"JOURNAL OF THE CONSTRUCTORS CLUB"

Hot Iron

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Contents

The Walford Electronics website is also at www.walfordelectronics.co.uk

Editorial

To take my mind off a most frustrating summer on the farm, I have been messing about with valved projects! I mentioned last time that I was re-furbishing Eric G3GC's plank mid 1930s CW transmitter - well, it was not long before I realised that it needed a companion receiver. To keep in the spirit of simplicity (and using what was to hand or relatively easy to obtain) this had to be a regen TRF! Then of course the transmitter which was originally rock bound, needed a bit more flexibility for modern conditions - hence a VFO module. More on these later! It has been great fun and I am indebted to Richard Booth for assistance with some of the parts as they are more in his line of expertise.

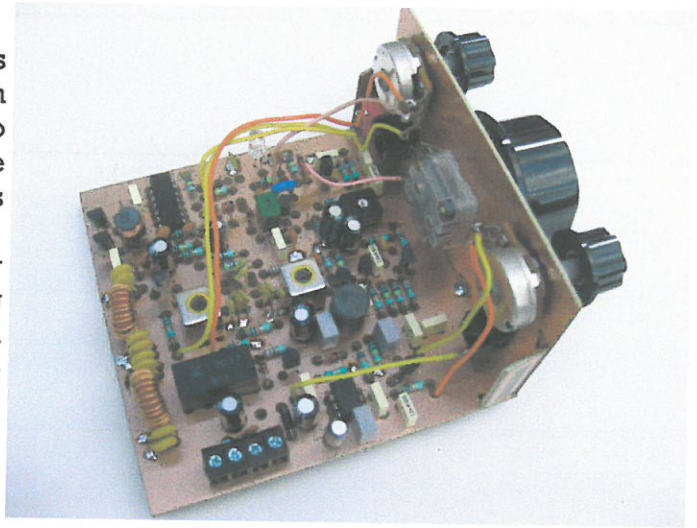
Neither of these Plank projects was conceived as kits but as fun 'one offs' using whatever parts I had available. Things like Muirhead slow motion tuning drives would be horrifically expensive if one had to buy them but luckily there were some in the spares which came originally from Eric. The good news is that Richard G0TTL is investigating the possibility of selling kits based on B9A valves (instead of octal valves which I wanted to match the Plank TX); the PSU and its transformer are one of the main obstacles but it is not insuperable! No doubt we will hear more on this from Richard in a later Hot Iron.

Meanwhile back to the transistors and chips! Tim G3PCJ

Kit Developments

The Brue prototype CW TCVR (right) is now working well; it is a builder friendly version of the Brent with several minor improvements to make it more versatile & easier to use. I have just recently added it to my website. The price is £44 + £3 P&P.

I have also drawn out the circuit for a new single 7 segment display 5 digit scanning counter. This should be rather easier to build than the old one and cheaper - target price about £25! I am also actively working on the Mendip 3 band phasing TCVR but have just realised that its transmitter ought also to suit the Knole! I must make certain it can do both! Tim



Hot Iron is a quarterly subscription newsletter for members of the Construction Club. Membership costs £7 per year with the first issue for each year appearing in September. Those people joining later in the year will be sent the earlier issues for that year. Membership is open to all and articles or questions or comments or notes about any aspect of electronics—principally on amateur radio related topics– is very welcome. Notes on member's experience building their own gear, from kits or otherwise is most interesting to other constructors. To keep it interesting, your thoughts and ideas are required please! For membership, I only need your name and address and subscription. Send it or any other suggestions to Tim Walford, Walford Electronics, Upton Bridge Farm, Long Sutton, Langport, Somerset TA10 9NJ © G3PCJ

Audio amplifiers in a chip - by Richard Booth G0TTL

These are monolithic integrated circuits to give them their posh name. We all use and abuse them, be it in their intended role as an audio amplifier on the output of a receiver. Or you can connect one up to a transformer and use it to modulate an AM transmitter. I have even used a pair of LM380N in the past with a MW tuned circuit up front, coupled together with a 1N4148 diode detector (not germanium as the potential voltages on strong signals are too high) as a MW TRF receiver. Yes, they are good up to a few MHz! Recently I have built a complete AF stage out of four logic gates and a LT700 transformer to match the Hi Z output to 8 ohms. Surprisingly loud it is too and more on this in a future edition. Presented here is what I hope is a useful reference sheet, for my favourite five devices. All are 8 pin DIL packages and cost less than £1 each.

TDA7052 No external components required. The power supply filter capacitors are optional; this has to be the simplest of all amplifiers currently available. The voltage gain is set internally at just short of 100 which is ample enough to be driven directly from an active mixer such as the SA602. The only disadvantage here is that both speaker connections are isolated from ground. It is happy operating from 12V and has a maximum supply of 18V. 1W output.

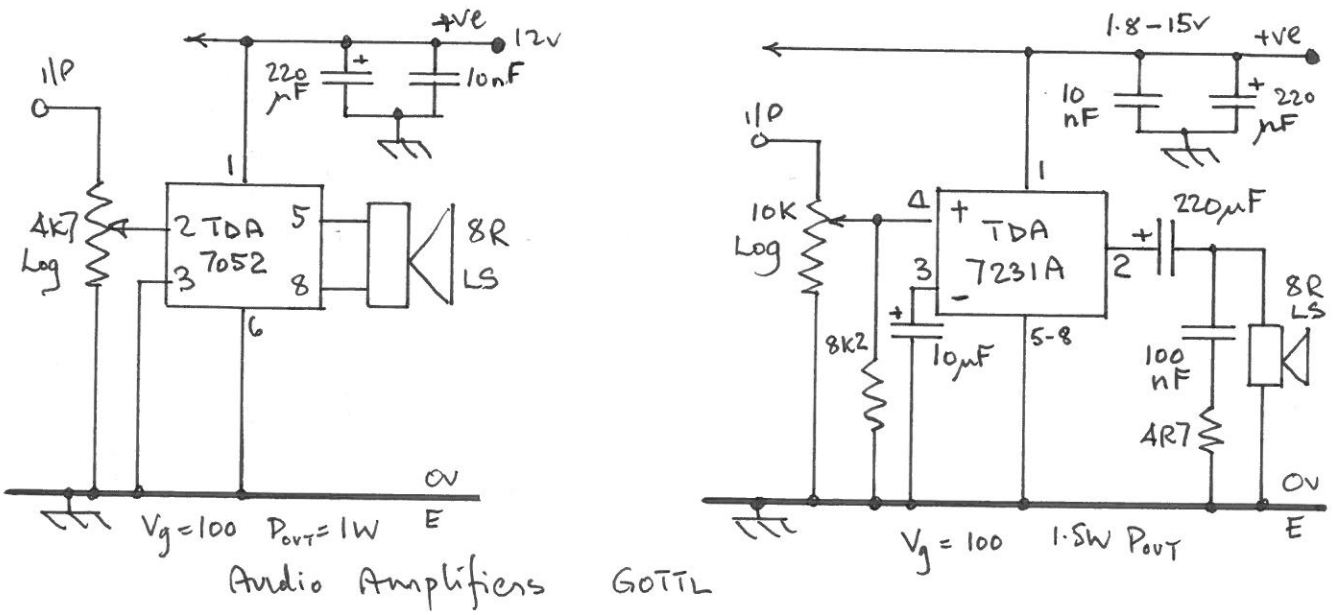
TBA820M Well this one has been around since the 1970's and well proven in a number of projects. Needs slightly more external components than the LM380 but has a number of advantages. The main one being variable gain control, which is calculated by R_{IN} / R_G. I like to use 8K2 as the input resistor value. This keeps the gain under control when the 10K log AFG pot is turned down towards ground. 22nF shunts any RF at the input to ground and prevents self destruct mode oscillation! Maximum supply voltage of 16V and develops 1.2W into 8 ohms.

LM386-4 There are several versions of the LM386 all of which have different operating voltages. The LM386-4 is the highest of all and can manage up to 18V. Has adjustable gain of sorts, removing the 10uF electrolytic between pins 1 and 8 drops the voltage gain to its internal set value of 20. With the capacitor fitted it is allegedly 200. This can be limited by adding a resistor in series with it, or in parallel there is the possibility of some audio filtering. Not my favourite device, the 386 tends to be a bit on the noisy side.

TDA7231A This is every bit as easy to use as the venerable LM380N-8 but with a few distinct advantages. The supply voltage can be anywhere from 1.8 to 15V and at 12V this little chip develops 1.5W output. Less distortion and the internal gain is set at 100. As used to good effect in the current range of Roberts Radio portables. Pins 5 - 8 are all ground connections and should be soldered to a thick pad of copper for heat sinking.

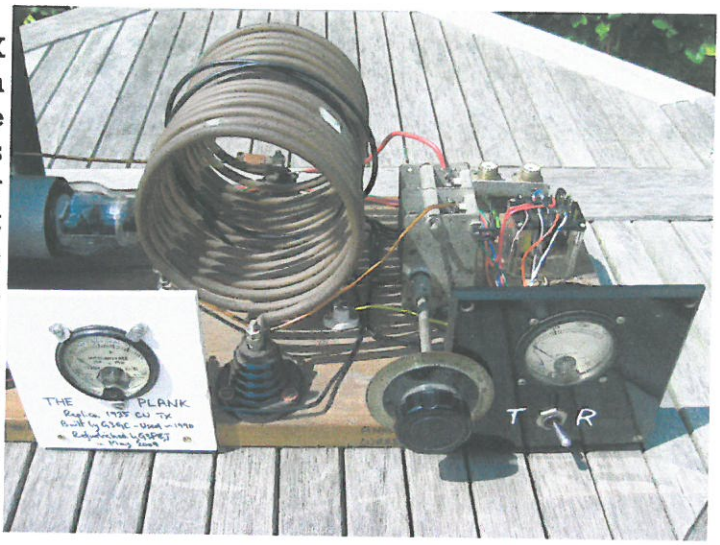
LM380/N-8 No list would be complete without it. I very much doubt you need to read anything from me about this performer, remember this one can handle up to 22V without breaking into a sweat. It can become an uncontrolled 2 MHz power oscillator! Internal voltage gain is set at 50.

(Richard has provided circuits for all but with space tight, I include the two least often seen. Tim)



Audio Amplifiers G0TTL

Plank Project Developments!

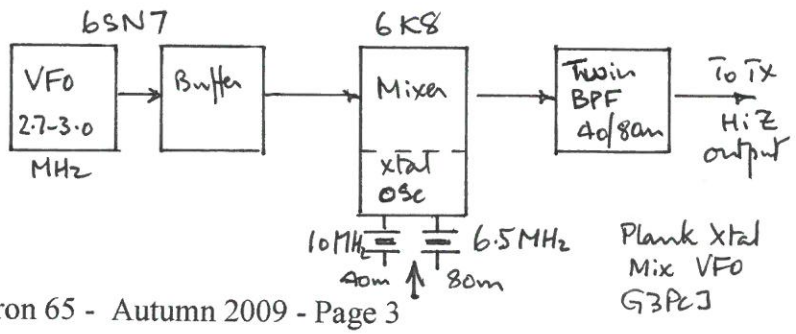


It did not take long to get the Plank TX working again - I removed the extra turns on the inductors to revert to 40m and altered the TR switching to suit the planned RX and it was away! I did have one funny that eluded me for a while - the output power was initially about 16W on the 400v supply but drooped over the next half minute to nearer 12W every time you went to transmit! All the usual culprits in the PSU were soon eliminated; eventually I found that the 807 was tired! The final improvement was to make it do either 40 or 80m by adding slide switches with extra fixed capacitors for 80m across all the inductors - they were all tuned by air variables so no need for trimming.

The companion RX was to use octal valves as I had some and plenty of valve-holders. A twin triode for the audio amp seemed a good idea, with one half being able to drive a small speaker transformer for low Z phones or an actual LS. Choice was either a 6SN7 or 6SL7, the former proving to have a little bit more gain. The regenerative detector needed to be an RF pentode with a pot controlling the screen grid voltage to control whether it actually oscillated or not - a 6K7 being chosen as it was to hand. 47v Zeners were used to stabilise the regen screen supply for ease of operation and frequency stability. I wanted to cover at least 40 and 80m, so plug in coils were mounted on old British 4 pin valve holders. The main tuning capacitor is a vintage air spaced unit with a nominal max capacity of 700 pF and was fitted with one of Eric's Muirhead drives; one coil covers 20 and 40, another does 80 and 160m, and a third the medium waveband for ease of demonstration. A small Jackson 802 capacitor gives band-spread. To prevent changes in aerial size and loading altering the frequency, and to prevent LO radiation, I added a grounded grid 6K7 RF amp stage and RFG pot. It copies CW, SSB and AM well for such a simple approach. The last RX item was a mains PSU!

The Plank format was used to match the transmitter with a thick plastic rigid front panel braced by the air variable capacitor mountings. The lack of a metal chassis is easily made up for by using plenty of thick copper interlinked wires! The frequency stability has pleasantly surprised me - maybe because I used silver mica resonating caps. The circuits are very standard - I can supply them if anybody wants them.

The crystal mixing VFO is to drive what was normally a 6K7 crystal oscillator in the TX. This approach avoids any chance of frequency pulling or chirp. The Hartley VFO (at 3 - 2.7 MHz) and its buffer are a 6SN7 twin triode feeding a 6K8 frequency changer; the triode section being a xtal oscillator at 10 or 6.5 MHz with the mixer having a double tuned tank for 40/80m with high Z hence high RF voltage output to replace the TX crystal. The final item is planned to be a twin 6L6 modulator for AM if I can find a suitable transformer! Tim



Aerial Antics and Tips by **Andrew Atkinson, G4CWX**

This past winter has not been kind to me. First, the storms took down my vertical aerial, then corrosion set in to my G5RV and that came down, then to cap it all I slipped on the icy decking at the back of the house and ... well that is another story. With the last of the snow beginning to thaw out it became been time to think about putting on a woolly jumper and braving the cold outside.

The first job to tackle was the G5RV. On closer inspection it was clear to me that the core of the flexweave main sections were completely corroded. Water had been sucked in from the connectors for a length of about two metres, no doubt due to capillary action. The solution was simple: buy a length of replacement flexweave, a bunch of new connectors and put it all back together again. The only difference was that this time I sealed everything in a product that I had not come across before. It is called Liquid Electrical Tape and is available from www.plastidip.com at a very reasonable price. Once you have joined the connectors securely together, take the brush out of the can and cover everything in a coat of the black gunk. Wait an hour or so for it to go off and then give it another liberal coating – making sure that quite literally everything (including the connectors and wire) is covered in the stuff. Leave it overnight to dry properly and you are ready to erect your aerial. This stuff really works and will give you a weather tight seal for years to come.

The next job was on my vertical - replacing it promised to be an expensive business, until I came across some useful articles on the internet – not the least of which was from G4NSJ, which prompted me to try a homebrew approach. Sandpiper aerials (www.sandpiper.entadsl.com) market a 10 metre long fibreglass fishing pole for about seventeen pounds. The real problem was working out how to mount the darn thing, but the solution was simplicity itself. Cut off the plastic retaining cup from the base of the largest section of the telescopic pole. It will now slide snugly inside a standard two inch aluminium aerial mast. Push the handle end of the pole down inside your aluminium pole so that about three feet are exposed. Wrap electrical insulating tape around the fishing pole until you can only just manage to push it into the aluminium pole and then use self-amalgamating tape around both poles to join them together and make them truly secure.

So what about the aerial? I had a reel of Watson enamelled copper wire laying around, so I straightened it, covered the top two feet in Araldite epoxy resin and then pushed it inside the smallest section of the fishing pole. One of my neighbours had previously complained about the noise my aerial feeder was making when it was rattling around inside an aluminium support pole. My solution on that occasion was to fill the pole with expanding foam – the sort that builders use to fill in large holes and cracks, as well as around door and window frames. This had been so successful that I decided to use it on my new fishing pole. As I fed out each section of pole with its inner core of copper wire, I squirted a liberal amount of expanding foam inside the fibreglass pole. I continued doing this until all of the sections of the pole were extended and then taped off the end to prevent any foam from escaping. It took a couple of days to dry, but the wire is now held firmly in the centre of the fishing pole and has also added some extra stiffness to stop the thing swaying about in high winds. For an extra couple of pounds I also bought a pair of guying attachments and that has reduced the sway even further. This proved reasonably reliable – until the first high wind, after which I realised that the fishing pole needed to be guyed in at least two places. I terminated the copper wire in the back of an SO259 socket which was screwed to the aluminium support pole and then covered the lot in liquid electrical tape for good measure. All that I had to do now was mount the support shaft on the top of my existing pole and I was in business.

This might sound a bit over the top, but down here in deepest darkest Somerset, between the Mendips and in the valleys, we suffer extremes of weather and I am really hoping that this will be the last time that I have to set foot on a ladder for some years to come. Roll on the DX !

In the next issue of Hot Iron, I will include Andrew's assessment of how it worked! G3PCJ

30m Midney-Kingsdon with 5 digit counter by Mark Bywater M0DFF

This project consisted of the construction of the Midney receiver, matching Kingsdon transmitter and five digit counter. These are mono band kits, and as the Walford Bristol had previously been constructed, I decided to build these for a band not covered by my Bristol - 30 metres. The Kingsdon also produced a nominal 5 watts output which matched the same level of power from the Bristol, both rigs would be switched to the input of a home brew linear amplifier giving the grand output of 25 watts.

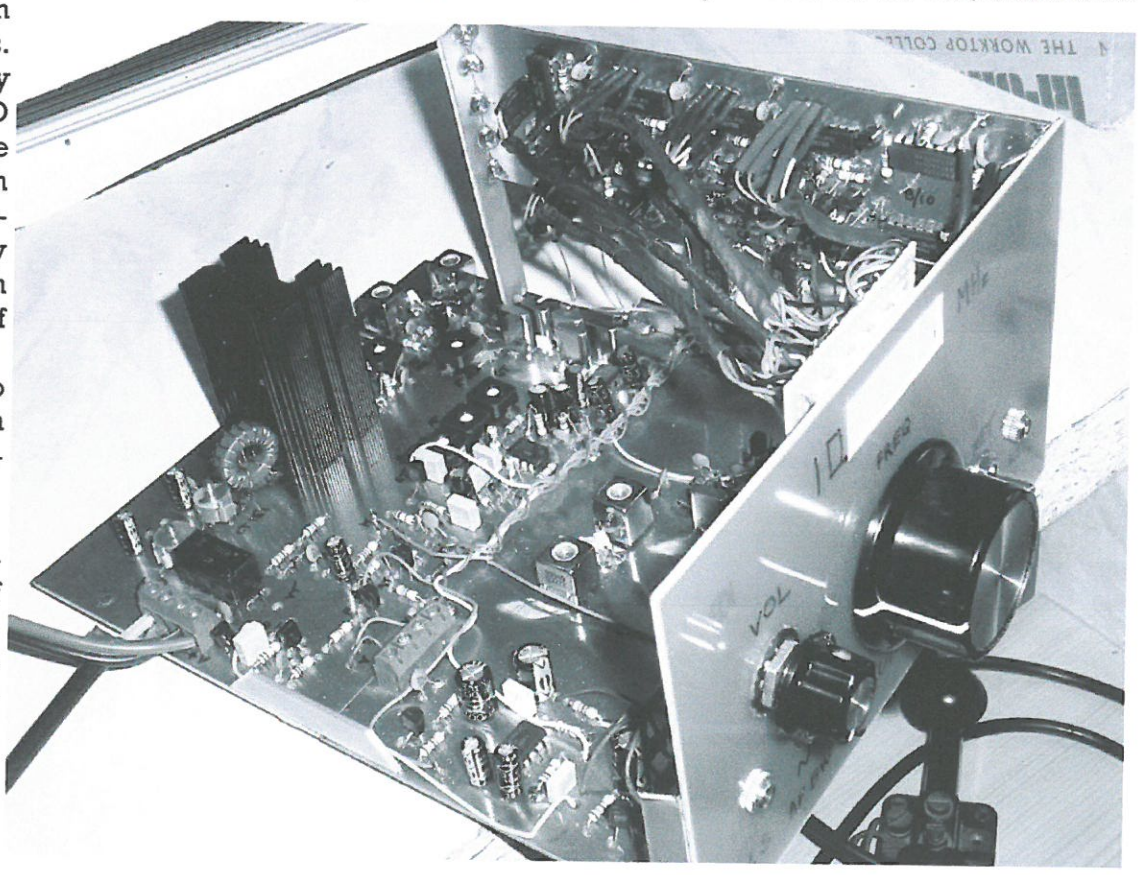
This project would also be constructed open chassis style unlike the Bristol which was boxed. After checking all the components the receiver was the first kit to be built. This was carried out section by section with testing along the way as described in the notes that come with each kit. A multi turn pot was used for the main VFO as the counter was to be used for exact frequency display. Everything progressed well and initial tests on the completed receiver were encouraging. Next the Kingsdon - again section by section with testing meant that this was completed without any major problems. Now the Midney and Kingsdon were linked together. A minor modification was to include a fixed resistor with the multi turn pot to restrict the tuning range, this meant that the ten turns of the pot covered just over 50kHz when the inductor and pre-set were adjusted correctly. No microphone socket was fitted for the Kingsdon, but the mike amplifier was built for completeness. The fixed capacitors on the output matching stage were replaced by pre-sets to make matching a little easier.

Now for the counter. Again step by step construction and testing as per the instructions meant that any minor problems were quickly overcome. The resistors for the display were mounted on the PCB end on, then wires were soldered to the other end of the resistors. Heat shrink sleeving was placed over the resistors and the end connection to make a nice tidy insulated joint. The wires were then methodically soldered to the display. The counter was connected to the rig and worked first time! Now for the counter clock modification. The clock was divided by a further 100 by passing it through two 4017 decade counters. This now causes the display to read 10s of Hz as the least significant digit, at the price of loosing the MHz digits. As the rig is a mono band rig the loss of MHz digits is of little consequence The two 4017 counters were mounted "spider like" just below the counter PCB on a couple of earth wires as can just be seen on one of the photographs. 4017 were used simply as they were already in my spares box.

Initial results have been promising and the audio out is very smooth on the ear, unlike a lot of modern black box rigs. It is a real joy to have a QSO on a home brew rig with the other operator usually commenting on the quality of the tone.

Now to get started on the 6m Chirnside rig.....

(Mark is building a pair of Chirnsides - we look forward to a report! Tim)

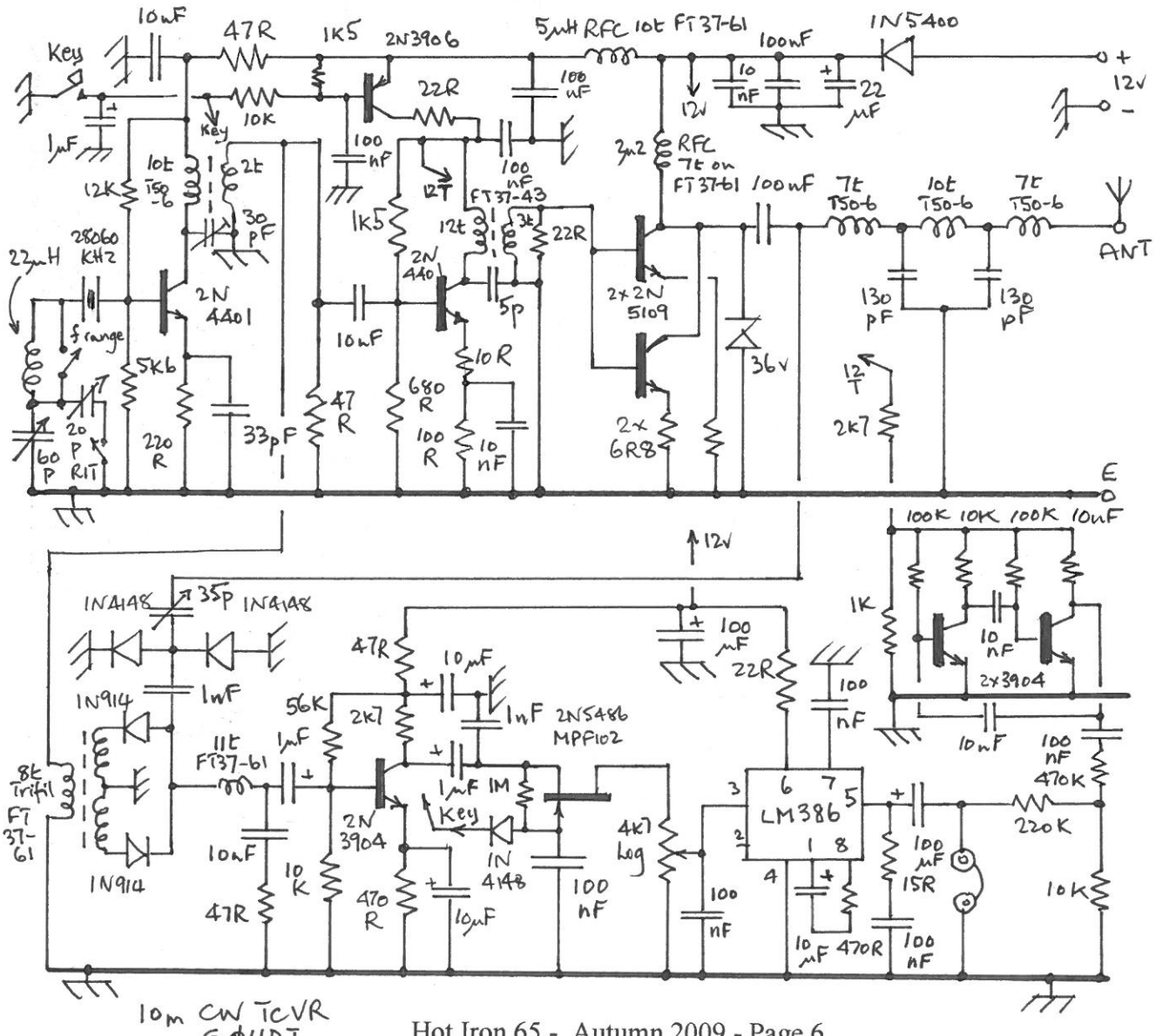


10m CW Transceiver by Craig Douglas G0HDJ

Craig has been working this design up for portable use over a number of months and has it now packed up ready with a portable aerial, table/chair, flask of tea etc ready for an opening! As a parting comment on the weather, he says that he is working on a design for a new ark having just taken up carpentry!

The circuits are derived from previously published circuits in Sprat, ARRL and RSGB handbooks. He uses a 2N5109 in the TX output in preference to the often seen 2N3553 as it is better suited to a 12 volt supply. The 2N3924 would be an alternative. (Ref ARRL 'QRP Power'). The TX output as configured, is 1.2w using a 12.4v gel cell (RX 28 mA and TX 184 mA) but this increases to 1.8W (32/320 mA) when used on a 13.8v supply. The two switches in the oscillator circuit provide a small change in frequency for RIT and for pulling the crystal; the nominal fundamental mode 28060 KHz crystal actually covers 28058 to 28077 KHz by using the optional 22 uH in series with the crystal. Craig warns that you do need to remember to turn off the RIT manually when transmitting, otherwise TR changeover is automatic! An earlier version did not include the RX muting stage nor a sidetone oscillator as there was some 'feed through', but the final version has these added with direct injection of the sidetone into the phones. He used double sided PCB material with one side as a continuous ground sheet, the other side having the circuits etched and wired together by point to point wiring.

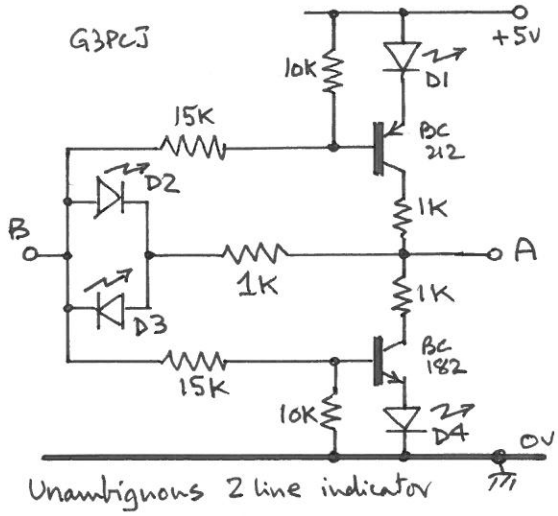
As a comment, I have no doubt that this basic design could be adapted for any of the HF bands. I happen also to have a selection of crystals for 10, 15 and 20m that are near the X.060 KHz nominal QRP CW calling frequencies - e mail me if you want details. Tim



Snippets!

Unambiguous 2 line logic indicator

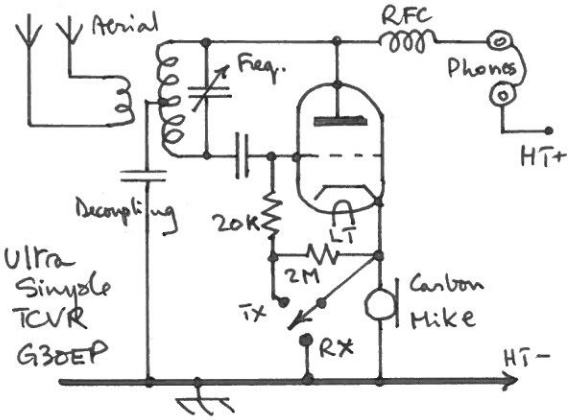
The circuit right always shows only one LED on for any the four normal combinations (high or low) of the two logic inputs A and B - no LEDs on or more than one denotes an error condition! Hence the display is unambiguous. The two logic inputs need to be fed from sources that can source or sink the nominal LED current of about 3 mA using 5 volt supplies. Use high efficiency LEDs! A and B inputs low lights D1, input A low and B high lights D2, input B high and A low lights D3, and inputs A and B both high lights D4. Transistors can be any common complimentary devices like BC182/212 etc..



Unambiguous 2 line indicator

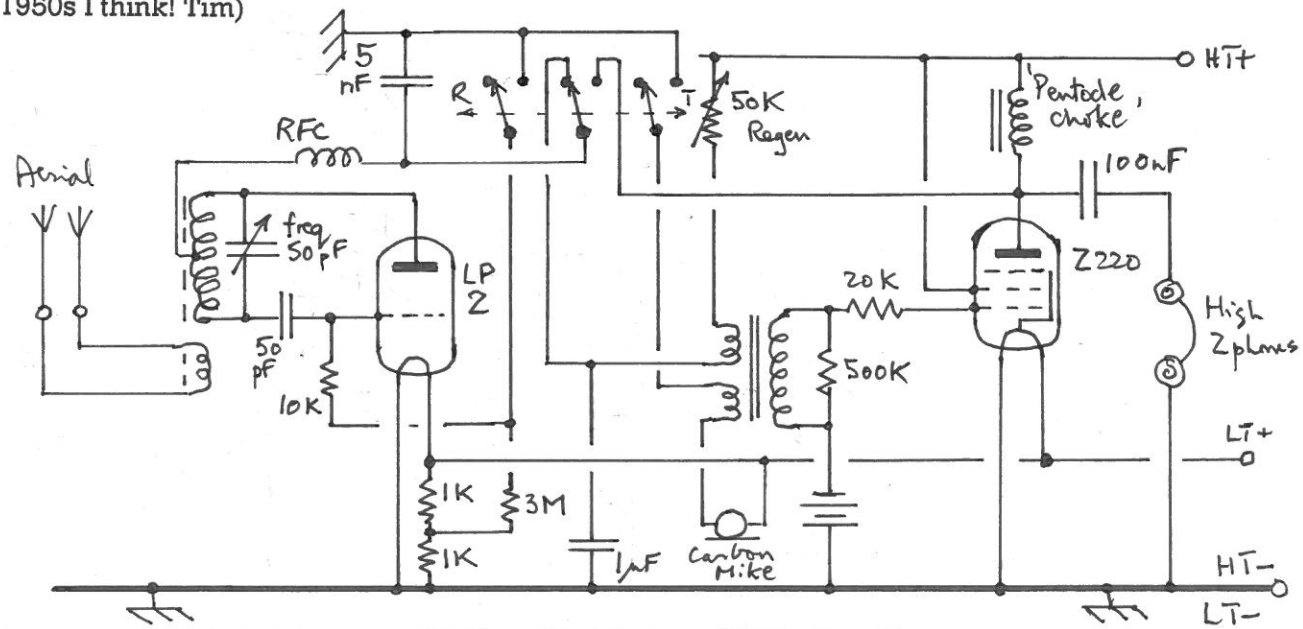
Ultra simple TCVR!

Dave Buddery G3OEP sent along this circuit which he thinks first appeared in an ARRL publication in 1937 or 1938. I don't think Dave has ever used it but suggests it would be fun on 6m!! But I bet its very tender and prone to frequency shifts with the wind! I imagine it would not be too difficult to make it into a regen on reception by controlling (reducing) the HT with a pot that is shorted out on transmission. Anybody like to try it out?



Two valve UHF transceiver

Dave also sent along an extract from one of the T and R Bulletin wartime handbooks books outlining what had been used for portable work pre-war UHF work. This circuit is actually remarkably similar to that of the 17 set that was used extensively for communication to searchlight batteries - I suspect a common designer. The article suggest that for reception, the first stage is a self quenching detector, which implies to me that it is a super-regen as in 17 set; the second stage being a conventional audio amplifier. For transmission the audio amp becomes a choke modulator for the triode acting as a power RF oscillator. Undoubtedly changes in the aerial circuit will pull its frequency! The note goes on to suggest that for serious work this form of self excited transmitter is not satisfactory. Modulation cannot be above 50%, and the writer suggests that when transmitting is again permitted after the war, this form of self excited UHF equipment will become as obsolete as spark was in 1939! (500 KHz spark emergency maritime transmitters were still rescuing people into the 1950s I think! Tim)



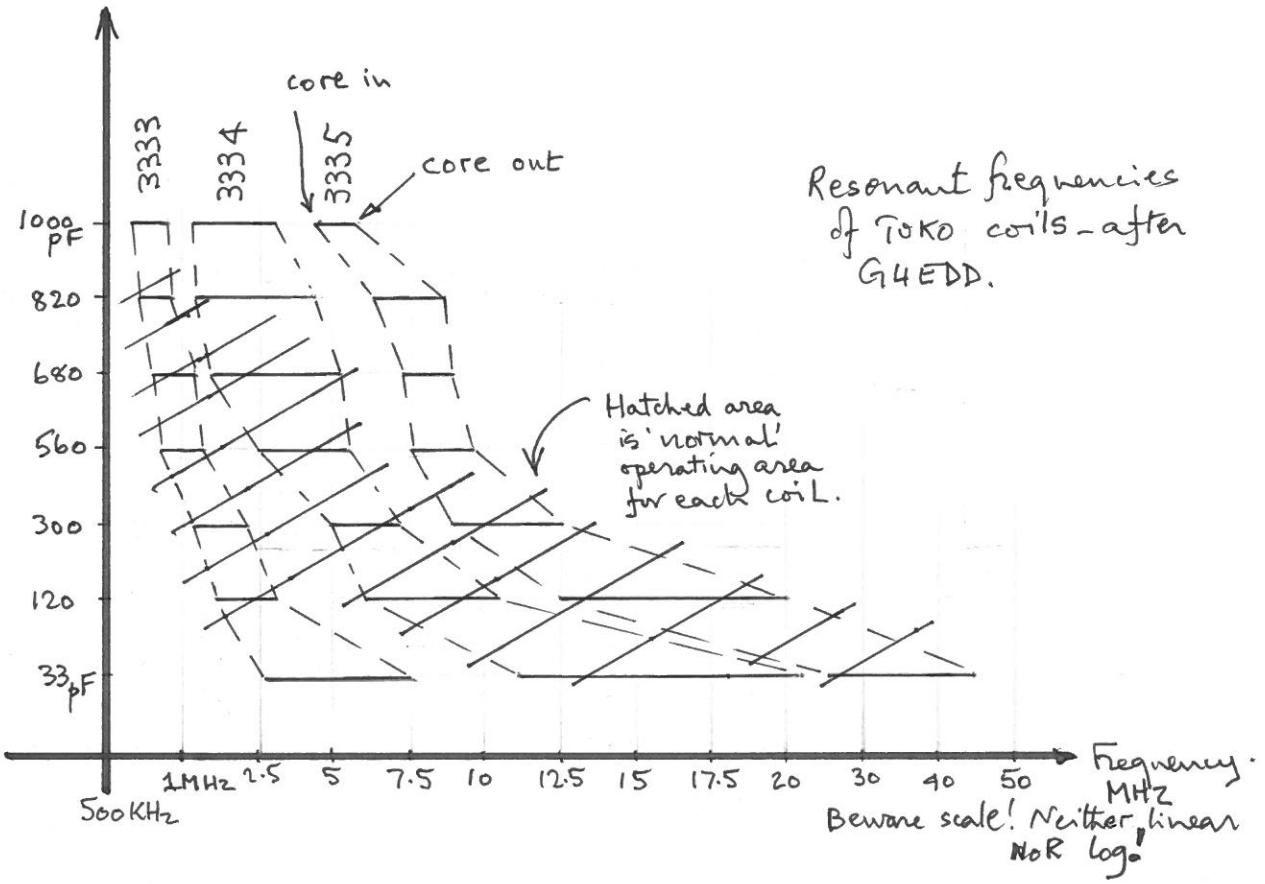
Discounted kit sale!

I have the following kits which I would prefer to sell cheap rather than break up for spares:- 4 off 50R attenuator kits; 0 - 20 dB in switched 1 dB steps. PCB is single sided 50 x 80 with 5 DPCO toggles. £10 each. Also 2 off Pylle CW transmitters for the Upton project - 1.5W 'crystal' or external drive, broadband TX with diode TR switching and 10 dB receiving RF amp, with muting & sidetone oscillator. Double sided PCB 50 x 80 mm. Does not include any TX LPFs - but see next item! £15 each. I also have 3 off relay switched two band cascadable transmitting low pass filter kits - £10 each. P and P £3.

I am always happy to supply Construction Club members with any spares - just e mail me about your needs and I will give you a price. Tim W G3PCJ

TOKO Coil Ranges

I came across this useful information in the Autumn 2008 SPRAT, the Journal of the GQRP Club. The information was originally compiled by G4EDD who measured the range of resonant frequencies of the three most common adjustable TOKO coils (commonly known as 3333, 3334 and 3335) with their adjusting cores 'in and out'. The core was deemed to be in when its top surface was flush with the top of the coil's can; core out is literally what it says! Although this range of TOKO coils is no longer made, they are in common use and it will be some time before my stocks are exhausted. The potential frequency/capacitance range for each type is the area bounded by each lozenge. The original data was compiled with a grid dip oscillator. Beware the scales – they are neither linear nor logarithmic ! I have left the extreme capacity/frequency points unchanged. You can use the diagram to determine what capacity should resonate with a chosen coil for a particular frequency or vice-versa. I have added a hatched area to suggest the normal operating range for each coil - the higher inductance 3333 being suited to higher capacitance and hence low frequency, while at the other extreme, the 3335 is best with low capacity for high frequencies. This data is a graphical form of the common parallel resonant circuit formula applied to the adjusting range of their nominal inductances. The manufacturer's published nominal inductance values (with core in) are 1.2 /uH for the 3335, 5 /uH for the 3334 and 45 /uH for the 3333. Tim G3PCJ



Resonant frequencies of TOKO coils – after G4EDD.