(3) Unless higher than 150ft, it hardly matters on 3.5MHz in which direction a horizontal dipole points: more significant will be obstructions, trees etc which absorb some of the power.

(4) A long antenna provides more receiver microvolts than a short one (ie less than a half-wavelength long) but a transmitting antenna radiates all the power that can be fed to it (except IR losses).

(5) Antennas, and the equipment connected to them, can confidently be expected to provide better and better results on HF as a sunspot cycle goes up and up.

(6) The result of doubling your RF output power will be virtually unnoticeable, but halving your input power may well be noticeable since output efficiency may be affected.

(7) A loosely-loaded transmitter sounds awful when overdriven.

(8) A tightly-loaded transmitter, when overdriven, sags at the knees and output may even be reduced.

(9) A properly tuned system is when the antenna correctly loads the transmitter.

(10) A poor antenna is always a poor antenna; but when conditions are good it will work.

(11) There are no magic formulas or magic boxes able to improve the performance of poor antennas, but it is easy to reduce dramatically the efficiency of a good antenna.

(12) A bought antenna is not a better antenna but merely a more expensive antenna; a better investment is a good book on antennas.

(13) Is your best friend afraid to tell you?

VERSATILE CRYSTAL TESTER

MANY YEARS AGO I included in *TT* and subsequently *ART*, circuit details of a simple bipolar transistor crystal oscillator that could be used as a simple means of testing the activity of assorted crystals. A rather more sophisticated unit capable of checking the activity of crystal and ceramic resonators over the range of about 40kHz to 20MHz has been described recently by M J Salvati of Flushing Communications in the 'Ideas for Design' feature of *Electronic Design* (July 9, 1992): **Fig 7.**

He points out that there are several reasons why crystal oscillators may fail to work. It may be due to faulty or low-activity crystals, or poor design. It is thus a good idea to check the crystal before starting to trouble shoot on the equipment (similarly it may be wise to check ex-equipment or even new crystals at the time of purchase). The arrangement shown can work with a wide variety of crystals and ceramic resonators; if used with a frequency counter it provides a check on the parallel-resonant oscillation frequency.

M J Salvati writes: "The crystal 'sees' approximately 30pF of circuit capacitance. The basic oscillator is a Pierce type that uses the first pair of MOSFETs in the CA4007A dual complimentary pair plus inverter, CMOS IC. The remaining MOSFET pairs form a meter driver and a low-impedance output driver. The meter is the primary indicator of the crystal performance. Any low-cost microammeter with about 200-500uA FSD will do (this is the ideal application for that 'tuning' meter from a discarded stereo etc).

"The resistor (R) in series with the meter is selected to produce about 90% FSD with an active crystal. Low-activity crystals of any frequency will generate less meter deflection, as will the good crystals at the upper frequency limit of this device. The low-impedance output can drive a frequency counter or oscilloscope through a terminated cable. Aside from their forming part of the Pierce oscillator, the network of resistors around the first MOSFET pair protects the MOSFET gates from electrostatic and leakage damage. To illustrate its ruggedness, this circuit has not experienced a failure after several years of use, even though the input leads are extensively handled in connecting the crystals or ceramic resonators that do not fit the holder."

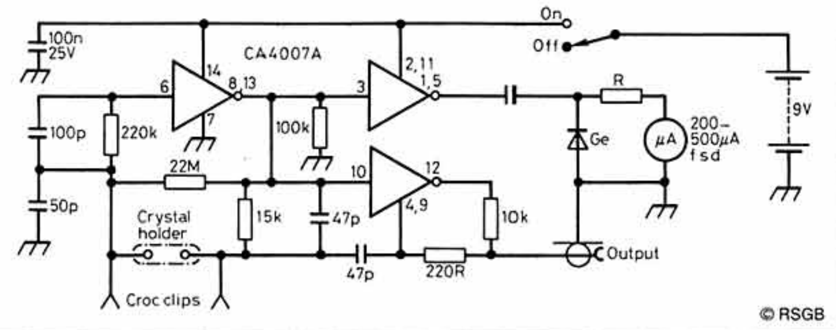

Fig 7: Versatile crystal/ceramic-resonator tester (M J Salvati, *Electronic Design*).

THE FIRST BEACONS

THOSE OF US WHO listened on the amateur bands during the 1939-45 war, either for personal interest or as Voluntary (or SCU3) Interceptors, soon became aware that, after an initial close-down, a number of pre-war German amateurs with D3 and D4 callsigns were permitted to resume CW operation on the HF bands. From 1942 these included a number of beacon transmissions (D4WYF2 3600kHz; D4WYF3 7000kHz; D4WYF4 14,130kHz; and D4WYF5 28,000kHz). A note on these transmissions was even published in the *RSGB Bulletin*, October 1944, p55, stemming from Frank Watts, G5BM, in connection with a report on propagation conditions on 28MHz. He noted that "These stations send V's followed by their calls continually throughout the 24 hours. They are very useful for checking frequency meters, besides providing an indication of the skip length on the various bands."

Now 50 years later, the story of why and by whom these first beacons were built has been told by Waldemar F Kehler, DL1IX, (pre-war D3FBA) in 'The Origin of Amateur Radio Beacons' (*CQ*, November 1942, pp17-18). To quote briefly from this interesting account: "In 1942 the German Wehrmacht was spread over most of the continent of Europe. This situation often resulted in difficult if not impossible communications links between front-line units and German headquarters. Faced with the problems of selecting reliable shortwave communications frequencies, the idea arose to build and operate continuously a transmitter (called a Richtsender) near Berlin . . . . The basic design was the responsibility of Herbert Salzbrunn, D4WYF who was employed by the German High Command (OKW). He designed two-stage and three-stage transmitters using tubes types RL12P10, RL12P35 and a P50 (input power 50 watts).

"The transmitter was built by a technician in a workshop at Ludwigsfede, a village south of Berlin (site of a monitoring station for foreign broadcasts) from where they were operated except for a short break when the station was bombed during the night of January 1, 1944 . . . . tests were made with a portable 20-watt transmitter in the German Embassy in Madrid . . . . the first two beacons were D4WYF2 on 3.5MHz and D4WYF5 on 28MHz. Later we added two additional beacons, in the 40m and 20m bands. These two were installed in the former office building of a German insurance company (Allianz-Versicherung) at Fehrbelliner Square in Berlin-Wilmersdorf, a building that became well-known in connection with the attempt on Hitler's life on July 20, 1944 after which General Thiels, head of German Signals Intelligence was executed in 1944. [Presumably this is a misprint for General Fritz Thiele who together with General Erich Fellgiebel, the Signalmaster of OKW, was executed in 1944 for their participation in the assassination plan - *G3VA*].

"A plan to open a beacon, D3FBA2, in East Prussia was abandoned. The Berlin beacons finally closed down in February 1945 when the Russian Army closed the ring around Berlin . . . . During the 1970s, amateurs rediscovered the idea of beacons, thereby proving the old adage that there is nothing new under the sun".

LOW-COST CHOKE 1:1 BALUN

TT, SEPTEMBER 1992 and January 1993, has provided information on two ways in which the increasingly popular ferrite-loaded sleeve baluns can be implemented and used to minimise RF current flowing along the outer surface of the braid of coaxial-cable feeders connected to the balanced feed-point of resonant dipole-type antenna elements.

An alternative technique which does not depend on the use of ferrite beads and a length of small diameter cable or sleeves fitting over conventional cable is described by Curt Wilson, W0KKQ, in *QST*, November 1992. This depends on the use of fine steel wool to attenuate any RF on the outer braid.

He writes: "For many years, I've used choke baluns made of cardboard (and more recently, PVC) tube stuffed with steel wool . . . and placed them along the coax feed line to attenuate RF energy outside the coaxial shield. Wanting to approximate the performance of the W2DU-type ferrite choke balun on a budget, I began a search for a cheaper material that could do the job of Type 43 ferrite. I tried numerous materials before returning to fine steel wool (US grade 000 or the finer 0000)!

This material proved to be ideal in three important categories. First, its RF attenuation properties are excellent. Second, steel wool is mechanically pliable and a distinct pleasure to use. Thirdly, these fine steel wool pads may be purchased at very reasonable prices from almost any hardware store." **Fig 8** shows the balun design.

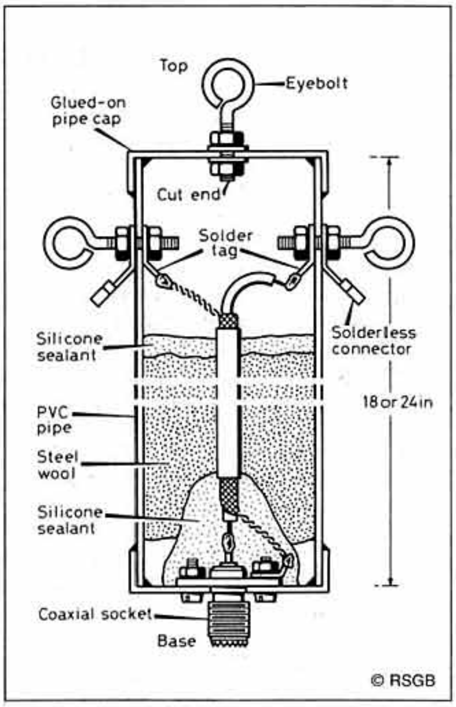

Fig 8: The low-cost 1:1 choke balun as implemented for outdoor use by W0KKQ using fine steel wool as an RF attenuator in place of ferrite rings.

W0KKC uses an 18in length of white (US Schedule 40) plastic tubing with an inside diameter of approximately 1.5 inches with two PVC caps to fit the ends of the tube. He provides very detailed constructional details but the basic arrangement should be clear from the diagram. 'Hints & Kinks' editor, David Newkirk, WJ1Z, adds two pertinent comments: (1) Since UHF series coaxial connectors are not designed to be weatherproof you can avoid having to seal your balun's jack and cable plug against the elements by using N connectors instead of SO-239s and PL-259s; and (2) especially in closed compartments, caulking compounds that liberate acetic acid vapour as they cure can severely corrode susceptible metals (such as steel wool) so avoid using such products when you build your balun".

One effective means of presenting outer-braid RF from feeding back into the shack and at the same time minimising EMC problems and the pick-up of local electrical interference is to bring the feeder cable vertically downwards from the antenna element and then to bury the remainder of the feeder before it reaches the house or outside shack. Unfortunately, as some have found, conventional coaxial cable, even if has a noncontaminating jacket, deteriorates rapidly when buried un-

THOSE COAXIAL CABLE SCRAPS

IN THE *TT* ITEM 'Using scraps of coaxial cable' (December. 1992, pp29-30) I noted that the information came to my notice from the *Mid-Sussex Newsletter* where it had been reprinted from *Airtime*, but with the original author not credited. A letter from Brian Kendall, G3GDU, provides the answer: the material was extracted from an article 'More uses for old coaxial cable' which he wrote (under the pen name 'Ken Williams') for the late-lamented British publication *Amateur Radio* (September 1990).

The original article included additional information, including advice on the not-so-easy-as-it-looks task of stripping the cable: "The first task is to strip the coaxial cable into its component parts. It might be thought that the simplest technique would be to run a sharp blade along the outer insulation to open up the cable, but this would destroy a useful component.

"The preferred method (**Fig 9**) is to cut 12-18in lengths of cable. About 1in of the outer covering is then removed with a knife and the braiding pushed back. The polythene inner insulation is then firmly gripped in a vice and with a cloth to protect the hand, a firm grip is taken of the outer covering and, relaxing the grip to allow the hand to slip, an attempt is made to pull off the outer cover.

"On the first attempt hardly any movement will be noticeable, but after the second or third attempt the braid and outer cover will have moved an inch or so. Two or three more pulls and the cover and outer braid will be free. A gentle pull should now be sufficient to remove the braid from inside the outer cover.

"Removing the inner conductor follows a similar pattern, but this is more firmly attached than the outer layers. Therefore, it is advisable to remove only 6-9in at a time. This process can often be assisted by applying a hot soldering iron to the inner conductor for a minute or so before clamping it in the vice".

The resulting sections of outer braid provide useful high-current, low-resistance conductors, while the inner pieces represent excellent insulators usable up to at least 100MHz for applications such as those described in the December *TT*. An application for the outer braid suggested in the *Amateur Radio* article is to form a common earthing bus: "One aspect which is often suggested by equipment manufacturers but rarely implemented by radio amateurs, is to attach a common earthing bus to all equipment. For this purpose the outer braiding is ideal.

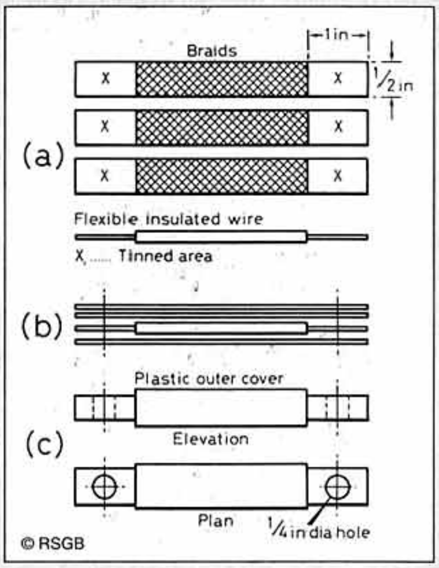

Fig 9: Construction of earthing braids or high current power cables from short lengths of coaxial cable. (a) Braids removed from cable and flattened, laid on bench and ends tinned. (b) Braids and flexible wire placed together, soldered and 0.25in holes drilled. (c) Outer cover pulled over braids.

"Take three or four equal lengths of braiding and lay them on the bench. Make sure that they are not stretched and flatten them so that each one forms a flexible strip about 0.5in wide. Heavily tin about 1in at the end. Take a similar length of flexible wire, strip 1in of insulation from each end and lay parallel with the braids.

"Now lay the braids on top of each other with the flexible wire between, and apply heat with a large (at least 60W) soldering iron at one end so that the braids and wire solder firmly together. Repeat this process at the other end. Drill a 0.25in hole through each end and apply a file to 'tidy up' the end.

"Tie a strong cord through one of the holes, pass it through a length of coaxial outer insulation which is 2in shorter than the braids and 'pull through' the braids so that only the tinned sections show.

"Such braids are capable of carrying extremely high currents and, if several are used to link equipment together and to the station earth, will fully answer all common earthing bus requirements. They can also be used to form low-resistance power feeds to high-power amplifiers, etc. 'Ken Williams' concludes this section as follows:

"With the very high current capacity of the braids, you may wonder why the flexible wire is included? The reason is that this maintains the braid at a constant length. Without it the braids will stretch beyond the length of the outer covering and cause insulation problems if used as a low-voltage power lead."