Here are plans for a neat tri-bander.

The LPQ Mk-V

A Low Profile Quad For 10, 15 and 20 Meters

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The LP quad antenna works and offers an improved version of it's 3 bander, as described in the December 1976 issue of *CQ*.

In any mechanically shortened antenna, loading must be inserted to achieve correct operation. The Mk IV relied upon center loading coils, the equivalent of base loading a quarter wave radiator. A loading coil, in the high current part of any antenna is easy to install, tunes up nicely, but radiates poorly. Moving the loading gimmick towards the high voltage portion is better; when capacity end-loading takes over, optimum signal is attained.

In this latest model, the 20 meter section gains the most and the 10-15 meter loops have been extended to one wavelength. A glance at fig. 1, shows the 10 meter element; practically an exact copy of a standard quad. The 15 meter section, takes on the aspect of a LP, while "20" is a 100 per cent LPQ. The short stubs on 15, allows its sloping wire to be centered between the 10 and 20 meter band wires.

To simplify resonating a loop, a bit of center loading was retained and upgraded to a tuning-coil status. In the driven element, these coils appear as mere "bumps on a log."

The most interesting experimental work was to contrive a simple and effective "capacity-leader" for 20 meters, presenting minimal wind and icing surface and capable of shifting the loop's fundamental resonant frequency from 19 MHz to 14.2 MHz. After trying several rather hay-wire arrangements, the scheme chosen can be easily understood from the drawings and photo. Connected at the loop's corner is a vertical stiff wire; also a length of 300 ohm TV twin lead, which runs along the inner side of the horizontal spreader.

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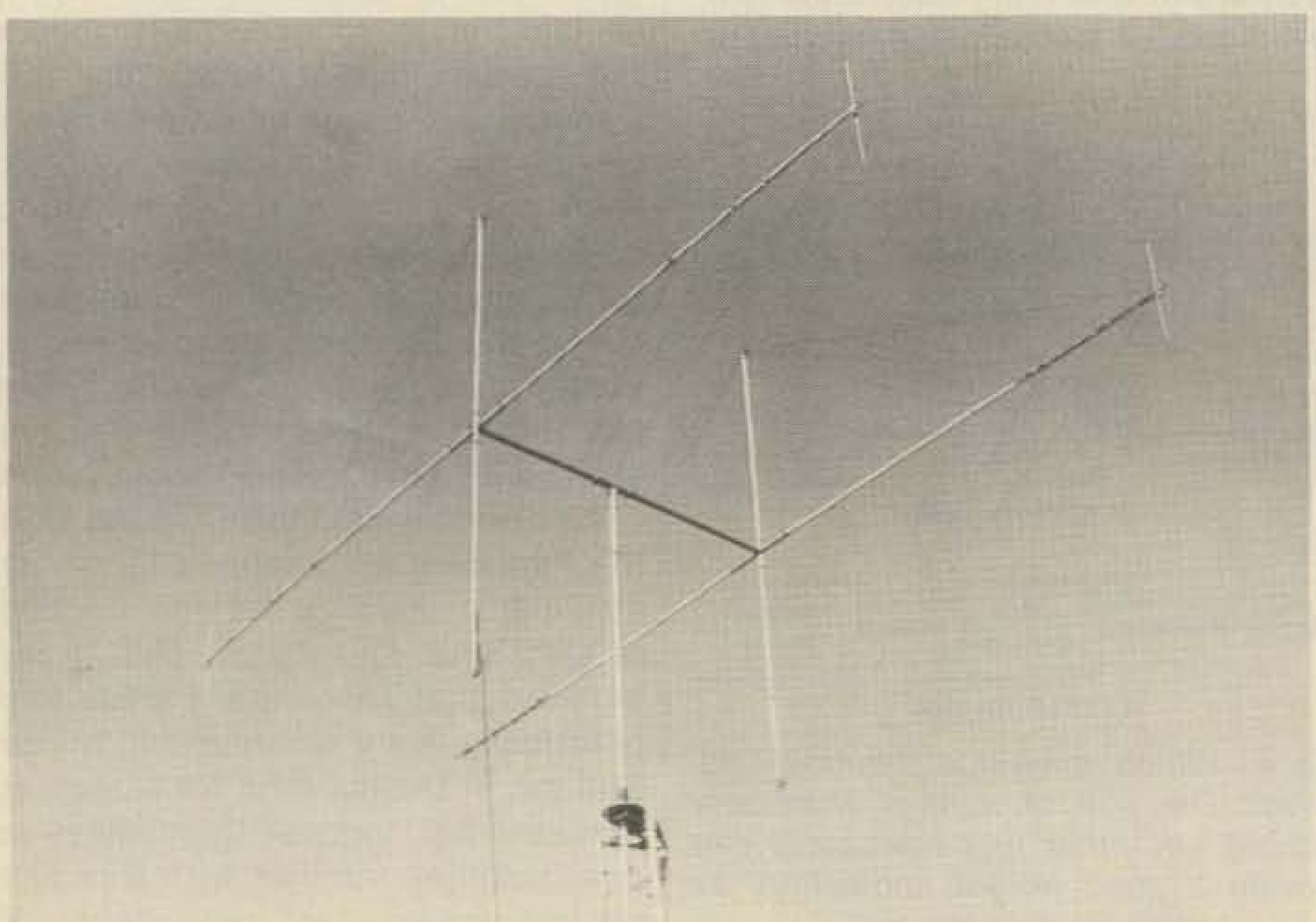


Construction

Material on hand or readily available will determine order of construction. Fig. 1 shows the layout and dimensions of the driven and reflector element; also close up detail pertaining to the 20 meter "capacity-loader."

The bamboo pole spreaders are prepared by reinforcing the tips with wood-dowel inserts, approximately 75 mm (3 in.) long and epoxy cement. With a coarse flat file, remove the sharp flashing growth at each bamboo joint. Using paper masking tape, 19 mm (¾ in) wide, spiral wrap the pole, making an overlap of 6.5 mm (¼ in.) or more.

Before applying a non-metallic base paint, set the masking tape by exposing it to the flame of a propane torch. While warm, mold the tape by hand firmly to the spreader and especially around the bamboo joint area. At the plexiglass insulator places, wrap 5 turns of PVC tape over an area 26 mm (1 in.) wide and at the spider-clamp locations, wrap friction tape. Install the vertical bamboo spreader with the smaller and reinforced end, bottom side. Select the stronger looking one for the driven element.

Insulators

Each vertical spreader requires two phenolic or plexiglass connector blocks as shown in fig. 2. The part is fastened to the outer side of spreader with one M3.5 (6-32) screw and banded at two places with No.16 galvanized iron wire. The wire-hole spacing dimension 15 to be 80 per cent of the bamboo diameter, at that point. Wrap two layers of friction tape around the bamboo, insert pre-formed wire through the holes, draw up firmly with pliers and lock with a twisted joint.

Most of the labeled galvanized iron wire is only flash plated. Therefore it should be tinned with solder or coated with a silicone or front wheel bearing car grease.

The tubular Plexiglass insulators, fig. 2, are fitted to the spreader, by filing a flat spot in the insulator. The cut-out radius is slightly less than the spreader dimension. Drilling the long concentric hole should be done in a lathe, using a soap-water cutting lubricant.

The 10 meter insulators will be attached to the inner side of the beam and the 15 meter set, on the outer side. Two pieces of pre-coated iron wire are used in a criss-cross manner per insulator. As per fig. 2, form one wire diagonally around the insulator and spreader, pull up at the free ends with pliers and start a twist joint. Slip the other coated wire halfway and under the twist joint, then form the other connection at opposite side. Alternate between twist joints in a final twisting operation, while checking for correct alignment of the insulator. The trick is to apply maximum squeeze before reaching the wire's yield point. Cut off excess wire, leaving twisted stubs 7 mm (5/16 in.) long. The 20 meter ceramic, egg or strain type insulators are attached closely to the spreader via a drilled hole, 6.5 mm (1/4 in.) from the reinforced end of the spreader.

Antenna Wire

Rigging starts with the 10 meter section, checking for horizontal and vertical spreader alignment, before installing the 15 and 20 meter wires. Use No.14 enameled or bare copper wire; the heavy plastic covered wire has a different propagation velocity factor.

Capacity-Loader

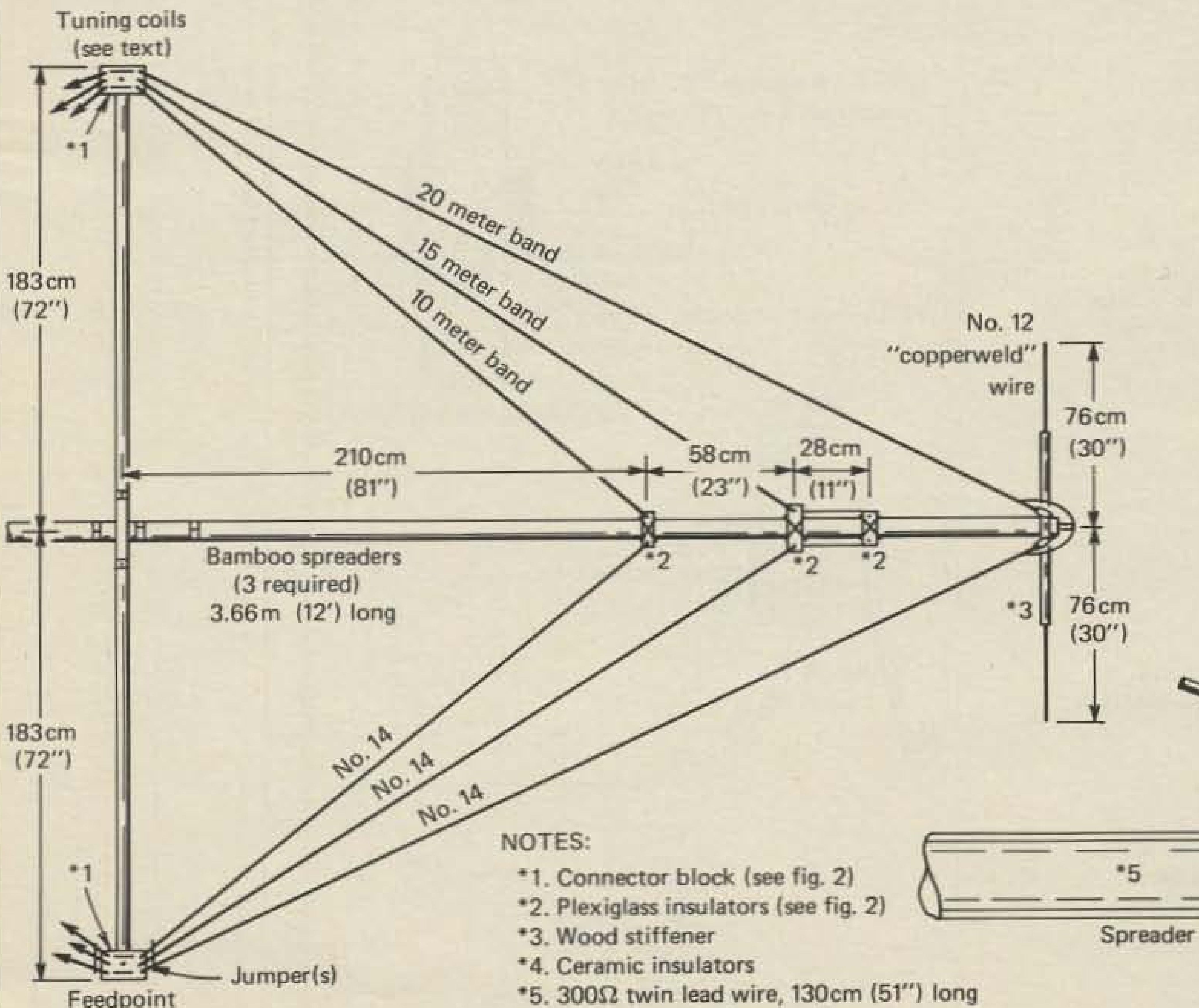
See fig. 1. This consists of three major pieces per unit. One No.12 Copperweld wire. 152 cm (60 in.) long. One No.14 wire jumper, 30 cm (12 in.) long and a piece of 300 ohm TV twin lead, 130 cm (51 in.) long. The twin lead used has a thin and solid polyethylene web.

The straight piece of Copperweld is skewered through the insulator holes, displacing them to the inner side of the beam. If the correct size of insulated "spaghetti" is unavailable, a wrapping of PVC tape will be adaquate. The jumper wire is hooked over the upper antenna wire, extended and wrapped one turn around the vertical Copperweld wire and carried over to the lower wires. Strip off 25 mm (1 in.) from one end of twin lead, twist the wires together and solder them to the middle of the jumper wire. The twin lead is taped to the inner side of the spreader at five or more places.

The vertical Copperweld wire is given some rigidity by adding a varnished wooden stick, 7 mm (5/16 in.) square by 76 cm (30 in.) long. Lay it along the inner side of the wire, and bind together with light guage wire at the Copperweld and jumper wire soldered joint. Start here and spiral wrap with paper masking tape; then finish the outer end with another wire binding to keep the tape from unraveling.

Tuning Coils

These, as required for the driven and reflector elements, are made with No.14 copper wire. The wire table, see fig. 1, indicates the correct overall length of wire used in making the air wound coils. Wind the 10 and 15 meter set on a 12.7 mm (1/2 in.) diameter rod, using a very coarse pitch. Form hooks at the lead ends, and fit the coil into place by altering it's pitch and diameter. The 15 meter coil extends across the center of the connector block, while the 10 and 20 meter coils, are off the inner and outer edges of the block. The 20 meter coils will be wound on a 19 mm



TUNING COIL WIRE LENGTH

BAND	10	15	20
Driven element	46cm (18")	15.3cm (6")	25.2cm (10")
Reflector 2 coils req'd.	43cm (17")	61cm (24")	76cm (30")

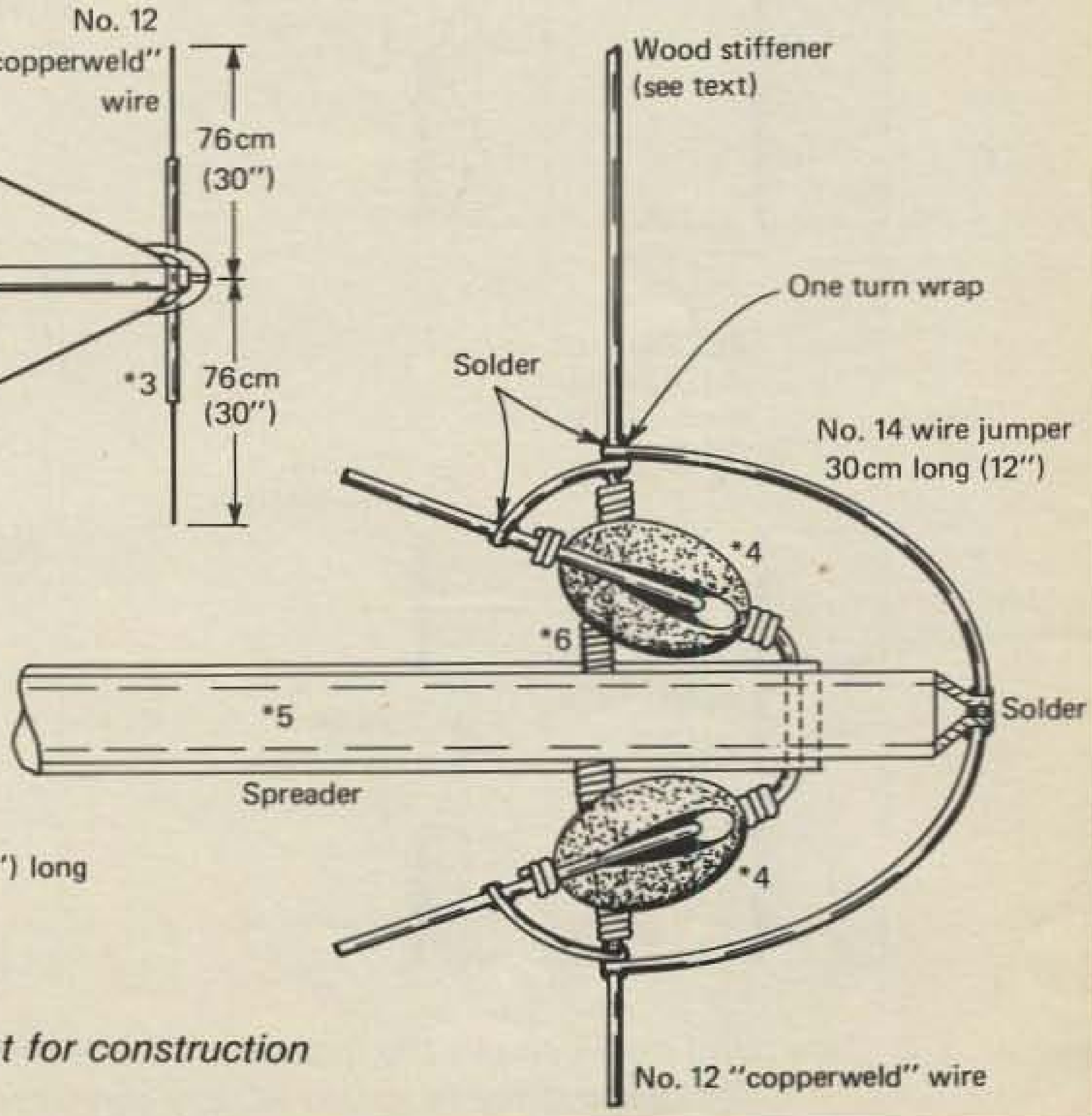


Fig. 1 - Construction of the tri-band driven element. See the text for construction of the reflector.

(3/4 in.) diameter form. The driven element uses one set of coils and the reflector requires coils across the upper and lower connector blocks.

Since the basic wire element are identical, the reflector coil inductance is much larger than the driven element coil leading. I suppose one should extend the reflector 10 and 15 meter loops and use more capacity leading in the 20 meter section for maximum gain. This would put the cap on what we started out to do.

Driven Element

This will be fed by a single RG/8 coaxial cable. The antenna wires on each side of the lower connector block, are connected in parallel with a wire jumper and to a modified SO-239 coax fitting. A photo of my installation shows the coax making a direct drop; actually it is attached a short distance above the connector block and makes a 180 degree loop, with the PL-259 fitting headed downward. To protect the underside of the SO-239 fitting from water and dirt accumulation over the narrow insulated gap, a drip-skirt, see fig. 2, made from a short section of brass tubing or rolled up sheet is soldered on; also the necessary wire leads to join the jumper wire connection.

Spider and related hardware, although finally covered, will probably be the starting point of your LP Quad. I used the same parts left over from the MK IV that were made to fit a 51 mm (2 in.) OD aluminum boom.

A cheaper and more common boom material is steel electrical mettalic tubing or EMT, 25.5 mm (1 in.) size. Fig. 3 shows all of the parts required and construction details. The angle iron can be a lighter gauge, if available. The iron pipe stubs may require some file work for a smooth fit to the EMT. An additional part to the original spreader clamp assembly is a curved sheet metal piece that bridges the open gap and improves clamp tightness.

Feeding And Adjustment

The driven element is fed directly by one RG/8 coaxial line; a balun is not required to equalize current distribution to both sides of antenna. The electrical path between the inner conductor and the outer sheath is via a loss copper wire circuit. A half wave dipole behaves quite differently. As to r.f. line radiation, if there is any, it is at a sub QRP level.

My antenna sections were peaked at 14.15, 21.15 and 28.4 MHz to cover the c.w. and lower end of the phone band. Tune-up for c.w. or phone bands only; this will improve performance. This can be done by altering the length of coil wire. In addition, the 20 meter element capacity-loader can be trimmed. A difference of 25.5 mm (1 in.) in the linear dimension of one twin lead will shift the frequency aproximately 16 kHz. The same change to one vertical Copperweld wire will move the frequency aproximately 18 kHz.

In actual practice, any capacity trimming should be equally divided, however the upper and lower pair of reflector coils can be different; the coil with the greater inductance should be at the top, to favor the driven element.

A transmatch or tuner must be used, in view of the simple feed and triple impedance. Initial testing should be done at low power to determine if antenna is performing as per "great expectations." The s.w.r. meter readings will be affected by the length of coax cable, since it's part of the tuning system. Optimum tune-up requires a simple field strength meter hookup to obtain relative power gain and front-to-back data. To complete our basic instrumentation, an antenna noise bridge can be very useful.

Conclusion

At the moment, I can see one more addition that will enhance the overall

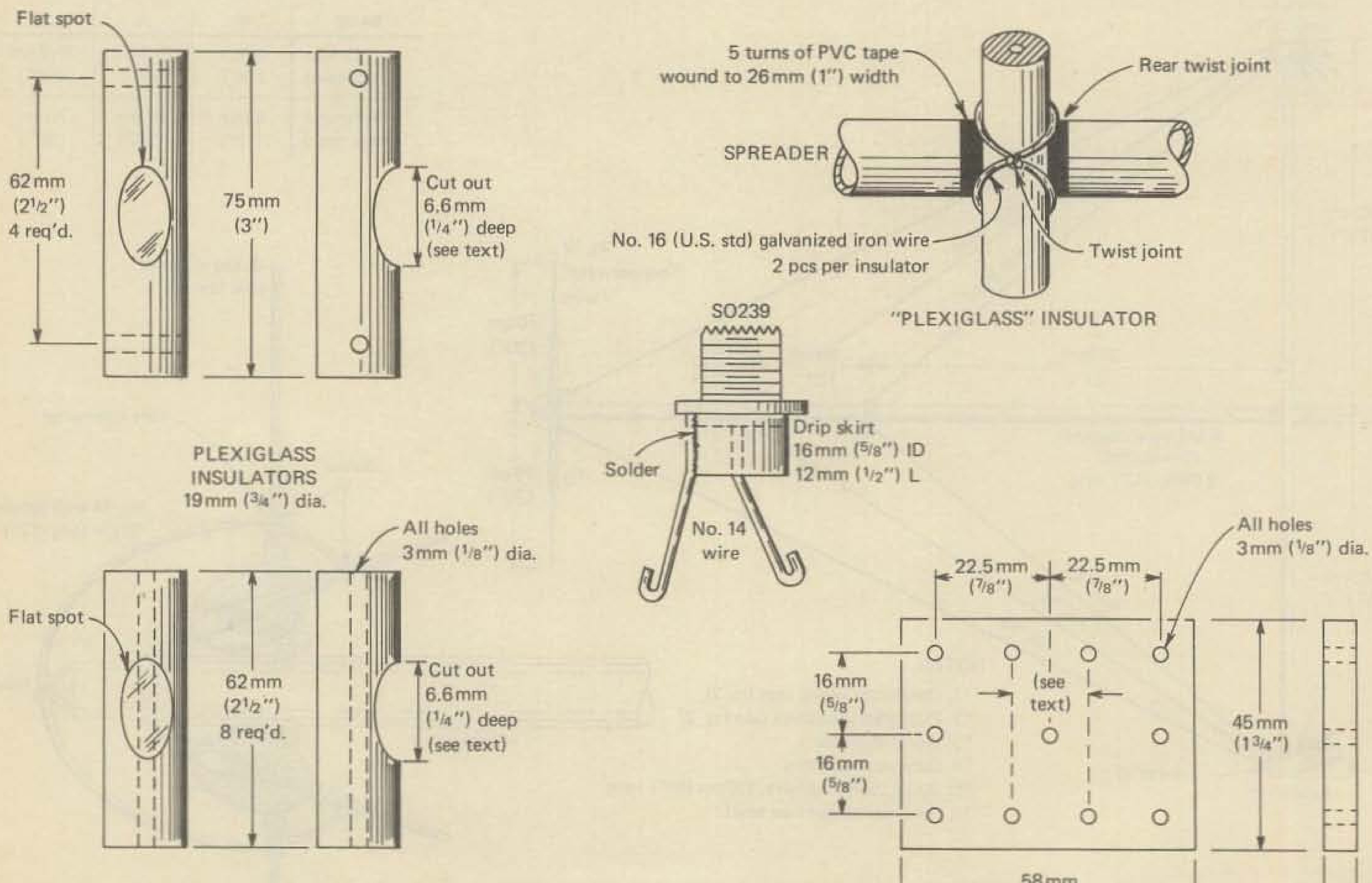
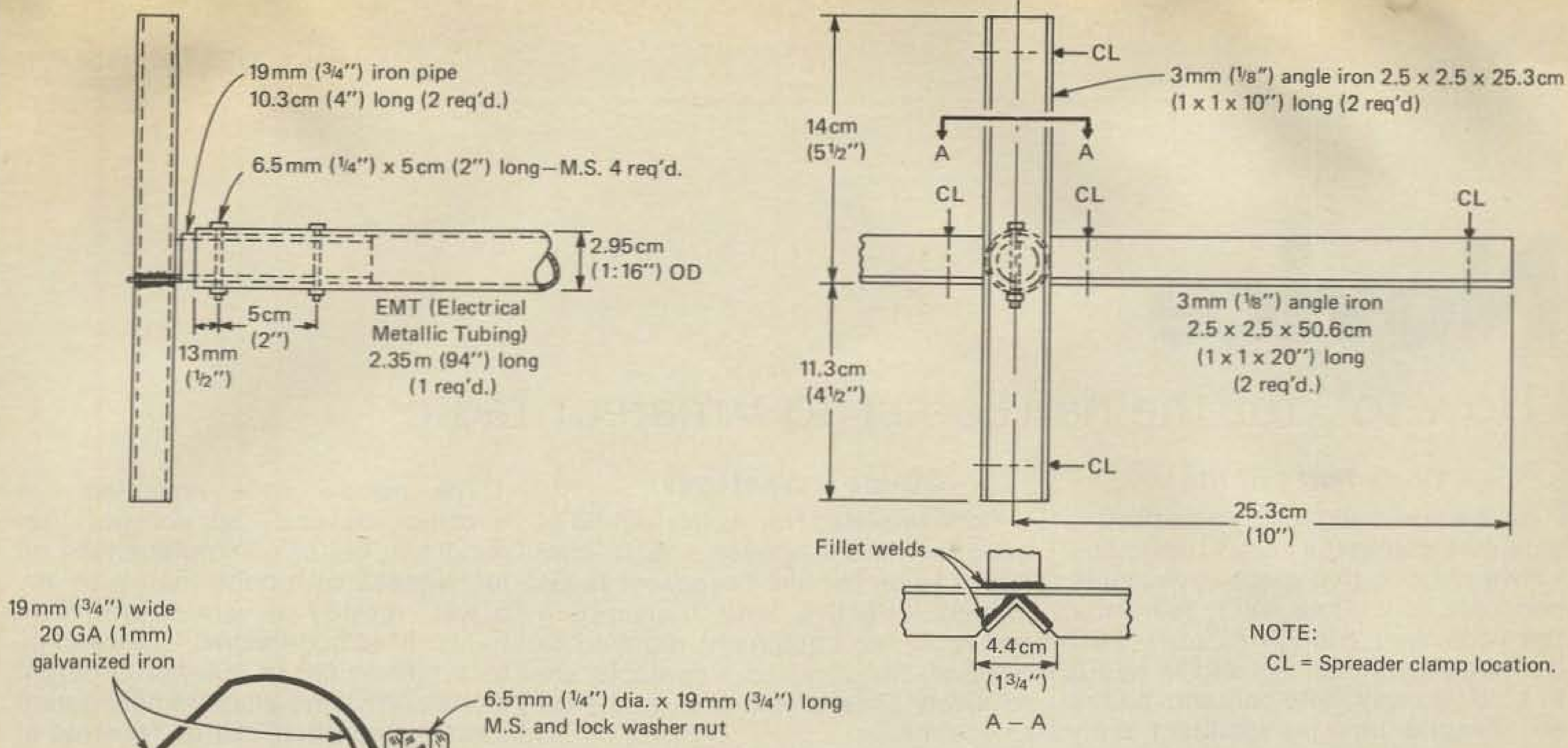


Fig. 2 - This parts detail shows the insulators, the fastener, the connector block and the modified SO-239 connector.



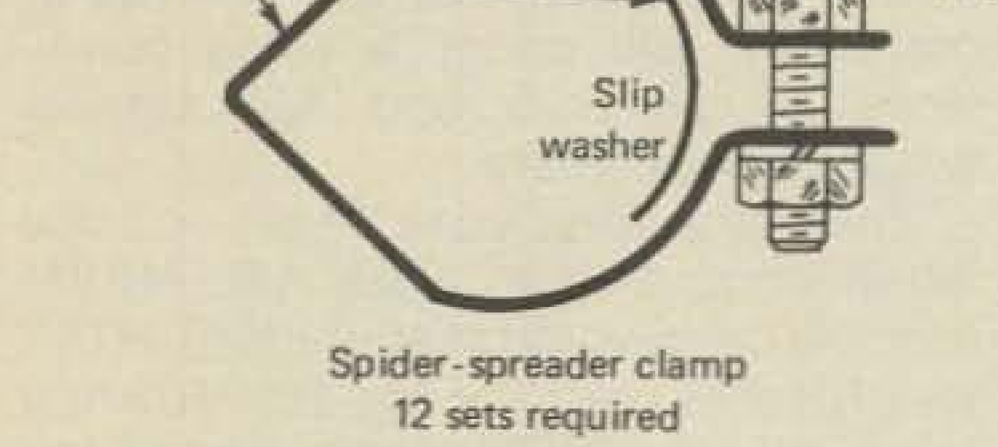


Fig. 3 - The spider spreader clamp and boom construction.

performance. Operation on the 10 meter band has frequently spread above 29 MHz; therefore to extend the antenna bandwidth, another set of loops can be connected in parallel with the present ones. I suggest installing the other set of Plexiglass insulators along the horizontal spreaders at 190 cm (75 in.). Try it. See what happens. Let us know.