THE MULTIBAND COAXIAL TRAP ANTENNA

By Peter McAdam VK2EVB

The space limitations placed on the suburban amateur, and the desire for a neat multiband antenna system to satisfy the average XYL, often makes trapped dipoles a very attractive proposition. Some amateurs, however, view traps with suspicion and claim massive power losses are incurred by their use. While this may be true of poorly-made home-brew traps, the commercial item is optimized for peak performance at resonance, but therein lies a hitch.

The conventional low loss, high-Q trap provides a high isolating impedance, which is directly proportional to Q. Unfortunately high-Q restricts bandwidth and, as maximum isolation occurs only at resonance, the further away from resonance the trap is operated, the greater the losses.

The N3GO low-Q coaxial trap provides the same high isolating impedance, but over a greater bandwidth than is possible with conventional traps, hence lower losses. Also the major component, coaxial cable, provides a continuity of manufacture, by virtue of its commercial origin, which is hard to repeat in the conventional home brew trap.

Gary O'Neal N3GO used a single length of coax to fabricate his low-Q trap. The shield acts as the inductor, and the centre core, in conjunction with the shield, as the capacitor. The coaxial cable is wound onto the former, and the centre core of one end of the coil is connected to the shield of the other end. Now the circuit is complete and ready to be tuned using a dip oscillator calibrated against a general coverage receiver.

Armed with this information from the 14th edition of the ARRL Antenna Handbook, the author conducted some experiments. The first attempt resonated at 2.4 MHz, but soon a 7 MHz version emerged. A piece of RG-58 was prepared as in **Fig. 1.** The white plastic pipe former was cut and drilled as in **Fig. 2.** Then the coax was wound

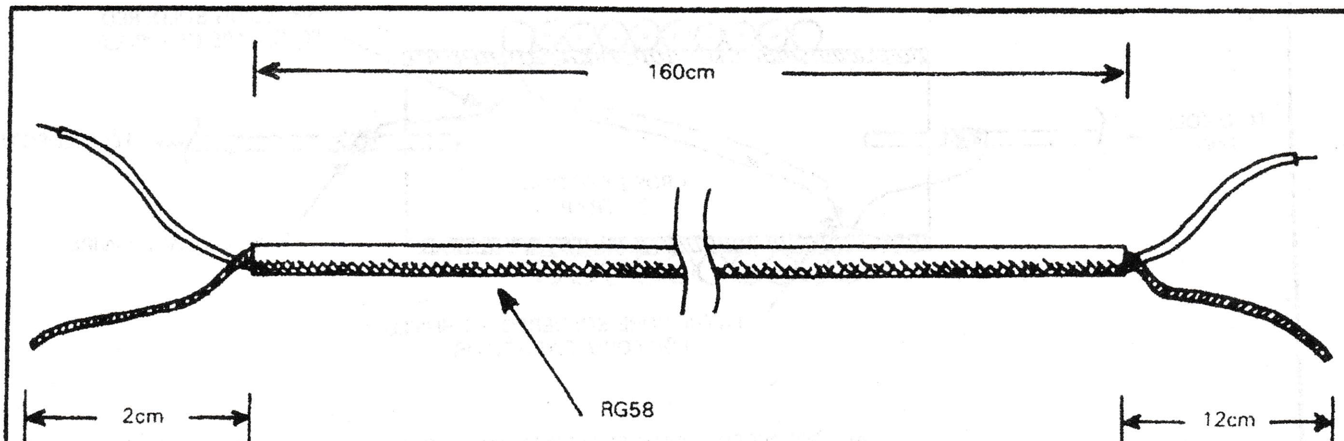

Fig. 1

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COAXIAL ANTENNA

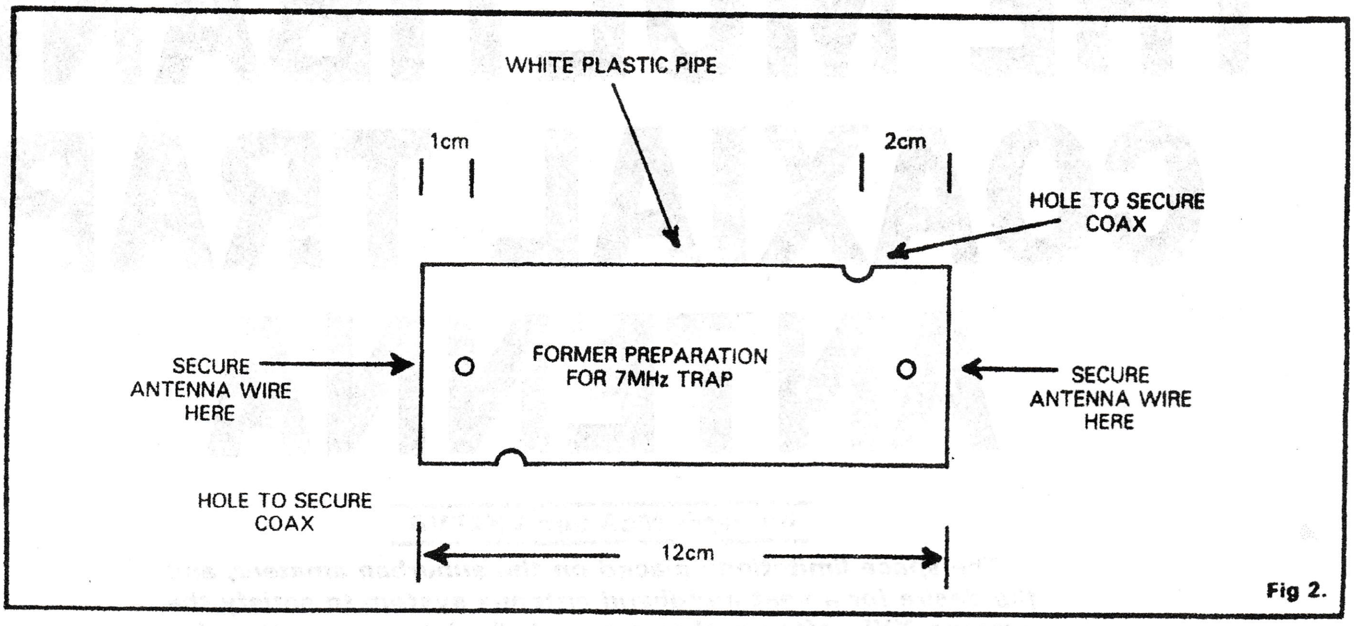

Fig 2.

on and connected as in **Fig. 3.** This now dipped at 6.5 MHz, so the centre turns of the coax coil were spread with plastic spagetti, until resonance at 7 MHz was achieved.

The trap was then bound with black insulation tape and the coax sealed with silicon sealant. Of course, heat shrink tubing would make a more professional and pleasing finish, but the author used what was at hand.

The new traps were installed in a W3DZZ-style 5-band dipole, (see Figs. 3 and 5), which was raised to 10 metres above ground. First the inner dipole was shortened at the feedpoint till it resonated at 7.050 MHz, and then the outer ends were cut for 3.560 MHz. The other bands were checked and were found to resonate on 14.250 MHz, 21.400 MHz and 29.500 MHz, respectively. The bandwidth under 1.5 to 1 on 80 metres was 115 kHz, and over 200 kHz on 40 metres. Beware of cutting the 40 metre inner dipole too short, as it will affect 10, 15 and 20 metres dramatically.

This 32-metre-long antenna proved to be stable and most satisfactory over a six month test period. It remained impervious to weather conditions and reports from regular contacts on 80 metres were the same as the previous simple dipole.

After moving QTH the trapped dipole was installed as an inverted Vee, but excessively high SWR on 10, 15 and 20 metres forced the use of an ATU on these bands. The antenna also required shortening to adjust resonance on 80 to 40 metres. Obviously the inverted position had changed the capacitive-reactance effect of the traps on the inner dipole producing an incorrect feedpoint impedance. The antenna

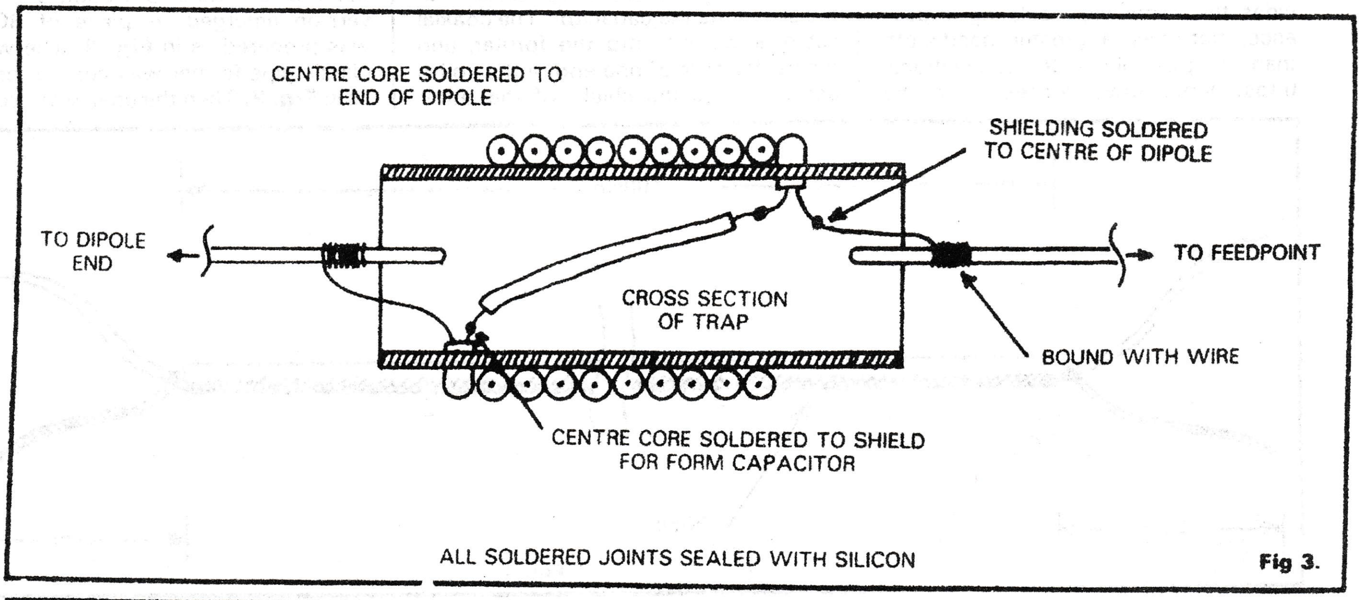

Fig 3.

Dimensions for coaxial traps

Freq.	Form Dia O.D.	Form Length	Turns Of Coax	Coax Type
14 MHZ	43 cm	7 cm	5½	RG58
7 MHZ ✓	43 mm	12 cm	10½	RG58
3.5 MHZ	56 cm	14 cm	17	RG58

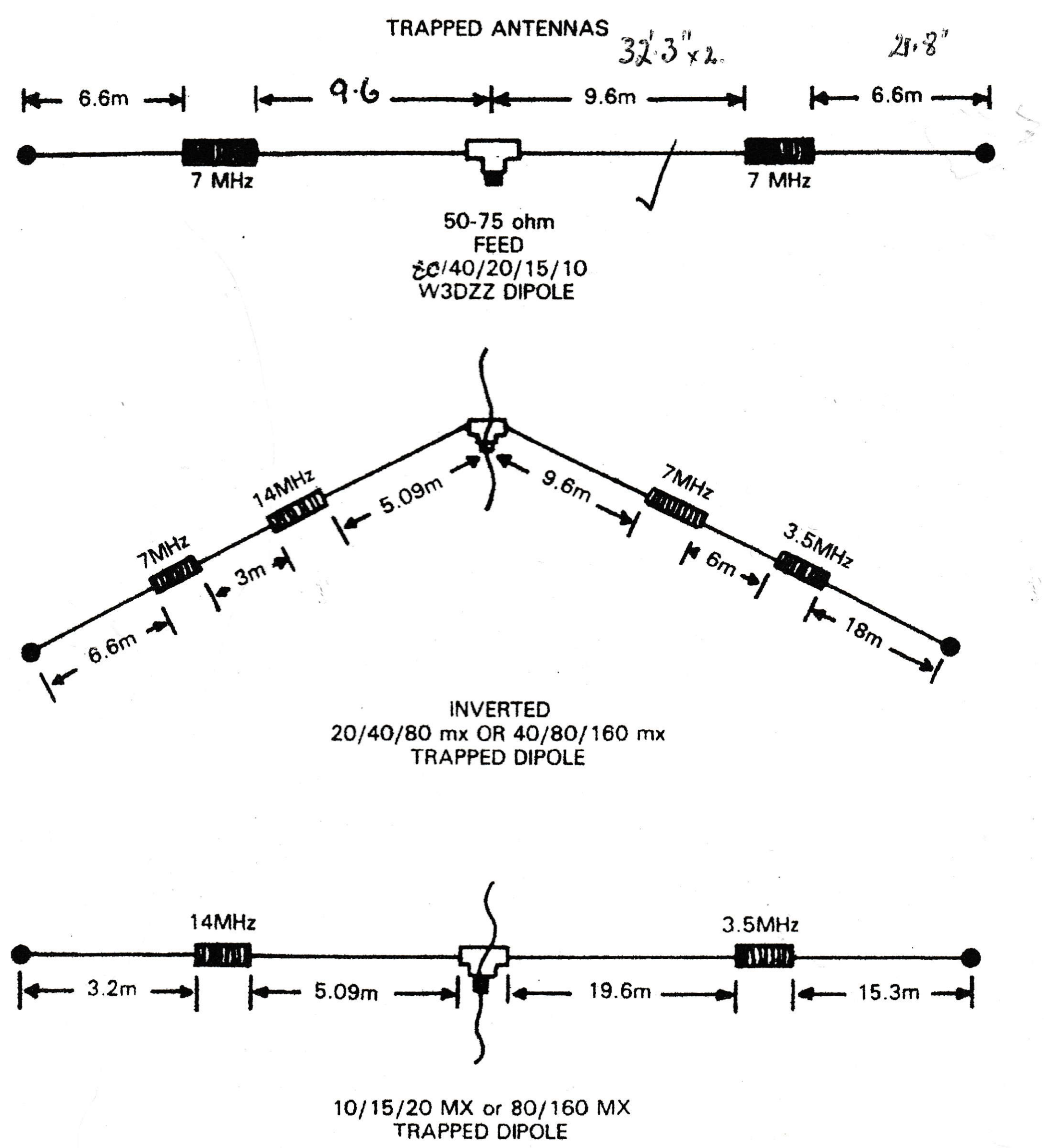

Fig. 5

40m 1.7 COAX

was temporarily placed in a horizontal position, and all was found to be well again.

The author made some 20 metre traps, installed them in the dipole, and returned it to the inverted position. The outcome was a 20/40/80 metre dipole, 30 metres long with low SWR. One point noted was that the 40 metre bandwidth narrowed, but the author still uses this antenna today.

Further experiments followed using 7 MHz and 3.5 MHz traps, which produced a 40/80/160 metre trapped dipole. While this dipole worked very well, the bandwidth on 80 metres was reduced to 85 kHz. Later a 40/80, and a 20/160 metre trap dipole system was operated from the same feedpoint with complete success.

The author has now reverted back to the 20/40/80 dipole, as he requires the space for further experiments. Obviously, for maximum bandwidth, one pair of traps per dipole is mandatory, but the author found that the 20/40/80 dipole provided the full band on 20m, 150 kHz on 40m and 100 kHz on 80m — all under 1.5 to 1, and decided that was sufficient for his needs.

A list of trap dimensions is given in **Fig. 4.** along with the trapped antenna variations in **Fig. 5.** During the experiments, a portable 5-band half-sloper type of antenna was developed, which produced surprising results, considering its height and length. The antenna **(Fig 6)** maybe rolled up and transported easily and erected quickly.

It consists of half a trap dipole with little length added to the 40m section. A 60 cm earth stake was used and the aerial fed against ground via a broadband 4 to 1 ferrite balun. 15 metres of coax with 6 of those metres lying on or buried in the ground, was used to feed the antenna. The counterpoise suggested could be used at ground level or above, to improve results further.

Using only the 60cm earth stake, reports on 80 metres were 10dB down on the dipole, but still 5 x 9 from VK3 and VK4. On 20 metres little difference was noted, and good reports from VK2, VK3, VK4, VK5 and ZL were received. This antenna is surprisingly broadbanded and performed well in a variety of locations.

A second 3.5 MHz trap could be added creating a coverage from 160 to 10 metres. Alternatively a smaller version could be made using a 14 MHz trap to provide coverage of 40 to 10 metres. If the slope of the antenna is increased to above 60 degrees the balun could be dispensed with and the section between the feedpoint and the trap can be shortened. This will make the antenna behave more like a vertical and a more reliable ground system would be required.

Another possibility, for the amateur with little space, is the elevated feed half-sloper. Take half a trap dipole, feed it about 10 to 15 metres up a mast, and connect the coax shield to earth, via a metal mast or earth lead.

The extremity of the aerial is tied to a suitable support like a fence etc. Two half-slopers can be coupled to the same feedling, so coverage of most amateur bands can be provided.

Well now its up to you, so go to it. Remember the reduction in efficiency of a properly made conventional trapped dipole compared with a simple dipole is small; too small, in fact to be noticed on air. But now the N3GO coaxial trap promises further increases in the efficiency of the modern trapped antenna.

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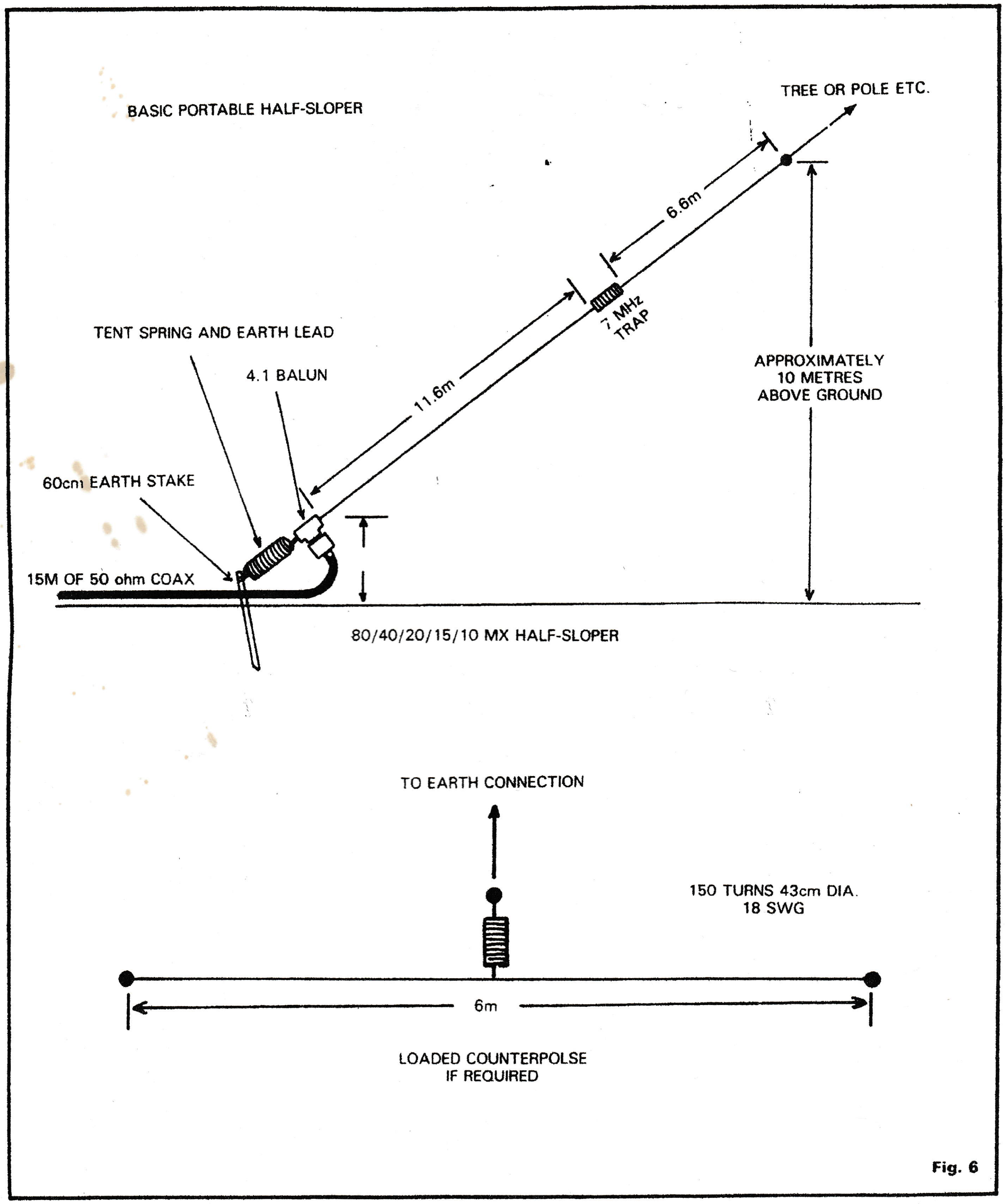

BASIC PORTABLE HALF-SLOPER
TREE OR POLE ETC.
6.6m
7 MHz TRAP
TENT SPRING AND EARTH LEAD
4.1 BALUN
11.6m
APPROXIMATELY 10 METRES ABOVE GROUND
60cm EARTH STAKE
15M OF 50 ohm COAX
80/40/20/15/10 MX HALF-SLOPER
TO EARTH CONNECTION
150 TURNS 43cm DIA. 18 SWG
6m
LOADED COUNTERPOLSE IF REQUIRED

Fig. 6