding the threaded portion. The exposed inner conductor is built up with two layers of number 24 bare wire. The brass inner conductor tubing is slotted for about 10 mm, slid over the built-up inner conductor, and the assembly is sweat-soldered together. The inner conductor is intentionally left too long and will be trimmed later.

Next, the outer conductor is cut to length (not critical) and slotted. The two slots are each one-quarter wave long. Slotting is best done by first inserting a one-half-inch diameter dowel rod in the outer conductor to prevent buckling. The slot width is a nominal one-sixteenth inch. The outer conductor is then slid back over the inner conductor assembly and the inner conductor length is marked. After trimming the inner conductor and remov-

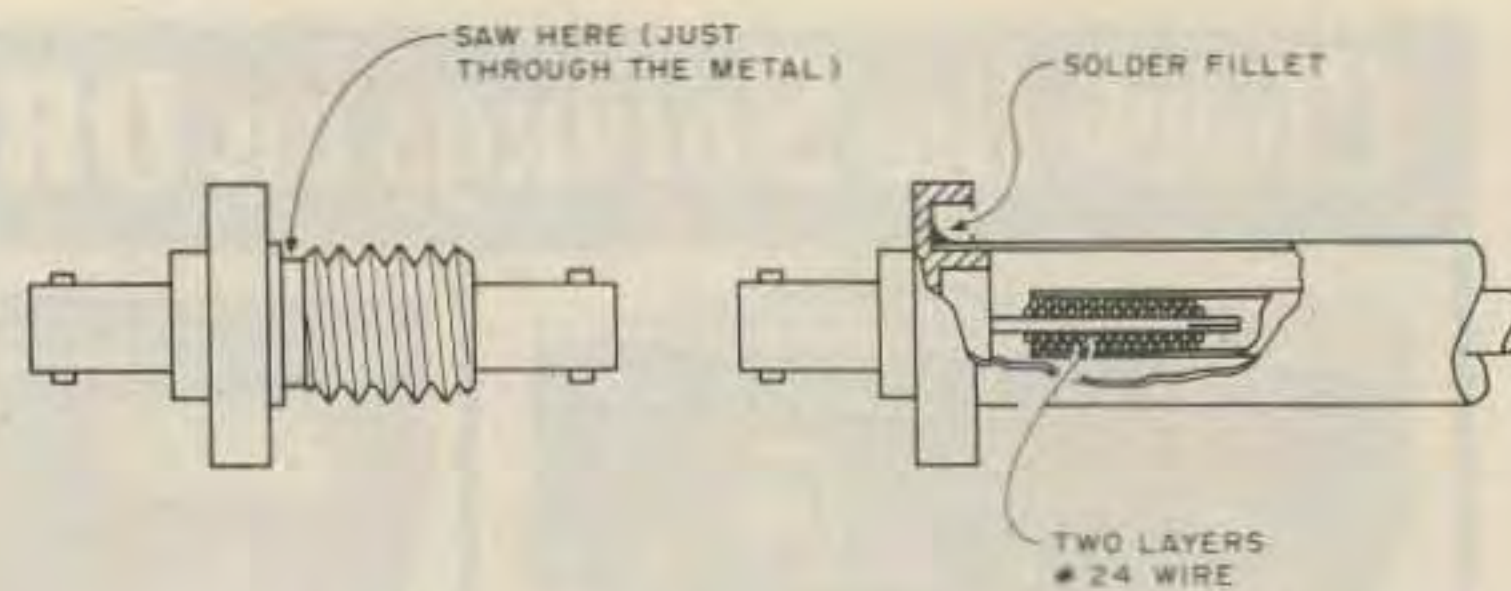


Fig. 3. Connector details.

ing any burrs, the assembly is joined together with a solder bead around the coax fitting. A hole slightly larger than the outer conductor is drilled in the center of the ground plane or support plate if you intend to make interchangeable feeds. The outer conductor is soldered in place with the slot roots flush with the front surface.

The dipole elements are added last. They are made from number 12 bare wire. The element that shorts the inner and outer conductors doubles as a support for the inner conductor. The subreflector disk is epoxied on two half-wavelength-long wooden posts. I used wood

instead of polystyrene because it was convenient.

Although adjustments aren't normally required, it should be easy to replace the dipole wires with telescopic tubing to permit fine tuning. My tests show that the short backfire has a gain of 8 to 9 dB over the horn, a level between large, high-gain antennas and simple dipoles. ■

#### References

1. H. W. Ehrenspeck, "The Short Backfire Antennas," *Proceedings of the IRE*, No. 53, pp. 1138-1140 (August, 1965).
2. Dr. Akhileshwar Kumar, "Backfire Antennas Aim At Direct Broadcast TV," *MicroWaves*, April, 1978 (contains 83 references).

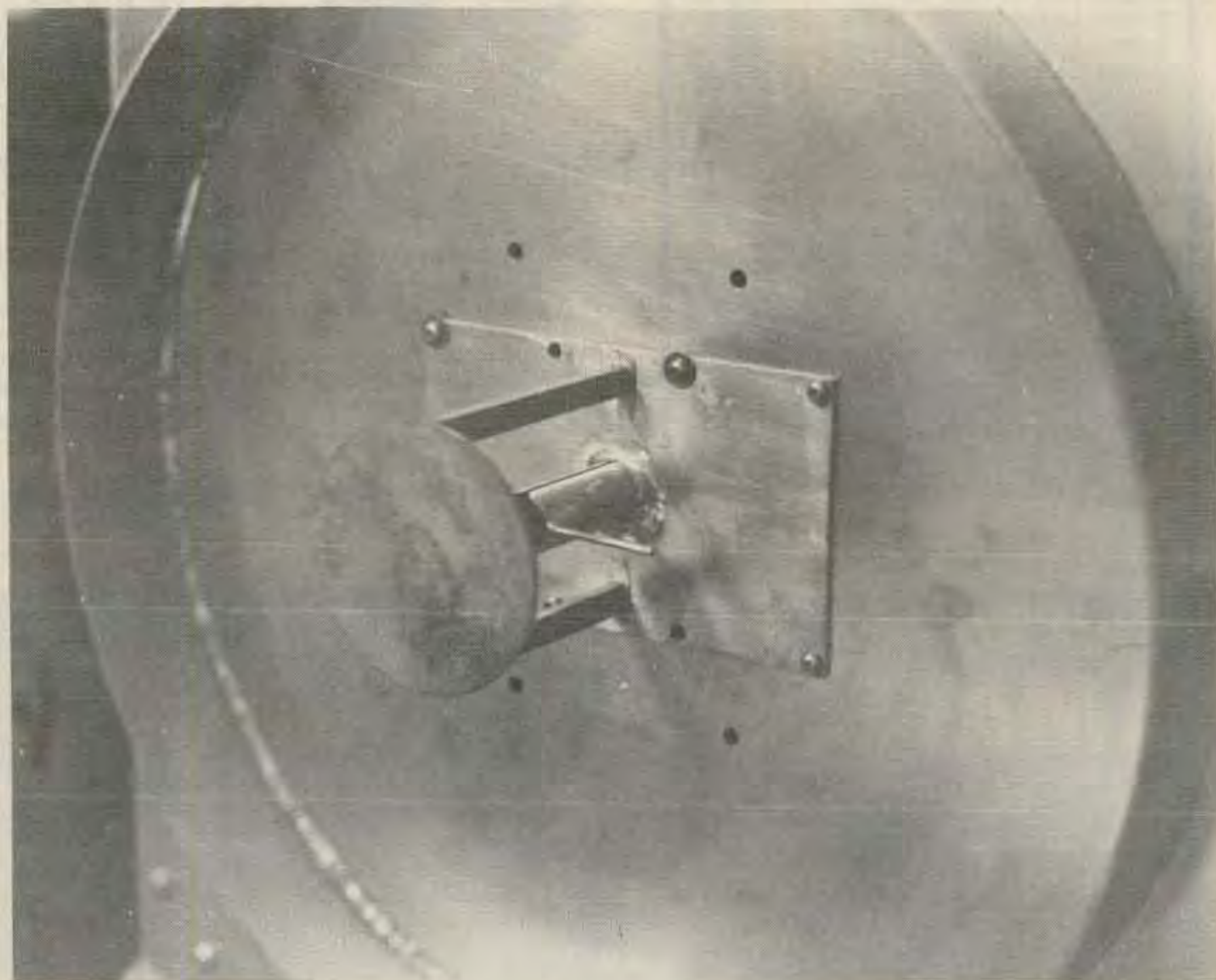


Photo B. Close-up of feed.