

**Somehow the thought of trying to put on an N connector turns some of us off. Fear not! W5QMU and W5LVE come to the rescue with a step-by-step procedure for working with N connectors.**

## How To Correctly Assemble Type N Connectors

### The First Time and Every Time

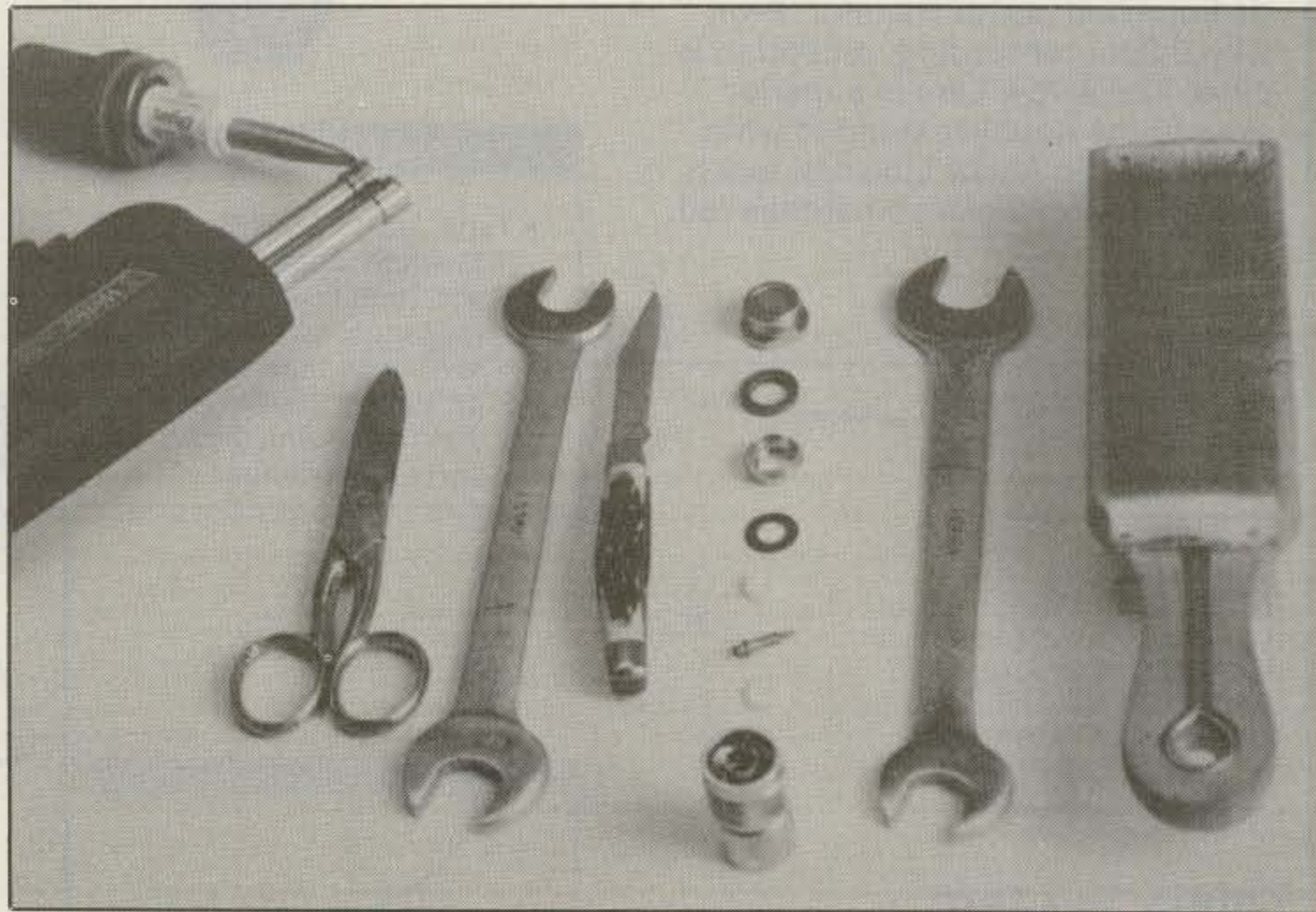
BY LARRY HIGGINS, W5QMU\*, AND JOHN BRUEMMER, W5LVE

**N**ot long ago we visited a local commercial UHF tower site to help with an amateur installation thereon. While nosing around, attention naturally fell on the existing commercial radios. The connectors on the backs of the radios were Type N, but the commercial installer apparently didn't have the know-how to apply the required mating Type N male connector, so he used an expensive adapter to a PL-259. Thus, his radio saw an impedance hump right away; the customer got a poorer signal and the owner less profit from his installation. After climbing the tower, we found similar adapters used between the antenna, factory supplied with a Type N male connector, and the jumper equipped with PL-259's to the hardline—more adapters!

Our group operates a fairly extensive system of linked radios in south Texas. There are numerous RF connections to be made to radios, duplexers, lightning arrestors, and antennas. Hence, we have a continuing need for good RF connections. As with the commercial installation above, our RF hardware came equipped with Type N's.

Thus began our experience with application of Type N connectors. At first we used the very plentiful UG-21/U style, but we soon found problems with intermittents and loose connectors.

Over coffee one Saturday morning W5LVE mentioned that we were using the wrong kind of type N connector, and introduced me to the newer type UG-1185/U, which uses what he called a "captivated" contact. Better yet, Johnny offered to show me how to apply the connectors, and with



*Photo 1—Tools and N connector (left to right): soldering iron, about 35 watts; soldering gun, small, with tip removed; lineman's scissors; 5/8 inch wrench; sharp pocket knife; N male connector with captive center pin; 1/8 inch open-end wrench; file comb (normally used to clean metal files); and (not shown) ruler graduated in 64ths of an inch.*

many years experience doing just that with the FAA, I was confident the job would be done right. What follows is Johnny's fail-safe method.

The "captivated" Type N connector differs from its predecessor by the addition of two Teflon™ washers, which are positioned on either side of a shoulder at the base of the center pin. (The older UG-21 connector pin has no shoulder and no Teflon washers.)<sup>1</sup> These washers sit in the connector body so as to maintain pin alignment in the exact center of the inner cylindrical shelf of the connector. In addition,

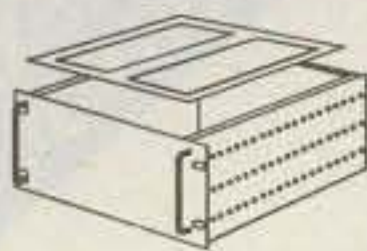
longitudinal movement is prevented by impingement of the forward washer rim on the connector body; rearward motion is prevented by the impaction of the outer shield over the clamp and the rear Teflon washer against the rear of the shoulder of the center pin and cable dielectric.

These improved connectors are still available at flea markets, but you need to wear bifocals to find them. If you wish to buy them new, you should ask for Amphe-nol® 82-313, or 82-3312, or 82-4352.

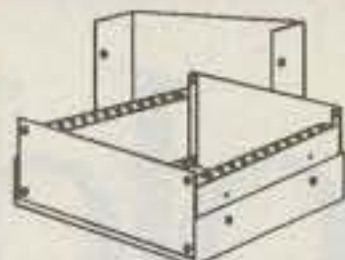
Once you've located some of these connectors, disassemble one to see how it is

\*Intertie, Inc., 8601 Village Dr., Suite 100, San Antonio, TX 78217

## ELECTRONIC ENCLOSURES

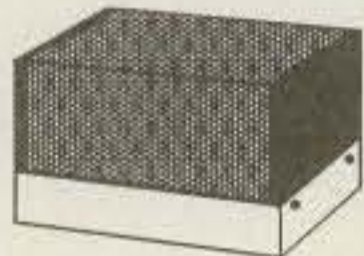


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Photo 2- Remove outer jacket: After square cutting the end, slide clamp jam nut and gasket on; make a clean circumferential single cut to the shield,  $\frac{23}{64}$  inch from squared off end of the cable. Try to avoid nicking the braid.

put together. You will find that the connector has eight parts. If you come upon short cables with UG-1185/U connectors already assembled, disassemble one, in order to see how it was put together. Beware:

The person who did the original assembly may not know what you are going to know and may have made mistakes.

You will find that the connector has eight parts (in order, top to bottom; see photo 1):



Photo 3- Comb out the braid over the tip.

clamp nut, washer, braid clamp, rubber gasket, thick Teflon washer, center pin, thin Teflon washer, and outer shell.

## How To Do It

Prepare your coaxial cable (photo 2). Using a sharp knife, square cut the cable end. Inspect the cable for breaks in the jacket. Amputate any cable that looks bad and trash it. Clean-wipe with a dry rag. Stay away from all silicone grease, etc.

Slide the jam nut and the rubber gasket with its groove facing the cut end of cable.

With a very sharp knife (I like a Case knife) make a clean circumferential single cut down to the shield  $\frac{23}{64}$  inch from the end (just a hair less than  $\frac{3}{8}$  inch). Remove the outer jacket. Try to avoid nicking the braid. Practice a little on a coax scrap if you feel the need.

With a file comb, comb out the braid over the tip (photo 3), fold back temporarily, and very carefully cut cable dielectric  $\frac{1}{8}$  inch from the end of the outer jacket (photo 4). Do not nick the center conductor. Big lineman's pliers can be used to separate the dielectric by gently squeezing the cutter part in the cut grooves to pick the dielectric off the end. Then, once freed up all the way around, grasp the dielectric with the pliers and gently pull it off the center conductor. Don't pull so hard that you pull the dielectric out of the shield. (It won't, if you've really freed it up thoroughly with a knife in the first place.)

Now recomb the shield over the tip of the center conductor and slide the clamp on with its sharp side toward the rubber gasket and jam nut. The sharp edge is supposed to slide into and cut into the gasket groove.

Comb the shield back over the clamp and trim with lineman's scissors (photo 5) or a large toe-nail clipper. (Diagonal cutter pliers will make a messy job.) Form the wires neatly over the clamp.

Tin the center conductor with minimum heat and #18 or #20 good-quality rosin core solder.

Slide on the metal washer and thick Teflon insulator **with the counter sunk part facing the jam nut**. It should seat over the cable dielectric and butt against the washer. **This is critical.**

Using a Weller® gun without the tip as a heater, heat center contact, tin it, and slide it over the exposed tinned center conductor (photo 6). The center-pin shoulder must fit snugly down into the Teflon insulator. Be sparing with solder; try not to make a mess with excess around the base of the pins. Too much heat softens the dielectric and may decenter the center conductor. Use a cold, wet rag to cool the pin if it gets too hot.

Now slide the thin washer over the center pin. **The indented saucered part must face the tip of the center pin.** You must be able to see the metal shoulder of the

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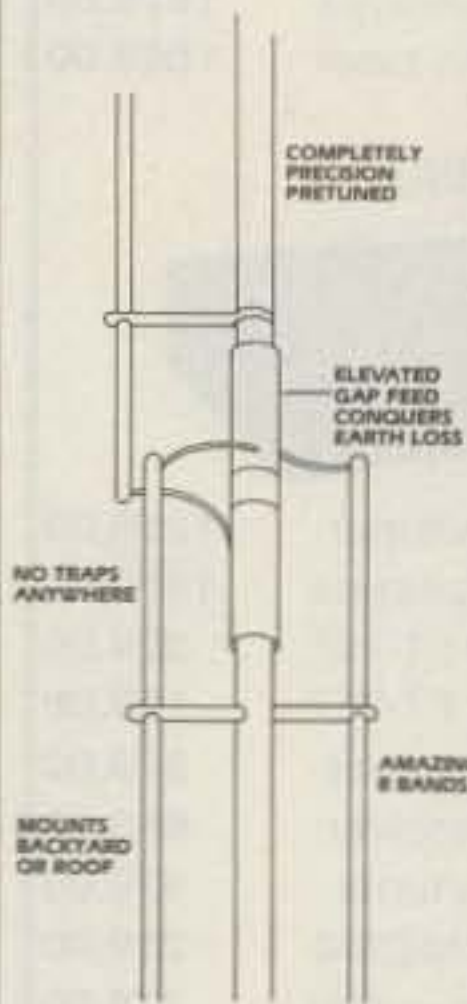
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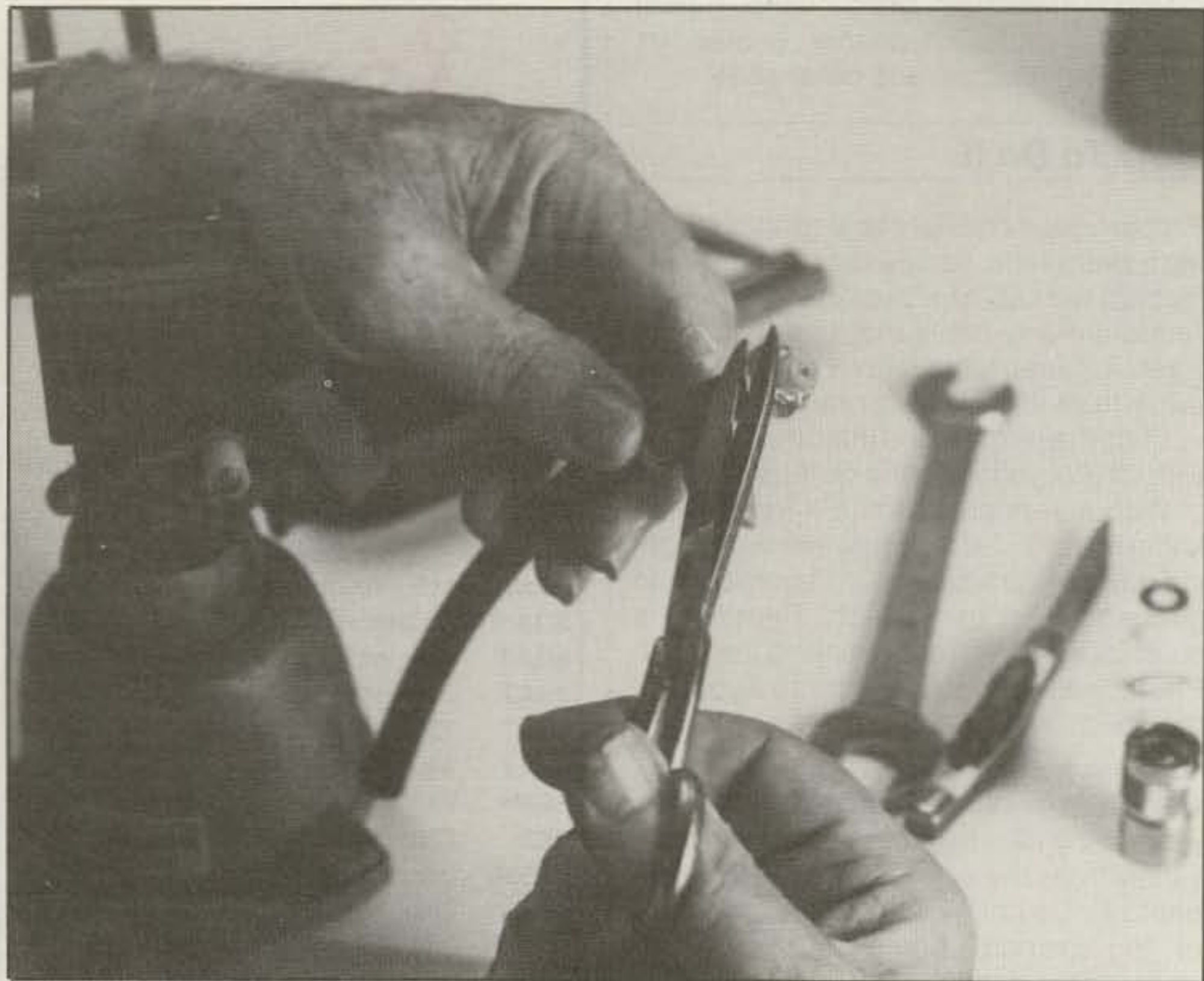


Photo 4— Trim excess braid. Do not use diagonal cutters!

center pin between the two Teflon washers. If you can't, re-check washer application (photo 7).

Re-check the shield for neat comb down and trim over the clamp.

Insert the prepared cable termination into the connector body. Before you tight-

en, check the tip to be certain that it is centered in the sleeve (photo 8). Watch it as you assemble to the shell, to make certain that it advances properly.

Tighten the nut using a 5/8 inch wrench; hold the body while you snug up the nut with an 1/8 inch wrench (photo 9). Don't use

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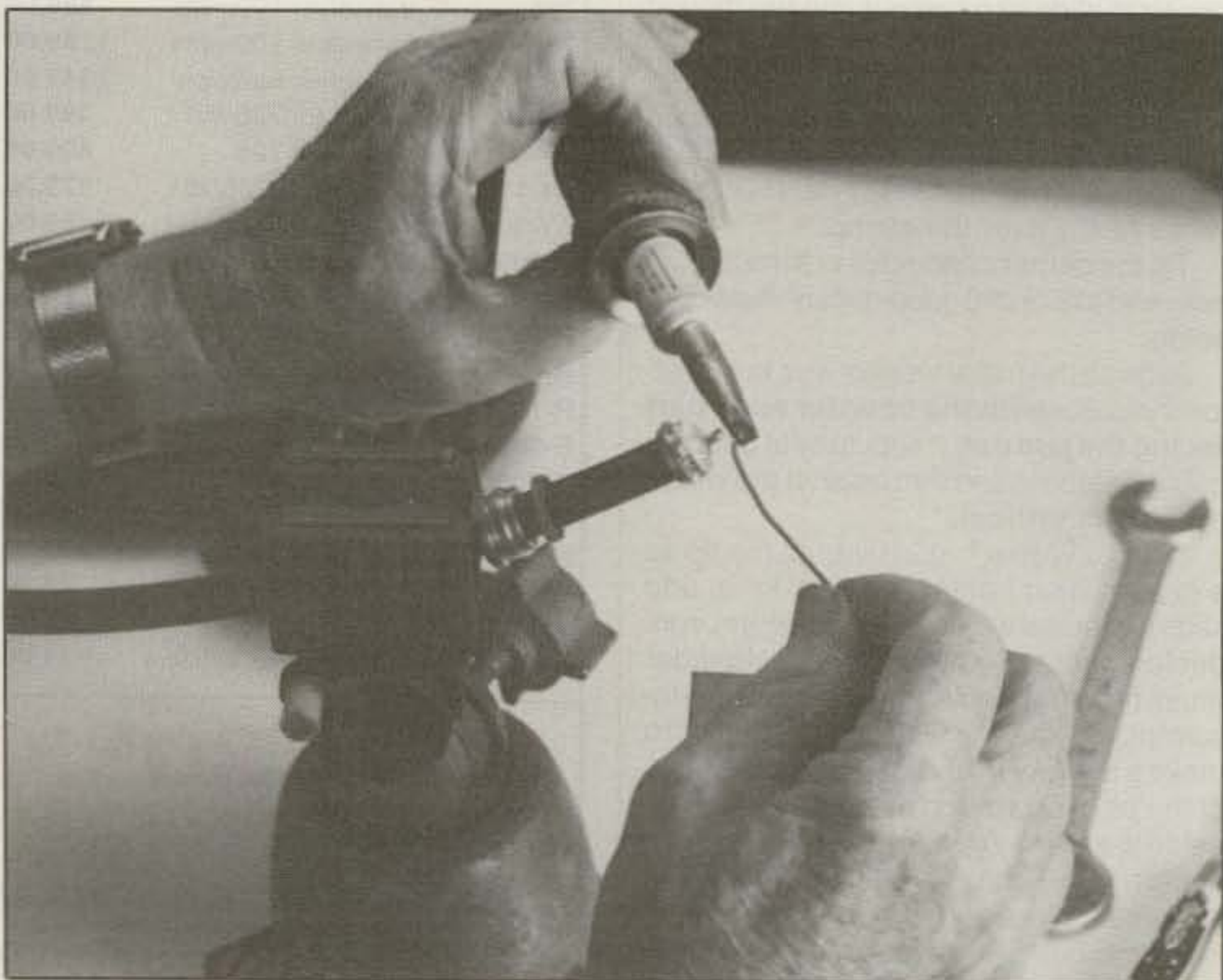


Photo 5— Cut cable dielectric 1/8 inch from the end of the outer jacket. Don't nick the center conductor. Tin exposed center conductor. Do not overheat!

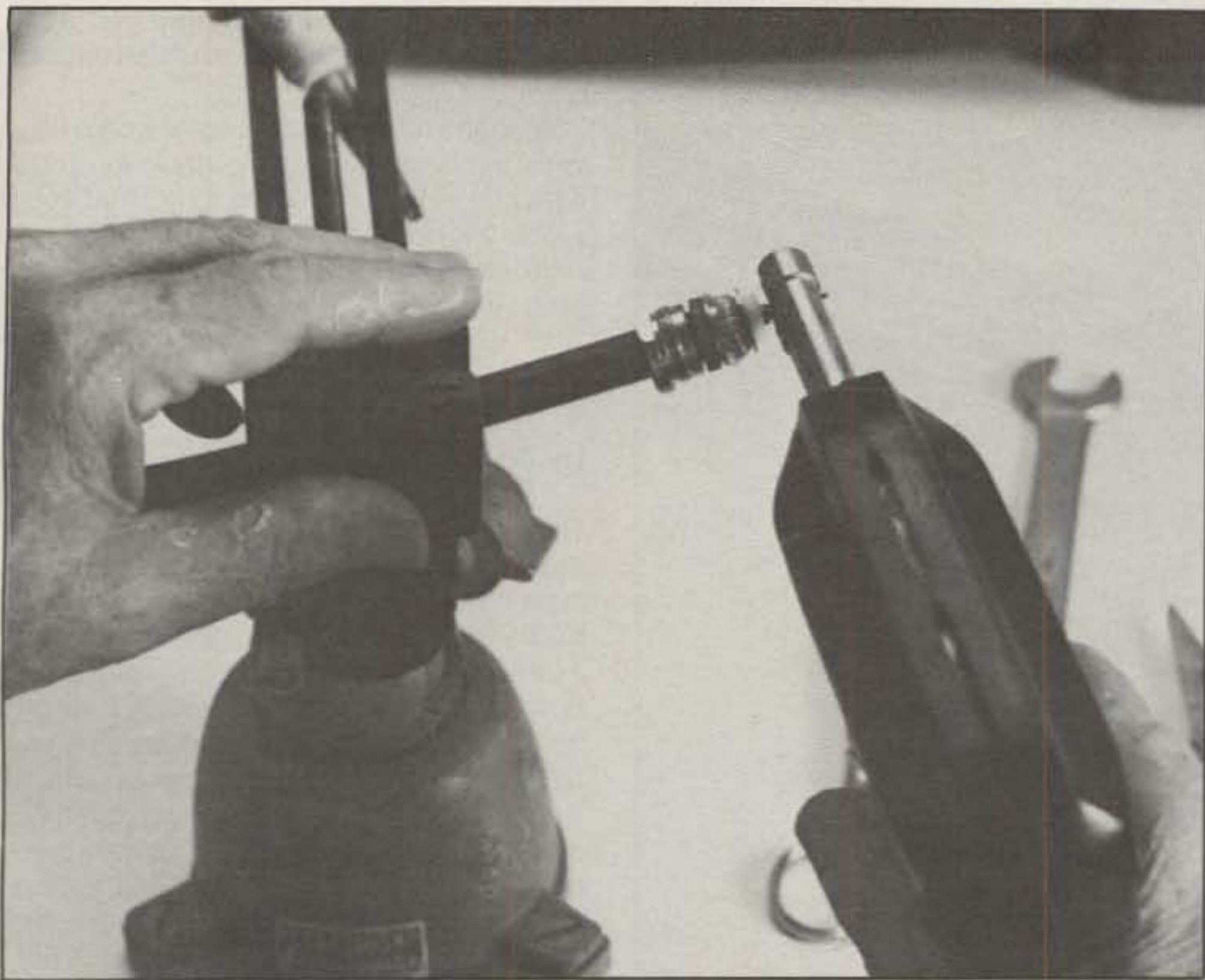


Photo 6—Apply center pin and solder. Use a soldering gun with the copper tip removed.

pliers, as it makes a mess of the expensive silver plate.

### The Twist Test

Give the cable to a friend and let him gently (well, a little more than gently) hand-twist

the body, while holding the cable right next to the nut. If it twists around the cable, chop it off and start over! If you don't, it won't be any good, will be noisy, arc over, get wet, and very rapidly corrode with a nasty coating of green, gooey, wet sandy material.



Photo 7—Finished prep ready for outer shell. You need to be able to see the metal shoulder of the center pin between the two Teflon™ washers.

Look at the tip. The center pin must be within a llama's hair of the end of the cylindrical piece that surrounds it. If it's not, chop off the connector and start over. If you do it the way we say, it will always be snug and stand the twist test and will always have the correct pin position.

A properly assembled connector should be noise free and exhibit no more than the rated 1/2 dB loss at 450 MHz.

### Taping (Bonus info)

Tape your connector with Scotch 23™, a special uncured rubber that cures as it is stretched and wrapped. Paint the 23 with Scotch-Kote™.

Carry the tape 3/4 inch below, then 1 inch above the connector. Cut the tape from the roll with a knife. Don't just pull it.

Keep all silicone grease away from these connectors. It will make taping much more difficult, because the tape won't stick. Touch only the edges of the tape roll. Tape down, then up. If you simply must use grease, as on a duplexer connector that is poorly machined, and the connector binds, place the minimum on the **threads only** and have a rag ready for a thorough hand wipe. Better yet, have a friend do the tape wrap with silicone-free fingers.

Prior to learning of Scotch 23, we tried Scotch-Kote™ in Texas and found that it

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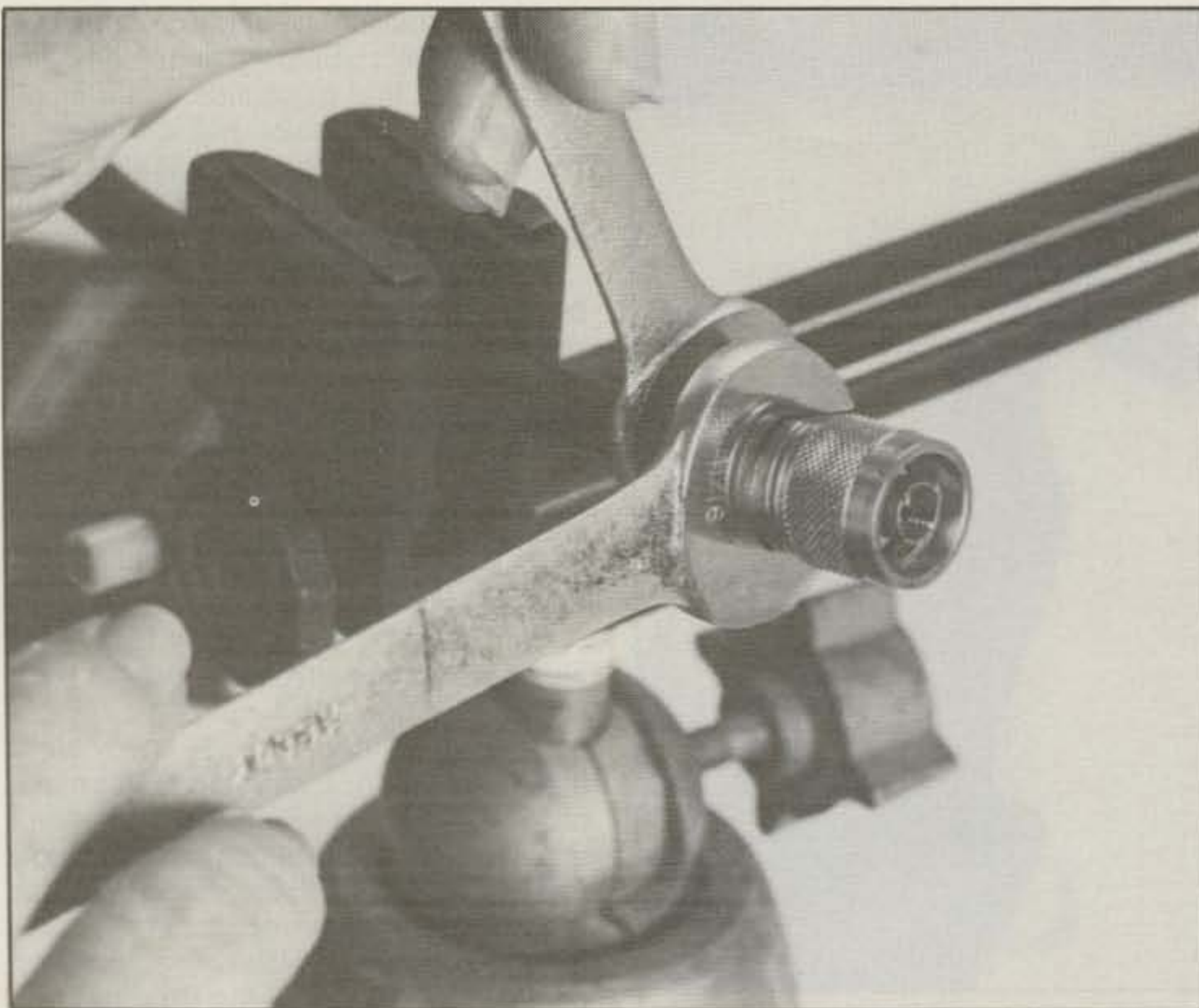


Photo 8—Hold the barrel still with a  $\frac{3}{8}$  inch wrench. Snug up the nut with an  $\frac{1}{16}$  inch wrench.

cracks when painted over Scotch 88 (or 33) and exposed to direct sunlight. It will stick without cracking to #23. This costs less per

connection than our old method of Scotch 88 plus silicone bathtub seal. We thank W5LBD, Mr. Bob Gallaway of Uvalde,

Texas, for this tip on #23, and WD5IYT, Houston, for the elimination of #88 tape as a second-layer wrapping.

Silicone rubber bathtub seal works very well, but is used by us mainly to keep UV light off the tape. We have found that used alone, it is not as permanent. Furthermore, near chimneys on buildings it has a very short (less than 2 years) life.

### Why Use Type N Connectors In The First Place?

The Type N connector has considerable advantage over standard PL-259's. Many equipment manufacturers now supply "N" bulkhead connectors on their equipment as standard, and these connectors are now available as an option on UHF amplifiers and antennas. They provide a very low SWR connection up to the low gigaHertz region. They are not waterproof, but their design makes them easier to weatherproof. Unlike PL-259's, there is a female connector available, which makes in-line connections much easier to weatherproof.

Of course, it is useful over the entire UHF range, and is capable of transmitting full legal power from amateur transmitters. But if the center pin is improperly positioned on the cable center-conductor-tip it may:

1. Split the mating female center pin,

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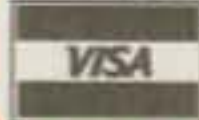





Photo 9— The pin should be centered and just scratch with your thumb as you move it over the tip of the connector.

causing receiver drop-out, or ruin a transmitter final amplifier.

These problems are totally eliminated by the captivated UG-1185/U style N connector. If assembled correctly, it will always mate properly and will not let you down with cold weather or cable movement at tower top. Even when assembled properly, the non-captivated UG-21 connector may fail when tugged on, or wind-whipped, or subjected to temperature changes. Hence, this connector should only be used indoors where it never moves and where cable length is not critical.

Use captivated type N connectors for all outdoor connections with the RG-8 series coax and for all phasing lines where length of cable is important. Learn to put them on correctly and be liberated from the melted dielectric and impedance humps of PL-259's. Seal your connections with Scotch 23 tape protected Scotch Kote™, or Scotch 88, followed by Dow-Corning silicone rubber. 

causing at best an unreliable connection. If this mating pin is on hardline, you've ruined a very expensive connection.

2. Not pushed in quite far enough, RF will get through for a while; then (often with cold weather) the connection may open,

### Footnote

1. For assembly of UG-21 style connectors, see Newkirk, D., "Connectors for (Almost) All Occasions—Part 2," *QST*, Vol. 75, May 1991, pp. 34-40.



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FOR TECHNICAL INFORMATION, OR IN CA, PLEASE CALL 1 (310) 433-5860



**ALINCO DJ590/599T:** OUR BIGGEST SELLER! 2M/440 mobile with PL encode & X-Band repeater (turn on/off, QSY with your HT with the EJ-8U). Head is remotable with EDC-19. WITH 2 YEAR LTD WARRANTY!



**ALINCO DR1200T:** Perfect for Packet! 9600 Baud rate with SIMPLE user mod! (2400 out of the box). Also has ALINCO's AMAZING 2 YEAR LTD WARRANTY.



**ALINCO DR119T:** BIG POWER (50 W) in a small package! A great 2M rig with ALINCO's AMAZING 2 YEAR LTD WARRANTY.

**ALINCO DJ580T:** A fantastic 2M/440 HT at a VERY LOW PRICE! Comes with PL encode and decode (CTCSS), DTMF squelch (DTSS) and ALINCO's AMAZING 2 YEAR LTD WARRANTY.



**KENWOOD TH-78A:** Tomorrow's tiny HT today. Every bell and whistle installed. Alpha numeric display, (50 memories expandable to 250). Too many features to list.



**YAESU FT-411E/811:** A very small 2m (411E) or 440 (811) HT with 50 memories, PL encode and decode (CTCSS) VOX, lots of goodies and very affordable.



**KENWOOD TS-450SAT:** Automatic antenna tuner, direct keypad entry of frequency. A beautiful radio that's a dream to use. Also available with 6 meters (TS-690S).



**KENWOOD TS-850SAT:** An exceptional radio with direct keypad entry, built-in VFO tracking antenna tuner for 160-10M, and lots more.



**YAESU FT-890AT:** World's smallest HF radio with an automatic antenna tuner. Extreme compactness is great for mobiling, such as in WILLYS Jeeps etc.

*Serving The LORD Since 1987*

**JOE: N6YYO**  
**DENISE: N6YYN**

### ANLI Antennas

**AL800W:** 2M/440, 3/5.2dB telescoping with rubber duck. **\$33.00**

**RD-78:** 2M/440 16 inch rubber duck. **\$24.00**

**S1:** 2M/440 16 inch cellular look-alike with BNC for HT, or mobile use with the mounts listed below.

**WA-1:** Clips on window, with 8.5 ft. of coax, BNC at each end. **\$15.00**

**CM-2:** Clips onto gutters, side-view windows, BICYCLES. Great for portable packet stations, mobile or cycling. **\$13.00**

We Stock All Lines of Books, Mobile, Base and HT Accessories.

**ON-GLASS 2M/440 18 inch long ONLY \$39.95**

P.O. Box 3624, Long Beach, CA 90803