HOT IRON

Issue 7 *"Journal of the Constructors Club"* **Spring 1995**

Contents

Hot Iron is a quarterly newsletter for radio amateurs interested in building equipment. It is published by Tim Walford G3PCJ for members of the **Constructors Club**. Articles, suggested topics and questions are always welcome. Please send correspondence and membership inquiries to:-
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 Subscriptions are £5 per year for the UK (£7 overseas) from Sept 1st in each year. Jan 1st 1994.

Editorial

I thought that as this is the first issue in 1995, I would transpose a new happy figure into the box on the left that my son has drawn elsewhere on this computer. I see it every time I turn the beast on but I have now been trying for over an hour to get it here with no success! I was going to go on and be rather negative about computers in general but I have just seen the article in the March RadCom about single chip micro controllers; it leads me to wonder what most builders would think about some form of micro control in their own home built rigs, for example to control a synthesizer? Some feedback on this would be most interesting please.

This issue has a strong theme of antennas with a very practical contribution from Derek Alexander G4GVM and several interesting ideas from Stewart Sims G3WQW. My thanks to them & other contributors. I also felt that members, who do not have Yeovils, might like to see one of my favourite antenna matching bridge circuits; my apologies if you have seen it before. Keep up the contributions please!

Craig Douglas, G0HDJ, has made the helpful suggestion that owners of Somerset Range rigs might like to have some printed "rig name" stickers that could be placed on your QSL cards in the space where you give details of your equipment. I have in mind the small stickers that are about 1 x 1.5 inches which are sometimes used as address label stickers; these could have the rig name and or other simple details. For example:-

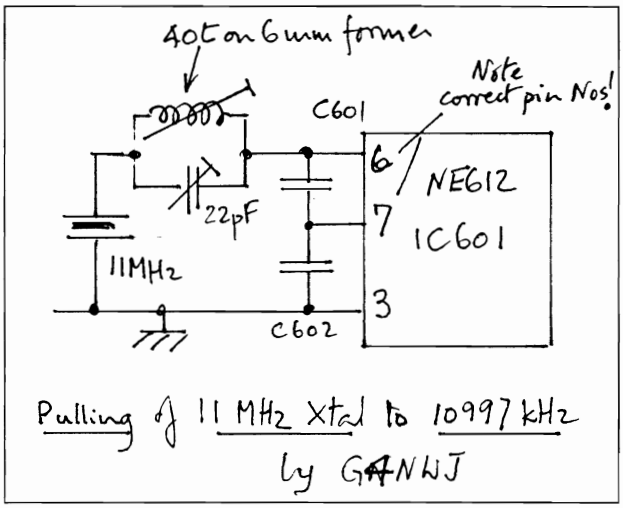
Yeovil TCVR
20 & 80m, 5 W
Walford Electronics

I would be happy to organise these, the cost would appear to be about £15 for 250 labels (post paid) or £20 for 1000, possibly significantly less if a lot of you are interested in one common label or rig etc. Please let me have your suggestions.

Some members have been inquiring about how the **Taunton** is progressing; I am pleased to answer "well". I have been working on it, amongst other things, for over a year now; the very first prototype is now working well and the design has now gelled sufficiently for the next stage of testing. Three members have kindly agreed to take on the onerous task of building and evaluating my instructions to get rid of the mistakes that I will have missed! I am hoping that it will be available for general release at the Yeovil QRP Convention on May 21st this year - see later. The Taunton is a superhet rig which can operate on any single HF band, including the WARC bands, by means of plug-in band cards. These cards contain all the parts that have to change with each band and are the only thing that will need changing to switch for one band to another. Initially, all bands will be available up to 15m; the higher ones are possible but need non standard crystals so will have to wait! At a later date, I hope to have a second band plug-in unit that will allow the fitting of parts for any two bands selected by a front panel switch. The rig will be available as RX, or TCVR, with an Optional Extras kit comprising receiver S meter & IF amplifier, transmitter matching bridge & power output indicator etc. The whole is based on one 100 x 160 mm PCB which is drilled for all the extras. Base TCVR about £90 + £15 per band. The standard frequency counter kit can be used and the matching CW kit with a very high performance tuneable switched capacitor filter is also in the late stages of design. Tim Walford Editor.

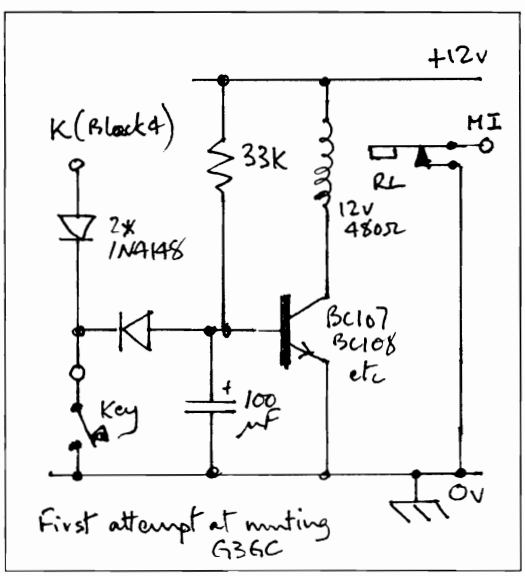
Yeovil Updates

40m converters. Both Geoff Gregor, G4OWH, and Jim Chick G4NWJ, found that their digital readouts were in error by about 3 KHz only when they operated on 40m. The rigs works perfectly normally but you would have to have a very good tuning and pointer mechanism to notice the 3 KHz dial calibration error on 40m compared to the calibration for 20 & 80m. This is why it has only been spotted by those with a digital readout. A certain amount of head scratching by all lead to the conclusion that it is due to sideband inversion as the signals pass through the 40m converter. The solution is to offset the crystal in the converter to 10997 KHz instead of the nominal figure of 11000 KHz. Regrettably this shift is beyond the adjustment range of the normal trimmer. Jim kindly tried substituting a ceramic resonator for me; this can easily be pulled down more than enough with the trimmer capacitor but it failed the stability tests. Both temperature effects and its repeatability from cold were not good enough. (Those of you contemplating ceramic resonators as high frequency VXOs for simple direct conversion transceivers beware!) The nice solution would be 10997 KHz crystals but these are non standard and prohibitively expensive in small numbers. Luckily the amount of pull that is needed is possible with standard 11000 KHz crystals but it needs extra parts. Jim Chick has used the following circuit with complete success - I have not tried it but other work on pulling a 6 MHz crystal for the Taunton suggests it should be fine. Only those members who have a digital readout and 40m need contemplate this modification. It needs a rearrangement of the tracks around the trimmer and crystal. I have given the details that Jim sent me. At 6 MHz, I needed 10 µH & about 30 pF to swing 3KHz; so perhaps a fixed 5 µH should do at 11 MHz with adjustment being solely by the trimmer capacitor. Try it out for yourself! Jim also pointed out the numbering error on pin 6 & 7 of IC601. In addition he has also tried several alternative FETs in the driver and output stages. His suggestion is an IRF621 as driver and a pair of IRF630s for the final. I do not know who manufactured these FETs and I do note significant differences with alternative IRF510 suppliers. His output increased to 18 W for 80 & 40 with slightly less on 20m. G3PCJ



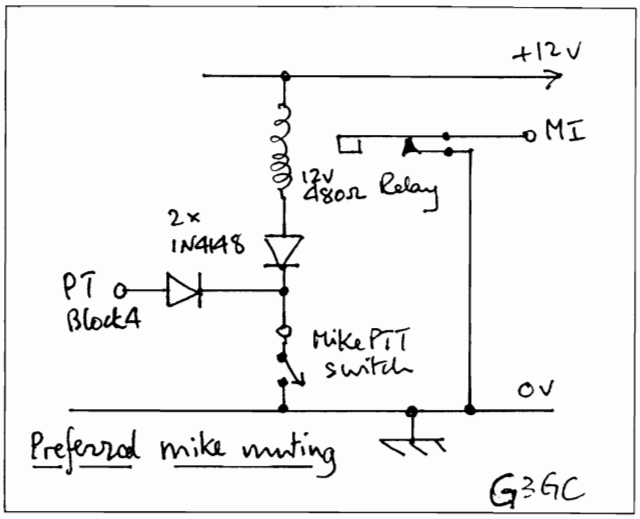
Using the CW filter on SSB. Eric Godfrey, G3GC, contributes the following which may well be of interest for other rigs apart from the Yeovil. "I fell into a trap the other day when working Howard, G4HMD in Northwood, Hertfordshire on 80m using the Yeovil on SSB in heavy QRM. I decided to put the CW filter in circuit to improve selectivity at the expense of SSB speech quality. This was satisfactory, bringing up what was a difficult signal to readability R5. However, at the end of my next over, I found that G4HMD had not copied me at all. I then remembered that the CW filter switch places a short across the microphone input. This has been included quite rightly to ensure that when on CW there are no random transmissions from the microphone which would otherwise be live until the T/R relays drop out. It was therefore necessary to change the filter switch to SSB when transmitting on SSB. This was inconvenient and some form of automatic arrangement was obviously required.

I decided the solution was to use a small relay operated by the key to provide a pair of normally open contacts (relay unenergised) in series with the earthy end of the CW filter switch. This would then ensure that the microphone would not normally be short circuited on SSB transmit. This worked except that the short circuit was only in place while the key was down. Obviously some hold delay was required and this was achieved by driving the relay from the transistor as shown on the right. In this circuit the transistor is normally conducting and the relay is energised except when the key is down, earthing the base of the transistor and cutting it off. Since the relay is now energised in the key up position, the normally open contacts (open unless the key is down) are now used to short the microphone to ground. The time constant of the resisitor/capacitor combination on the base of the transistor



provides a hold delay a little longer than the maximum T/R delay, thus ensuring the microphone remains dead on CW transmit.

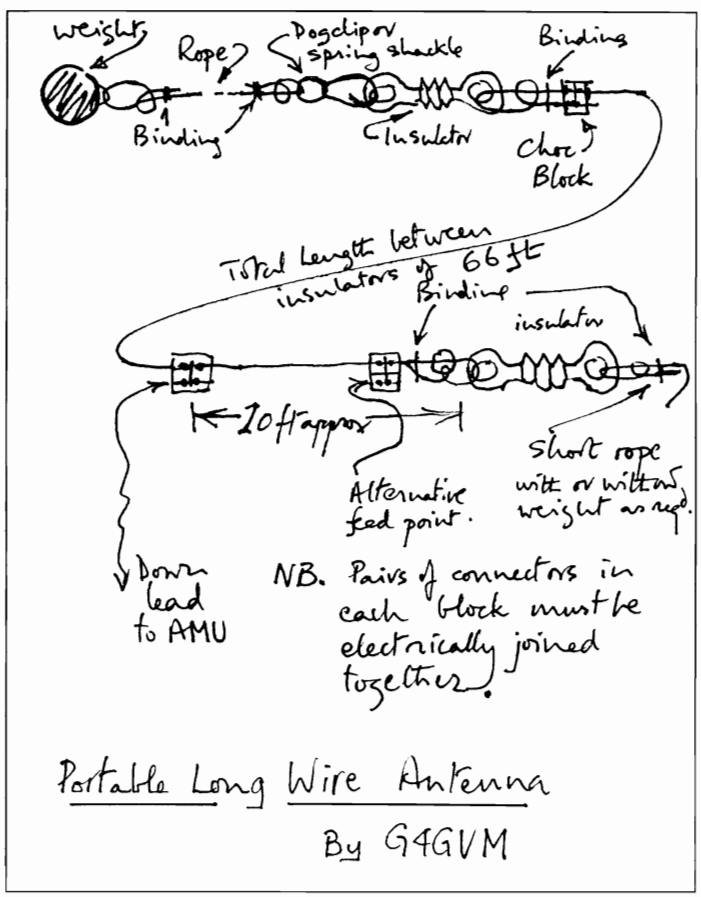
After a little more thought, I decided that a simpler and more elegant way to achieve this objective was to control the relay from the microphone press to talk switch. This would require that the microphone was always shorted to ground except when the PTT switched was operated during SSB transmission. This way there are no requirements for any hold delay and the final circuit which comprises one relay and two isolating diodes is shown on the right. These three components can be assembled on a piece of veroboard less than a square inch in area and mounted close to the microphone socket. This circuit is in effect inserted in the PT line from the transmitter to the microphone socket. If you do incorporate this circuit in your Yeovil, then do not forget to remove the earth lead from the CW filter switch if the PT line is still connected to it. G3ICO has also pointed out that some CB microphones have a two way push to talk switch, which shorts the microphone on receive. If one of these is used, then no additional circuit is needed and you only need remove the lead from the CW filter switch to the mike socket." Eric Godfrey G3GC



A Versatile Portable Aerial by G4GVM

I do a fair amount of /P operating visiting friends and relatives - mostly on 80m. I have, in the past, often used a portable trap dipole, G whip and so on but I have been impressed by the signal reports when using an end fed or long wire aerial. The end fed aerial is perhaps the easiest to erect - the total length is not critical (with a good AMU and earth! - Ed) but I have found that the 80m 66 ft length is convenient. A weight on the end of a supporting rope tossed into a good tree (or a suitable climbing Grandchild!) can give sufficient height at the far end. The other operating end can be fixed to a window hinge for example. It doesn't even have to be fed from the end of the main wire! As a variation, I have mine 1/7 th (harmonic?) from the operating end (about 9 ft 6 in) to allow operation from a ground floor extension with the end of the aerial fixed to an upstairs window above the extension. Here is a practical way to cover most situations and give good results.

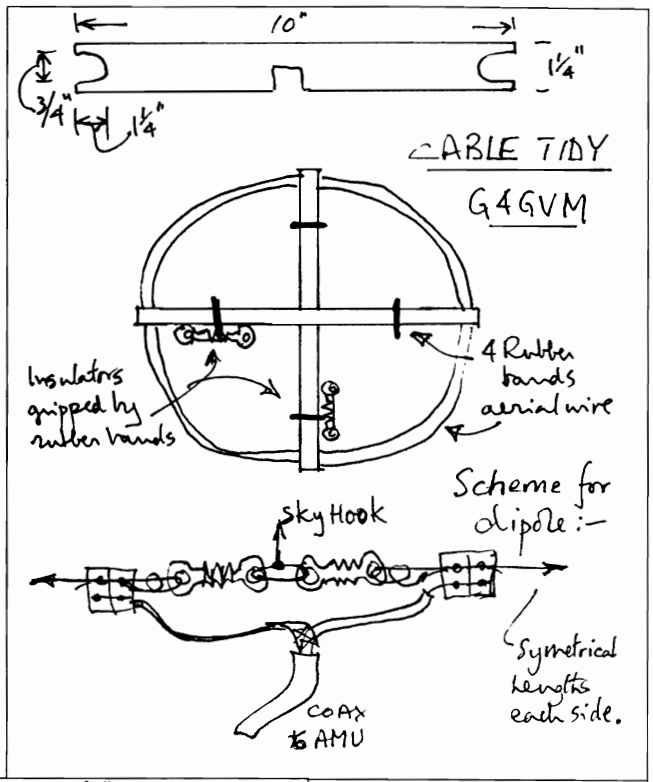
1. Prepare three pairs of 2 A block connectors. Make two cuts about 3/16 th inch apart with a hacksaw into the polythene underneath across the two inserts. Solder a short stub of thick wire to join the two brass inserts. Use a heavy duty iron to avoid melting the polythene!
2. Obtain a 70 ft length of good flexible PVC covered wire (Henry Westlake - 8p per metre). Cut to 66 ft 6 ins and remove 1/2 in insulation from each end 6 inches in from each end and 10 feet from one end.
3. Slide all three connecting block pairs onto the wire. Tighten up the middle block on the bared 1/2 inch which is 10 ft in from the end.
4. Loop each end through an insulator with one turn around the wire. Secure the bared end, and the 6 inches in, into the same insert of a block pair, leaving the other insert for the down lead. Bind with strong thread.
5. Similarly loop and bind suitable nylon cord or rope to the insulator (or via a dogclip) with a suitable weight on the other end of the rope.



6. Use the 13 ft 6 in (or thereabouts) offcut as a down lead from one end or the 9 ft 6 in point.

7. A cable tidy can be made from standard wood lathe obtainable from most DIY stores. It is about 5/16 in by 11/4 in wide. Cut two 10 in lengths and form a "U" at each end 3/4 in wide and 11/4 in deep. Cut a slot the thickness of the piece wide and half the width deep, so that each length fits into the other, forming a cross. Make this a tight fit and glue up. Place a strong rubber band around each of the four arms. The idea is to trap the weight (or insulator if you are only winding on the aerial) under a rubber band and then turn the cable tidy to wind on the wire. This will avoid kinking the wire; finally trap the other weight or insulator when you reach the other end.

8. Although intended as along wire aerial for use with an AMU, two such arrangements could easily be used as a centre fed 80m dipole. Just tie the two centre insulators together and attach the coax inner and outer to each half. The block connectors make connecting up a simple matter and extra support can be provided in the centre on the linked insulators if there is a suitable sky hook! Derek Alexander G4GVM

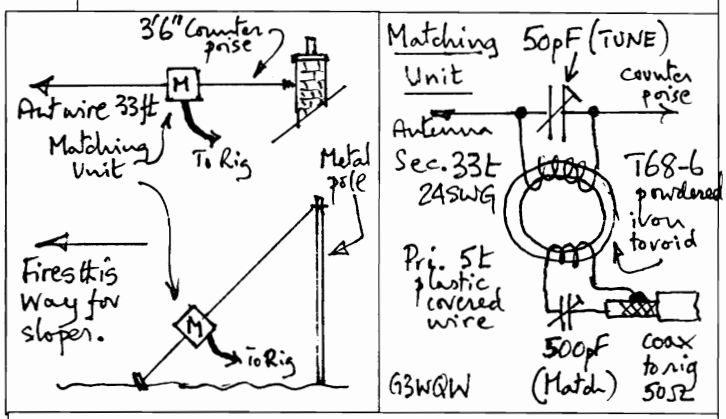


End fed half wave antenna for 20m

This antenna can be rigged as a sloper or as an ordinary horizontal one; it uses a small counterpoise and a matching unit at the feed point. Used as a sloper supported by a metal pole typical reports with my Yeovil are:-

IK6QRD	59	9K2ZZ	59
DL3KDH	58-9	4N7NN	57
UX0LT	57	VO1NP	52-6

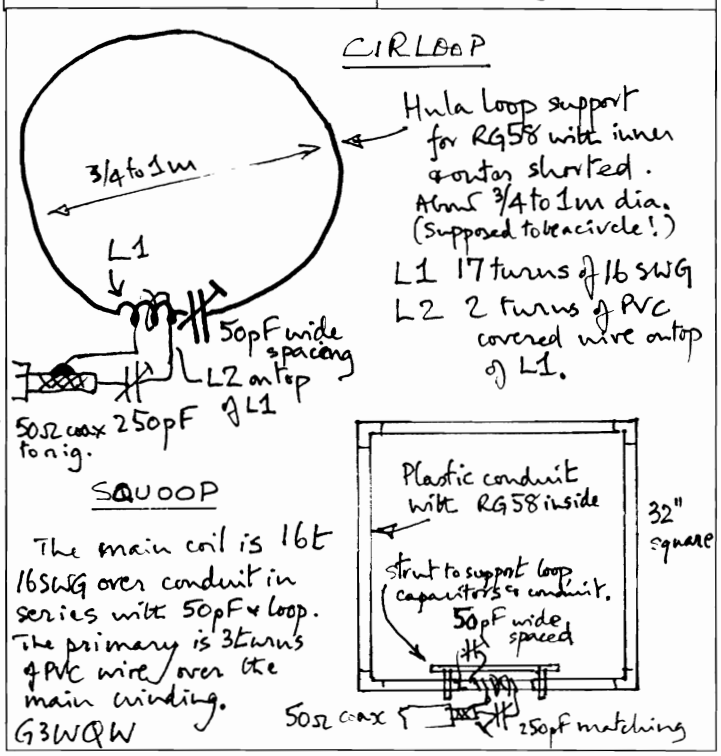
Stewart Sims G3WQW



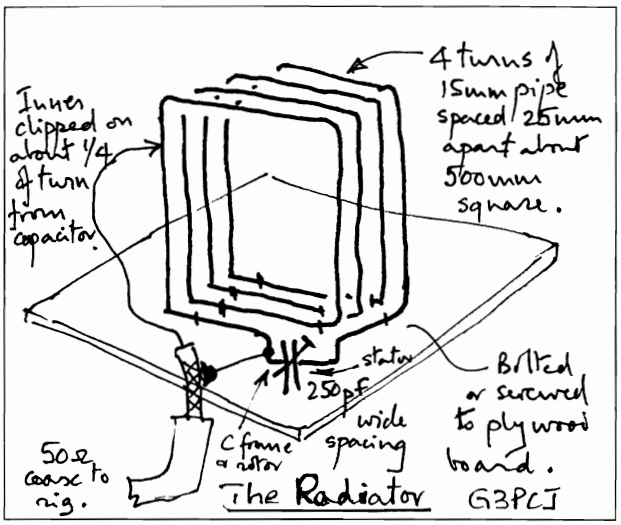
"Cirloop" and "Squoop" Antennas

Herewith two basically similar antennas but with different physical shapes and mechanical construction. Both are loaded loops for 30, 20 and 17m bands with inductive coupling. The main loop tuning capacitor needs to have wide air spacing of the plates and is placed in series with the loading coil and the radiating loop. Outputs up to 25 W should be all right but do NOT place yourself nearer than about 10 feet when actually transmitting as there is the possibility of dangerous field strengths. Both these designs operate with a high Q and have a bandwidth of about 180 KHz on 20m, making retuning necessary if you wish to operate over the whole band. G0CRZ & G3WQW

(Tune the loop capacitor on receive for max. signal and then adjust the coupling capacitor with a few Watts for best match to 50R. G3PCJ)

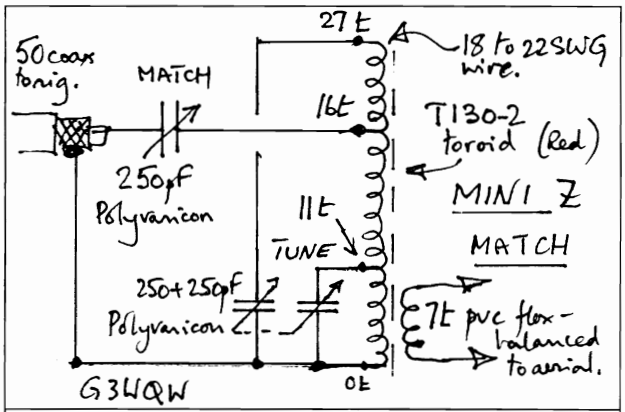


"The (central heating) Radiator"



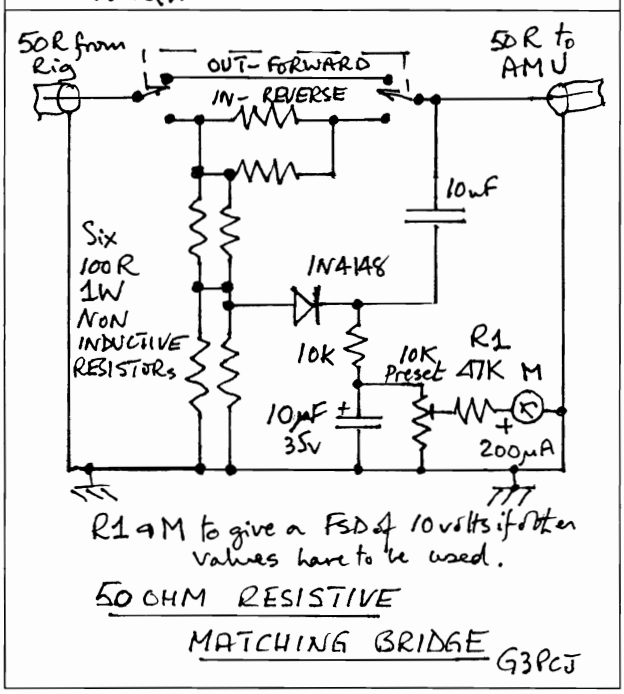
This portable loop antenna had its origins in a QRP Convention Construction Challenge some years back. Part of the task was to make the most efficient 80m antenna within a 0.5m cube. I now use it for demonstration purposes and have used it for QRP QSOs over a few tens of miles. It is made of soft or malleable 15 mm copper tube bent into an approximate square. It can be obtained in good plumbers merchants. Its very effective because although the performance is dependent on the loop area, it is also dependent on the square of the number of turns. 22 mm pipe would be even better! The task was to get on as many turns as possible, with sufficient spacing to minimise self capacity, as can be made to resonate on 80m with about 1-200 pF. In fact I ran out of pipe first! Mine is bolted onto a sheet of plywood for stability and to keep the turns in place. Matching is simply a question of adjusting the crop clip until your matching indicator indicates nothing reflected. Move the tap nearer to the capacitor frame for low impedances and further away for higher Z outputs. Although not a balanced or symmetrical design, I have never found it to be sufficiently directional for this to matter. G3PCJ

A single coil Mini Z match AMU for 80 - 15m



This AMU is intended for QRP up to a max. power of 15 Watts; being fully balanced it works well with 300R slotted feeder. Polyvaricon mini variable capacitors are used (from Birketts of Lincoln or from scrap domestic portables). T130-2 toroids are available from Cirkit and copper wire can be obtained from electric motor repairers possibly - see Yellow Pages. It tunes my delta loop on any frequency I choose and is hardly bigger than a packet of cigarettes! It goes very well with my Yeovil. Stewart Sims G3WQW

A Resistive Antenna Matching Bridge



The circuit on the right is basically that used in the Yeovil's bridge but can be used on any frequency up to VHF with careful layout and a small switch or relay. It has the advantage that when it is in circuit, it will always present a safe load to the transmitter, even if there is a short or open circuit on the aerial terminals. The three arms of the bridge need values of 50R for use in a 50R antenna line. A good compromise is to use two 1 Watt 100R non-inductive resistors in parallel for each arm. This will enable safe use with a 5 Watt transmitter. The use of a 2 pole switch, or a relay if remote control is desired, means that there is not another contact available to alter the meter sensitivity between forward and reverse. The reverse reading is not normally more than half full scale unless the rigs output impedance (not it's desired load impedance which is the usual 50R) is more than a few ohms. The preset is adjusted for full scale when the bridge is out, operating into a 50R dummy load. In use, since the antenna matching controls are adjusted for the lowest reading when the bridge is in circuit, the fact that the upper limit is only half scale doesn't matter too much. When the bridge is out, the meter actually indicates output voltage but since the AMU is now known to be presenting a 50R load, it can also be calibrated in output power (with a square law). G3PCJ

The Eleventh Yeovil QRP Convention

This year the event has been put back a little to May 21st 1995 so as to avoid clashing with others. Doors open at 10 am and an even more diverse programme has been devised; all the usual things are planned with a series of talks, traders and demonstrations related to QRP construction and operation. The QRP Fun Run contest, which takes place in the preceding two weeks, has a slightly different format this year to make it more diverse. There will be a display of pre 1930 equipment and an advice clinic for anyone seeking technical assistance with their gear. Simple test equipment will be on hand but if anybody has a particularly knotty problem it would be best to warn the organisers in advance so that extra brain power or special test gear can be organised! This years Construction Challenge is to design and build an audio CW filter, using not more than 10 passive components, which will be evaluated on the day to see whose has the best interference rejecting properties. The event will be opened by the **President of the RSGB** , Clive Trotman GW4YKL, who will be in attendance all day; it will an excellent opportunity for anybody to meet him and discuss any amateur radio and RSGB matters. Full details of this and other aspects of the event can be obtained from Peter Burridge, G3CQR who is QTHR or on 01935 813054. It should be a good event - hope to see you there. G3PCJ

The Coker's Sidetone

One instance has come to light of the sidetone oscillator on the Coker transmitter not keying on and off cleanly or even staying on continuously. It is due to component tolerances around the transistor TR6; if yours exhibits this symptom the solution is very easy, just add a 1K resistor from TX test point 2 (collector of TR25) to 0 volts which should turn TR26 off when the key is up. I am not bothering to alter the PCB because I doubt whether more than another one or two are likely to be effected; I have now put a warning note in the transmitter instructions. G3PCJ

Construction Club Membership

I recently found that not all members of the Club, were in my current name and address file. I believe this is now correct but there is the faint possibility that some of you may not have received the last Hot Iron Issue number 6 - if this is so, I apologise; please let me know and I will send it. Tim Walford G3PCJ

VFO Design

During development of the Coker, and recently when doing long term testing of the Taunton's VFO, I became aware that there is much more to this topic than meets the eye! The considerations for a VFO are complex:-

1. Nominal frequency - this is dictated by the rig's band structure for a superhet and will attempt to avoid undesired harmonics and unwanted mixer products being within any working band. For DC rigs there is little choice except perhaps that the VFO operate at a multiple of the output frequency.
2. Tuning range - often dictated by the rig's band structure leading to a typical 500 KHz swing; it is also influenced by the cost of different varactor diode types; in a simple rig a compromise is needed between resolution and single knob tuning which usually limits coverage to about 100 to 150 KHz for a 270° rotation pot.
3. Configuration - many different oscillator schemes are possible. They seldom dominate frequency stability considerations because the effect of coil and capacitors is more significant. I like Hartley VFOs as they use less parts. Amplitude stabilisation is necessary; with FETs it is easily done by gate capacitive coupling and a diode which decreases the FET bias as oscillation voltage increases. The gate coupling to the RF tank should be as low as permits reliable starting of the oscillator in order to preserve tank Q. The FET supply voltage needs to be stable and lowish to minimise power dissipation and hence heating effects in the FET and in the RF tank.
4. Choice of Inductor - kit builders are notoriously keen to avoid winding their own and there is little choice but to use commercially made ones. I find the TOKO range admirable, there is a wide range of screened coils with many choices of inductance, taps and extra windings for RF transformers where commonality of parts is important. Generally their temperature coefficient is +150 parts per million per degree centigrade (ppm/°c).
5. Choice of capacitors - herewith the fun! To avoid long term drift, ideally the temperature coefficient of the RF tank capacitors should be the opposite of the coil's i.e. -150 ppm/°c. Low K ceramic plate capacitors have this characteristic for 22 pF to 150 pF; smaller ones with a nominal zero tempco are fine for the gate coupling capacitor. They are both often used for the RF tank. The snag is that sometimes they seem to cause significant short term wanderings in frequency. Silver mica types used to have a bad reputation for being inconsistent, but my experience is that modern ones do not exhibit this wandering effect. Their tempco of +39 ppm/°c for typical values means that drift will remain unless something else is done. My suggestion is to then use polystyrene types with their -150 ppm/°c characteristic for coupling to the varactor diode. Polystryene capacitors do also have a slight tendency for this wandering effect but not as much as some ceramics. Because the varactor coupling capacitor is usually smaller than the main tank C, the slight wandering effect is reduced to an acceptable level and drift from the coil is partly compensated. See circuit. Varactor supply stability is also crucial! The problem free cheap VFO continues to elude us! G3PCJ